# PRELIMINARY ENGINEERING AND STORMWATER MANAGEMENT REPORT

for

# LAURELPARK SUBDIVISION

Final Report Prepared for:

Laurelpark Inc.
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Missisauga, Ontario
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Prepared by:

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June 2017

Reference: 16-168

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## APPENDICES

## 1.0 INTRODUCTION

Calder Engineering Ltd. has been retained by Laurelpark Inc. to complete a Preliminary Engineering and Stormwater Management Report for the proposed Laurelpark Subdivision residential development in the Palgrave Estate Residential Community of the Town of Caledon. The report is supporting documentation for the respective subdivision Draft Plan application and has been prepared to meet requirements of sections 7.1.18.7 and 7.1.18.8 of the Town of Caledon Official Plan and applicable sections of the Oak Ridges Moraine Conservation Plan (Ontario Regulation 140/02).

The site location is shown in Figure 1.1. The site is bounded by Mount Pleasant Road and estate residential development to the east, estate and rural residential development to the north, agricultural land to the west, and rural residential land to the south. The legal description of the property is Part of the East Half of Lot 19, Concession 8, former Township of Albion, Town of Caledon, Regional Municipality of Peel.

The overall site comprises approximately 10.38 hectares or 25.64 acres. It is proposed to develop the site with 8 estate residential lots using a combined rural and urban road cross-section, individual private septic systems for sewage disposal, and municipal water. Drainage and storm water would be managed using an adaptive stormwater management approach and application of Low Impact Development (LID) practices. The objective of the adaptive stormwater management approach is to provide the framework and process for meeting Town of Caledon and Conservation Authority stormwater management criteria, and protection of site environmental features.

The objective of this report is to describe proposed road grades, methods for site sanitary and water servicing, plan for drainage and stormwater management, site grading, and other proposed servicing infrastructure. The information provided herein is preliminary and subject to detailed design. Detailed design of the road system, site sanitary and water services, and drainage and stormwater management infrastructure would be undertaken following Draft Plan approval.

FIGURE 1.1
STUDY AREA LOCATION

Reference: Aerial Image from Google Earth (2016)

Calder Engineering Ltd.

# 2.0 STUDY AREA

## 2.1 General

The site is bounded by Mount Pleasant Road and estate residential development to the east, estate and rural residential development to the north, agricultural land to the west, and rural residential land to the south. The legal description of the property is Part of the East Half of Lot 19, Concession 8, former Township of Albion, Town of Caledon, Regional Municipality of Peel.

The overall site comprises approximately 10.38 hectares (ha). It is proposed to develop the site with 8 estate residential lots using a combined rural and urban road cross-section, individual private septic systems for sewage disposal, and municipal water. Drainage and storm water would be managed using an adaptive stormwater management approach and application of Low Impact Development (LID) practices. The objective of the adaptive stormwater management approach is to provide the framework and process for meeting Town of Caledon and Conservation Authority stormwater management criteria, and protection of site environmental features.

Illustrated on Figure 2.1 is the proposed lot pattern and road alignment. Access to the subdivision would be from Mount Pleasant Road for lots in the eastern part of the site and from Diamondwood Drive for lots in the western part of the site. The proposed Draft Plan is provided in Appendix A.

## 2.2 Physiography and Landform

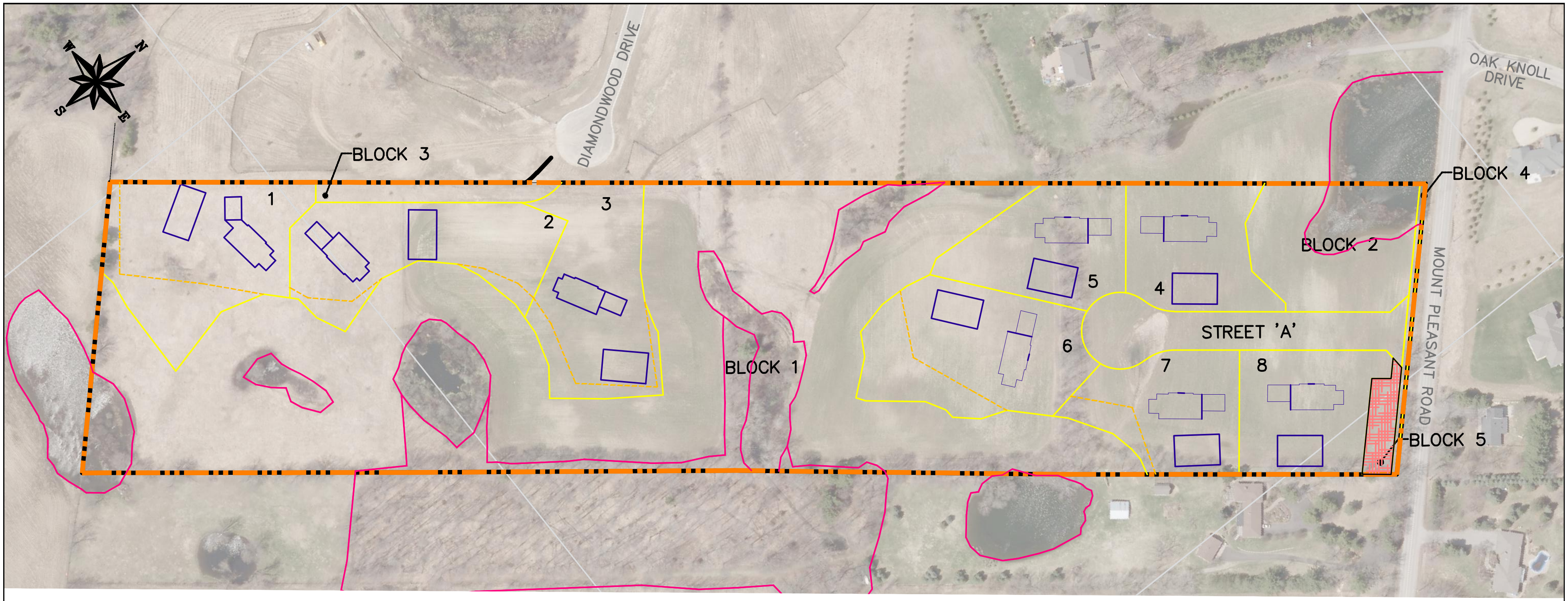
The property is located within the physiographic region referred to as the Oak Ridges Moraine (Chapman and Putnam, 1984). The Oak Ridges Moraine is a prominent physiographic feature in south-central Ontario forming a west to east trending ridge that is approximately 160 kilometres (km) long and 2 to 11 km wide. Extending from the Niagara Escarpment to the Trent Talbot River, the Oak Ridges Moraine consists of several distinct sections. The subject property is located within the Albion Hills area of the Town of Caledon. The Albion Hills typically consist of deep beds of evenly graded fine sand, however, in the vicinity of the property, the physiographic setting consists of a Till Moraine.

The key geological units found within the property are the Thorncliffe Formation, the Northern Till, the Oak Ridges Moraine sediments, and the Halton Till. The property is located on the southern flanks of Mount Wolfe, which is an inlier of the Northern Till, which extends up through the younger deposits of the Oak Ridges Moraine.

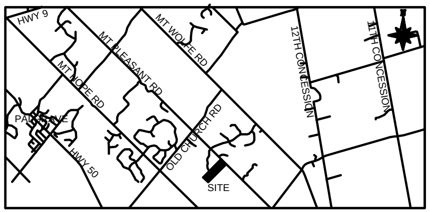
Additional information on local geology, landform, hydrology, and hydrogeology has been provided by Azimuth Environmental Consulting Inc. (2017a).

## 2.3 Topography

The site topography is undulating and hummocky with moderate to steep slopes. Areas with identified seasonal groundwater levels within a metre of the ground surface (i.e., designated as Environmental Zone 2 areas per the Town of Caledon Official Plan) and wetland features are typically located in the topographic lows.



KEY PLAN



TOWN OF CALEDON
NTS

LEGEND

| | |
|---|---|
| ▬ ▪ ▬ | PROPERTY LINE |
| ── | PROPOSED LOT/BLOCK LINE |
| - - - | PROPOSED STRUCTURE ENVELOPE |
| ── | ORMCP KEY NATURAL HERITAGE FEATURE |
| ▭ | CONCEPTUAL HOUSE LOCATION |
| □ | CONCEPTUAL SEPTIC LOCATION |
| ▦ | PROPOSED SWM BLOCK |
| 2 | PROPOSED LOT/BLOCK NUMBER |

NOTES

1. IMAGE SOURCE: FIRST BASE SOLUTIONS, 2002. IMAGE PLACEMENT IS APPROXIMATE AND NOT ORTHORECTIFIED

50m 0 50m 100m

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PART OF EAST HALF OF LOT 19, CONCESSION 8
TOWN OF CALEDON, REGION OF PEEL

FIGURE 2.1
PROPOSED LOT PATTERN AND ROAD ALIGNMENT

The highest elevation on the site occurs on two small hills within the property (each at approximate elevation 285.5 metres) and the lowest elevation occurs in the southwest corner of the property (approximate elevation 269.5 metres).

The Palgrave Estates Residential Community Secondary Plan (PERCSP) contains policies for development within the Palgrave Estates area which apply to this proposed subdivision. Specific references to topography and slopes within the secondary plan are discussed below.

Section 7.1.9.11 of the PERSCP specifies that structure envelopes will generally be restricted to areas with slopes of 10 per cent or less and may include areas with 11 to 15 per cent slope and occasionally greater than a 15 percent slope in order to permit the advantageous siting of a house designed for steep slopes. Additionally, all structure envelopes must include a well-drained area with slopes of 10 percent or less for a sewage disposal system. Consistent with this policy, all proposed lots have an appropriate area for sewage disposal system (discussed further in Section 7.1 of this report) and generally include gentler slopes within the structure envelope.

Section 7.1.9.23 of the PERSCP specifies that the continuity and integrity of the lowland open space system must be maintained in estate residential plans of subdivision. The proposed subdivision is in general conformance with this policy based the siting of lots away from the lowland areas and out of the Key Natural Heritage Features and associated minimum vegetation protection zones.

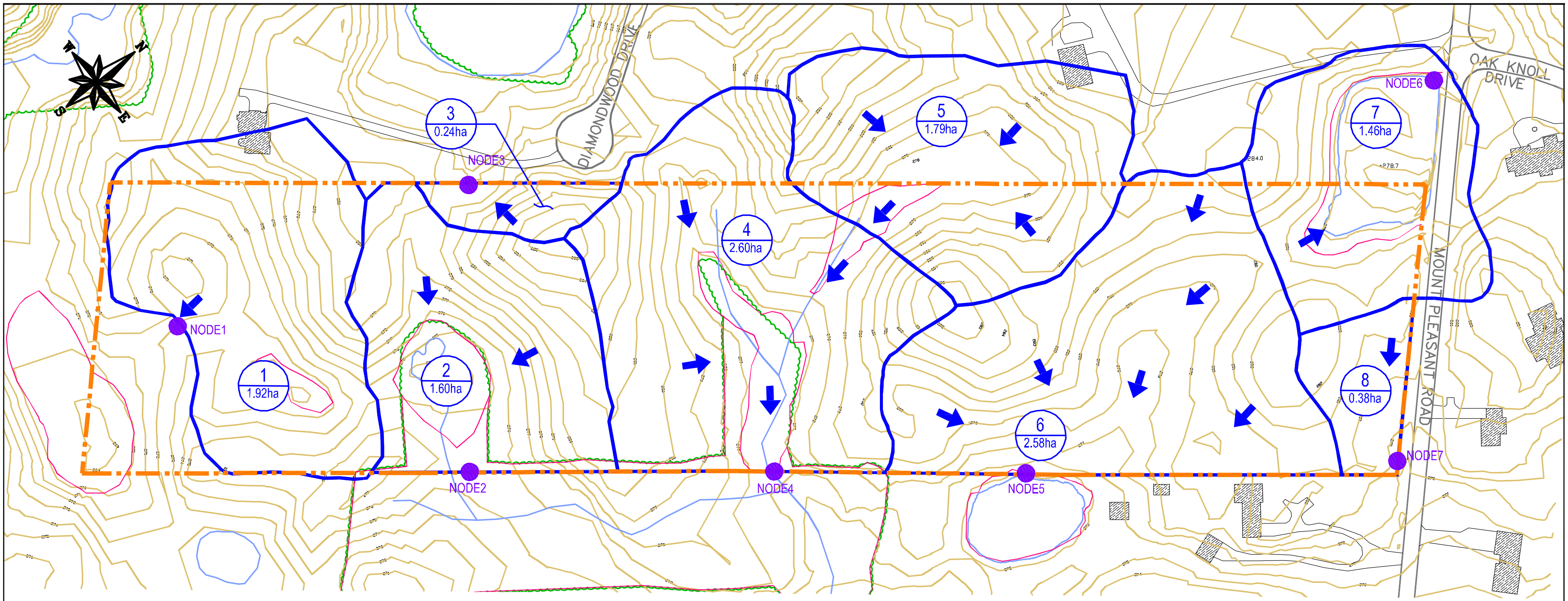
Section 7.1.9.40 of the PERSCP specifies that roads in estate residential developments should follow the topography of the site and Section 7.1.9.41 specifies that the depth of cut for local streets and structure envelopes in future estate residential plans of subdivision will normally be restricted to 1 to 2 metres. The Street A alignment and lot grading for lots 4 through 8 does not result in a depth of cut greater than 2 metres from the existing ground surface. With exception of a very small area associated the driveway access to lots 2 and 3 where the cut is approximately 2.5 metres, the lot grading for lots 1 through 3 does not result in a depth of cut greater than 2 metres from the existing ground surface.

## 2.4 Pre-Development Land Uses and Drainage Patterns

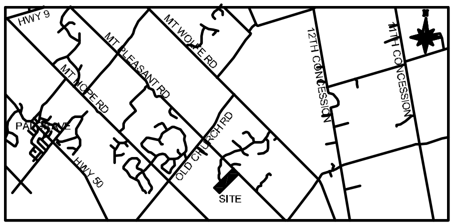
The land was historically cleared and farmed. Currently, portions of the lands are planted with agricultural crops. The remaining areas are either cultural meadows or wetland and hedgerow features. There are no buildings or structures on the property.

The site is part of the Humber River Watershed. Surface flow on the site is typically via sheet flow to the topographic lows and then off-site via either intermittent or ephemeral drainage features. A portion of the site drains northward and a portion drains southward: both to tributaries of Cold Creek which is part of the Humber River Watershed. Cold Creek is a tributary of the main branch of the Humber River. The site falls within the jurisdiction of the Toronto Region Conservation Authority.

The pre-development drainage patterns have been broken down into the 9 sub-basins shown in Figure 2.2. Sub-basins 3, 7 and 9 drain to the north, and sub-basins 1, 2, 4, 5, 6, and 8 drain to the south. There are no external drainage areas conveying flow to the site. Summarized in Table 2.1 are pre-development sub-basin characteristics.



## KEY PLAN



TOWN OF CALEDON

NTS

## LEGEND

- PROPERTY LINE
- STREAM OR WATER BODY
- 279 MAJOR CONTOUR (1m INTERVALS)
- ORMCP KEY NATURAL HERITAGE FEATURE
- DRAINAGE BOUNDARY
- A7 SUB-CATCHMENT ID
- 1.48ha SUB-CATCHMENT AREA (ha)
- ➡ MAJOR FLOW DIRECTION
- ● FLOW NODE
- NODE1

## NOTES

1. CONTOURS GENERATED FROM ORTHOPHOTOGRAPHY DEVELOPED IN THE SPRING OF 2002 AND SURVEYED ELEVATIONS BY CALDER ENGINEERING LTD. (2017) AND EPLETT WOROBEC RAIKES SURVEYING LTD. (2015). ACTUAL ELEVATIONS MAY VARY FROM THOSE SHOWN.
2. CONTOUR INTERVAL IS 1m.
3. FEATURE LOCATIONS (e.g. TREELINES, BUILDINGS, ETC.) ARE APPROXIMATE.

50m 0 50m 100m

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# FIGURE 2.2
## EXISTING DRAINAGE BOUNDARIES

## TABLE 2.1
## SUMMARY OF PRE-DEVELOPMENT SUB-BASIN CHARACTERISTICS

| Sub-basin | Drainage Area (ha) | Outlet | Receiver |
|---|---|---|---|
| **1** | 1.92 | site wetland feature | Cold Creek Tributary, Humber River Watershed |
| **2** | 1.60 | dry swale in Sub-basin A2 | Cold Creek Tributary, Humber River Watershed |
| **3** | 0.18 | Diamondwood Drive | Cold Creek Tributary, Humber River Watershed |
| **4** | 2.60 | dry swale on property to the south | Cold Creek Tributary, Humber River Watershed |
| **5** | 1.79 | dry swale on property to the south | Cold Creek Tributary, Humber River Watershed |
| **6** | 2.58 | pond feature on property to the south | Cold Creek Tributary, Humber River Watershed |
| **7** | 1.46 | Existing Pond and Mount Pleasant Road Ditch (draining north) | Cold Creek Tributary, Humber River Watershed |
| **8** | 0.38 | Mount Pleasant Road Ditch (draining south) | Cold Creek Tributary, Humber River Watershed |
| **9** | 0.05 | Diamondwood Drive | Cold Creek Tributary, Humber River Watershed |
| **Total:** | 12.56 | | |

Note:
1. Units:  ha – hectares.
2. Refer to Figure 2.2 for sub-basin delineation.

## 2.5 Surficial Soils

A geotechnical investigation was performed by Terraprobe Inc. (2017) comprising 12 boreholes extending to a depth of approximately 6.5 metres. In addition, 12 test pits were excavated across the site. The borehole and test pit locations, and respective logs are provided in Appendix B. Generally, the site consists of an approximately 250 to 400 millimetre layer of topsoil which overlays typically a native clayey silt/silt soil. In vicinity of two boreholes, a native sandy silt was encountered.

It is indicated in the geotechnical investigation that the native clayey-silt/silt is practically impervious with an estimated coefficient of permeability of $10^{-6}$ centimetres per second (cm/s) and the native sandy silt has a moderate to relatively low permeability with an estimated coefficient of permeability in the range of $10^{-4}$ to $10^{-5}$ cm/s. The sandy silt soil was encountered at boreholes 5 and 12 which are located in vicinity of the two high points on the site.

## 2.6 Geology

The regional and local geology in the study area have been discussed by Azimuth Environmental Consulting Inc. (2017a). With respect to regional geology, the key geological units found within the study area are the Thorncliffe Formation, the Northern Till, the Oak Ridges Moraine sediments, and the Halton Till. The subject property is located on the southern flanks of Mount Wolfe, which is an inlier of the Northern Till, which extends up through the younger deposits of the Oak Ridges Moraine.

With respect to local geology, it is stated by Azimuth Environmental Consulting Inc. that surficial geology is quite consistent across the subject property. The underlying deposits within the upper 6.6 metres of overburden are primarily silty in nature, with some sand and trace clay found in sporadic deposits across the subject property.

## 2.7 Hydrogeology and Groundwater

To comply with requirements of the Oak Ridges Moraine Conservation Plan (Ontario Regulation 140/02) and the Town of Caledon Palgrave Estates Residential Community Secondary Plan, a hydrogeologic assessment has been prepared by Azimuth Environmental Consulting Inc. (2017a) to determine and describe the hydrogeologic and hydrologic functions of sensitive features. The evaluation focused on the nature of the interaction between the ground water system and the surface water system. The evaluation examined the effect of the proposed development and site alteration on the ground and surface water regimes through the completion of pre and post water balance assessments and RUP evaluation.

It is reported by Azimuth Environmental Consulting Inc. that data compiled during the long-term monitoring program provides sufficient evidence that impacts to surface/ground water quality and quantity will be minimal following construction of the proposed estate residential subdivision. Therefore, it is recommended by Azimuth Environmental Consulting Inc. that no changes to the proposed Draft Plan are recommended (i.e., lot density).

It is concluded by Azimuth Environmental Consulting Inc. that the present hydrologic and hydrogeologic conditions upon the subject property will not experience a significant change due to do the proposed development. By incorporating the criteria as described by Azimuth Environmental Consulting Inc., pre-development infiltration will experience an approximate gain of 11%. This gain in infiltration will have no negative impact on the local ground water regime and associated natural features. In addition, it is stated that the proposed development adheres to the requirements of the Oak Ridges Moraine Conservation Plan, and that no negative post-construction impacts are predicted to occur to the quality/quantity of surface and ground water, ground water recharge, or natural sensitive features.

# 3.0 STORMWATER MANAGEMENT

## 3.1 Planning Context

The Provincial Policy Statement, 2014, under Section 3 of the Planning Act, provides that planning for stormwater management shall:

- minimize, or where possible, prevent increase in contaminant loads
- minimize changes in water balance and erosion
- mot increase risks to human health and safety and property damage
- maximize the extent and function of vegetative and pervious surfaces
- promote stormwater management best practices, including stormwater attenuation and re-use, and low impact development

A stormwater management plan is required under Sections 45 (1) and 46 (3) of the Oak Ridges Moraine Conservation Plan (ORMCP). In the ORMCP, planning, design, and construction practices are discussed in Section 45 (2) and stormwater management plan criteria are discussed in Section 46 (1). The Town of Caledon is the approval authority for these respective components of the Oak Ridges Moraine Conservation Plan.

In addition to the specific sections of the ORMCP, the Town of Caledon Official Plan provides policies for the Oak Ridges Moraine under Section 7.10 - Oak Ridges Moraine Conservation Plan. In Section 7.10.6.8.1, specified are the requirement for a stormwater management plan as detailed in Section 7.10.6.9. Section 7.6.10.9.1 details objectives of a stormwater management plan and Section 7.10.6.9.2 suggests the application of a ‘treatment train’ approach to controlling stormwater.

The Palgrave Estates Residential Community Secondary Plan (PERCSP) contains additional policies for stormwater management, specifically:

- Section 7.1.8.9 – estate residential plans will be required to minimize the amount of stormwater draining from the site and adhere to the zero increase in stormwater runoff principle in a manner acceptable to the Town and TRCA

- Section 7.1.8.10 – wherever possible the 100-year design stormwater runoff will be detained and recharged to the groundwater aquifers or slowly released from the site in an environmentally acceptable manner.

The Regional Municipality of Peel Official Plan (Section 2.2.10.5.20) directs the Town of Caledon to require stormwater management plans for applications for development and site alteration in the Protected Countryside, specifically that:

- planning, design and construction practices will minimize vegetation removal, grading and soil compaction, sediment erosion and impervious surfaces

- where appropriate, an integrated treatment approach shall be used to minimize stormwater management flows and structures through such measures as lot level controls and conveyance techniques such as grass swales

- applicable recommendations, standards or targets within watershed plans and water budges are complied with

The policies associated with these documents have been incorporated into the criteria and objectives of the stormwater management plan proposed for the Laurelpark Subdivision and identified in subsequent sections of this report.

Drainage and storm water is proposed to be managed using an adaptive stormwater management approach and application of Low Impact Development (LID) practices. The objective of the adaptive stormwater management approach is to provide the framework and process for meeting applicable planning policies, and Town of Caledon and Conservation Authority stormwater management criteria and protection of site environmental features. The approach includes:

- establishment of stormwater management criteria
- establishment of performance objectives
- outline of a stormwater management strategy
- monitoring to gain additional information on site natural features and groundwater conditions
- identification of indicators to assess effectiveness of the stormwater management strategy
- identification of triggers to initiate review of the stormwater management strategy
- development of contingency plans and adaptive management measures to offset any identified impacts

### 3.2 Stormwater Management Criteria

Stormwater management criteria are proposed that are consistent with the Provincial Policy Statement (2014), ORMCP (Ontario Regulation 140/02), and current municipal and Conservation Authority criteria and guidelines, and are intended to avoid impacts to site natural features and local groundwater resources.

Per the Town of Caledon Development Standards, Policies, and Guidelines (2009), the following stormwater management criteria are specified:

- Quantity Control – peak flows are controlled to pre-development levels;

- Quality Control – water quality treatment in conformance with Provincial requirements as outlined in the Stormwater Management Planning and Design Manual (Ministry of the Environment, 2003); and

- Erosion Control – erosion protection be provided in accordance with the policies of the Toronto and Region Conservation Authority.

In addition, Toronto and Region Conservation Authority stormwater management criteria are as follows:

- Quantity Control – control of 2 to 100-year post-development peak flows to pre-development peak flows based on applicable Unit Flow Equations

- Quality Control – enhanced level of treatment (Level 1)

- Erosion Control – storm runoff from a 25 millimetre design storm be detained and released over a 48-hour period

- Water Balance – retention of storm runoff from the first 5 mm of rainfall on the site through infiltration, evapotranspiration, and/or reuse

### 3.3 Stormwater Management Performance Objectives

In addition to the stormwater management criteria outlined in Section 3.2, the following performance objectives, consistent with the PPS (2014), ORMCP (Ontario Regulation 140/02), and Town of Caledon Official Plan are proposed to minimize impact the site and adjacent natural features and groundwater conditions:

- minimize impact to wetland water balances
- minimize impact to wetland water levels
- minimize impact to wetland hydro-periods
- minimize impact to wetland ecology
- minimize impact to groundwater levels and quality

### 3.4 Stormwater Management Strategy

Consistent with Section 7.10.6.9.2 of the Town of Caledon Official Plan, the proposed stormwater management strategy comprises a “treatment train” approach utilizing a combination of lot level controls and Low Impact Development (LID) measures to minimize potential increases in volume of runoff and provide, as far as practical, a natural hydrologic response. Measures are proposed to be undertaken at the source, and conveyance and end of pipe locations, and are as follows:

- recharge of residential roof and driveway storm water by direction to grassed and naturalized areas to promote filtering and natural infiltration;

- discharge of foundation drain water to rear and side lot areas;

- by lot grading, direction of structure envelope drainage, via sheet flow, towards grassed and naturalized areas versus the road right of way;

- as far as practical, application of grassed swales for road drainage versus a piped storm sewer system;

- minimization of road drainage to the wetland features;

- use of a bioretention area to temporarily detain and slowly release storm water to meet applicable stormwater management criteria; and

- use of filter strips and level spreaders to diffusely discharge storm water.

The use of grassed swales versus a piped storm sewer system is proposed to encourage passive infiltration of storm water, provide linear storage in the conveyance system to dampen hydrologic response, and provide pre-treatment of storm water prior to discharge to the bioretention area. Additionally, grassed swales rather than a pipe sewer system is consistent with the PPS (2014) by maximizing the extent and function of pervious areas and promoting stormwater management best practices.

The respective bioretention area proposed is a hybrid between a traditional “bioretention area” and a “dry” pond as the drainage area serviced is slightly larger than recommended in the Low Impact Development Stormwater Management Planning and Design Guide (Credit Valley Conservation and Toronto and Region Conservation, 2010). The intent is to provide similar design features and function as a bioretention area. Inclusion of a low impact development facility such as a bioretention area is consistent with PPS (2014). This approach is considered reasonable as the impervious area serviced (e.g., area that will generate the majority of storm water from the frequent short duration events) either meets or slightly exceeds that minimum recommended drainage area. With respect to the proposed bioretention area, factors considered to ensure the proposed facilities function as intended are as follows:

- depth and duration of water pooling after a storm event;
- soil media and volumetric capacity;
- subsurface soil hydraulic conductivity; and
- proximity to the seasonal high-water table.

In regards to the above and for sizing of Block 5, the volumetric contribution associated with the soil media has not been accounted for in the hydrologic computations. This is a conservative approach to sizing of the bioretention area.

In addition to the above, an adaptive approach is proposed whereby the stormwater management strategy includes:

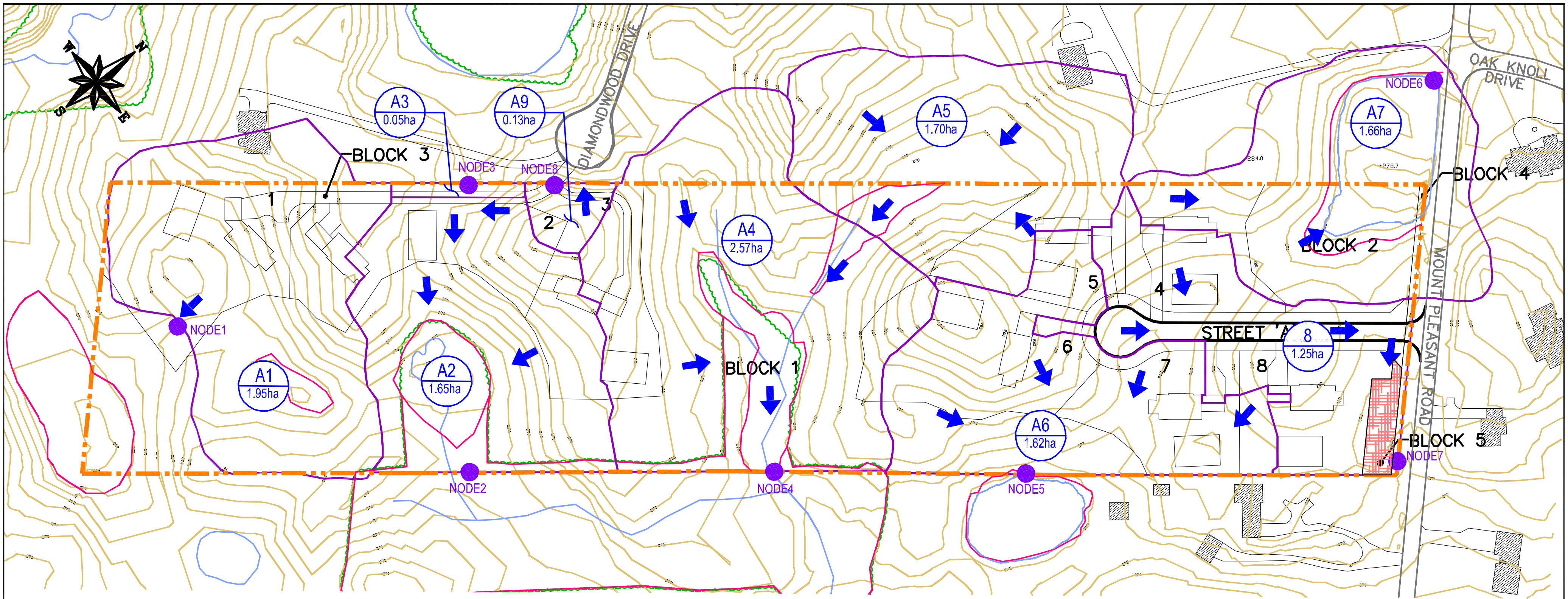
- monitoring to gain additional information on site natural features and groundwater conditions;

- identification of indicators to assess effectiveness of the stormwater management strategy;

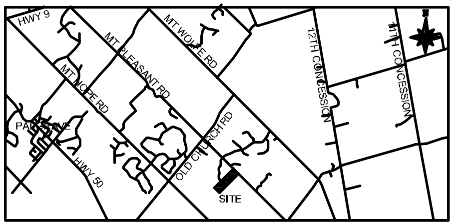
- identification of triggers to initiate review of the stormwater management strategy; and

- development of contingency plans and adaptive management measures to offset any identified impacts.

The adaptive approach is outlined in Section 4 and will provide the opportunity to refine the stormwater management strategy as more information becomes available and in the event other design considerations are identified.



## KEY PLAN



TOWN OF CALEDON NTS

## LEGEND

- PROPERTY LINE
- STREAM OR WATER BODY
- 279 MAJOR CONTOUR (1m INTERVALS)
- LOT/BLOCK LINES
- ORMCP KEY NATURAL HERITAGE FEATURE
- PROPOSED DRAINAGE BOUNDARY
- A7 PROPOSED SUB-CATCHMENT ID
- 1.48ha PROPOSED SUB-CATCHMENT AREA (ha)
- ➡ MAJOR FLOW DIRECTION
- ● FLOW NODE (NODE1)
- ▨ PROPOSED SWM BLOCK

## NOTES

1. CONTOURS GENERATED FROM ORTHOPHOTOGRAPHY DEVELOPED IN THE SPRING OF 2002 AND SURVEYED ELEVATIONS BY CALDER ENGINEERING LTD. (2017) AND EPLETT WOROBEC RAIKES SURVEYING LTD. (2015). ACTUAL ELEVATIONS MAY VARY FROM THOSE SHOWN.
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50m 0 50m 100m

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## FIGURE 3.1
PROPOSED DRAINAGE BOUNDARIES

## 3.5 Stormwater Management Assessment – Quantity Control

### 3.5.1 Hydrologic Modelling Approach

A hydrologic modelling approach was used to determine and evaluate measures for quantity (peak flow) control. A hydrologic model (SWMHYMO Version 4.07 dated July 1999) was set up to reflect the existing (pre-development) condition shown in Figure 2.2 and post-development condition shown in Figure 3.1. Available soils, land use, and topographic information was used to calculate SWMHYMO parameters, including curve number (CN), time to peak (tp), and catchment slope. Due to the estate residential nature of the subdivision and large associated open space blocks, the catchments typically had a total imperviousness (TIMP) of less than 20% and were modeled using the Calibrate NASHYD command under post-development conditions. The time to peak was calculated using the Airport method. The Atmospheric Environment Service (AES) 6-hour and 12-hour duration storms were applied to determine the critical storm duration for the study area. Based on this analysis, the AES 6-hour duration storm was determined to be the critical design storm and applied.

For this project, it was assumed that only sub-basins containing the proposed road allowance would require control to pre-development flow rates. Under post-development conditions, the road allowance falls totally within Sub-basin A8. Sub-basin 8 was modeled using the STANDHYD command in SWMHYMO. With the proposed stormwater management strategy, an effort has been made to separate lot drainage, as far as practical, from road drainage. However, there are two areas where lot drainage will report to a road allowance (e.g., sub-basins A8 and A9).

The remaining sub-basins (e.g., sub-basins A1 through A7), will drain typically by sheet flow in a diffuse manner to grassed or naturalized areas. The change in percent imperviousness in these basins would only be associated with houses and driveways, and typically be less than 5 percent. As far as practical, residential roof and driveway storm water will be directed to grassed and naturalized areas to promote filtering and natural infiltration.

Summarized in Table 3.1 are post-development sub-basin characteristics.

**TABLE 3.1**
**SUMMARY OF POST-DEVELOPMENT SUB-BASIN CHARACTERISTICS**

| Sub-basin | Drainage Area (ha) | Outlet | Receiver |
|---|---|---|---|
| **A1** | 1.95 | site wetland feature | Cold Creek Tributary, Humber River Watershed |
| **A2** | 1.65 | dry swale in Sub-basin A2 | Cold Creek Tributary, Humber River Watershed |
| **A3** | 0.05 | Lot 9 Diamondwood Drainage Easement | Cold Creek Tributary, Humber River Watershed |
| **A4** | 2.57 | dry swale on property to the south | Cold Creek Tributary, Humber River Watershed |
| **A5** | 1.70 | dry swale on property to the south | Cold Creek Tributary, Humber River Watershed |
| **A6** | 1.62 | wetland feature on property to the south | Cold Creek Tributary, Humber River Watershed |
| **A7** | 1.66 | Existing Pond and Mount Pleasant Road Ditch (draining north) | Cold Creek Tributary, Humber River Watershed |

| | | | |
|---|---|---|---|
| **A8** | 1.25 | Mount Pleasant Road Ditch (draining south) | Cold Creek Tributary, Humber River Watershed |
| **A9** | 0.13 | Diamondwood Drive | Cold Creek Tributary, Humber River Watershed |
| **Total:** | 12.58 | | |

Note:
1. Units: ha – hectares.
2. Refer to Figure 3.1 for sub-basin delineation.

The TRCA Humber River unit flow rate equations were used to calculate pre-development peak flow rates for the site and were used as target flow rates to be managed under post-development conditions. The unit flow rates were calculated using Equation C for Sub-basin 10 from Table E.1: Summary of Unit Flow Relationships, Humber River Watershed, Appendix A of the Toronto and Region Conservation document entitled Stormwater Management Criteria (2012).

One bioretention area is proposed for peak flow control. The location is shown in Figure 3.1. The bioretention area associated with Block 5 will receive drainage from Sub-basin A8, temporarily detain and release storm water to the ditch on Mount Pleasant Road. This ditch drains south along Mount Pleasant Road and ultimately discharges to a tributary of Cold Creek.

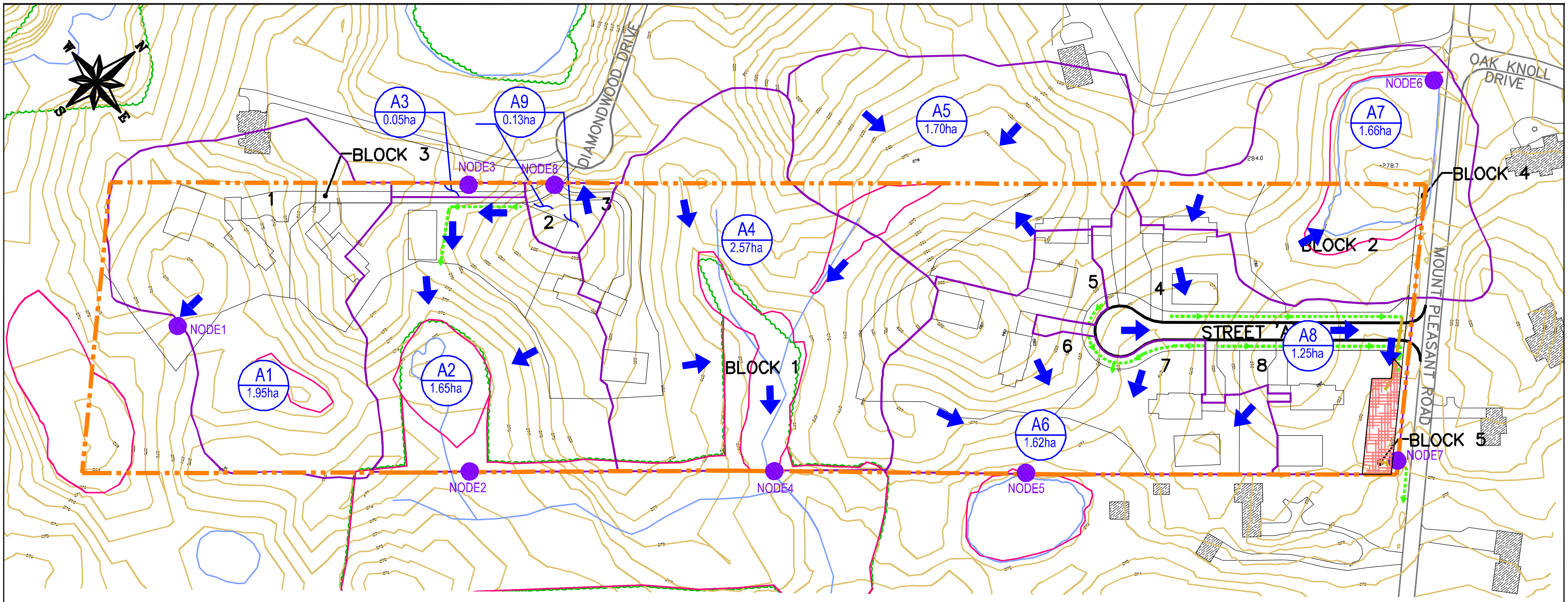
For preliminary design, the storage volume estimated to control to calculated pre-development flow rates was estimated using the COMPUTE VOLUME command in SWMHYMO. Summarized in Table 3.2 is the post-development target release rate for the 100-year design event and estimated storage volume requirements. Estimated pre-development peak flow rates and storage volumes for the 2-year through 100-year design events are summarized in Appendix C. This information was used to develop stage-storage-discharge characteristics and to prepare the concept design for the proposed bioretention area. The bioretention area was sized to provide quantity control for up to the 100-year design event; this is consistent with the PERCSP Section 7.1.8.10.

## TABLE 3.2
## SUMMARY OF POST-DEVELOPMENT TARGET RELEASE RATE

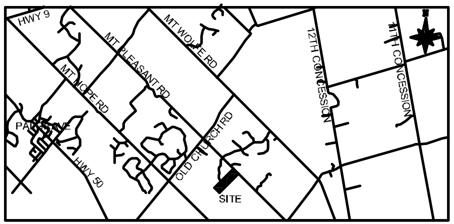
| Storm Drainage Block | Sub-basin | Total Drainage Area (ha) | Impervious Drainage Area (ha) | 100-Year Unit Flow Rate (cms) | 100-Year Storage Volume (cu.m) |
|---|---|---|---|---|---|
| **Block 5** | **A8** | 1.25 | 0.39 | 0.017 | 450 |

Note:
1. Units: ha - hectares; cms - cubic meters per second; cu.m - cubic meters.
2. Unit Flow Rate calculated using Equation C for Sub-basin 10 from Table E.1: Summary of Unit Flow Relationships, Humber River Watershed, Appendix A of the Toronto and Region Conservation document entitled Stormwater Management Criteria (2012).
3. Refer to Figure 3.1 for sub-basin delineation and location of Storm Drainage Block (e.g., bioretention area).
4. Refer to Appendix C for estimated 2-year through 100-year pre-development peak flow rates and storage volumes.

Design characteristics of the bioretention area are described in Section 3.5.2. Operating characteristics for the 2-year through 100-year design events are summarized in Appendix C. These results were obtained by incorporating the bioretention area as a reservoir element in the SWMHYMO model.



KEY PLAN



TOWN OF CALEDON NTS

LEGEND

- ▬ ▪ ▪ ▬ PROPERTY LINE
- STREAM OR WATER BODY
- 279 MAJOR CONTOUR (1m INTERVALS)
- LOT/BLOCK LINES
- ORMCP KEY NATURAL HERITAGE FEATURE
- PROPOSED DRAINAGE BOUNDARY
- A7 PROPOSED SUB-CATCHMENT ID
- 1.48ha PROPOSED SUB-CATCHMENT AREA (ha)
- ➡ MAJOR FLOW DIRECTION
- ● NODE1 FLOW NODE
- ▨ PROPOSED SWM BLOCK
- ▪▪▪▶▪▪▪ PROP. DITCH
- ━▶━ PROP. STM SEWER

NOTES

1. CONTOURS GENERATED FROM ORTHOPHOTOGRAPHY DEVELOPED IN THE SPRING OF 2002 AND SURVEYED ELEVATIONS BY CALDER ENGINEERING LTD. (2017) AND EPLETT WOROBEC RAIKES SURVEYING LTD. (2015). ACTUAL ELEVATIONS MAY VARY FROM THOSE SHOWN.

2. CONTOUR INTERVAL IS 1m.

3. FEATURE LOCATIONS (e.g. TREELINES, BUILDINGS, ETC.) ARE APPROXIMATE.

50m 0 50m 100m

**Calder Engineering Ltd.**
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THE CORPORATION OF THE
TOWN OF CALEDON

LAURELPARK INC.

LAURELPARK SUBDIVISION
PART OF EAST HALF OF LOT 19, CONCESSION 8
TOWN OF CALEDON, REGION OF PEEL

FIGURE 3.2
PROPOSED STORM WATER MANAGEMENT PLAN

Peak flows were estimated at seven locations where surface water discharges from the site. These locations have been denoted as nodes 1, 2, 3, 4, 5, 6, 7, and 8 and are shown on Figure 2.2 and Figure 3.1. The peak flow estimates for post-development conditions include the storage effect of the proposed bioretention area. Summarized in Table 3.3 are estimated pre-development and post-development peak flows at nodes 1, 2, 3, 4, 5, 6, 7 and 8. As shown in Table 3.3, peak flows can be controlled to pre-development levels with the proposed stormwater management approach. The exception is Node 8: drainage to the existing pond.

### TABLE 3.3
### SUMMARY OF ESTIMATED PEAK FLOWS FROM THE PROJECT SITE

| Node | Pre-Development Peak Flow (cms) | Post-Development Peak Flow (cms) |
|---|---|---|
| **2-Year Return Period** | | |
| 1 | 0.036 | 0.032 |
| 2 | 0.033 | 0.030 |
| 3 | 0.004 | 0.002 |
| 4 | 0.059 | 0.057 |
| 5 | 0.034 | 0.027 |
| 6 | 0.044 | 0.050 |
| 7 | 0.006 | 0.002 |
| 8 | 0.001 | 0.003 |
| **5-Year Return Period** | | |
| 1 | 0.071 | 0.064 |
| 2 | 0.064 | 0.059 |
| 3 | 0.007 | 0.004 |
| 4 | 0.119 | 0.115 |
| 5 | 0.069 | 0.054 |
| 6 | 0.081 | 0.092 |
| 7 | 0.013 | 0.003 |
| 8 | 0.002 | 0.005 |
| **10-Year Return Period** | | |
| 1 | 0.098 | 0.089 |
| 2 | 0.088 | 0.082 |
| 3 | 0.010 | 0.005 |
| 4 | 0.168 | 0.162 |
| 5 | 0.096 | 0.074 |
| 6 | 0.108 | 0.123 |
| 7 | 0.018 | 0.003 |
| 8 | 0.003 | 0.007 |

| | | |
|---|---|---|
| **25-Year Return Period** | | |
| 1 | 0.134 | 0.123 |
| 2 | 0.120 | 0.113 |
| 3 | 0.013 | 0.006 |
| 4 | 0.235 | 0.227 |
| 5 | 0.135 | 0.103 |
| 6 | 0.143 | 0.103 |
| 7 | 0.025 | 0.004 |
| 8 | 0.004 | 0.010 |
| **50-Year Return Period** | | |
| 1 | 0.164 | 0.151 |
| 2 | 0.146 | 0.138 |
| 3 | 0.016 | 0.007 |
| 4 | 0.290 | 0.280 |
| 5 | 0.166 | 0.126 |
| 6 | 0.170 | 0.194 |
| 7 | 0.030 | 0.007 |
| 8 | 0.005 | 0.012 |
| **100-Year Return Period** | | |
| 1 | 0.194 | 0.179 |
| 2 | 0.172 | 0.163 |
| 3 | 0.019 | 0.008 |
| 4 | 0.348 | 0.336 |
| 5 | 0.198 | 0.150 |
| 6 | 0.198 | 0.225 |
| 7 | 0.036 | 0.013 |
| 8 | 0.006 | 0.014 |

Note:
1. Units: cms – cubic metres per second.
2. Refer to Figure 2.2 and Figure 3.1 for location of flow nodes.
3. Pre-development peak flows are based on hydrologic modelling using SWMHYMO.

A summary of model parameters and SWMHYMO input and output files are provided in Appendix C.

### 3.5.2 Bioretention Area

The bioretention area has been designed in general conformance with guidelines provided in the Low Impact Development Stormwater Management Planning and Design Guide (Credit

Valley Conservation and Toronto and Region Conservation, 2010). Key design characteristics of the bioretention area are as follows:

- provision of a filter bed surface with a mixture of sand, fines, and organic material;
- shallow depth of flooding (e.g., 0.10 to 0.20 metres) to contain and slowly release storm water during and following small rainfall events via infiltration and evapotranspiration;
- naturalized landscaping; and
- outlet works comprising a multizone treatment filterstrip to diffusely discharge to the environment.

Summarized in Table 3.4 are characteristics of the bioretention area. Pretreatment of storm water prior to discharge to the bioretention area would be achieved with the grassed swale conveyance system. In regards to the above and for sizing of Block 5, the volumetric contribution associated with the soil media has not been taken into account. It is anticipated the bioretention area will function as a dry pond during winter conditions and the spring snowmelt.

## TABLE 3.4
## SUMMARY OF BIORETENTION AREA CHARACTERISTICS

| Bioretention Area | Storage Volume Required for 100-Year Peak Flow Control (cu.m) | Storage Volume Provided in Bioretention Area (cu.m) | Filter Bed Footprint (sq.m) | Typical Operating Depth (m) |
|---|---|---|---|---|
| Block 5 | 507 | 594 | 90 | 1.7 |

Note:
1. Units: cu.m - cubic meters; sq.m – square metres; m – metres.
2. Storage volume provided is maximum available storage in bioretention area for water quantity/quality control and excludes any storage in the underlying soil media.

Subject to detailed design, the outlet works will comprise the following:

- perforated pipe outlet set in a perforated corrugated steel pipe (CSP) riser encased with clearstone;
- concrete headwall with a V-notch shaped weir for peak flow control and act as an emergency spillway; and
- pretreatment multizone filterstrip.

With respect to the perforated pipe outlet in the perforated CSP riser, the perforated pipe would be 250 mm diameter with an AASHTO Class II perforation. This perforation pattern would represent 15 slots with a nominal inlet area similar to that of a 40-mm orifice. It is recognized that the Town of Caledon minimum orifice size is 75 mm, however, a smaller size is required to meet the respective unit flow release rates. The proposed smaller effective 40 mm orifice size has been provided with triple protection from clogging (e.g., perforated pipe outlet set in a perforated corrugated steel pipe (CSP) riser encased with clearstone). Routine and annual inspection and maintenance considerations are discussed in Section 6.0. The respective stage-storage-discharge information for the bioretention area is provided in Appendix C.

## 3.6 Stormwater Management Assessment – Quality Control

### 3.6.1 Total Suspended Solids Removal Assessment

The stormwater management criteria for quality control is to achieve an enhanced level of treatment (Level 1) consistent with the Stormwater Management Planning and Design Manual (Ministry of the Environment, 2003). Typically, Total Suspended Solids (TSS) is used as the parameter to evaluate water quality and the long-term average removal rate to achieve an enhance level of treatment (Level 1) is 80%.

A “desk-top” accounting approach was used to calculate a nominal average annual TSS removal over the site. This approach was used to account for the various “treatment train” elements. The site was partitioned according to surface condition and an effective average annual TSS removal rate assumed for each surface condition based on flow path and “treatment train” component(s). The effective average annual TSS removal rate was assumed based on information provided in the Low Impact Development Stormwater Management Planning and Design Guide (Credit Valley Conservation and Toronto and Region Conservation, 2010) and Wet Weather Flow Management Guidelines (City of Toronto, 2006). With this approach, each TSS removal value is multiplied by respective percent of site total area to determine the TSS removal rate for each surface condition. The sum of all TSS removal rates for each surface condition is equal to the TSS removal over the site.

Summarized in Table 3.5 are the various types of surface conditions, flow paths and “treatment train” components, and assumed average annual TSS removal rate. Provided in Table 3.6 are computations for the site average annual TSS removal. Based on this approach, the calculated nominal average annual TSS removal rate for the site is 84.8%. This indicates an enhanced level of treatment can be achieved with the proposed stormwater management approach.

**TABLE 3.5**
**SUMMARY OF SURFACE CONDITIONS, TREATMENT TRAIN COMPONENTS AND ASSUMED AVERAGE ANNUAL TSS REMOVAL RATE**

| Surface Condition and Flow Path | Surface Condition Type | Average Annual TSS Removal Rate |
|---|---|---|
| Lot and natural areas draining diffusely to the environmental and not to road areas | 1 | 85% |
| Lot areas draining to Diamondwood Drive | 2 | 80% |
| Road areas draining to grassed swales and bioretention area | 3 | 85% |
| Road areas draining to grassed swales | 4 | 40% |

Note:
1. Units: TSS – Total Suspended Solids.

## TABLE 3.6
## ESTIMATION OF SITE AVERAGE ANNUAL TSS REMOVAL

| Sub-basin | Surface Condition Type | Drainage Area (ha) | Percent of Site Area | Effective TSS Removal | Overall TSS Removal |
|---|---|---|---|---|---|
| A1 | 1 | 1.95 | 15.5% | 85% | 13.2% |
| A2 | 1 | 1.65 | 13.1% | 85% | 11.1% |
| A3 | 4 | 0.05 | 0.4% | 40% | 0.2% |
| A4 | 1 | 2.57 | 20.4% | 85% | 17.4% |
| A5 | 1 | 1.70 | 13.5% | 85% | 11.5% |
| A6 | 1 | 1.62 | 12.9% | 85% | 10.9% |
| A7 | 1 | 1.66 | 13.2% | 85% | 11.2% |
| A8 | 3 | 1.25 | 9.9% | 85% | 8.4% |
| **A9** | 2 | 0.13 | 1.0% | 80% | 0.8% |
| **Totals:** | - | 12.58 | 100% | | 84.8% |

Note:
1. Units: ha – hectares; TSS – Total Suspended Solids.

### 3.7 Stormwater Management Assessment – Water Balance

The water balance related stormwater management criteria is retention of storm runoff from the first 5 millimetres (mm) of rainfall on the site through infiltration, evapotranspiration, and/or reuse. This is proposed to be achieved through the use of a combination of source, conveyance, and end-of-pipe measures. As far as practical, storm water from the lots will be separated from storm water from the road and directed via grading and sheet flow to grassed and naturalized areas. In addition, drainage from Street Awill be, as far as practical, directed to grassed swales and subsequently to a proposed bioretention area. Drainage from the shared condo driveway will be, as far as practical, directed to enhanced swales and grassed areas on Lots 1, 2 and 3. These elements will provide retention of storm water on-site by infiltration and evapotranspiration.

A “desk-top” accounting approach was used to calculate the typical depth of rainfall that would retained on-site. This approach was used to account for the various “treatment train” elements. The site was partitioned according to surface condition and an effective initial abstraction assumed for each surface condition based on flow path and “treatment train” component(s). The effective initial abstraction was assumed based on information provided in the Wet Weather Flow Management Guidelines (City of Toronto, 2006). With this approach, each initial abstraction value is multiplied by respective percent of site total area to determine the initial abstraction value for each surface condition. The sum of all initial abstraction values for each surface condition is equal to the initial abstraction of the site as a whole.

Summarized in Table 3.8 are the various types of surface conditions, flow paths and “treatment train” components, and assumed initial abstraction. Provided in Table 3.9 are computations for the site initial abstraction. Based on this approach, the calculated site initial abstraction is 11.4 mm. This indicates retention of storm water from the first 5 mm of rainfall on the site can be achieved with the proposed stormwater management approach.

## TABLE 3.8
## SUMMARY OF SURFACE CONDITIONS, TREATMENT TRAIN COMPONENTS AND ASSUMED INITIAL ABSTRACTION

| Surface Condition and Flow Path | Surface Condition Type | Initial Abstraction (mm) |
|---|---|---|
| Lot and natural areas draining diffusely to the environmental and not to road areas | 1 | 12.0 |
| Lot areas draining to Diamondwood Drive | 2 | 9.0 |
| Road areas draining to grassed swales and bioretention area | 3 | 6.5 |
| Road areas draining to grassed swales | 4 | 3.5 |

Note:
1. Units: mm – millimetres.

## TABLE 3.9
## SITE WATER BALANCE COMPUTATIONS AND ESTIMATION OF OVERALL INITIAL ABSTRACTION

| Sub-basin | Surface Condition Type | Drainage Area (ha) | Percent of Site Area | Effective Initial Abstraction (mm) | Overall Initial Abstraction (mm) |
|---|---|---|---|---|---|
| A1 | 1 | 1.95 | 15.5% | 12.0 | 1.9 |
| A2 | 1 | 1.65 | 13.1% | 12.0 | 1.6 |
| A3 | 4 | 0.05 | 0.4% | 3.5 | 0.01 |
| A4 | 1 | 2.57 | 20.4% | 12.0 | 2.5 |
| A5 | 1 | 1.70 | 13.5% | 12.0 | 1.6 |
| A6 | 1 | 1.62 | 12.9% | 12.0 | 1.5 |
| A7 | 1 | 1.66 | 13.2% | 12.0 | 1.6 |
| A8 | 3 | 1.25 | 9.9% | 6.5 | 0.6 |
| A9 | 2 | 0.13 | 1.0% | 9.0 | 0.1 |
| **Totals:** | - | 12.58 | 100% | - | 11.4 |

Note:
1. Units: ha – hectares; mm – millimetres.
2. Sub-basins 4 and 9 have been excluded from the analysis as there is either no or negligible development proposed.

## 3.8 Stormwater Management Assessment – Erosion Control

The erosion control related stormwater management criteria is that storm runoff from a 25 millimetre design storm be detained and released over a 48-hour period. This is proposed to be achieved through the use of extended detention in the bioretention area.

Retention time was estimated for the 25-mm design storm for the bioretention area. The results are summarized in Table 3.10. Retention time is computed based on the storage volume in the bioretention area used for the 25-mm design storm and assumed average release rate. The average release rate was assumed as 25% of the peak release rate. As shown in Table 3.10, projected retention time for runoff from the 25-mm design storm exceeds

48 hours. This indicates that stormwater management criteria for erosion control site can be achieved with the proposed stormwater management approach.

### TABLE 3.10
### SUMMARY OF BIORETENTION AREA RELEASE RATES FOR THE 25 MILLIMETRE DESIGN EVENT

| Storm Drainage Block | Sub-basin | Total Drainage Area (ha) | Peak Release Rate (cms) | Assumed Average Release Rate (cms) | Storage Volume Used (cu.m) | Retention Time (hr) |
|---|---|---|---|---|---|---|
| **Block 5** | **A8** | 1.25 | 0.001 | 0.00025 | 66.5 | 74 |

Note:

1. Units: ha - hectares; cms - cubic meters per second; cu.m - cubic meters; hr – hours.
2. Refer to Figure 3.1 for sub-basin delineation.
3. Refer to Appendix C for estimated 2-year through 100-year post-development peak flow rates and storage volumes.

## 4.0 ADAPTIVE STORMWATER MANAGEMENT PLAN

### 4.1 Monitoring

The adaptive stormwater management approach includes monitoring to collect additional information on site natural features and groundwater conditions, and assess the effectiveness of the proposed stormwater management strategy. The monitoring program would continue through the design phase, servicing construction phase, and for a term post-construction of services. It is anticipated that the monitoring program would be refined and updated as part of the adaptive stormwater management approach. Summarized in Table 4.1 is the proposed monitoring program.

### TABLE 4.1
### ADAPTIVE STORMWATER MANAGEMENT PLAN MONITORING PROGRAM

| **Category and Type of Monitoring** | **Description** | **Location** |
|---|---|---|
| **Design Phase** | | |
| Surface Water – Baseline Water Quality Sampling | 2 sampling rounds to establish baseline conditions | Wetland Features[2] |
| Surface Water – Wetland Water Levels | Continuous Monitoring | Wetland Features[2] |
| Groundwater – Baseline Water Quality Sampling | 2 sampling rounds to establish baseline conditions | Private Wells in 500 m Radius including select Site Monitoring Wells |
| Groundwater – Groundwater Levels - Site | Continuous Monitoring | Select Site Monitoring Wells[3] |
| **Construction Phase** | | |
| Surface Water – Wetland Water Levels | Continuous Monitoring | Wetland Features[2] |
| Groundwater – Water Quality Sampling | Pre and Post installation of site services | Private Wells in 500 m Radius including select Site Monitoring Wells |
| Groundwater – Groundwater Levels - Site | Continuous Monitoring | Site Monitoring Wells[3] |
| Erosion and Sediment Controls | Routine Inspection | per Erosion and Sediment Control Plan |
| **Post Services Construction** | | |
| Surface Water – Water Quality Sampling | annual sampling following installation of site services to 3 years post construction | Wetland Features[2] |
| Surface Water – Wetland Water Levels | Continuous Monitoring to 3 years post construction | Wetland Features[2] |
| Groundwater – Water Quality Sampling | Annually to 3 years post construction | Private Wells in 500 m Radius |
| Groundwater – Groundwater Levels - Site | Continuous Monitoring to 3 years post construction | Existing Monitoring Wells[3] |
| Erosion and Sediment Controls | Routine Inspection | per Erosion and Sediment Control Plan |
| LID Features | Annual Inspection, Review of Functionality, and Performance Reporting[4.5] | - |

Note:
1. Units: m – metres.
2. Wetland Features – select features to be determined.
3. Existing Monitoring Wells – select wells to be determined.
4. Performance Reporting is to include a summary and review of collected monitoring information.

5. Inspection and maintenance considerations for bioretention area are identified in Section 4.5.3 of the Low Impact Development Stormwater Management Planning and Design Guide (Credit Valley Conservation and Toronto and Region Conservation, 2010). Inspection and maintenance considerations for other types of LIDs are also identified in this document.

## 4.2 Indicators and Triggers

The below indicators are proposed to assess effectiveness of the proposed stormwater management strategy:

**Surface Water**

- water quality
- wetland water levels
- wetland water balance
- erosion

**Groundwater**

- water levels
- water quality

**Terrestrial/Wetland Resources**

- vegetation extents and flora/fauna present
- wildlife and amphibian present

Information from the monitoring program would be reviewed to identify change in water quality from baseline levels, and change in trends of wetland and groundwater levels. Identified changes would trigger an action plan comprising notification, review, and follow-up additional monitoring/assessment, and implementation of adaptive management measures, as required.

## 4.3 Management Framework and Contingency Planning

As part of the adaptive stormwater management strategy, an administration and contingency planning framework is proposed to be established. This framework would include:

- notification
- performance reporting
- process for implementing potential future adaptive stormwater management measures

Notification would comprise informing the Town of Caledon, Toronto and Region Conservation Authority, and Regional Municipality of Peel of any identified change in water quality from baseline levels or change in trends of wetland and groundwater levels.

Performance reporting would comprise provision of a report on annual basis containing the following information:

- a summary and interpretation of monitoring data and the performance of the Stormwater Management Plan based on established design criteria and performance objectives;

- an evaluation of the Stormwater Management Plan’s performance and ability to meet established design criteria and performance objectives, and its effect (if any) on the site wetland features and water balance;

- a description of any operating problems encountered and corrective actions taken during the reporting period and the need for further investigations in the following reporting period for Stormwater Management Plan refinements or ways of improving to meet established design criteria and performance objectives;

- any need for modifications of the monitoring program and/or the Stormwater Management Plan;

- a summary of any complaints received during the reporting period and any steps taken to address the complaints; and

- any other information that is deemed to have been obtained and is relevant for inclusion in the reports from time to time.

## 5.0 MINOR AND MAJOR DRAINAGE SYSTEM DESIGN

The minor and major drainage system will consist of the proposed road system and grassed swales. As much as practical, the existing natural drainage patterns will be maintained. The drainage system will be designed to manage storm water for up to the 100-year design storm consistent with Town of Caledon Development Standards, Policies, and Guidelines (2009) and Toronto and Region Conservation stormwater management criteria. Peak flows up to the 100-year design level would be contained within the municipal road right-of-way and bioretention area prior to release to the environment.

Summarized in Table 5.1 are site drainage conveyance features and design criteria. As shown in Table 5.1, drainage conveyance features have been sized to convey design peak flows. Supporting engineering drawings and design calculations are provided in Appendix E.

Design calculations were also undertaken for grassed swales along the road right-of-way to ensure the following:

- that flooding of private property will not occur under the 100-year design event; and
- that ditch average flow velocity will not exceed the maximum permissible average flow velocity that would result in erosion in a grassed channel.

The design calculations for grassed swales are provided in Table E.3 (Appendix E). The results of design calculations for grassed swales indicate for the 100-year design event that flow depths will range from 0.12 to 0.22 metres and flow velocities will range from 0.73 to 1.03 metres per second. The minimum grassed swale depth is 0.55 metres, therefore, the 100-year design event will be contained within the road right-of-way. Per the Ministry of Transportation Drainage Manual (1997), the maximum permissible average velocity for a grassed channel (erosion resistant soil) is in the order of 1.5 metres per second, therefore, the maximum permissible average flow velocity for grassed channels is not exceeded.

### TABLE 5.1
### SUMMARY OF DRAINAGE CONVEYANCE FEATURE CHARACTERISTICS

| Drainage Feature | Design Criteria | Type | Size | Hydraulic Capacity (cms) | Design Peak Flow (cms) |
|---|---|---|---|---|---|
| **Grassed Swales** | | | | | |
| Road Cross-Section | 100-year | Grassed Swale | V shaped with 4H:1V side slopes | Varies with slope | Varies with Location |
| **Road Crossings** | | | | | |
| Street to Block 5 | 100-year | Storm Sewer | 450 mm | 0.202 | 0.122 |
| Block 5 | 100-Year | Storm Sewer | 450 mm | 0.202 | 0.120 |

Note:
1. Units: cms – cubic metres per second; m – metres; mm – millimetres.
2. Design calculations for grassed swales and storm sewers are provided in Appendix E (tables E.1, E.2, E.3).

## 6.0 DRAINAGE SYSTEM OPERATION AND MAINTENANCE CONSIDERATIONS

Listed below are operation and maintenance considerations for the drainage system and stormwater management features. Inspection and maintenance considerations for bioretention area are identified in Section 4.5.3 of the Low Impact Development Stormwater Management Planning and Design Guide (Credit Valley Conservation and Toronto and Region Conservation, 2010). Inspection and maintenance considerations for other types of LIDs are also identified in this document.

1. Construction of the drainage works, specifically Low Impact Development (LID) features be scheduled and phased to ensure integrity is not compromised during construction.

2. Drainage works, stormwater management measures, and LID features be inspected on a routine basis to verify they are functioning as intended. This could include periodic inspections after major storm events to determine whether corrective actions are required. For the first two years following construction the LID features should be inspected quarterly and after major storm events. Subsequently, inspections should be conducted in the spring and fall of each year and after major storm events.

3. The grassed swales be maintained on a routine basis to remove any accumulated trash, mow grass, and remove woody material. It is anticipated that significant portions of the system will be maintained by the adjacent private property owners.

4. The grassed swale system be inspected on a routine basis and any identified erosion, gullies, rills, or bare spots repaired.

5. With respect to the bioretention area, summarized in Table 6.1 are suggested routine inspection and maintenance activities, and annual spring inspection and maintenance activities. This information is adapted from Credit Valley Conservation and Toronto and Region Conservation (2010).

6. Signage be posted indicating natural or environmental protection areas, and that they are not to be disturbed or altered without authorization from the Town of Caledon or Toronto Region Conservation Authority.

In addition to the above, operation and maintenance considerations for stormwater management facilities are outlined in the Town of Caledon Development Standards, Policies, and Guidelines (2009).

### TABLE 6.1
### BIORETENTION AREA INSPECTION AND MAINTENANCE ACTIVITIES

| **Activity/Inspection Item** | **Schedule/Corrective Action** |
|---|---|
| **Routine Inspection and Maintenance Activities** | |
| Inspect for vegetation density, damage by foot or vehicular traffic, channelization, accumulation of debris, trash and sediment, and structural damage to either pretreatment devices or outlet works. | After every major storm event, quarterly for first two years, and twice annually thereafter. |
| Regular watering may be required during the first two years until vegetation established. | As needed for the first two years of operation. |

| | |
|---|---|
| Remove trash and debris from pretreatment devices, bioretention area surface, and inlets and outlets. | At least twice annually. More frequently if desired for aesthetic reasons. |
| Remove accumulated sediment from pretreatment devices and inlet/outlet areas, remove accumulated sediment on bioretention area surface, trim trees and shrubs, replace vegetation and remove invasive growth, repair eroded or sparsely vegetated areas. | Annually or as needed. |
| **Annual Inspection Items and Corrective Actions** | |
| Vegetation health, diversity, and density. | Remove dead and diseased plants, add reinforcement planting to maintain desired vegetation density, prune woody matter, check soil pH for specific vegetation, add mulch to maintain 25 mm layer. |
| Sediment build-up and clogging of inlets/outlets. | Remove sand that may accumulate at the inlets/outlets or on the surface following snow melt, examine the contributing drainage area for bare soil and stabilize accordingly, check that pretreatment device or measures are properly functioning. |
| Ponding for more than 48 hours. | Check underdrain for clogging and flush out, apply core aeration or deep tilling, mix amendments into the soil, remove and replace top 75 mm of bioretention soil. |

## 7.0 SANITARY AND WATER SERVICING PLAN

The proposed Laurelpark subdivision will be serviced with municipal water and private on-site sewage disposal systems. Consistent with Section 44 (4) of the Oak Ridges Moraine Conservation Plan (ORMCP), the construction of partial services is permitted within the Palgrave Estates Residential Community. Section 43 of the ORMCP requires that water and sewage services maintain the ecological integrity of hydrological features and key natural heritage features, maintain quantity and quality of groundwater and surface water, maintain stream baseflows, comply with the applicable watershed plan and water budget and conservation plan, that the water use projected for the development will be sustainable, and that water and service trenches be planned designed and constructed so as to keep disruption of natural groundwater flow to a minimum.

The Regional Municipality of Peel Official Plan requires that proposals for water infrastructure within or crossing areas designated as Protected Countryside demonstrate that:

- servicing can be provided in a manner that does not negatively impact ecological features and functions, quality and quantity of ground and surface water, including stream baseflow, and is sufficient to accommodate the proposed use;

- applicable recommendations, standards or targets within watershed plans and water budgets are reflected; and

- any sewage and water servicing installation is planned, designed and constructed to minimize surface and groundwater disruption.

The sanitary and water servicing plan for the proposed Laurelpark subdivision is consistent with these policies. For instance, proposed services are shallow in depth and will not impact the local and regional groundwater regime.

### 7.1 Sanitary Servicing Plan

Consistent with Section 7.1.8.1 of the Town of Caledon Official Plan, sanitary servicing for the proposed subdivision will be by individual on-site sewage disposal systems (e.g., septic systems) conforming to the Ontario Building Code. Subject to detailed design at the Building Permit application stage, it is anticipated that the on-site sewage disposal systems would comprise a septic tank(s) sized at twice the daily design flow, effluent filter, tertiary treatment unit, dispersal bed, and ancillary piping, pumping system(s), and controls. A tertiary treatment unit is anticipated to be required to fit the respective area bed within the lot structure envelope in conjunction with the dwelling and driveway features. Alternative tertiary treatment units can be found in Supplementary Standard SB-5, Approved Treatment Units, of the Ontario Building Code.

Illustrated on drawings 16-168-A-1 and 16-168-A-2 (Appendix E) are preliminary grading plans for the subdivision with preliminary sitings of the dwellings and dispersal beds. As shown, the dispersal beds have been sited on lands within structure envelopes where the slope is less than 10% consistent with Section 7.1.9.11 of the Town of Caledon Official Plan. It should be noted that the maximum slope for siting of dispersal or leaching beds, per the Ontario Building Code, is 25% (i.e., 4 horizontal to 1 vertical). Section 7.1.9.32 of the PERCSP identifies that sewage disposal systems will be normally located a minimum of 30 metres from any pond or stream to minimize nutrient enrichment. Proposed preliminary sitings for dispersal beds associated with sewage disposal systems are consistent with this policy.

The septic system dispersal bed sizes shown on the grade control plans are based on the following assumptions:

- the lots will be serviced with a dispersal bed of 400 square metres; and
- in-situ soil percolation rate or \`T\` time is greater than 50 minutes per centimeter.

With a typical tertiary treatment system, a dispersal bed with a size of 400 square metres and in-situ soil percolation rate or \`T\` time of greater than 50 minutes per centimeter can accommodate a maximum daily design flow of 3,200 litres per day.

By way of example, a maximum daily design flow of 3,200 litres per day is representative of an approximately 320 square metre (3,444 square foot) home with four bedrooms. This is consistent with the size of homes anticipated for the proposed subdivision.

It is anticipated detailed engineering design of the on-site sewage disposal will be undertaken at the Building Permit application stage and reflect site specific soil conditions and house designs. Detailed design of the on-site sewage disposal systems would be in general conformance with the Ontario Building Code.

## 7.2 Water Servicing Plan

### 7.2.1 Water Demand

The proposed subdivision comprises 8 estate residential lots. The estimated water demand is summarized in Table 7.1.

**TABLE 7.1**
**ESTIMATED WATER DEMAND**
**LAURELPARK SUBDIVISION**

| Population Type | Number of Units | Population Density | Average Consumption Rate (L/cap/day) | Subdivision Average Day Consumption (L/day) | Subdivision Max. Day Consumption (L/day) | Subdivision Peak Hour Consumption (L/hour) |
|---|---|---|---|---|---|---|
| Residential | 8 | 2.7 | 280 | 6,048 | 12,096 | 2,660 |

Note:
1. Units: L/cap/day – litres per capita per day; L/day – litres per day; L/hour – litres per hour.
2. Consumption values determined by rounding the total subdivision population to 22 people.

### 7.2.2 Water Supply and Distribution

The Laurelpark Subdivision will be serviced by municipal water. There is an existing 300 millimetre diameter watermain located on the west side of Mount Pleasant Road and a 50 millimetre watermain on the Diamondwood Drive cul-de-sac. It is proposed that lots 4 through 8 on Street ‘A’ of the Laurelpark Subdivision will be serviced by a 150 millimetre diameter watermain that would be connected to the 300 millimetre watermain on Mount Pleasant Road.

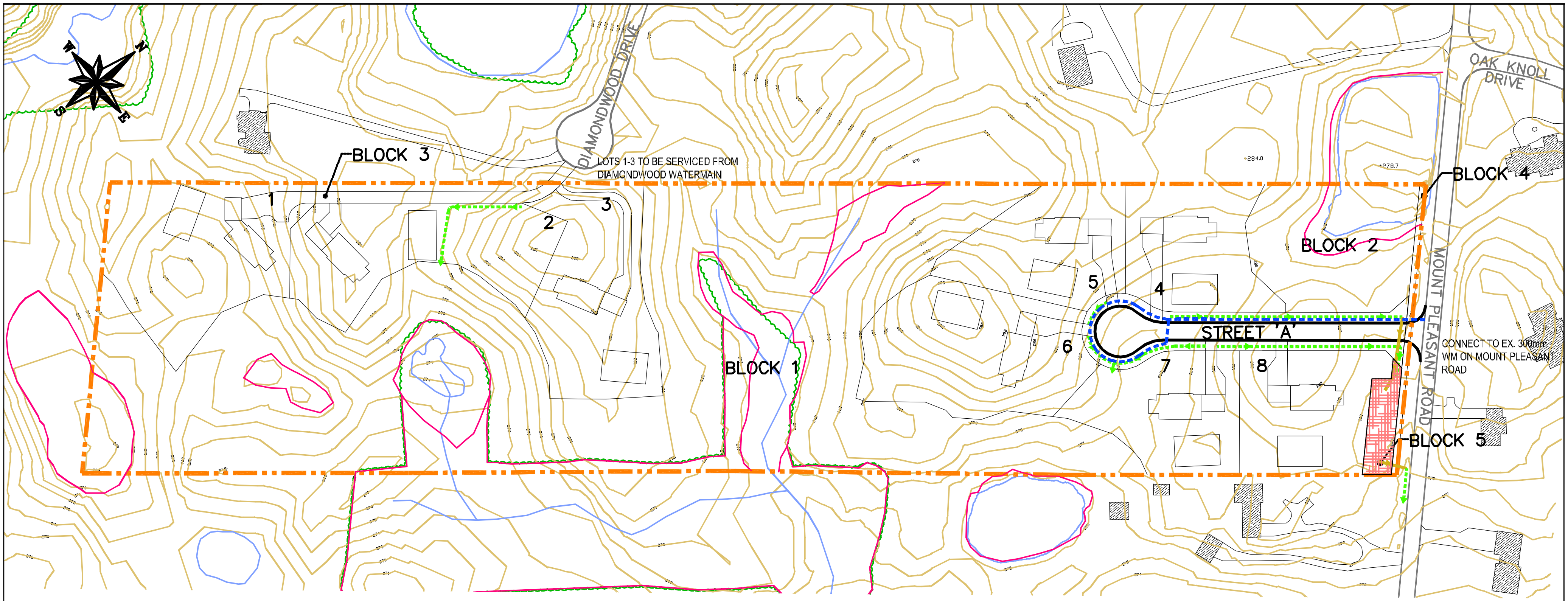
The Street ‘A’ watermain would be complete with required appurtenances such as valving and hydrants. A schematic of the water serving plan is provided in Figure 7.1.

The water services for lots 1, 2, and 3 would be connected to the existing 50 millimetre diameter watermain on Diamondwood Drive.

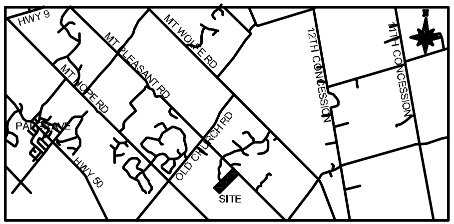
The water distribution system would be designed, supplied, and installed in general conformance with the Region of Peel Public Works Design, Specifications and Procedures Manual, Linear Infrastructure, Watermain Design Criteria (2010).

### 7.2.3 Water Services

All water services will be single service connections that are supplied and installed in general conformance with the Region of Peel Public Works Design, Specifications and Procedures Manual, Linear Infrastructure, Watermain Design Criteria (2010). The minimum water service size will be 25 millimetres (mm) consistent with Region of Peel design criteria.



KEY PLAN



TOWN OF CALEDON NTS

LEGEND

| | |
|---|---|
| ▬ · · ▬ | PROPERTY LINE |
| ➝ | PROPOSED DITCH |
| ➝ | PROPOSED STORM SEWER |
| ▬ ▬ ▬ | PROPOSED WATERMAIN |
| ▨ | PROPOSED SWM BLOCK |

NOTES

1. CONTOURS GENERATED FROM ORTHOPHOTOGRAPHY DEVELOPED IN THE SPRING OF 2002 AND SURVEYED ELEVATIONS BY CALDER ENGINEERING LTD. (2017) AND EPLETT WOROBEC RAIKES SURVEYING LTD. (2015). ACTUAL ELEVATIONS MAY VARY FROM THOSE SHOWN.
2. CONTOUR INTERVAL IS 1m.
3. FEATURE LOCATIONS (e.g. TREELINES, BUILDINGS, ETC.) ARE APPROXIMATE.

50m 0 50m 100m

**Calder Engineering Ltd.**
T 905-857-7600 W www.caldereng.com

THE CORPORATION OF THE
TOWN OF CALEDON

LAURELPARK INC.

LAURELPARK SUBDIVISION
PART OF EAST HALF OF LOT 19, CONCESSION 8
TOWN OF CALEDON, REGION OF PEEL

FIGURE 7.1
PROPOSED WATERMAIN SERVICING

## 8.0 ROADWAY AND GRADING

### 8.1 General Description and Location

Access to the Laurelpark Subdivision would be from Mount Pleasant Road for lots in the eastern part of the site (i.e., lots 4-8) and from Diamondwood Drive for lots in the western part of the site (i.e., lots 1-3). The internal road layout is shown in Figure 2.1 and the prelimimary grading plans provided in Appendix E. As shown in Figure 2.1, the road network comprises one street designated as Street ‘A’. Street ‘A’ is a cul-de-sac which starts at Mount Pleasant Road and extends approximately 170 metres west.

The proposed road associated with Street ‘A’ will comprise a combined rural and urban road cross-section. The right of way width for Street ‘A’ would be 20 metres. The pavement width would be 7.9 metres consistent with Town of Caledon Standard No. 202.

The cross section of Street A (refer to Figure 8.1) would comprise a curbed road with grass swales to better reflect the rural setting, accept drainage from adjacent lots where applicable, encourage passive infiltration of storm water, provide linear storage in the conveyance system to dampen hydrologic response, and provide pre-treatment of storm water prior to discharge to the bioretention area. Within the road right of way, where applicable, driveway culverts would be provided for the lots and also, if required, to access infrastructure such as fire hydrants and transformers. Where possible, the utilities and services would be located along one side of the road. Drainage from the paved section of road to the grass swales would be via curb outlets.

Lots 1, 2, and 3 are proposed to be accessed by a common driveway off Diamondwood Drive.

### 8.2 Road Design

The proposed road alignment and preliminary road grades are shown on the engineering drawings provided in Appendix E. Design of the road in both plan and profile is in general conformance with Town of Caledon Development Standards, Policies, and Guidelines. A schematic of the typical road cross-section for Street ‘A’ is provided in Figure 8.1.

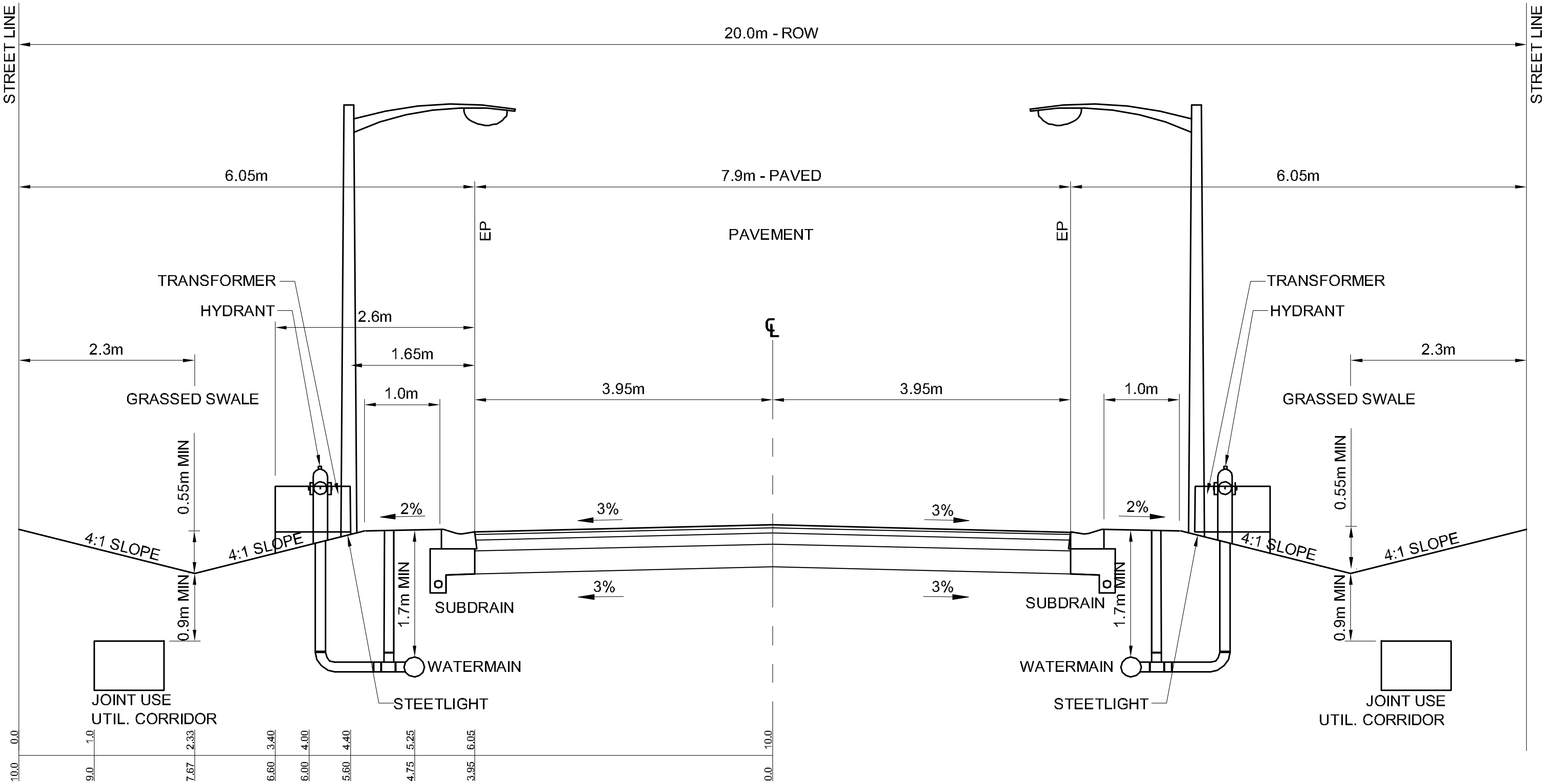


**FIGURE 8.1**

**LAURELPARK SUBDIVISION - PROPOSED TYPICAL 20.0m ROW ROAD CROSS SECTION**

**SCALE: N.T.S.**

Calder Engineering Ltd.

## 9.0 EROSION AND SEDIMENT CONTROL

### 9.1 General

An Erosion and Sediment Control Plan will be prepared at the detailed design stage consistent with the Town of Caledon Development Standards, Policies & Guidelines (2009) and the Erosion & Sediment Control Guideline for Urban Construction prepared by the Greater Golden Horseshoe Area Conservation Authorities (2006). For project construction, the key items will be limiting construction activities to defined working areas, managing water from dewatering activities, and managing surface runoff. Summarized in Table 9.1 are general procedures and mitigation measures to be implemented to avoid impacts.

**TABLE 9.1**
**GENERAL PROCEDURES AND MITIGATION MEASURES FOR EROSION AND SEDIMENT CONTROL**

| Principle No. | Description |
|---|---|
| 1. | Prepare a typical Erosion and Sediment Control Plan for the project construction outside of stream crossings and water bodies. |
| 2. | Install temporary sediment controls prior to the start of construction per the typical details on the Erosion and Sediment Control Plan. |
| 3. | Delineate the working area prior to the start of construction and confine operations to the defined area. |
| 4. | Enclose temporary topsoil and subsoil stockpile areas with sediment control fence. |
| 5. | Maintain construction accesses, working areas, and temporary material storage areas in good repair. |
| 6. | Operate machinery in a manner that minimizes disturbance to the environment:<br>- protect entrances at machinery access points (e.g., using swamp mats, log mats, or rock pads), and establish single site entry and exit points.<br>- construction equipment and machinery to arrive on site in a clean condition and be maintained free of fluid leaks.<br>- no equipment operation on the streambed and in flowing water.<br>- wash, refuel and service machinery and store fuel and other materials in designated areas away from water bodies.<br>- keep an emergency spill kit on site in case of fluid leaks or spills. |
| 7. | Inspect, maintain, and repair sediment controls until completion of construction and site restoration. |
| 8. | Keep additional erosion and sediment control materials, such as sediment control fencing and clearstone, on-site for emergencies and repairs. |
| 9. | Remove and dispose temporary sediment controls following completion of construction and site restoration. |
| 10. | Vegetate any disturbed areas by planting and seeding preferably with native grasses and cover such areas with mulch to prevent soil erosion and to help seeds germinate. If there is insufficient time remaining in the growing season, the site should be stabilized (e.g., cover exposed areas with mulch, straw, or erosion control blankets to keep the soil in place and prevent erosion) and vegetated the following growing season. |

The erosion and sediment controls will comprise management actions and measures to be implemented prior to any land grading or construction activities on the site. Consistent with the Town of Caledon Development Standards, Policies & Guidelines (2009), erosion and temporary sediment controls would be inspected on a weekly basis and after each rain event 10 millimetres or greater or a significant snow melt. These inspections would ensure that the controls are in proper working condition and maintained. A permanent record of these inspections is required to be forwarded to the Town of Caledon Public Works and Engineering Department within five days of the inspection.

All disturbed ground left inactive, including topsoil stockpiles, would be stabilized by seeding, sodding, mulching or covering, or equivalent control measures. The period of time of inactivity shall not exceed 30 days, unless otherwise authorized by the Project Manager.

## 9.2 Topsoil Management Plan

Consistent with the Town of Caledon Development Standards, Policies & Guidelines (2009), all stockpiles containing more than 100 cubic metres of material shall be located a minimum of 10 metres away from the roadway, drainage channels, or an occupied residential lot. The maximum side-slopes for topsoil stockpiles shall be 1.5 horizontal to 1.0 vertical. Location of topsoil stockpiles on lands to be dedicated to the public is prohibited. Topsoil stockpiles shall be located, where possible, on private lands between houses and on rear yards.

The Geotechnical Report for the project prepared by Terraprobe Inc. (2017) has identified a 250 to 400 mm layer of topsoil across the site. Construction of site services will involve stripping and stockpiling of topsoil associated with the road right of way and a strip along the right of way to facilitate grading. The lots would not be graded until house construction.

Based on an assumed average topsoil depth of 300 mm, it is estimated that the volume of topsoil to be managed during the site servicing phase is 2,000 cubic metres. The estimated 2,000 cubic metres of topsoil would be managed as follows:

- 2,000 cubic metres stripped from the road right-of-way plus an average width of 5 metres and stockpiled

- 1,500 cubic metres of topsoil removed from the stockpiles and placed on the boulevard areas

- the remaining 500 cubic metres of topsoil from the stockpiles spread on the lots as lot and house construction progresses.

It is anticipated that no topsoil will be either exported from the site or imported to the site.

Each estate lot, within the structure envelope, will be individually graded based on house design and orientation, and driveway and septic system design. Topsoil would remain on the property during grading. Once house, driveway, septic system construction, and lot grading is completed, the topsoil would be spread and seeded. Any lots with a topsoil deficit could have material supplemented from the topsoil stockpiles.

The location of topsoil stockpiles would be determined following Draft Plan approval at the detailed design stage. For erosion and sediment control planning, it would be specified that any stockpiles remaining at the end of the season will be hydroseeded with a native seed mixture and closed off with full perimeter siltation fencing.

## 9.3 Emergency Contact Information

As part of the erosion and sediment control planning process, a copy of emergency contact numbers would be kept on-site and readily available. An example emergency contact list is provided in Table 9.1. The applicable contacts would be confirmed at the construction stage.

**TABLE 9.1**
**EMERGENCY CONTACT LIST**

| Name/Agency | Phone Number |
|---|---|
| Town of Caledon – Public Works | (905) 584-2272 |
| Toronto and Region Conservation | (416) 661-6600 |
| Ministry of Environment Spills Reporting | (416) 325-3000 |
| Toronto Water 24 hour Spills Reporting | (416) 338-8888 |
| Owner – Laurelpark Inc. | (905) 822-2615 |
| Project Engineer – Calder Engineering Ltd. | (905) 857-7600 |

## 10.0 UTILITY SERVICES

It is proposed that private gas and communication utilities will be provided for the Laurelpark Subdivision by connection to existing utilities either (i) in vicinity of the intersection of Oak Knoll Drive and Mount Pleasant Road, (ii) along Mount Pleasant Road, or (iii) available from Diamondwood Drive. Oak Knoll Drive is located approximately 130 metres north of the proposed entrance to the Laurelpark Subdivision.

Electrical power to the site will be provided by connection to existing power line infrastructure either on Mount Pleasant Road or Diamondwood Drive.

## 11.0 SUMMARY

1. Calder Engineering Ltd. has been retained by Laurelpark Inc. to complete a Preliminary Engineering and Stormwater Management Report for the proposed Laurelpark Subdivision residential development in the Palgrave Estate Residential Community of the Town of Caledon. The report is supporting documentation for the respective subdivision Draft Plan application and has been prepared to meet requirements of sections 7.1.18.7 and 7.1.18.8 of the Town of Caledon Official Plan and applicable sections of the Oak Ridges Moraine Conservation Plan (Ontario Regulation 140/02).

2. The overall site comprises approximately 10.38 hectares or 25.64 acres. It is proposed to develop the site with 8 estate residential lots using a combined rural and urban road cross-section, individual private septic systems for sewage disposal, and municipal water. Drainage and storm water would be managed using an adaptive stormwater management approach and application of Low Impact Development (LID) practices. The objective of the adaptive stormwater management approach is to provide the framework and process for meeting Town of Caledon and Conservation Authority stormwater management criteria, and protection of site environmental features.

3. The site is part of the Humber River Watershed. Surface flow on the site is typically via sheet flow to the topographic lows and then off-site via either intermittent or ephemeral drainage features. A portion of the site drains northward and a portion drains southward: both to tributaries of Cold Creek which is part of the Humber River Watershed. Cold Creek is a tributary of the main branch of the Humber River. The site falls within the jurisdiction of the Toronto Region Conservation Authority.

4. Drainage and storm water would be managed using an adaptive stormwater management approach and application of Low Impact Development (LID) practices. The objective of the adaptive stormwater management approach is to provide the framework and process for meeting Town of Caledon and Conservation Authority stormwater management criteria and protection of site environmental features. The approach includes:

    - establishment of stormwater management criteria
    - establishment of performance objectives
    - outline of a stormwater management strategy
    - monitoring to gain additional information on site natural features and groundwater conditions
    - identification of indicators to assess effectiveness of the stormwater management strategy
    - identification of triggers to initiate review of the stormwater management strategy
    - development of contingency plans and adaptive management measures to offset any identified impacts

5. The proposed stormwater management strategy comprises a “treatment train” approach utilizing a combination of lot level controls and Low Impact Development (LID) measures to minimize potential increases in volume of runoff and provide, as far as practical, a natural hydrologic response. Measures are proposed to be undertaken at the source, and conveyance and end of pipe locations, and are as follows:

   - recharge of residential roof and driveway storm water by direction to grassed and naturalized areas to promote filtering and natural infiltration;
   - discharge of foundation drain water to rear and side lot areas;
   - by lot grading, direction of structure envelope drainage, via sheet flow, towards grassed and naturalized areas versus the road right of way;
   - as far as practical, application of grassed swales for road drainage versus a piped storm sewer system;
   - minimization of road drainage to the wetland features;
   - use of a bioretention area to temporarily detain and slowly release storm water to meet applicable stormwater management criteria; and
   - use of filter strips and level spreaders to diffusely discharge storm water.

   The use of grassed swales versus a piped storm sewer system is proposed to encourage passive infiltration of storm water, provide linear storage in the conveyance system to dampen hydrologic response, and provide pre-treatment of storm water prior to discharge to the proposed bioretention area.

6. Hydrologic modelling and “desk-top” assessments were performed to develop and evaluate the proposed Stormwater Management Plan. Based on the respective technical analyses, proposed stormwater management criteria for quantity control, quality control, erosion control, and water balance can be achieved.

7. The minor and major drainage system will consist of both the proposed road system, grassed swales, and storm sewers. As much as practical, the existing natural drainage patterns will be maintained. The drainage system will be designed to manage storm water for up to the 100-year design storm consistent with Town of Caledon Development Standards, Policies, and Guidelines (2009) and Toronto and Region Conservation stormwater management criteria. Peak flows up to the 100-year design level would be contained within the municipal road right-of-way, and a bioretention area prior to release to the environment.

8. Sanitary servicing for the proposed subdivision will be by individual on-site sewage disposal systems (e.g., septic systems). Subject to detailed design at the Building Permit application stage, it is anticipated that the on-site sewage disposal systems would comprise a septic tank(s) sized at twice the daily design flow, effluent filter, tertiary treatment unit, dispersal bed, and ancillary piping, pumping system(s), and controls. A tertiary treatment unit is anticipated required to fit the respective dispersal bed within the lot structure envelope in conjunction with the dwelling and driveway features.

9. The Laurelpark Subdivision will be serviced by municipal water. There is an existing 300 millimetre diameter watermain located on the west side of Mount Pleasant Road and a 50 millimetre watermain on the Diamondwood Drive cul-de-sac. It is proposed that lots 4 through 8 on Street ‘A’ of the Laurelpark Subdivision will be serviced by a 150 millimetre diameter watermain that would be connected to the 300 millimetre watermain on Mount Pleasant Road. The Street ‘A’ watermain would be complete with required appurtenances such as valving and hydrants. The water services for lots 1, 2, and 3 would be connected to the existing 50 millimetre diameter watermain on Diamondwood Drive. The water distribution system would be designed, supplied, and installed in general conformance with the Region of Peel Public Works Design, Specifications and Procedures Manual, Linear Infrastructure, Watermain Design Criteria (2010).

10. Considerations are provided for erosion and sediment control planning. Erosion and Sediment Control Plans have been prepared consistent with the Town of Caledon Development Standards, Policies & Guidelines (2009) and the Erosion & Sediment Control Guideline for Urban Construction prepared by the Greater Golden Horseshoe Area Conservation Authorities (2006).

Respectfully submitted,

**CALDER ENGINEERING LTD.**

Robert J. Whyte

Robert J. Whyte, M.Sc., P.Eng.
Project Manager

LICENSED PROFESSIONAL ENGINEER
R. J. WHYTE
30/06/2017
PROVINCE OF ONTARIO

## REFERENCES

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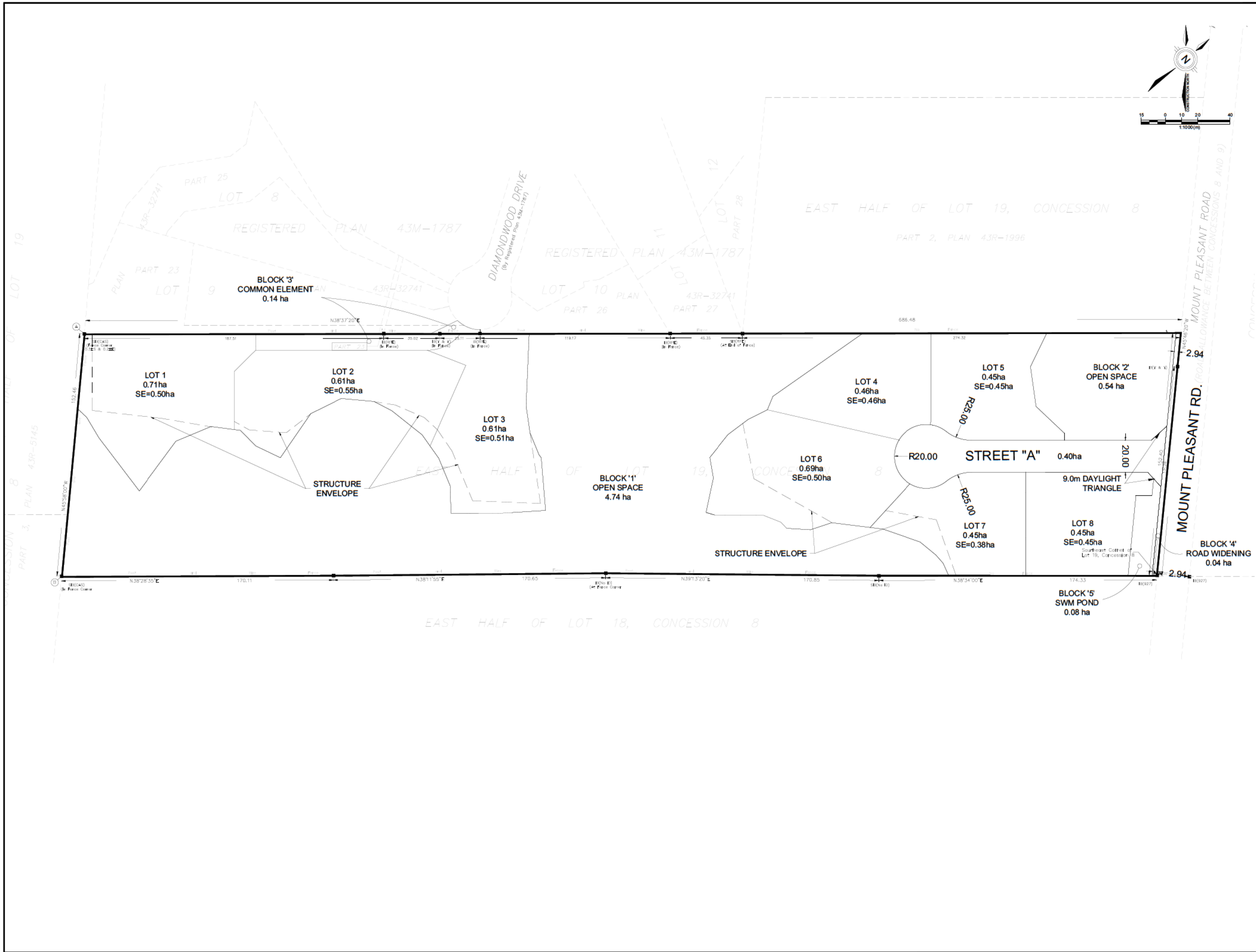
# APPENDIX A

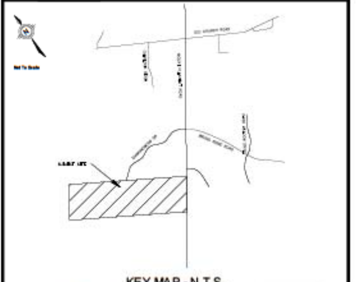
# DRAFT PLAN



# DRAFT PLAN OF SUBDIVISION

## LAURELPARK ESTATES

SKETCH OF
PART OF THE EAST HALF OF LOT
19, CONCESSION 8
(GEOGRAPHIC TOWNSHIP OF ALBION)
TOWN OF CALEDON
REGIONAL MUNICIPALITY OF PEEL



KEY MAP - N.T.S.

**BENCHMARK**

**INFORMATION REQUIRED**

UNDER SECTION 51(17) OF THE PLANNING ACT, R.S.O. 1990, c.P.13 AS AMENDED

(a) - AS SHOWN
(b) - AS SHOWN
(c) - AS SHOWN
(d) - AS LISTED BELOW
(e) - AS SHOWN
(f) - AS SHOWN
(g) - AS SHOWN
(h) - MUNICIPAL WATER
(i) - GLACIAL TILL
(j) - AS SHOWN
(k) - SEPTIC SANITARY AND STORM SEWERS
(l) - NONE

**SURVEYOR'S CERTIFICATE**

I HEREBY CERTIFY THAT THE BOUNDARIES OF THE LANDS TO BE SUBDIVIDED ON THIS PLAN AND THEIR RELATIONSHIP TO THE ADJACENT LANDS ARE ACCURATELY AND CORRECTLY SHOWN.

SIGNED ______________________

DATE __________

**OWNER'S CERTIFICATE**

I HEREBY CONSENT TO THE FILING OF THIS PLAN BY IBI GROUP, IN DRAFT FORM.

SIGNED ______________________
MARK CROWE
HARBOUR VIEW INVESTMENTS LIMITED

DATE __________

**LAND USE SCHEDULE**

| LOTS/BLKS | LAND USE | AREA ha | POTENTIAL # OF UNITS MIN | MAX |
|---|---|---|---|---|
| RESIDENTIAL | | | | |
| LOTS 1-8 | ESTATE RESIDENTIAL | 4.44 | 8 | 8 |
| BLKS. 1-2 | OPEN SPACE | 5.28 | | |
| BLK. 3 | COMMON ELEMENT | 0.14 | | |
| BLK. 4 | ROAD WIDENING | 0.04 | | |
| BLK. 5 | SWM | 0.08 | | |
| ROW | | 0.40 | | |
| TOTAL | | 10.38 | 8 | 8 |

**REVISIONS**

| # | DATE | BY | DESCRIPTION |
|---|---|---|---|
| 1 | | | |

**APPROVALS**

APPROVED: DATE:

| | | | |
|---|---|---|---|
| DESIGNED BY: | GD | DATE: | 20170613 |
| DRAWN BY: | GD | FILE NUMBER: | 30477 |
| CHECKED BY: | SA | SHEET NUMBER: | DP1 |

IBI GROUP
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ibigroup.com

FILE: J:\39680_Laurelpark\5.9 Drawings\59plnl\current\39680_Laurelpark_DP_20170509.dwg LAYOUT: Draft Plan
SAVED BY: Gavin.davis, Tuesday, June 13, 2017 4:03:21 PM PLOTTED BY: Gavin Davis Tuesday, June 20, 2017 11:19:40 AM

# APPENDIX B

# GEOTECHNICAL DOCUMENTS

# APPENDIX

TERRAPROBE INC.

Terraprobe

# ABBREVIATIONS AND TERMINOLOGY

## SAMPLING METHODS

| | |
|---|---|
| AS | auger sample |
| CORE | cored sample |
| DP | direct push |
| FV | field vane |
| GS | grab sample |
| SS | split spoon |
| ST | shelby tube |
| WS | wash sample |

## PENETRATION RESISTANCE

**Standard Penetration Test (SPT)** resistance ('N' values) is defined as the number of blows by a hammer weighing 63.6 kg (140 lb.) falling freely for a distance of 0.76 m (30 in.) required to advance a standard 50 mm (2 in.) diameter split spoon sampler for a distance of 0.3 m (12 in.).

**Dynamic Cone Test (DCT)** resistance is defined as the number of blows by a hammer weighing 63.6 kg (140 lb.) falling freely for a distance of 0.76 m (30 in.) required to advance a conical steel point of 50 mm (2 in.) diameter and with 60° sides on 'A' size drill rods for a distance of 0.3 m (12 in.)."

## COHESIONLESS SOILS

| Compactness | 'N' value |
|---|---|
| very loose | < 4 |
| loose | 4 – 10 |
| compact | 10 – 30 |
| dense | 30 – 50 |
| very dense | > 50 |

## COHESIVE SOILS

| Consistency | 'N' value | Undrained Shear Strength (kPa) |
|---|---|---|
| very soft | < 2 | < 12 |
| soft | 2 – 4 | 12 – 25 |
| firm | 4 – 8 | 25 – 50 |
| stiff | 8 – 15 | 50 – 100 |
| very stiff | 15 – 30 | 100 – 200 |
| hard | > 30 | > 200 |

## COMPOSITION

| Term (e.g) | % by weight |
|---|---|
| *trace* silt | < 10 |
| *some* silt | 10 – 20 |
| silt*y* | 20 – 35 |
| sand *and* silt | > 35 |

## TESTS AND SYMBOLS

| | |
|---|---|
| MH | mechanical sieve and hydrometer analysis |
| w, $w_c$ | water content |
| $w_L$, LL | liquid limit |
| $w_P$, PL | plastic limit |
| $I_P$, PI | plasticity index |
| k | coefficient of permeability |
| $\gamma$ | soil unit weight, bulk |
| $G_s$ | specific gravity |
| $\varphi'$ | internal friction angle |
| c' | effective cohesion |
| $c_u$ | undrained shear strength |

| | |
|---|---|
| ▽ | Unstabilized water level |
| ▼ | 1st water level measurement |
| ▼ | 2nd water level measurement |
| ▼ | Most recent water level measurement |
| 3.0 + | Undrained shear strength from field vane (with sensitivity) |
| $C_c$ | compression index |
| $c_v$ | coefficient of consolidation |
| $m_v$ | coefficient of compressibility |
| e | void ratio |

## FIELD MOISTURE DESCRIPTIONS

| | |
|---|---|
| **Damp** | refers to a soil sample that does not exhibit any observable pore water from field/hand inspection. |
| **Moist** | refers to a soil sample that exhibits evidence of existing pore water (e.g. sample feels cool, cohesive soil is at plastic limit) but does not have visible pore water |
| **Wet** | refers to a soil sample that has visible pore water |

# BOREHOLE LOGS

TERRAPROBE INC.

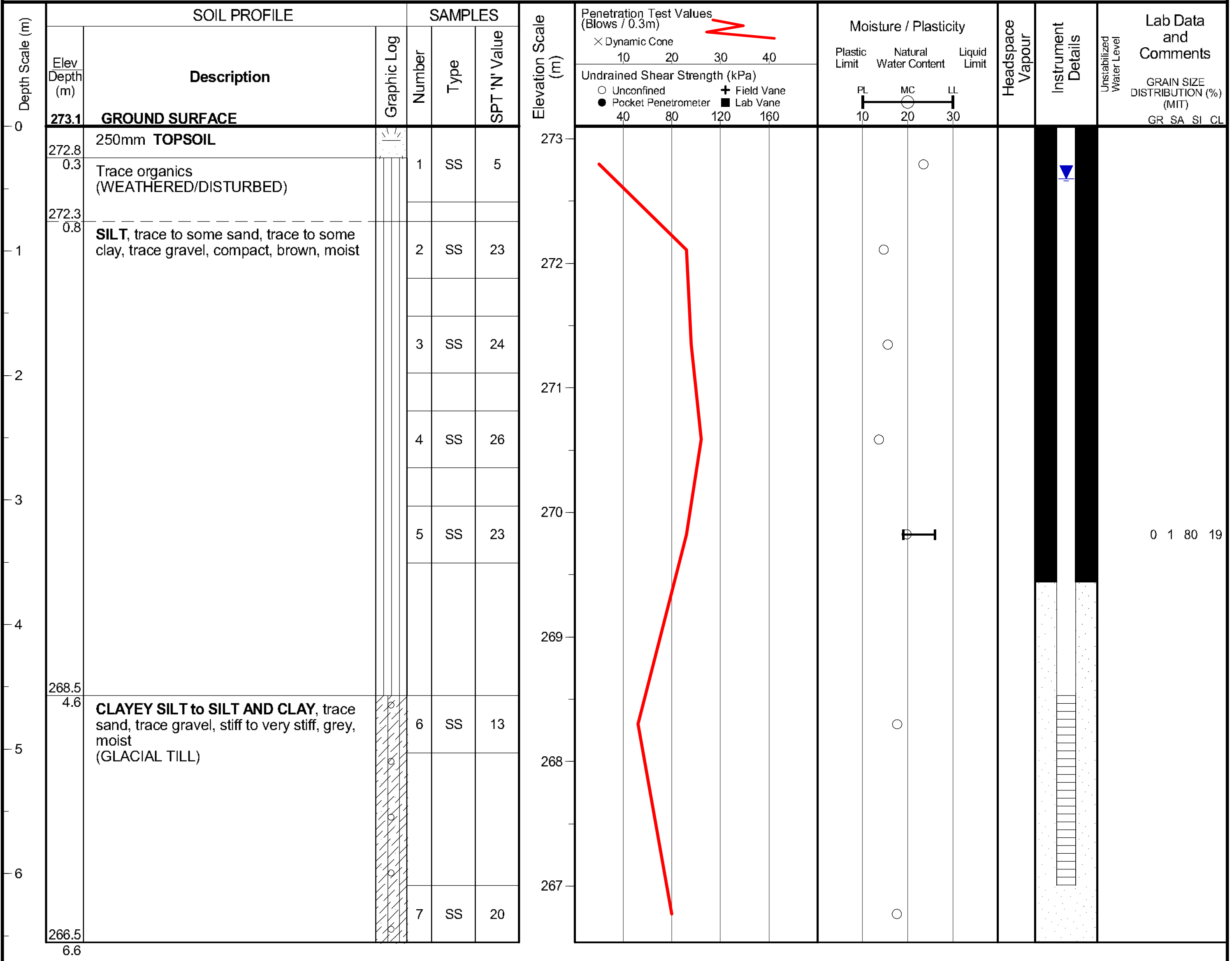
**Terraprobe**

# BOREHOLE LOG 1

Client : Laurelpark Inc.
Project : Palgrave Estates II
Location : Caledon, Ontario

Project No.: 11-13-3052
Date started : May 16, 2013
Sheet No. : 1 of 1

Position : E: 598025, N: 4865443 (UTM 17T)
Rig type : track-mounted
Elevation Datum : Geodetic (NAD83)
Drilling Method : Solid stem augers



| Elev / Depth (m) | Description | Number | Type | SPT 'N' Value | GR | SA | SI | CL |
|---|---|---|---|---|---|---|---|---|
| 273.1 | **GROUND SURFACE** | | | | | | | |
| 272.8<br>0.3 | 250mm **TOPSOIL** | | | | | | | |
| | Trace organics (WEATHERED/DISTURBED) | 1 | SS | 5 | | | | |
| 272.3<br>0.8 | **SILT**, trace to some sand, trace to some clay, trace gravel, compact, brown, moist | 2 | SS | 23 | | | | |
| | | 3 | SS | 24 | | | | |
| | | 4 | SS | 26 | | | | |
| | | 5 | SS | 23 | 0 | 1 | 80 | 19 |
| 268.5<br>4.6 | **CLAYEY SILT to SILT AND CLAY**, trace sand, trace gravel, stiff to very stiff, grey, moist (GLACIAL TILL) | 6 | SS | 13 | | | | |
| | | 7 | SS | 20 | | | | |
| 266.5<br>6.6 | **END OF BOREHOLE** | | | | | | | |

Borehole was dry and open upon completion of drilling.

WATER LEVEL READINGS

| Date | Water Depth (m) | Elevation (m) |
|---|---|---|
| May 24, 2013 | 0.4 | 272.7 |

**Terraprobe**

# BOREHOLE LOG 2

Client : Laurelpark Inc.
Project : Palgrave Estates II
Location : Caledon, Ontario

Project No.: 11-13-3052
Date started : May 16, 2013
Sheet No. : 1 of 1

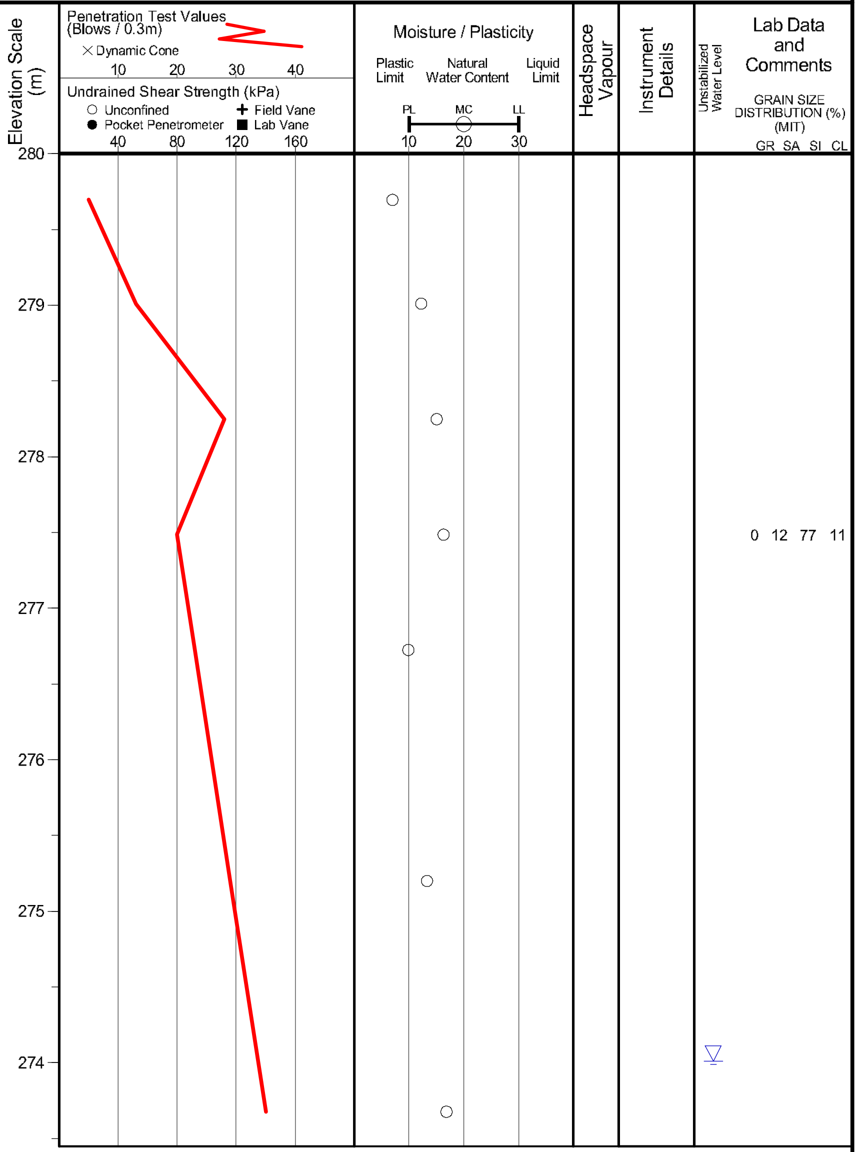
Position : E: 598111, N: 4865495 (UTM 17T)
Rig type : track-mounted
Elevation Datum : Geodetic (NAD83)
Drilling Method : Solid stem augers

## SOIL PROFILE

| Elev Depth (m) | Description |
|---|---|
| 280.0 | **GROUND SURFACE** |
| | 300mm **TOPSOIL** |
| 279.7<br>0.3 | Trace organics (WEATHERED/DISTURBED) |
| 279.2<br>0.8 | **SILT**, trace to some sand, trace to some clay, trace gravel, (possible intermittent sand seams), compact, brown, moist<br>...silty sand |
| 273.9<br>6.1 | **CLAYEY SILT**, trace sand, trace gravel, hard, brown, moist (GLACIAL TILL) |
| 273.4<br>6.6 | **END OF BOREHOLE** |

## SAMPLES

| Number | Type | SPT 'N' Value | Lab Data and Comments GRAIN SIZE DISTRIBUTION (%) (MIT) GR SA SI CL |
|---|---|---|---|
| 1 | SS | 5 | |
| 2 | SS | 13 | |
| 3 | SS | 28 | |
| 4 | SS | 20 | 0 12 77 11 |
| 5 | SS | 23 | |
| 6 | SS | 29 | |
| 7 | SS | 35 | |



Unstabilized water level measured at 6.0m below ground surface; borehole was open upon completion of drilling.

**Terraprobe**

# BOREHOLE LOG 3

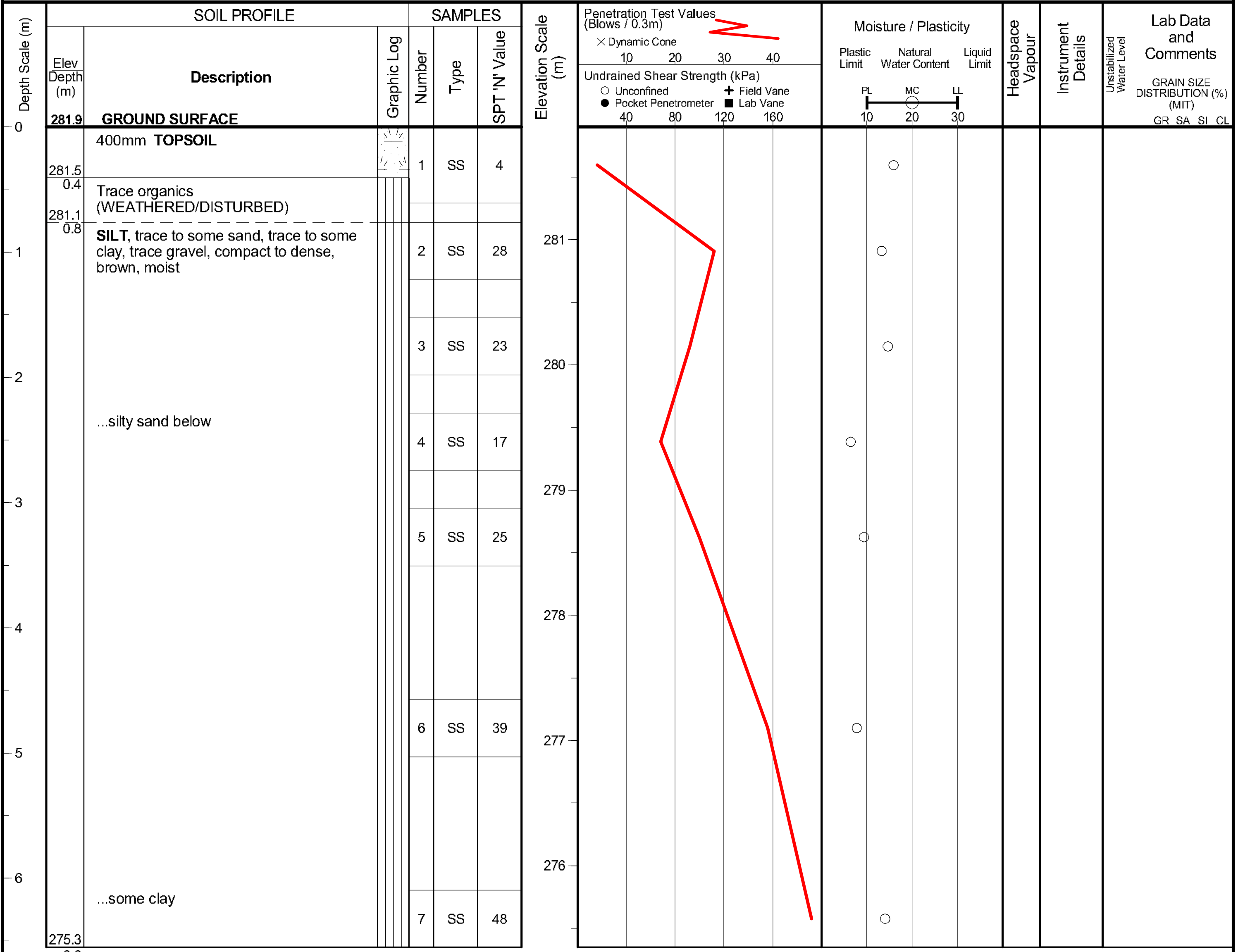
Client : Laurelpark Inc.
Project : Palgrave Estates II
Location : Caledon, Ontario

Project No.: 11-13-3052
Date started : May 16, 2013
Sheet No. : 1 of 1

Position : E: 295137, N: 4865588 (UTM 17T)
Rig type : track-mounted
Elevation Datum : Geodetic (NAD83)
Drilling Method : Solid stem augers

| Elev Depth (m) | SOIL PROFILE Description | SAMPLES Number | Type | SPT 'N' Value |
|---|---|---|---|---|
| 281.9 | **GROUND SURFACE** | | | |
| | 400mm **TOPSOIL** | 1 | SS | 4 |
| 281.5<br>0.4 | Trace organics (WEATHERED/DISTURBED) | | | |
| 281.1<br>0.8 | **SILT**, trace to some sand, trace to some clay, trace gravel, compact to dense, brown, moist | 2 | SS | 28 |
| | | 3 | SS | 23 |
| | ...silty sand below | 4 | SS | 17 |
| | | 5 | SS | 25 |
| | | 6 | SS | 39 |
| | ...some clay | 7 | SS | 48 |
| 275.3<br>6.6 | **END OF BOREHOLE** | | | |

Borehole was dry and open upon completion of drilling.



**Terraprobe**

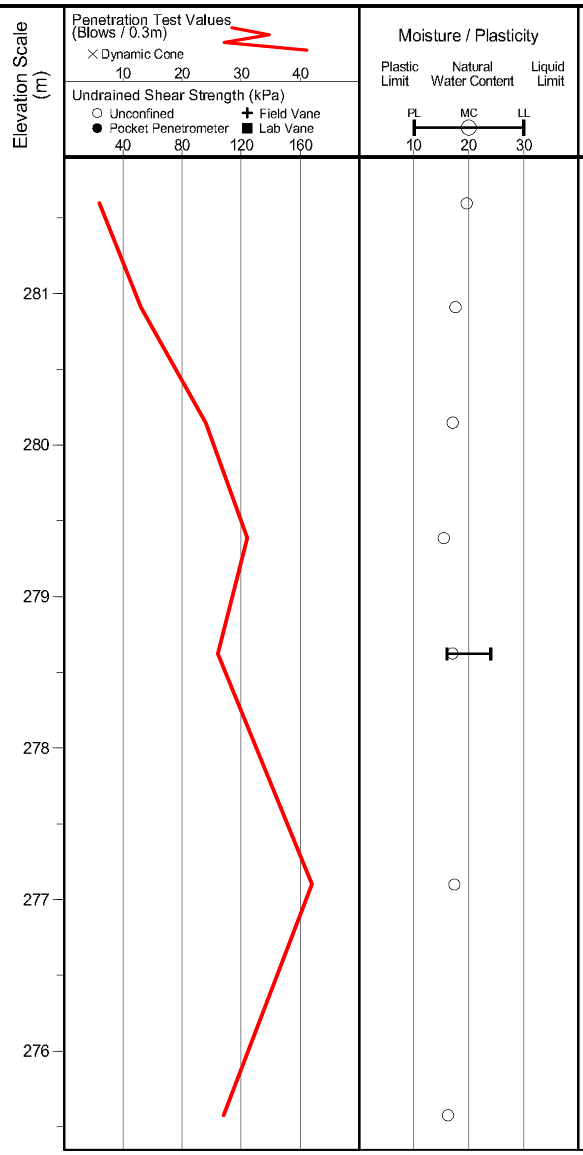
# BOREHOLE LOG 4

Client : Laurelpark Inc.
Project : Palgrave Estates II
Location : Caledon, Ontario

Project No.: 11-13-3052
Date started : May 16, 2013
Sheet No. : 1 of 1

Position : E: 598223, N: 4865593 (UTM 17T)
Rig type : track-mounted
Elevation Datum : Geodetic (NAD83)
Drilling Method : Solid stem augers

| Elev Depth (m) | Description | Number | Type | SPT 'N' Value | Lab Data and Comments GRAIN SIZE DISTRIBUTION (%) (MIT) GR SA SI CL |
|---|---|---|---|---|---|
| 281.9 | **GROUND SURFACE** | | | | |
| 281.6<br>0.3 | 300mm **TOPSOIL**<br>Trace organics (WEATHERED/DISTURBED) | 1 | SS | 6 | |
| 281.1<br>0.8 | **SILT**, some clay to clayey silt, trace sand, trace gravel, stiff to hard, brown, moist (GLACIAL TILL) | 2 | SS | 13 | |
| | | 3 | SS | 24 | |
| | | 4 | SS | 31 | |
| | | 5 | SS | 26 | 3 9 69 19 |
| | | 6 | SS | 42 | |
| | ...grey below | 7 | SS | 27 | |
| 275.3<br>6.6 | | | | | |



Headspace Vapour | Instrument Details | Unstabilized Water Level

**END OF BOREHOLE**

Borehole was dry and open upon completion of drilling.

**library:** library - terraprobe gint.glb **report:** terraprobe soil log **file:** 11-13-3052 bh logs.gpj

# BOREHOLE LOG 5

**Terraprobe**

Client : Laurelpark Inc.
Project : Palgrave Estates II
Location : Caledon, Ontario

Project No.: 11-13-3052
Date started : May 16, 2013
Sheet No. : 1 of 1

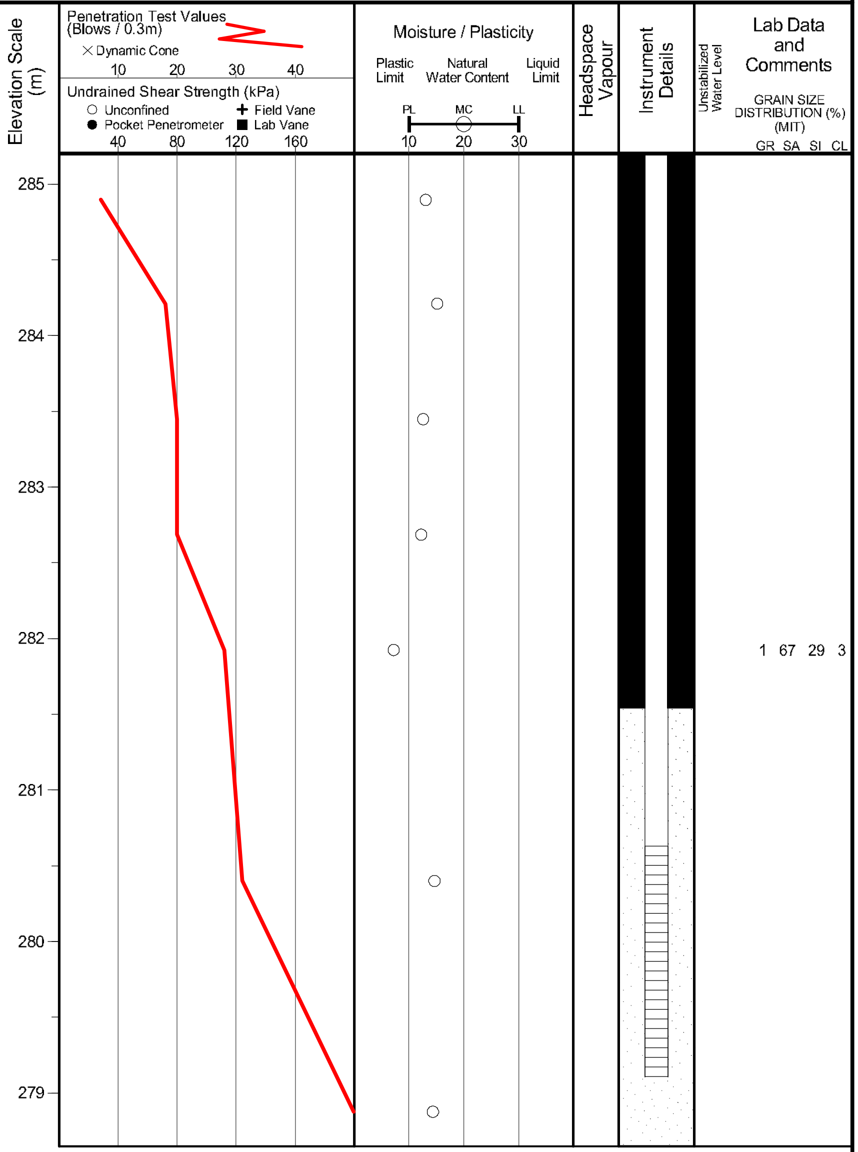
Position : E: 598309, N: 4865735 (UTM 17T)
Rig type : track-mounted
Elevation Datum : Geodetic (NAD83)
Drilling Method : Solid stem augers

## SOIL PROFILE

| Elev Depth (m) | Description |
|---|---|
| 285.2 | **GROUND SURFACE** |
|  | 300mm **TOPSOIL** |
| 284.9<br>0.3 | Trace organics (WEATHERED/DISTURBED) |
| 284.4<br>0.8 | **SANDY SILT to SILT AND SAND**, trace clay, trace gravel, compact to dense, brown, moist |
|  | ...silty sand |
|  | ...very dense |
| 278.6<br>6.6 | **END OF BOREHOLE** |

## SAMPLES

| Number | Type | SPT 'N' Value |
|---|---|---|
| 1 | SS | 7 |
| 2 | SS | 18 |
| 3 | SS | 20 |
| 4 | SS | 20 |
| 5 | SS | 28 |
| 6 | SS | 31 |
| 7 | SS | 76 |



Depth Scale (m): 0, 1, 2, 3, 4, 5, 6

Borehole was dry and open upon completion of drilling.

WATER LEVEL READINGS

| Date | Water Depth (m) | Elevation (m) |
|---|---|---|
| May 24, 2013 | dry | n/a |

# Terraprobe

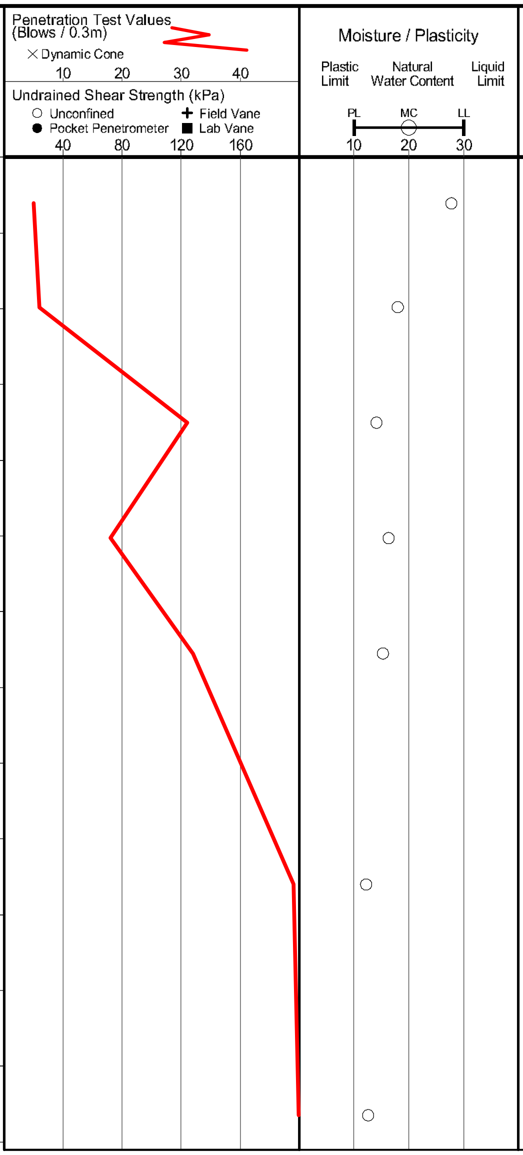
# BOREHOLE LOG 6

Client : Laurelpark Inc.
Project : Palgrave Estates II
Location : Caledon, Ontario

Project No.: 11-13-3052
Date started : May 15, 2013
Sheet No. : 1 of 1

Position : E: 598386, N: 4865796 (UTM 17T)
Rig type : track-mounted
Elevation Datum : Geodetic (NAD83)
Drilling Method : Solid stem augers

| Elev Depth (m) | SOIL PROFILE Description | Graphic Log | SAMPLES Number | Type | SPT 'N' Value | Unstabilized Water Level | Lab Data and Comments GRAIN SIZE DISTRIBUTION (%) (MIT) GR SA SI CL |
|---|---|---|---|---|---|---|---|
| 278.0 | **GROUND SURFACE** | | | | | | |
| 277.7<br>0.3 | 300mm **TOPSOIL** | | | | | | |
| | **FILL**, clayey silt, trace to some sand, trace gravel, trace organics, topsoil, firm, brown / grey, moist<br>...(REWORKED/DISTURBED) | ▨ | 1 | SS | 5 | | |
| | | ▨ | 2 | SS | 6 | ∇ | |
| 276.5<br>1.5 | **SILT**, trace to some sand, trace to some clay, trace gravel, (possible intermittent sand seams), compact to dense, brown, moist | | 3 | SS | 31 | | spoon wet |
| | | | 4 | SS | 18 | | |
| | ...grey below | | 5 | SS | 32 | | |
| | | | 6 | SS | 49 | | |
| | ...very dense | | 7 | SS | 70 | | 0 11 79 10 |
| 271.4<br>6.6 | | | | | | | |



Headspace Vapour | Instrument Details

**END OF BOREHOLE**

Unstabilized water level measured at 1.2m below ground surface; borehole was open upon completion of drilling.

**Terraprobe**

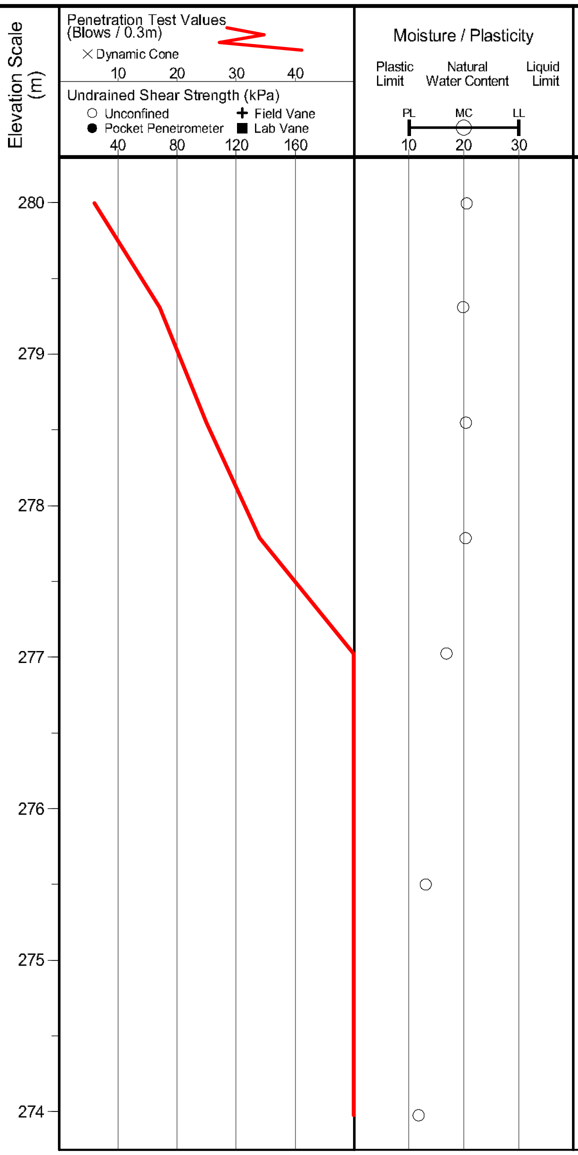
# BOREHOLE LOG 7

Client : Laurelpark Inc.
Project : Palgrave Estates II
Location : Caledon, Ontario

Project No.: 11-13-3052
Date started : May 15, 2013
Sheet No. : 1 of 1

Position : E: 598421, N: 4865843 (UTM 17T)
Rig type : track-mounted
Elevation Datum : Geodetic (NAD83)
Drilling Method : Solid stem augers

| Elev Depth (m) | SOIL PROFILE Description | SAMPLES Number | Type | SPT 'N' Value | Unstabilized Water Level | Lab Data and Comments |
|---|---|---|---|---|---|---|
| 280.3 | **GROUND SURFACE** | | | | | |
| | 350mm **TOPSOIL** | 1 | SS | 6 | | |
| 279.9<br>0.4 | Trace organics (WEATHERED/DISTURBED) | | | | | |
| 279.5<br>0.8 | **SILT**, trace to some sand, trace to some clay, trace gravel, (possible intermittent sand seams), compact to very dense, brown, moist | 2 | SS | 17 | | |
| | | 3 | SS | 25 | | |
| | | 4 | SS | 34 | | |
| | | 5 | SS | 55 | | spoon wet |
| | ...grey below | 6 | SS | 67 | | |
| | | 7 | SS | 68 | ∇ | |
| 273.7<br>6.6 | **END OF BOREHOLE** | | | | | |



Headspace Vapour | Instrument Details | GRAIN SIZE DISTRIBUTION (%) (MIT) GR SA SI CL

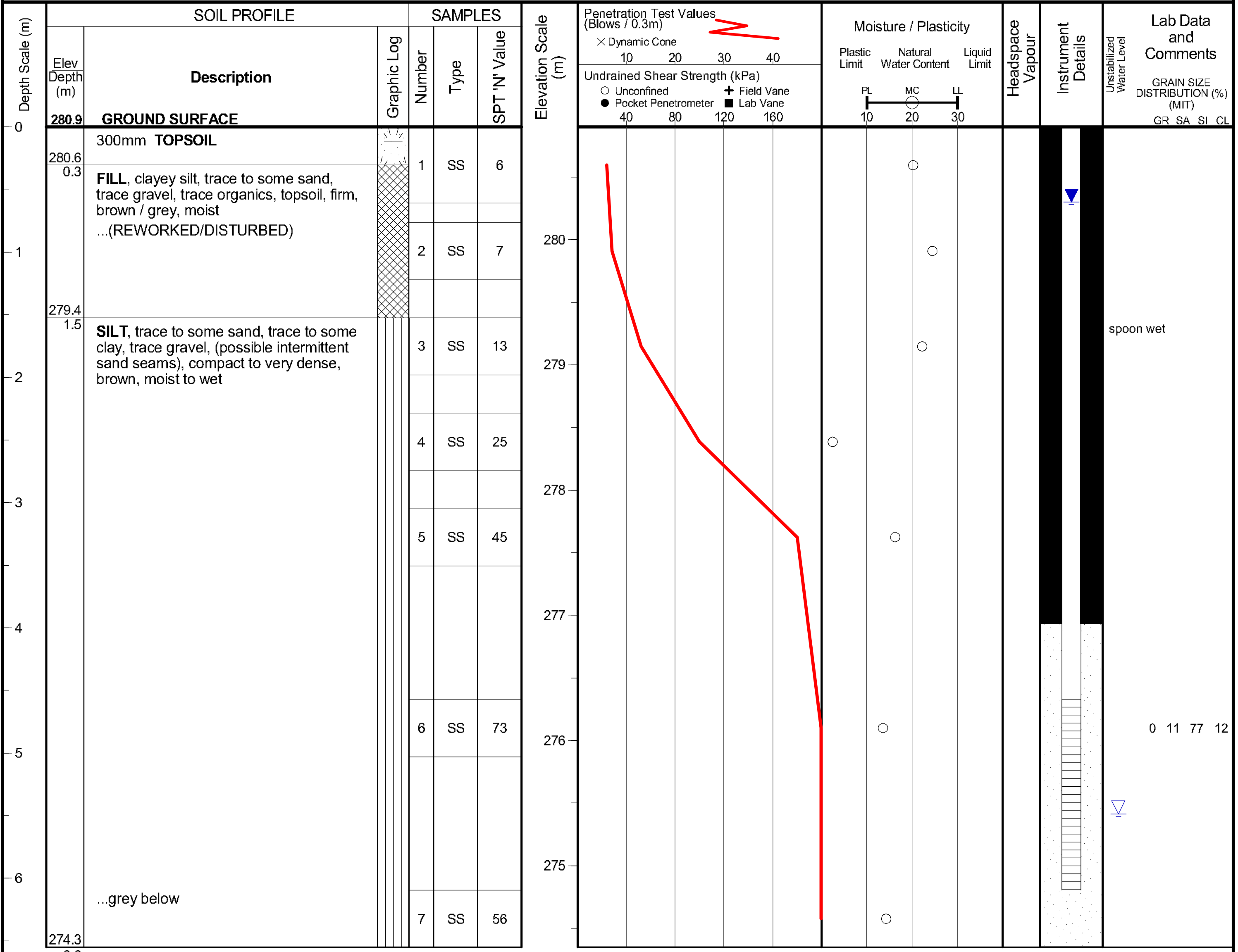
Unstabilized water level measured at 5.9m below ground surface; borehole was open upon completion of drilling.

**Terraprobe**

# BOREHOLE LOG 8

| | | | |
|---|---|---|---|
| Client | : Laurelpark Inc. | Project No.: | 11-13-3052 |
| Project | : Palgrave Estates II | Date started : | May 15, 2013 |
| Location | : Caledon, Ontario | Sheet No. : | 1 of 1 |

| | | | |
|---|---|---|---|
| Position | : E: 598465, N: 4865898 (UTM 17T) | Elevation Datum | : Geodetic (NAD83) |
| Rig type | : track-mounted | Drilling Method | : Solid stem augers |



| Elev Depth (m) | Description | Number | Type | SPT 'N' Value | Lab Data and Comments |
|---|---|---|---|---|---|
| 280.9 | **GROUND SURFACE** | | | | |
| | 300mm **TOPSOIL** | | | | |
| 280.6<br>0.3 | **FILL**, clayey silt, trace to some sand, trace gravel, trace organics, topsoil, firm, brown / grey, moist ...(REWORKED/DISTURBED) | 1 | SS | 6 | |
| | | 2 | SS | 7 | |
| 279.4<br>1.5 | **SILT**, trace to some sand, trace to some clay, trace gravel, (possible intermittent sand seams), compact to very dense, brown, moist to wet | 3 | SS | 13 | spoon wet |
| | | 4 | SS | 25 | |
| | | 5 | SS | 45 | |
| | | 6 | SS | 73 | 0 11 77 12 |
| | ...grey below | 7 | SS | 56 | |
| 274.3<br>6.6 | | | | | |

**END OF BOREHOLE**

Unstabilized water level measured at 5.5m below ground surface; borehole was open upon completion of drilling.

WATER LEVEL READINGS

| Date | Water Depth (m) | Elevation (m) |
|---|---|---|
| May 24, 2013 | 0.6 | 280.3 |

# BOREHOLE LOG 9

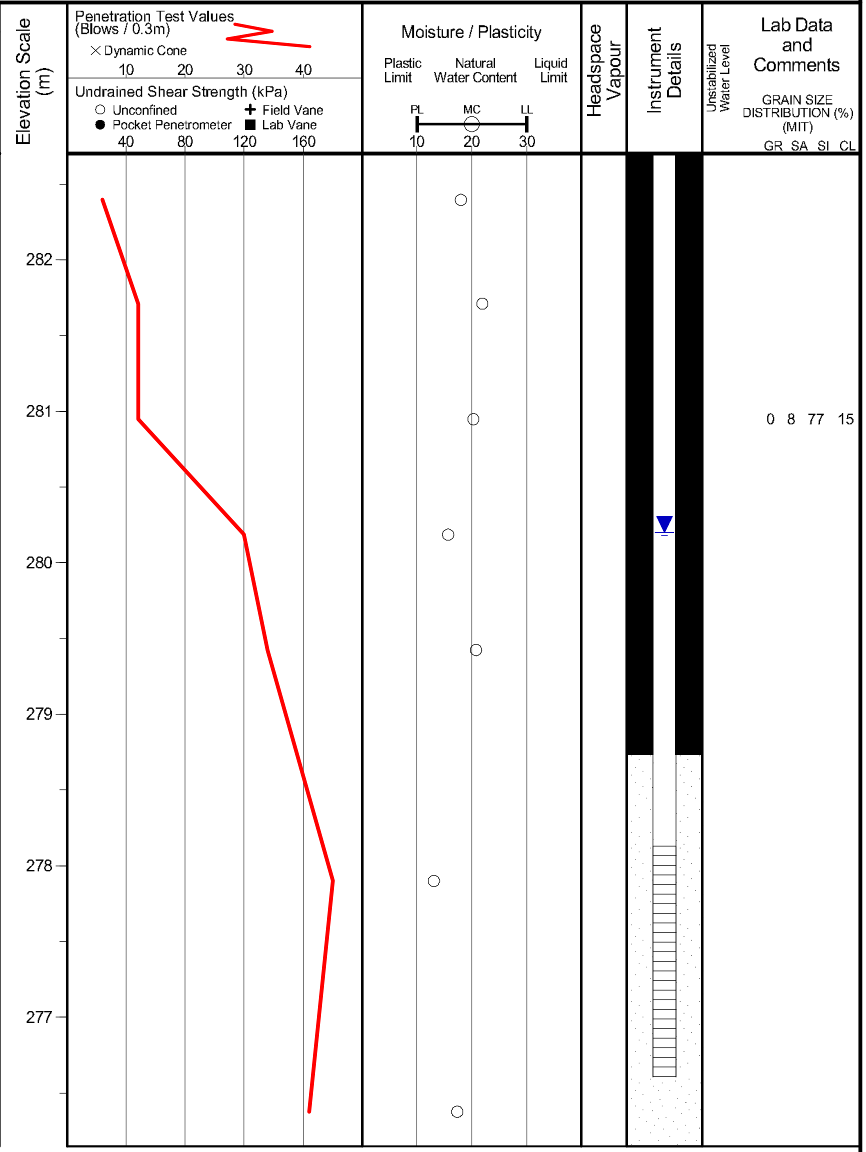
Client : Laurelpark Inc.
Project : Palgrave Estates II
Location : Caledon, Ontario

Project No.: 11-13-3052
Date started : May 16, 2013
Sheet No. : 1 of 1

Position : E: 598343, N: 4865854 (UTM 17T)
Rig type : track-mounted

Elevation Datum : Geodetic (NAD83)
Drilling Method : Solid stem augers

| Elev Depth (m) | SOIL PROFILE Description | SAMPLES Number | Type | SPT 'N' Value | Lab Data and Comments GRAIN SIZE DISTRIBUTION (%) (MIT) GR SA SI CL |
|---|---|---|---|---|---|
| 282.7 | **GROUND SURFACE** | | | | |
| | 300mm **TOPSOIL** | | | | |
| 282.4<br>0.3 | Trace organics (WEATHERED/DISTURBED) | 1 | SS | 6 | |
| 281.9<br>0.8 | **SILT**, trace to some sand, trace to some clay, trace gravel, compact to dense, brown, moist | 2 | SS | 12 | |
| | | 3 | SS | 12 | 0 8 77 15 |
| | | 4 | SS | 30 | |
| | | 5 | SS | 34 | |
| | | 6 | SS | 45 | |
| | | 7 | SS | 41 | |
| 276.1<br>6.6 | | | | | |



**END OF BOREHOLE**

Borehole was dry and open upon completion of drilling.

WATER LEVEL READINGS

| Date | Water Depth (m) | Elevation (m) |
|---|---|---|
| May 24, 2013 | 2.5 | 280.2 |

# BOREHOLE LOG 10

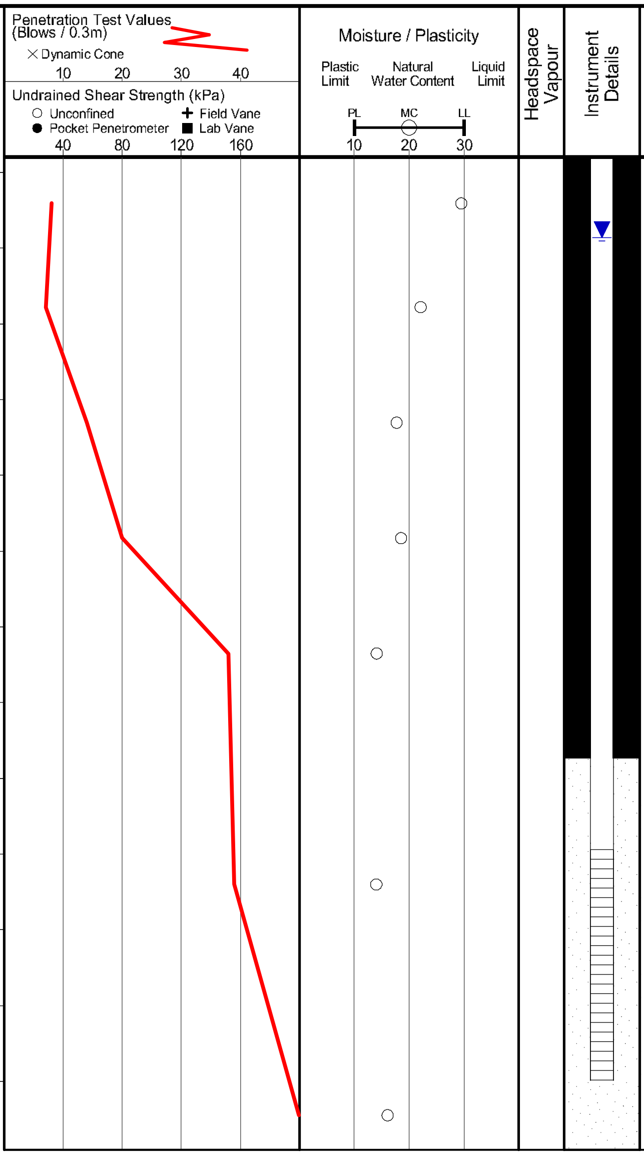
**Terraprobe**

Client : Laurelpark Inc.
Project : Palgrave Estates II
Location : Caledon, Ontario

Project No.: 11-13-3052
Date started : May 15, 2013
Sheet No. : 1 of 1

Position : E: 598480, N: 4865808 (UTM 17T)
Rig type : track-mounted
Elevation Datum : Geodetic (NAD83)
Drilling Method : Solid stem augers

| Elev Depth (m) | Description | Number | Type | SPT 'N' Value | Lab Data and Comments (GRAIN SIZE DISTRIBUTION (%) (MIT) GR SA SI CL) |
|---|---|---|---|---|---|
| 279.1 | **GROUND SURFACE** | | | | |
| | 350mm **TOPSOIL** | 1 | SS | 8 | |
| 278.7<br>0.4 | **FILL**, silt, some sand, trace to some clay, trace organics, topsoil presence, loose, brown / grey, moist ...(REWORKED/DISTURBED) | 2 | SS | 7 | |
| 277.6<br>1.5 | **SILT**, trace to some sand, trace to some clay, trace gravel, (possible intermittent sand seams), compact to dense, brown, moist | 3 | SS | 14 | |
| | | 4 | SS | 20 | spoon wet |
| | | 5 | SS | 38 | 0 7 86 7 |
| | ...grey below | 6 | SS | 39 | |
| 273.0<br>6.1 | **CLAYEY SILT**, trace sand, trace gravel, hard, grey, moist (GLACIAL TILL) | 7 | SS | 58 | |
| 272.5<br>6.6 | **END OF BOREHOLE** | | | | |



Unstabilized water level measured at 5.4m below ground surface; borehole was open upon completion of drilling.

WATER LEVEL READINGS

| Date | Water Depth (m) | Elevation (m) |
|---|---|---|
| May 24, 2013 | 0.5 | 278.6 |

**Terraprobe**

# BOREHOLE LOG 11

Client : Laurelpark Inc.
Project : Palgrave Estates II
Location : Caledon, Ontario

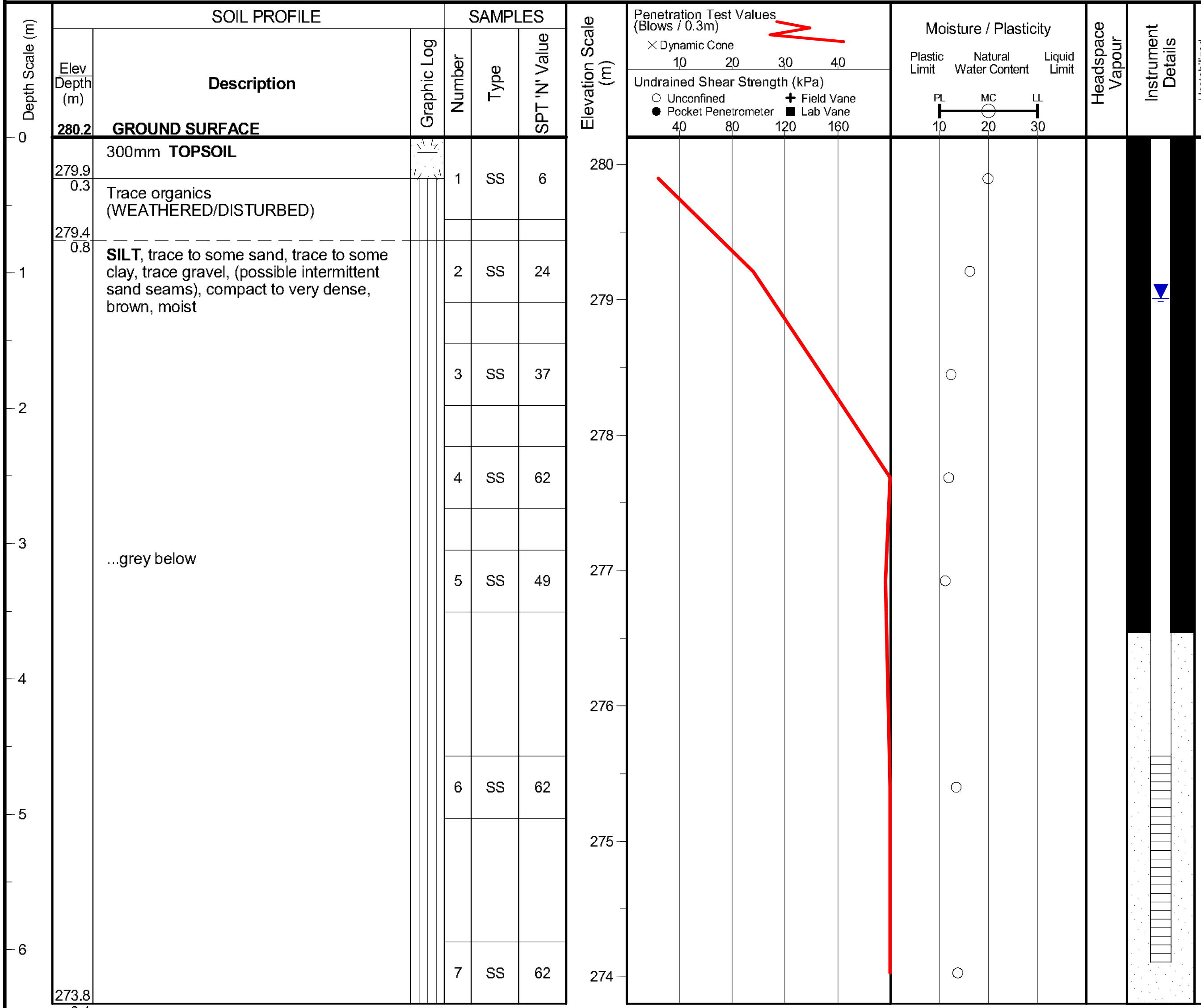
Project No.: 11-13-3052
Date started : May 16, 2013
Sheet No. : 1 of 1

Position : E: 598392, N: 4865760 (UTM 17T)
Rig type : track-mounted
Elevation Datum : Geodetic (NAD83)
Drilling Method : Solid stem augers

| Elev<br>Depth (m) | Description |
|---|---|
| 280.2 | **GROUND SURFACE** |
|  | 300mm **TOPSOIL** |
| 279.9<br>0.3 | Trace organics (WEATHERED/DISTURBED) |
| 279.4<br>0.8 | **SILT**, trace to some sand, trace to some clay, trace gravel, (possible intermittent sand seams), compact to very dense, brown, moist |
|  | ...grey below |
| 273.8<br>6.4 | **END OF BOREHOLE** |

| Number | Type | SPT 'N' Value | GR | SA | SI | CL |
|---|---|---|---|---|---|---|
| 1 | SS | 6 |  |  |  |  |
| 2 | SS | 24 |  |  |  |  |
| 3 | SS | 37 |  |  |  |  |
| 4 | SS | 62 | 0 | 7 | 81 | 12 |
| 5 | SS | 49 |  |  |  |  |
| 6 | SS | 62 |  |  |  |  |
| 7 | SS | 62 | 0 | 9 | 80 | 11 |

Lab Data and Comments: GRAIN SIZE DISTRIBUTION (%) (MIT)



Borehole was dry and open upon completion of drilling.

WATER LEVEL READINGS

| Date | Water Depth (m) | Elevation (m) |
|---|---|---|
| May 24, 2013 | 1.2 | 279.0 |

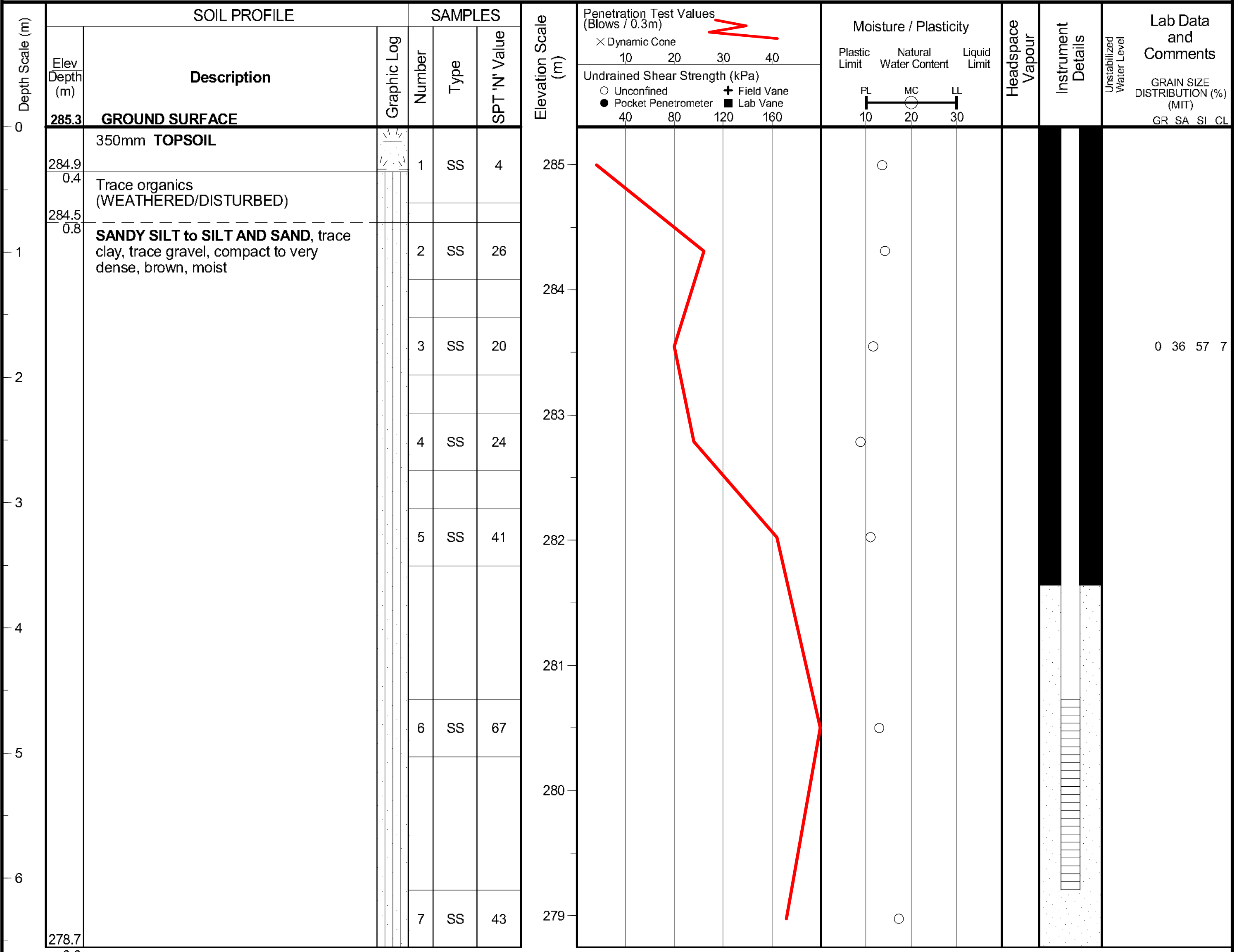
Terraprobe

# BOREHOLE LOG 12

Client : Laurelpark Inc.
Project : Palgrave Estates II
Location : Caledon, Ontario

Project No.: 11-13-3052
Date started : May 16, 2013
Sheet No. : 1 of 1

Position : E: 598168, N: 4865581 (UTM 17T)
Rig type : track-mounted
Elevation Datum : Geodetic (NAD83)
Drilling Method : Solid stem augers



| Elev Depth (m) | SOIL PROFILE Description | SAMPLES Number | Type | SPT 'N' Value | Lab Data and Comments GRAIN SIZE DISTRIBUTION (%) (MIT) GR SA SI CL |
|---|---|---|---|---|---|
| 285.3 | **GROUND SURFACE** | | | | |
| 284.9<br>0.4 | 350mm **TOPSOIL** | 1 | SS | 4 | |
| 284.5<br>0.8 | Trace organics (WEATHERED/DISTURBED) | | | | |
| | **SANDY SILT to SILT AND SAND**, trace clay, trace gravel, compact to very dense, brown, moist | 2 | SS | 26 | |
| | | 3 | SS | 20 | 0 36 57 7 |
| | | 4 | SS | 24 | |
| | | 5 | SS | 41 | |
| | | 6 | SS | 67 | |
| 278.7<br>6.6 | | 7 | SS | 43 | |

**END OF BOREHOLE**

Borehole was dry and open upon completion of drilling.

WATER LEVEL READINGS

| Date | Water Depth (m) | Elevation (m) |
|---|---|---|
| May 24, 2013 | dry | n/a |

# TEST PIT
# LOGS

TERRAPROBE INC.

**Terraprobe**

# TEST PIT LOG 1

Client : Laurelpark Inc.
Project : Palgrave Estates II
Location : Caledon, Ontario

Project No. : 11-13-3052
Date excavated : August 15, 2013
Sheet No. : 1 of 1

Position : E: 598036, N: 4865443 (UTM 17T)
Elevation Datum : N/A
Rig type : BACKHOE

Undrained Shear Strength (kPa): ○ Unconfined; ● Pocket Penetrometer; + Field Vane; ■ Lab Vane — scale 40, 80, 120, 160

Moisture / Plasticity: Plastic Limit PL, Natural Water Content MC, Liquid Limit LL — scale 10, 20, 30

Lab Data and Comments: GRAIN SIZE DISTRIBUTION (%) (MIT) — GR SA SI CL

| Depth Scale (m) | Elev Depth (m) | SOIL PROFILE Description | SAMPLES Number | SAMPLES Type | Elevation Scale (m) | Undrained Shear Strength (kPa) | Moisture / Plasticity | Headspace Vapour | Unstabilized Water Level | Lab Data and Comments |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.0 | | GROUND SURFACE | | | | | | | | |
| | | 300mm **TOPSOIL** | | | | | | | | |
| | 0.3 | Trace organics (WEATHERED/DISTURBED) | 1 | GS | | | | | | |
| 0.5 | 0.5 | **SILT**, trace to some sand, trace to some clay, trace gravel, compact, brown / grey, moist | | | | | | | | |
| 1.0 | | | | | | | | | | |
| 1.5 | | | 2 | GS | | | | | | |
| 2.0 | | | | | | | | | | |
| | | ...wet below | 3 | GS | | | | | ∇ | |
| | 2.4 | **END OF TEST PIT** | | | | | | | | |

Unstabilized water level measured at 2.3m below grade; test pit was open upon completion of excavation.

SEEPAGE MEASUREMENTS

| Time | Water Depth (m) | Elevation (m) |
|---|---|---|
| 8/19/2013 | 1.9 | |
| 8/23/2013 | 1.7 | |

**Terraprobe**

# TEST PIT LOG 2

Client : Laurelpark Inc.
Project : Palgrave Estates II
Location : Caledon, Ontario

Project No. : 11-13-3052
Date excavated : August 15, 2013
Sheet No. : 1 of 1

Position : E: 598040, N: 4865462 (UTM 17T)
Elevation Datum : N/A
Rig type : BACKHOE

Undrained Shear Strength (kPa)
○ Unconfined
● Pocket Penetrometer
+ Field Vane
■ Lab Vane
40 80 120 160

Moisture / Plasticity
Plastic Limit PL 10 — Natural Water Content MC 20 — Liquid Limit LL 30

Headspace Vapour

Unstabilized Water Level

Lab Data and Comments
GRAIN SIZE DISTRIBUTION (%) (MIT)
GR SA SI CL

| Depth Scale (m) | Elev Depth (m) | Description | Number | Type | Unstabilized Water Level | Lab Data and Comments |
|---|---|---|---|---|---|---|
| | | **GROUND SURFACE** | | | | |
| 0.0 | | 250mm **TOPSOIL** | | | | |
| | 0.3 | Trace organics (WEATHERED/DISTURBED) | 1 | GS | | |
| 0.5 | 0.5 | **SILT**, trace to some sand, trace to some clay, trace gravel, compact, brown / grey, moist | 2 | GS | | |
| 1.0 | | | | | | |
| | 1.2 | **SANDY SILT**, trace clay, compact, brown / grey, moist | 3 | GS | | |
| 1.5 | | | | | | |
| | 1.7 | **SILTY SAND**, trace clay, dense, brown / grey, wet | | | | ...at 1.7m, water seepage |
| 2.0 | | | 4 | GS | ▽ | |
| | 2.4 | **END OF TEST PIT** | | | | |

Unstabilized water level measured at 2.3m below grade; test pit was open upon completion of excavation.

SEEPAGE MEASUREMENTS

| Time | Water Depth (m) | Elevation (m) |
|---|---|---|
| 8/19/2013 | 2.2 | |
| 8/23/2013 | 2.0 | |

**Terraprobe**

# TEST PIT LOG 3

Client : Laurelpark Inc.
Project : Palgrave Estates II
Location : Caledon, Ontario

Project No. : 11-13-3052
Date excavated : August 15, 2013
Sheet No. : 1 of 1

Position : E: 598073, N: 4865443 (UTM 17T)
Elevation Datum : N/A
Rig type : BACKHOE

| Depth Scale (m) | SOIL PROFILE |  |  | SAMPLES |  | Elevation Scale (m) | Undrained Shear Strength (kPa)<br>○ Unconfined<br>● Pocket Penetrometer<br>+ Field Vane<br>■ Lab Vane<br>40 80 120 160 | Moisture / Plasticity<br>Plastic Limit PL · Natural Water Content MC · Liquid Limit LL<br>10 20 30 | Headspace Vapour | Unstabilized Water Level | Lab Data and Comments<br>GRAIN SIZE DISTRIBUTION (%) (MIT)<br>GR SA SI CL |
|---|---|---|---|---|---|---|---|---|---|---|---|
|  | Elev Depth (m) | Description | Graphic Log | Number | Type |  |  |  |  |  |  |
| 0.0 |  | **GROUND SURFACE** |  |  |  |  |  |  |  |  |  |
|  |  | 300mm **TOPSOIL** |  |  |  |  |  |  |  |  |  |
|  | 0.3 | Trace organics (WEATHERED/DISTURBED) |  | 1 | GS |  |  |  |  |  |  |
| 0.5 | 0.5 | **SILTY SAND**, trace clay, trace organics, very loose, dark brown, moist / wet |  | 2 | GS |  |  |  |  | ∇ | ...at 0.8m, water seepage |
| 1.0 | 0.9 | **SAND**, trace silt, trace clay, trace organics, very loose, brown, wet |  | 3 | GS |  |  |  |  |  |  |
| 1.5 | 1.5 | **CLAYEY SILT**, some sand, stiff, grey, moist wet |  | 4 | GS |  |  |  |  |  |  |
|  | 2.0 | **END OF TEST PIT** |  |  |  |  |  |  |  |  |  |

Unstabilized water level measured at 0.8m below grade; test pit was open upon completion of excavation.

SEEPAGE MEASUREMENTS

| Time | Water Depth (m) | Elevation (m) |
|---|---|---|
| 8/19/2013 | 0.8 |  |
| 8/23/2013 | 0.6 |  |

**Terraprobe**

# TEST PIT LOG 4

Client : Laurelpark Inc.
Project : Palgrave Estates II
Location : Caledon, Ontario

Project No. : 11-13-3052
Date excavated : August 15, 2013
Sheet No. : 1 of 1

Position : E: 598076, N: 4865460 (UTM 17T)
Elevation Datum : N/A
Rig type : BACKHOE

Undrained Shear Strength (kPa): ○ Unconfined; ● Pocket Penetrometer; + Field Vane; ■ Lab Vane — 40 80 120 160

Moisture / Plasticity: Plastic Limit (PL), Natural Water Content (MC), Liquid Limit (LL) — 10 20 30

Lab Data and Comments: GRAIN SIZE DISTRIBUTION (%) (MIT) — GR SA SI CL

| Depth Scale (m) | Elev Depth (m) | SOIL PROFILE Description | Graphic Log | SAMPLES Number | SAMPLES Type | Elevation Scale (m) | Undrained Shear Strength (kPa) | Moisture / Plasticity | Headspace Vapour | Unstabilized Water Level | Lab Data and Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.0 | | **GROUND SURFACE** | | | | | | | | | |
| | | 250mm **TOPSOIL** | | | | | | | | | |
| | 0.3 | Trace organics (WEATHERED/DISTURBED) | | 1 | GS | | | | | | |
| 0.5 | 0.5 | **SILT**, trace to some sand, trace to some clay, trace gravel, compact, brown / grey, moist | | | | | | | | | |
| 1.0 | | | | | | | | | | | |
| 1.5 | | | | 2 | GS | | | | | | |
| | 1.7 | **SILTY SAND**, trace clay, compact, brown, wet | | | | | | | | | ...at 1.8m, water seepage |
| 2.0 | | | | 3 | GS | | | | | ∇ | |
| | 2.4 | **END OF TEST PIT** | | | | | | | | | |

Unstabilized water level measured at 2.3m below grade; test pit was open upon completion of excavation.

SEEPAGE MEASUREMENTS

| Time | Water Depth (m) | Elevation (m) |
|---|---|---|
| 8/19/2013 | 1.8 | |
| 8/23/2013 | 1.7 | |

**Terraprobe**

# TEST PIT LOG 5

Client : Laurelpark Inc.
Project : Palgrave Estates II
Location : Caledon, Ontario

Project No. : 11-13-3052
Date excavated : August 19, 2013
Sheet No. : 1 of 1

Position : E: 598376, N: 4865832 (UTM 17T)
Elevation Datum : N/A
Rig type : BACKHOE

| Depth Scale (m) | Elev Depth (m) | SOIL PROFILE Description | Graphic Log | SAMPLES Number | SAMPLES Type | Elevation Scale (m) | Undrained Shear Strength (kPa) ○ Unconfined ● Pocket Penetrometer + Field Vane ■ Lab Vane 40 80 120 160 | Moisture / Plasticity Plastic Limit PL 10, Natural Water Content MC 20, Liquid Limit LL 30 | Headspace Vapour | Unstabilized Water Level | Lab Data and Comments GRAIN SIZE DISTRIBUTION (%) (MIT) GR SA SI CL |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.0 | | **GROUND SURFACE** | | | | | | | | | |
| | | 350mm **TOPSOIL** | | | | | | | | | |
| | 0.4 | Trace organics (WEATHERED/DISTURBED) | | | | | | | | | |
| 0.5 | | | | 1 | GS | | | | | | |
| | 0.6 | **SANDY SILT to SAND**, trace to some clay, trace gravel, (intermittent sand seams), compact to dense, brown / grey, moist | | | | | | | | | |
| 1.0 | | | | | | | | | | | |
| 1.5 | | | | 2 | GS | | | | | | |
| | 1.8 | **SILT**, some sand to sandy, trace clay (intermittent sand seams), compact, wet | | | | | | | | | ...at 1.8m, water seepage |
| | | | | 3 | GS | | | | | ∇ | |
| | 2.0 | **END OF TEST PIT** | | | | | | | | | |

Unstabilized water level measured at 2.0m below grade; test pit was open upon completion of excavation.

SEEPAGE MEASUREMENTS

| Time | Water Depth (m) | Elevation (m) |
|---|---|---|
| 8/23/2013 | 1.9 | |

# TEST PIT LOG 6

Client : Laurelpark Inc.

Project : Palgrave Estates II

Location : Caledon, Ontario

Project No. : 11-13-3052

Date excavated : August 19, 2013

Sheet No. : 1 of 1

Position : E: 598387, N: 4865862 (UTM 17T)

Elevation Datum : N/A

Rig type : BACKHOE

Undrained Shear Strength (kPa)
○ Unconfined
● Pocket Penetrometer
+ Field Vane
■ Lab Vane
40 80 120 160

Moisture / Plasticity
Plastic Limit PL — Natural Water Content MC — Liquid Limit LL
10 20 30

Headspace Vapour

Unstabilized Water Level

Lab Data and Comments
GRAIN SIZE DISTRIBUTION (%) (MIT)
GR SA SI CL

| Depth Scale (m) | Elev Depth (m) | Description | Samples Number | Samples Type | Lab Data and Comments |
|---|---|---|---|---|---|
| 0.0 | | GROUND SURFACE | | | |
| | | 350mm **TOPSOIL** | | | |
| | 0.4 | Trace organics (WEATHERED/DISTURBED) | | | |
| 0.5 | | | 1 | GS | |
| | 0.7 | **SAND**, trace to some silt, trace clay, compact to dense, brown, moist | | | |
| 1.0 | | | 2 | GS | |
| | | | | | ...at 1.3m, water seepage |
| | 1.4 | **SILT**, some sand to sandy, trace clay, very dense, brown, wet | | | |
| 1.5 | | | 3 | GS | ∇ |
| | 2.0 | **END OF TEST PIT** | | | |

Unstabilized water level measured at 2.0m below grade; test pit was open upon completion of excavation.

SEEPAGE MEASUREMENTS

| Time | Water Depth (m) | Elevation (m) |
|---|---|---|
| 8/23/2013 | 1.5 | |

**Terraprobe**

# TEST PIT LOG 7

Client : Laurelpark Inc.
Project : Palgrave Estates II
Location : Caledon, Ontario

Project No. : 11-13-3052
Date excavated : August 19, 2013
Sheet No. : 1 of 1

Position : E: 598393, N: 4865838 (UTM 17T)
Elevation Datum : N/A
Rig type : BACKHOE

Undrained Shear Strength (kPa)
○ Unconfined
● Pocket Penetrometer
+ Field Vane
■ Lab Vane
40 80 120 160

Moisture / Plasticity
Plastic Limit — Natural Water Content — Liquid Limit
PL MC LL
10 20 30

Headspace Vapour

Unstabilized Water Level

Lab Data and Comments
GRAIN SIZE DISTRIBUTION (%) (MIT)
GR SA SI CL

| Depth Scale (m) | Elev Depth (m) | Description | Sample Number | Sample Type | Lab Data and Comments |
|---|---|---|---|---|---|
| 0.0 | | **GROUND SURFACE**<br>300mm **TOPSOIL** | | | |
| 0.5 | 0.5 | Trace organics (WEATHERED/DISTURBED) | 1 | GS | |
| | 0.7 | **SANDY SILT**, trace clay, trace gravel, compact to dense, brown / grey, moist | | | |
| 1.0 | | | 2 | GS | |
| 1.5 | 1.4 | **SANDY SILT to SAND**, trace clay, compact, brown / grey, wet | | | ...at 1.4m, water seepage |
| | | | 3 | GS | |
| | 1.9<br>2.0 | **SILT**, trace to some sand, trace to some clay, dense, brown / grey, wet | 4 | GS | ▽ |

**END OF TEST PIT**

Unstabilized water level measured at 2.0m below grade; test pit was open upon completion of excavation.

SEEPAGE MEASUREMENTS

| Time | Water Depth (m) | Elevation (m) |
|---|---|---|
| 8/23/2013 | 1.4 | |

Terraprobe

# TEST PIT LOG 8

Client : Laurelpark Inc.
Project : Palgrave Estates II
Location : Caledon, Ontario

Project No. : 11-13-3052
Date excavated : August 16, 2013
Sheet No. : 1 of 1

Position : E: 598436, N: 4865818 (UTM 17T)
Elevation Datum : N/A
Rig type : BACKHOE

Undrained Shear Strength (kPa): ○ Unconfined ● Pocket Penetrometer + Field Vane ■ Lab Vane — 40 80 120 160

Moisture / Plasticity: Plastic Limit PL, Natural Water Content MC, Liquid Limit LL — 10 20 30

Headspace Vapour

Unstabilized Water Level

Lab Data and Comments — GRAIN SIZE DISTRIBUTION (%) (MIT): GR SA SI CL

| Depth Scale (m) | Elev Depth (m) | Description | Sample Number | Sample Type | Lab Data and Comments |
|---|---|---|---|---|---|
| | | **GROUND SURFACE** | | | |
| 0.0 | | 250mm **TOPSOIL** | | | |
| | 0.3 | Trace organics (WEATHERED/DISTURBED) | 1 | GS | |
| 0.5 | | | | | |
| | 0.6 | **SILT**, trace to some sand, trace to some clay, (intermittent sand seams), compact to dense, brown / grey, moist | | | |
| 1.0 | | | | | |
| 1.5 | | | 2 | GS | |
| | 1.7 | **SILT**, trace to some sand, trace to some clay, (intermittent sand seams), compact to dense, brown / grey, wet | | | ...at 1.7m, water seepage |
| 2.0 | | | | | ▽ |
| | | | 3 | GS | |
| 2.5 | 2.5 | **END OF TEST PIT** | | | |

Unstabilized water level measured at 2.1m below grade; test pit was open upon completion of excavation.

SEEPAGE MEASUREMENTS

| Time | Water Depth (m) | Elevation (m) |
|---|---|---|
| 8/19/2013 | 2.2 | |
| 8/23/2013 | 2.1 | |

**library:** library - terraprobe gint.glb **report:** terraprobe test pit log **file:** 11-13-3052 test pit logs.gpj

# TEST PIT LOG 9

Client : Laurelpark Inc.
Project : Palgrave Estates II
Location : Caledon, Ontario

Project No. : 11-13-3052
Date excavated : August 16, 2013
Sheet No. : 1 of 1

Position : E: 598456, N: 4865792 (UTM 17T)
Elevation Datum : N/A
Rig type : BACKHOE

| Depth Scale (m) | SOIL PROFILE<br>Elev Depth (m) | <br>Description | <br>Graphic Log | SAMPLES<br>Number | <br>Type | Elevation Scale (m) | Undrained Shear Strength (kPa)<br>○ Unconfined<br>● Pocket Penetrometer<br>+ Field Vane<br>■ Lab Vane<br>40 80 120 160 | Moisture / Plasticity<br>Plastic Limit PL, Natural Water Content MC, Liquid Limit LL<br>10 20 30 | Headspace Vapour | Unstabilized Water Level | Lab Data and Comments<br>GRAIN SIZE DISTRIBUTION (%) (MIT)<br>GR SA SI CL |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.0 | | **GROUND SURFACE** | | | | | | | | | |
| | | 200mm **TOPSOIL** | | | | | | | | | |
| | 0.2 | Trace organics (WEATHERED/DISTURBED) | | | | | | | | | |
| 0.5 | | | | 1 | GS | | | | | | |
| | 0.6 | **SILT**, trace to some sand, trace clay, (intermittent sand seams), compact to dense, brown, moist | | | | | | | | | |
| 1.0 | | | | | | | | | | | |
| 1.5 | | | | | | | | | | | |
| | | | | 2 | GS | | | | | | |
| 2.0 | | ...wet | | | | | | | | ▽ | |
| | 2.1 | **END OF TEST PIT** | | | | | | | | | |

Unstabilized water level measured at 2.0m below grade; test pit was open upon completion of excavation.

SEEPAGE MEASUREMENTS

| Time | Water Depth (m) | Elevation (m) |
|---|---|---|
| 8/19/2013 | 2.0 | |
| 8/23/2013 | 2.0 | |

**Terraprobe**

# TEST PIT LOG 10

Client : Laurelpark Inc.
Project : Palgrave Estates II
Location : Caledon, Ontario

Project No. : 11-13-3052
Date excavated : August 19, 2013
Sheet No. : 1 of 1

Position : E: 598432, N: 4865786 (UTM 17T)
Elevation Datum : N/A
Rig type : BACKHOE

| Depth Scale (m) | SOIL PROFILE | | | SAMPLES | | Elevation Scale (m) | Undrained Shear Strength (kPa)<br>○ Unconfined<br>● Pocket Penetrometer<br>+ Field Vane<br>■ Lab Vane<br>40 80 120 160 | Moisture / Plasticity<br>Plastic Limit PL 10 — Natural Water Content MC 20 — Liquid Limit LL 30 | Headspace Vapour | Unstabilized Water Level | Lab Data and Comments<br>GRAIN SIZE DISTRIBUTION (%) (MIT)<br>GR SA SI CL |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Elev Depth (m) | Description | Graphic Log | Number | Type | | | | | | |
| | | **GROUND SURFACE** | | | | | | | | | |
| 0.0 | | 300mm **TOPSOIL** | | | | | | | | | |
| | 0.3 | Trace organics (WEATHERED/DISTURBED) | | 1 | GS | | | | | | |
| 0.5 | 0.5 | **CLAYEY SILT**, trace to some sand, very stiff, brown / grey, moist | | | | | | | | | |
| 1.0 | | | | | | | | | | | |
| 1.5 | | | | 2 | GS | | | | | | |
| | 1.8 | **SILT**, trace to some sand, trace to some clay, compact to dense, brown / grey, moist to wet | | | | | | | | | ...at 1.8m, water seepage |
| 2.0 | | | | 3 | GS | | | | | ▽ | |
| | 2.1 | **END OF TEST PIT** | | | | | | | | | |

Unstabilized water level measured at 2.0m below grade; test pit was open upon completion of excavation.

SEEPAGE MEASUREMENTS

| Time | Water Depth (m) | Elevation (m) |
|---|---|---|
| 8/23/2013 | 1.9 | |

**Terraprobe**

# TEST PIT LOG 11

Client : Laurelpark Inc.
Project : Palgrave Estates II
Location : Caledon, Ontario

Project No. : 11-13-3052
Date excavated : August 19, 2013
Sheet No. : 1 of 1

Position : E: 598415, N: 4865777 (UTM 17T)
Elevation Datum : N/A
Rig type : BACKHOE

Undrained Shear Strength (kPa)
○ Unconfined
● Pocket Penetrometer
+ Field Vane
■ Lab Vane
40 80 120 160

Moisture / Plasticity
Plastic Limit PL 10 · Natural Water Content MC 20 · Liquid Limit LL 30

Lab Data and Comments
GRAIN SIZE DISTRIBUTION (%) (MIT)
GR SA SI CL

| Depth Scale (m) | Elev Depth (m) | SOIL PROFILE Description | SAMPLES Number | SAMPLES Type | Elevation Scale (m) | Headspace Vapour | Unstabilized Water Level | Lab Data and Comments |
|---|---|---|---|---|---|---|---|---|
| 0.0 | | **GROUND SURFACE** | | | | | | |
| | | 300mm **TOPSOIL** | | | | | | |
| | 0.3 | Trace organics (WEATHERED/DISTURBED) | | | | | | |
| 0.5 | | | 1 | GS | | | | |
| | 0.6 | **CLAYEY SILT**, trace to some sand, trace gravel, stiff, brown / grey, moist | | | | | | |
| 1.0 | | | | | | | | |
| | | ...wet | 2 | GS | | | | |
| | | | 3 | GS | | | | ...at 1.4m, water seepage |
| 1.5 | 1.5 | **SILT**, trace to some sand, trace to some clay, compact to dense, brown / grey, moist | | | | | | |
| | | ...wet | 4 | GS | | | ▽ | |
| | 2.0 | **END OF TEST PIT** | | | | | | |

Unstabilized water level measured at 2.0m below grade; test pit was open upon completion of excavation.

SEEPAGE MEASUREMENTS

| Time | Water Depth (m) | Elevation (m) |
|---|---|---|
| 8/23/2013 | 1.5 | |

**Terraprobe**

# TEST PIT LOG 12

Client : Laurelpark Inc.
Project : Palgrave Estates II
Location : Caledon, Ontario

Project No. : 11-13-3052
Date excavated : August 16, 2013
Sheet No. : 1 of 1

Position : E: 598405, N: 4865760 (UTM 17T)
Elevation Datum : N/A
Rig type : BACKHOE

| Depth Scale (m) | Elev Depth (m) | Description | Graphic Log | Number | Type |
|---|---|---|---|---|---|
| 0.0 | | GROUND SURFACE<br>250mm **TOPSOIL** | | | |
| | 0.3 | Trace organics (WEATHERED/DISTURBED) | | | |
| 0.5 | | | | 1 | GS |
| | 0.7 | **SANDY SILT**, (intermittent sand seams), compact to dense, brown, moist<br>...intermittent sand seams | | | |
| 1.0 | | | | | |
| 1.5 | | | | 2 | GS |
| | 1.6 | **SILT**, trace to some sand, trace to some gravel, compact to dense, brown / grey, moist | | | |
| 2.0 | | | | 3 | GS |
| | 2.2 | **END OF TEST PIT**<br>Test pit was dry and open upon completion of excavation. | | | |

Elevation Scale (m)

Undrained Shear Strength (kPa)
○ Unconfined
● Pocket Penetrometer
+ Field Vane
■ Lab Vane
40 80 120 160

Moisture / Plasticity
Plastic Limit — Natural Water Content — Liquid Limit
PL MC LL
10 20 30

Headspace Vapour

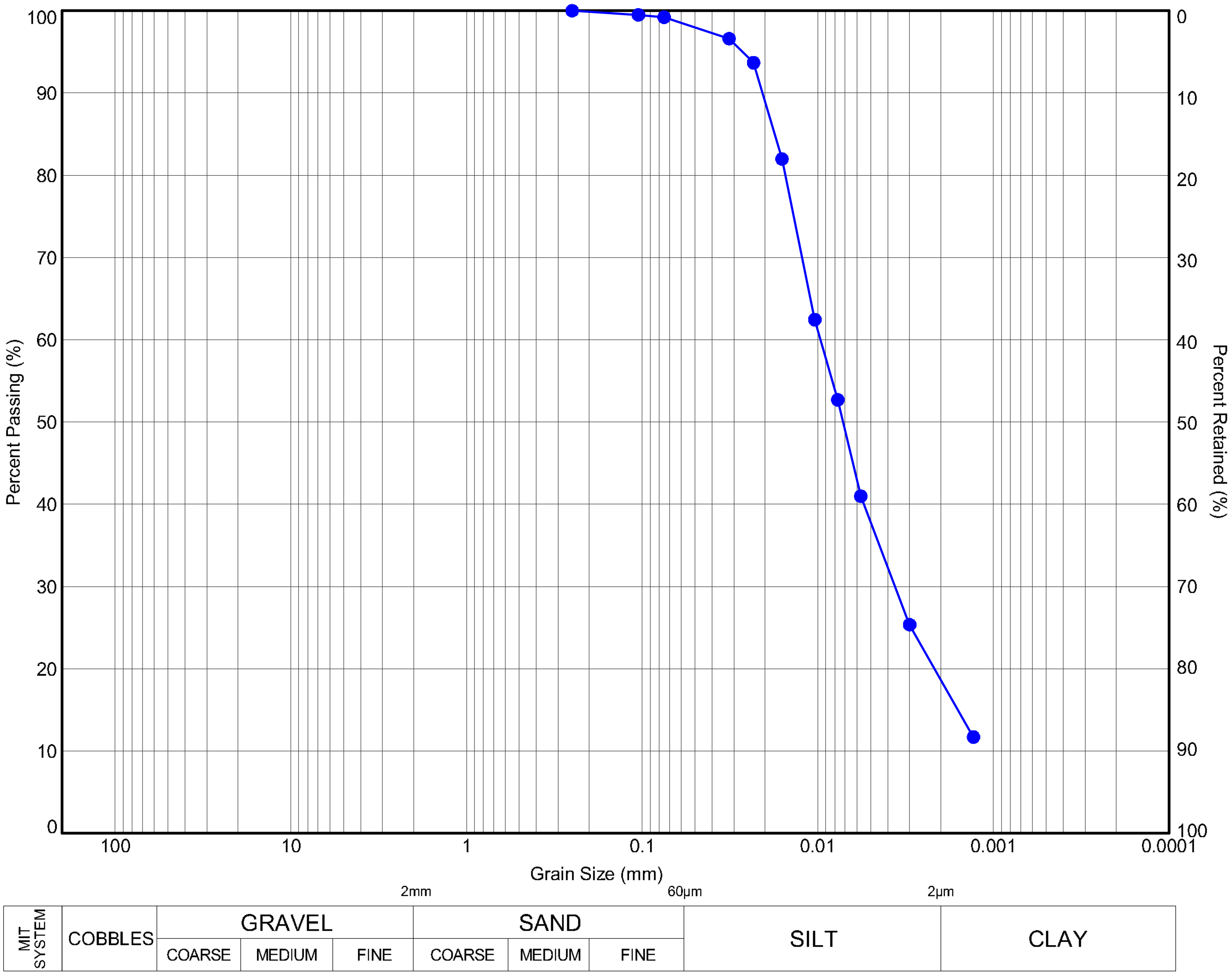
Unstabilized Water Level

Lab Data and Comments
GRAIN SIZE DISTRIBUTION (%) (MIT)
GR SA SI CL

**library:** library - terraprobe gint.glb **report:** terraprobe test pit log **file:** 11-13-3052 test pit logs.gpj

# SIEVE AND HYDROMETER ANALYSIS

TERRAPROBE INC.



| | | | | | MIT SYSTEM | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Hole ID | Sample | Depth (m) | Elev. (m) | Gravel (%) | Sand (%) | Silt (%) | Clay (%) | *(Fines, %)* |
| ● | **1** | SS5 | 3.3 | 269.8 | 0 | 1 | 80 | 19 | |

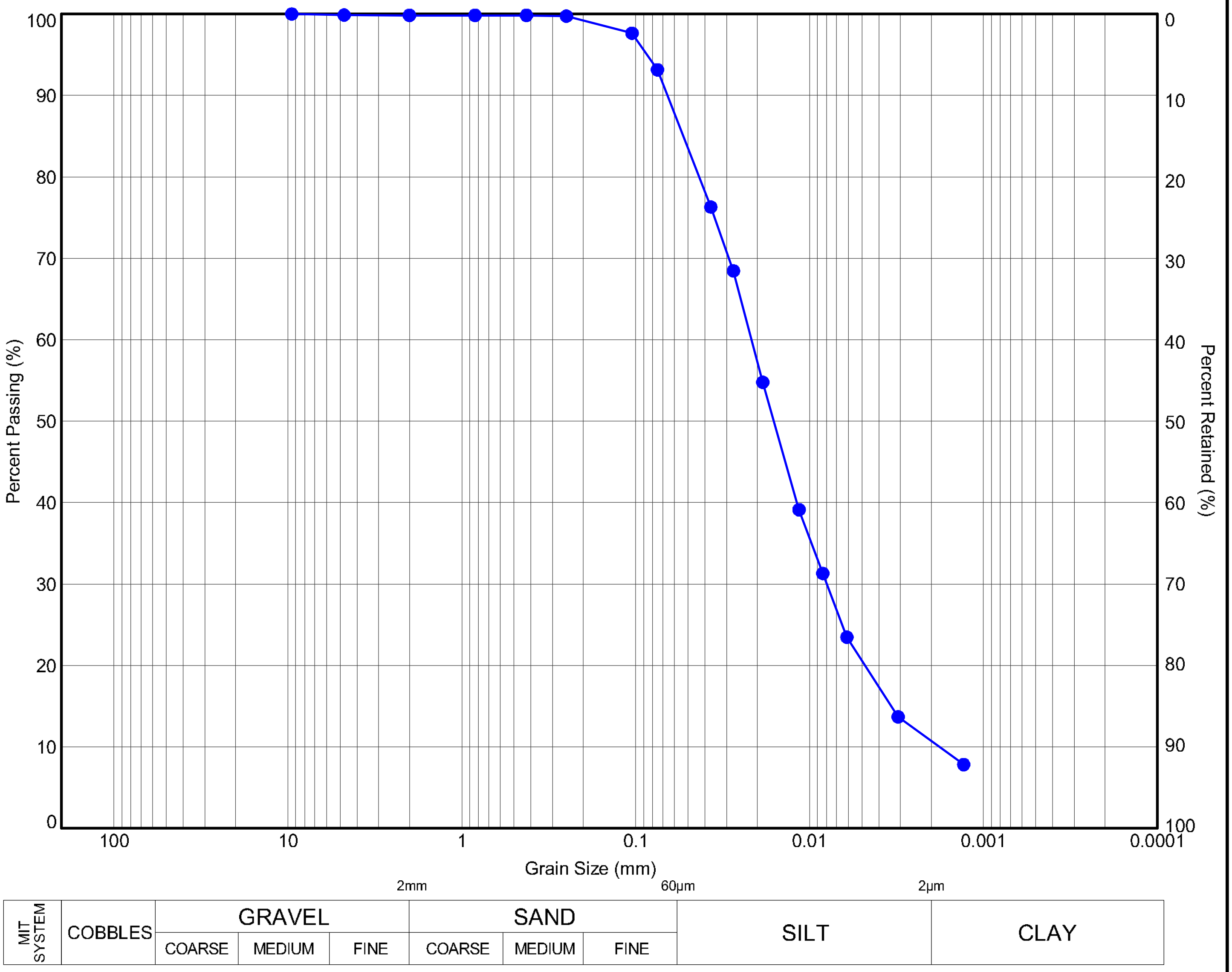
**Terraprobe**

11 Indell Lane, Brampton Ontario L6T 3Y3
(905) 796-2650

Title:

**GRAIN SIZE DISTRIBUTION**
**SILT, SOME CLAY, TRACE SAND**

File No.: **11-13-3052**



MIT SYSTEM

| | Hole ID | Sample | Depth (m) | Elev. (m) | Gravel (%) | Sand (%) | Silt (%) | Clay (%) | *(Fines, %)* |
|---|---|---|---|---|---|---|---|---|---|
| ● | **2** | SS4 | 2.5 | 277.5 | 0 | 12 | 77 | 11 | |

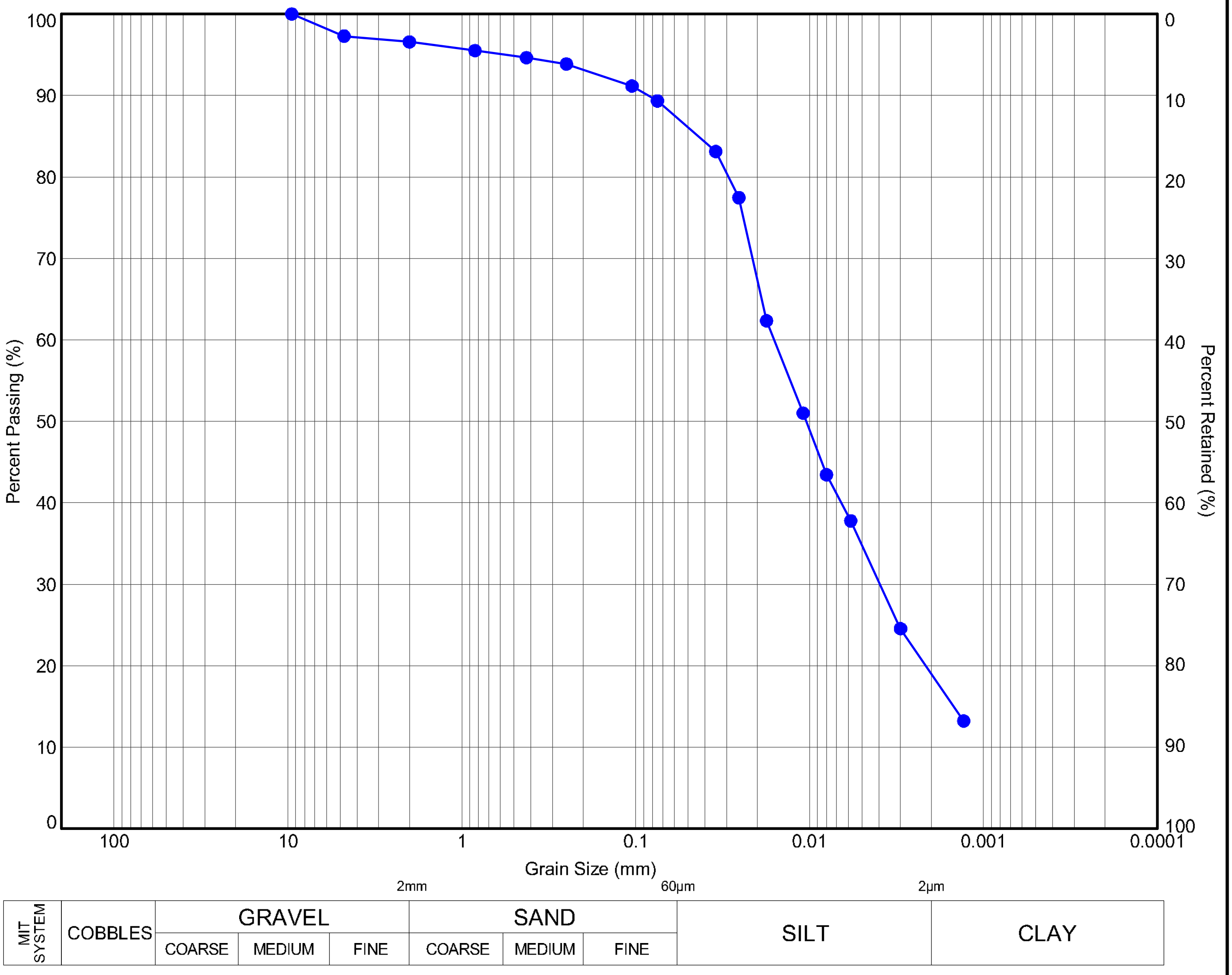
**Terraprobe**

11 Indell Lane, Brampton Ontario L6T 3Y3
(905) 796-2650

Title:

**GRAIN SIZE DISTRIBUTION**
**SILT, SOME SAND, SOME CLAY**

File No.: **11-13-3052**



|  |  |  |  |  | MIT SYSTEM |  |  |  |  |
|---|---|---|---|---|---|---|---|---|---|
|  | Hole ID | Sample | Depth (m) | Elev. (m) | Gravel (%) | Sand (%) | Silt (%) | Clay (%) | *(Fines, %)* |
| ● | **4** | SS5 | 3.3 | 278.6 | 3 | 9 | 69 | 19 |  |

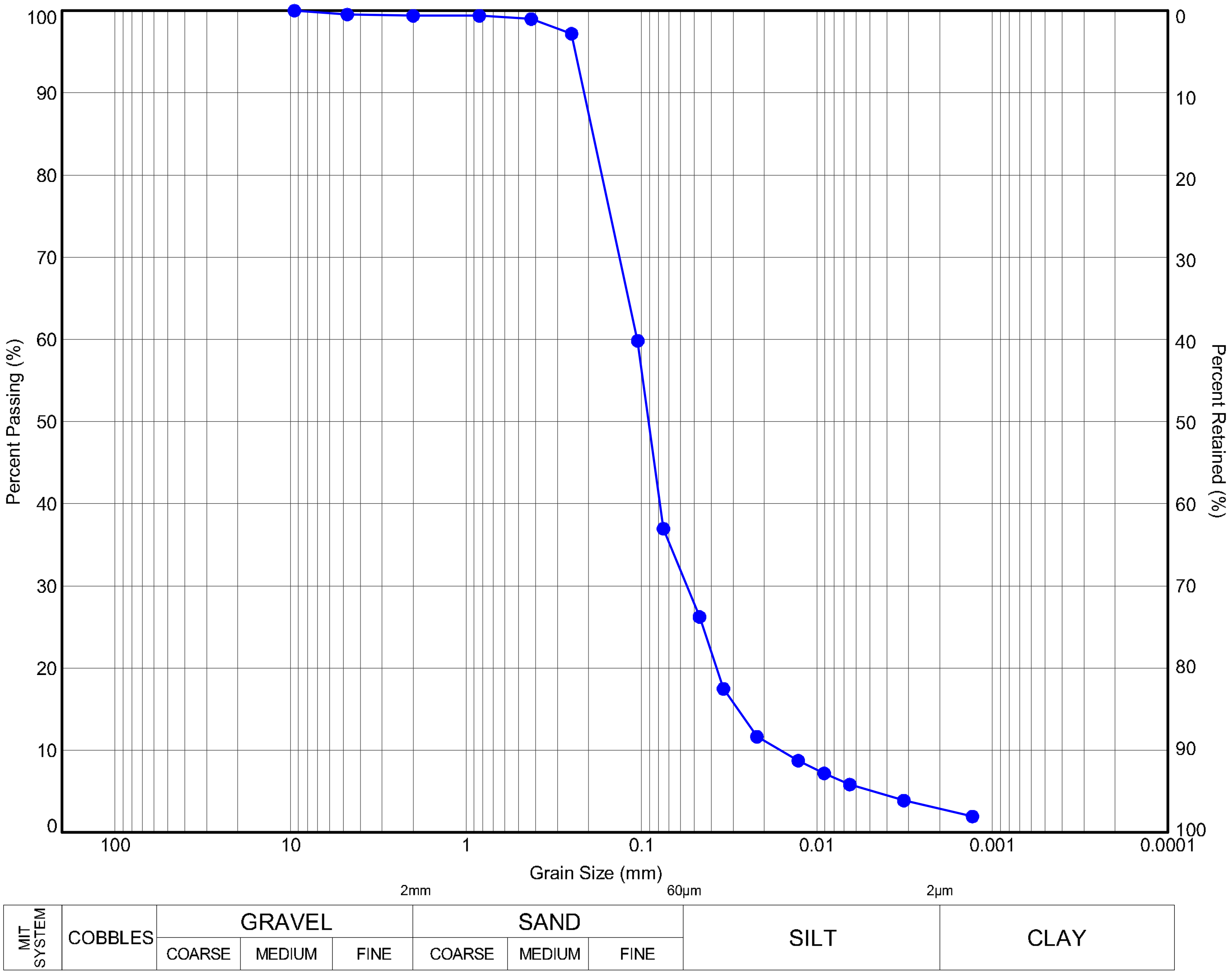
**Terraprobe**

11 Indell Lane, Brampton Ontario L6T 3Y3
(905) 796-2650

Title:

**GRAIN SIZE DISTRIBUTION**
**SILT, SOME CLAY, TRACE SAND, TRACE GRAVEL**

File No.: **11-13-3052**



MIT SYSTEM

| | Hole ID | Sample | Depth (m) | Elev. (m) | Gravel (%) | Sand (%) | Silt (%) | Clay (%) | *(Fines, %)* |
|---|---|---|---|---|---|---|---|---|---|
| ● | **5** | SS5 | 3.3 | 281.9 | 1 | 67 | 29 | 3 | |

**Terraprobe**

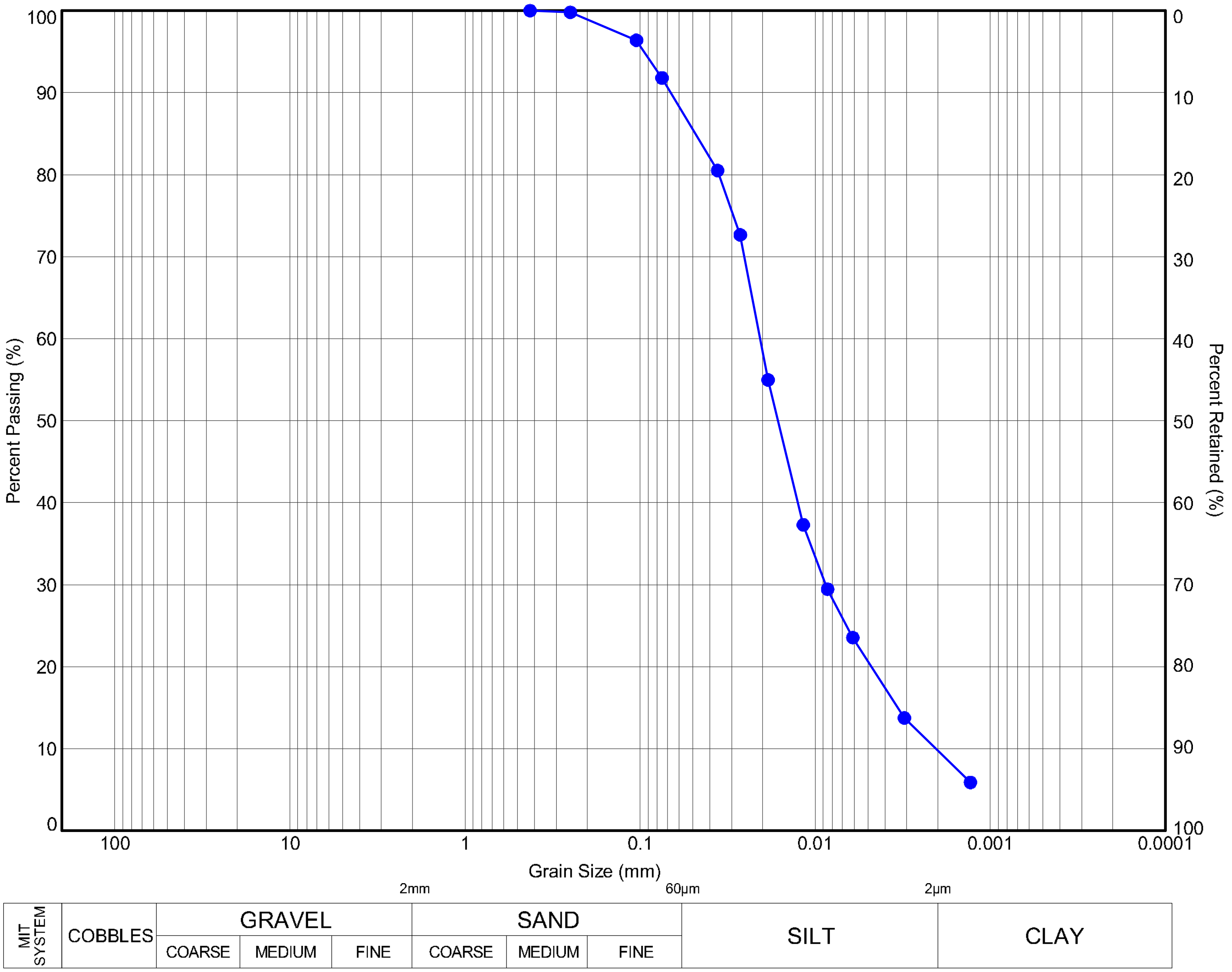
11 Indell Lane, Brampton Ontario L6T 3Y3
(905) 796-2650

Title:

**GRAIN SIZE DISTRIBUTION**
**SILTY SAND, TRACE CLAY, TRACE GRAVEL**

File No.:

**11-13-3052**



|  |  |  |  |  | MIT SYSTEM |  |  |  |  |
|---|---|---|---|---|---|---|---|---|---|
|  | Hole ID | Sample | Depth (m) | Elev. (m) | Gravel (%) | Sand (%) | Silt (%) | Clay (%) | *(Fines, %)* |
| ● | **6** | SS7 | 6.3 | 271.7 | 0 | 11 | 79 | 10 |  |

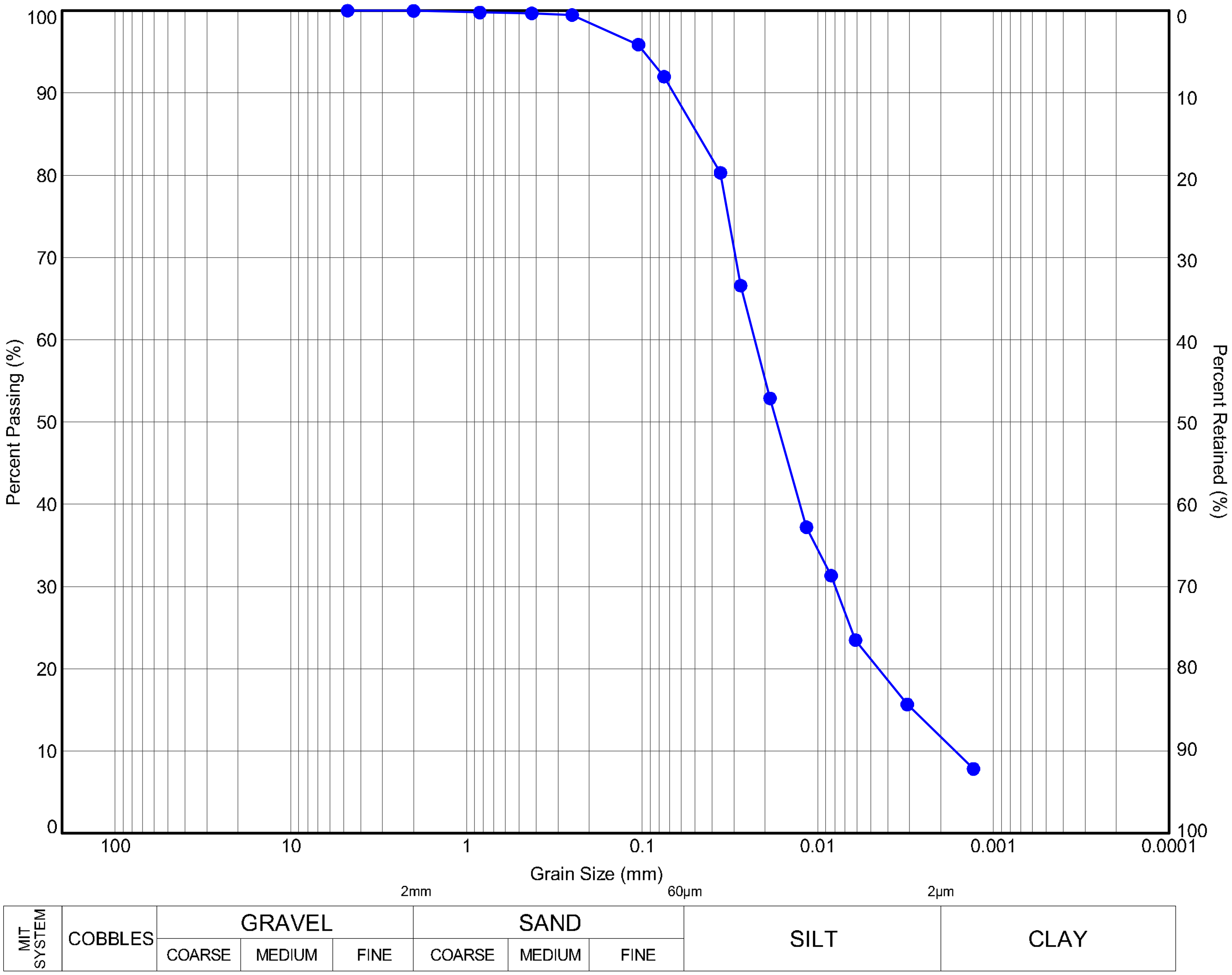
**Terraprobe**

11 Indell Lane, Brampton Ontario L6T 3Y3
(905) 796-2650

Title:

**GRAIN SIZE DISTRIBUTION**
**SILT, SOME SAND, SOME CLAY**

File No.: **11-13-3052**



MIT SYSTEM

| | Hole ID | Sample | Depth (m) | Elev. (m) | Gravel (%) | Sand (%) | Silt (%) | Clay (%) | *(Fines, %)* |
|---|---|---|---|---|---|---|---|---|---|
| ● | **8** | SS6 | 4.8 | 276.1 | 0 | 11 | 77 | 12 | |

**Terraprobe**

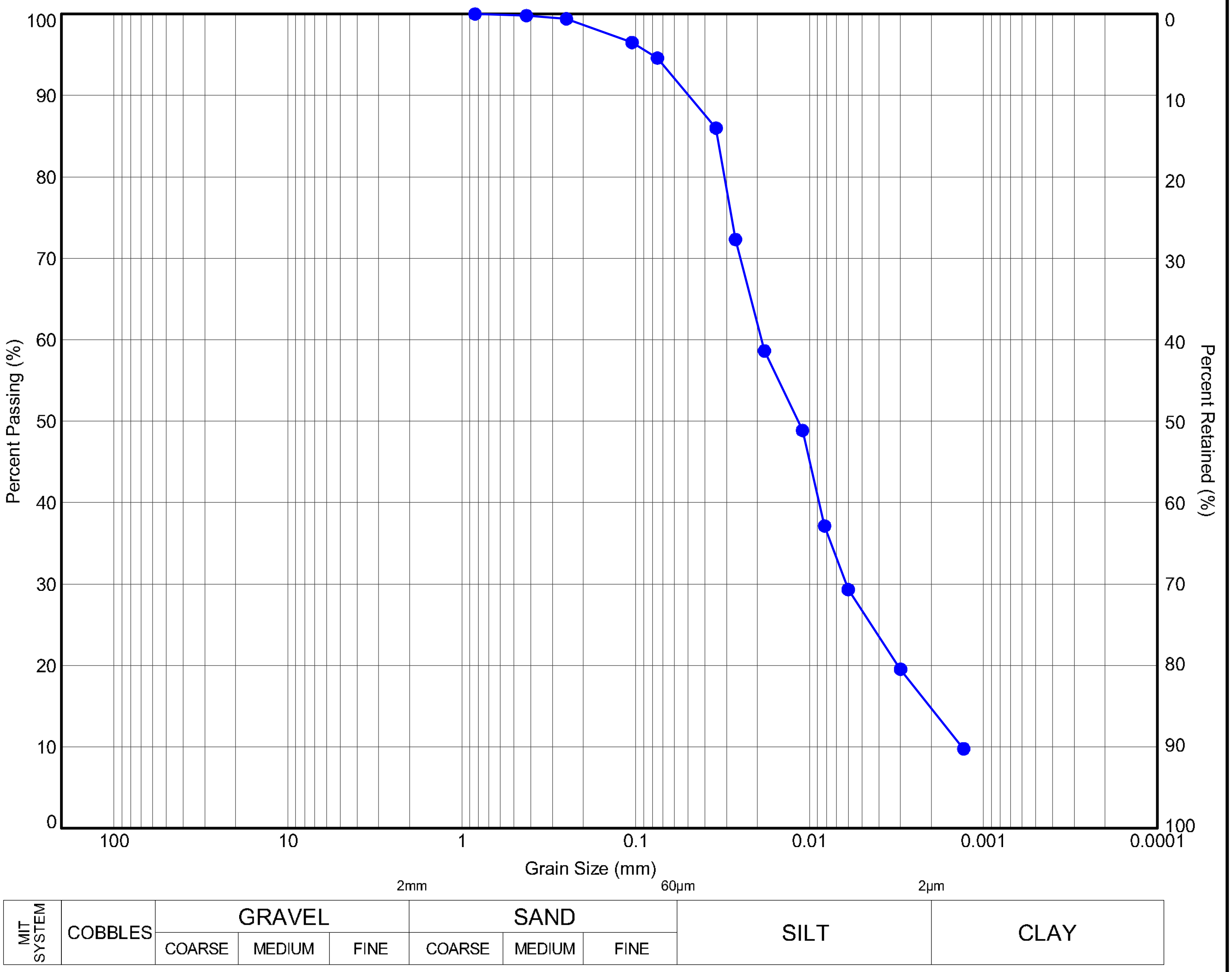
11 Indell Lane, Brampton Ontario L6T 3Y3
(905) 796-2650

Title:

**GRAIN SIZE DISTRIBUTION**
**SILT, SOME CLAY, SOME SAND**

File No.:

**11-13-3052**



|  |  |  |  |  | MIT SYSTEM |  |  |  |  |
|---|---|---|---|---|---|---|---|---|---|
|  | Hole ID | Sample | Depth (m) | Elev. (m) | Gravel (%) | Sand (%) | Silt (%) | Clay (%) | *(Fines, %)* |
| ● | **9** | SS3 | 1.8 | 280.9 | 0 | 8 | 77 | 15 |  |

**Terraprobe**

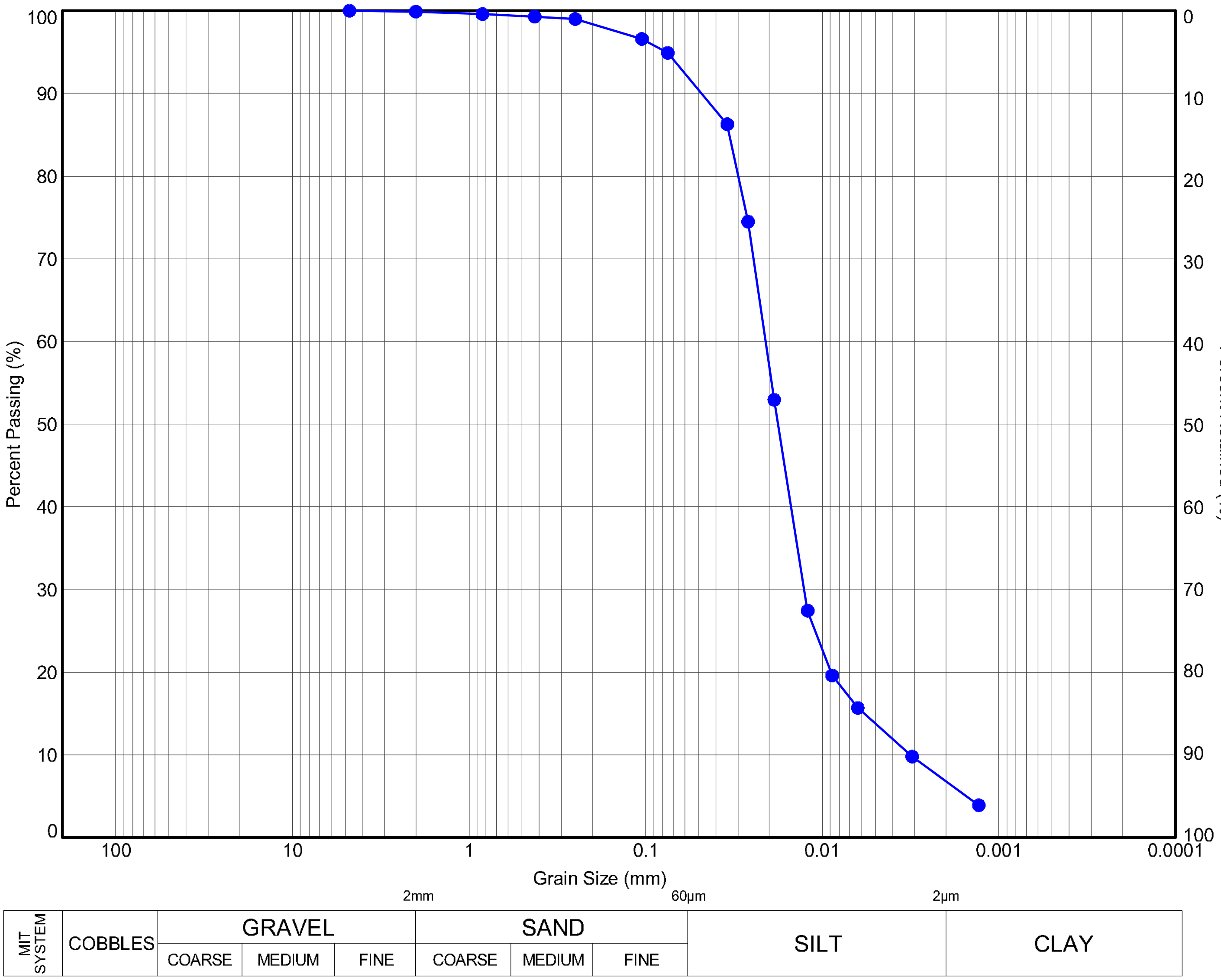
11 Indell Lane, Brampton Ontario L6T 3Y3
(905) 796-2650

Title:

**GRAIN SIZE DISTRIBUTION**
**SILT, SOME CLAY, TRACE SAND**

File No.:

**11-13-3052**



|  | Hole ID | Sample | Depth (m) | Elev. (m) | Gravel (%) | Sand (%) | Silt (%) | Clay (%) | *(Fines, %)* |
|---|---|---|---|---|---|---|---|---|---|
|  |  |  |  |  | MIT SYSTEM |  |  |  |  |
| ● | **10** | SS5 | 3.3 | 275.8 | 0 | 7 | 86 | 7 |  |

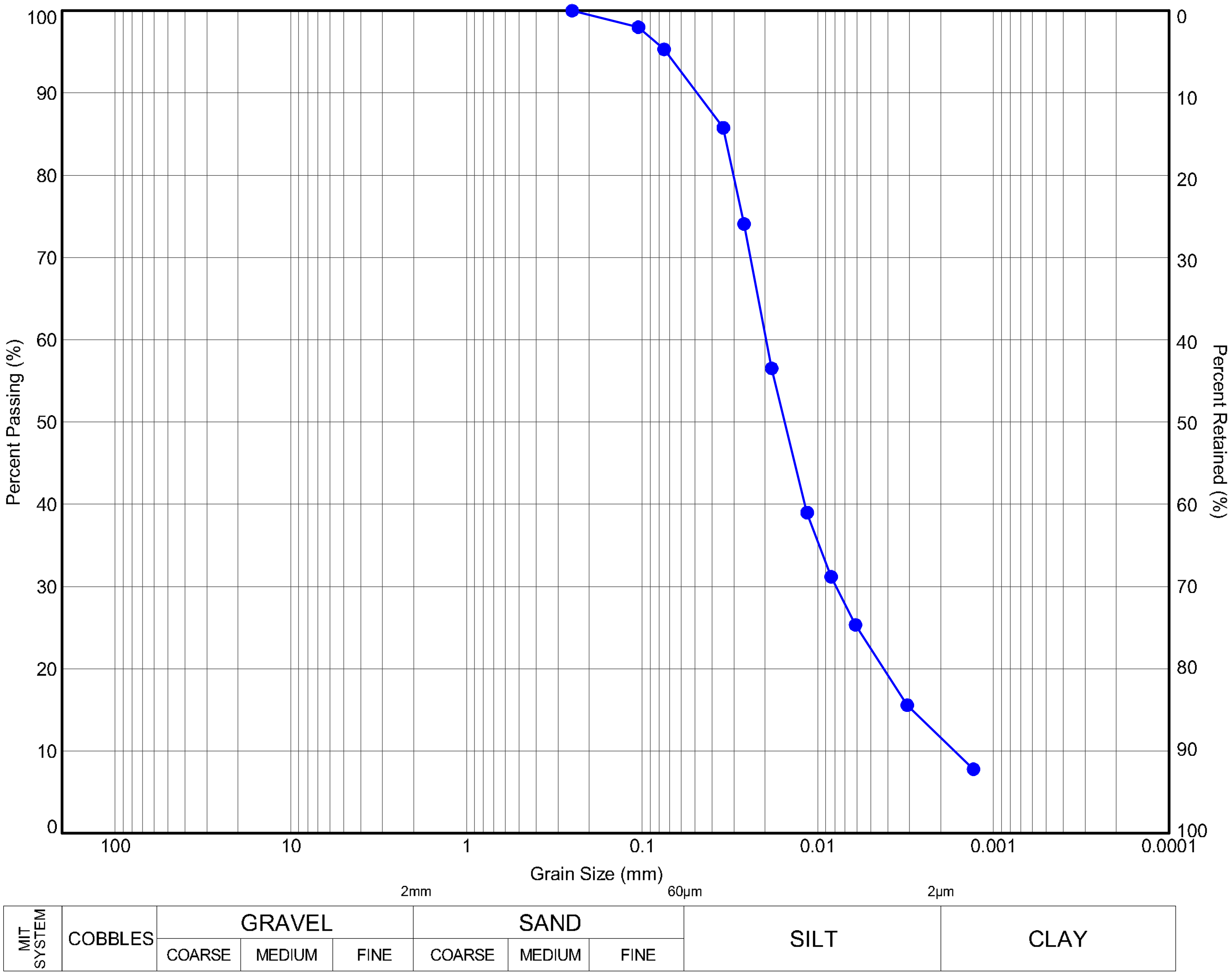
**Terraprobe**

11 Indell Lane, Brampton Ontario L6T 3Y3
(905) 796-2650

Title:

**GRAIN SIZE DISTRIBUTION**
**SILT, TRACE CLAY, TRACE SAND**

File No.: **11-13-3052**



|  |  |  |  |  | MIT SYSTEM |  |  |  |  |
|---|---|---|---|---|---|---|---|---|---|
|  | Hole ID | Sample | Depth (m) | Elev. (m) | Gravel (%) | Sand (%) | Silt (%) | Clay (%) | *(Fines, %)* |
| ● | **11** | SS4 | 2.5 | 277.7 | 0 | 7 | 81 | 12 |  |

**Terraprobe**

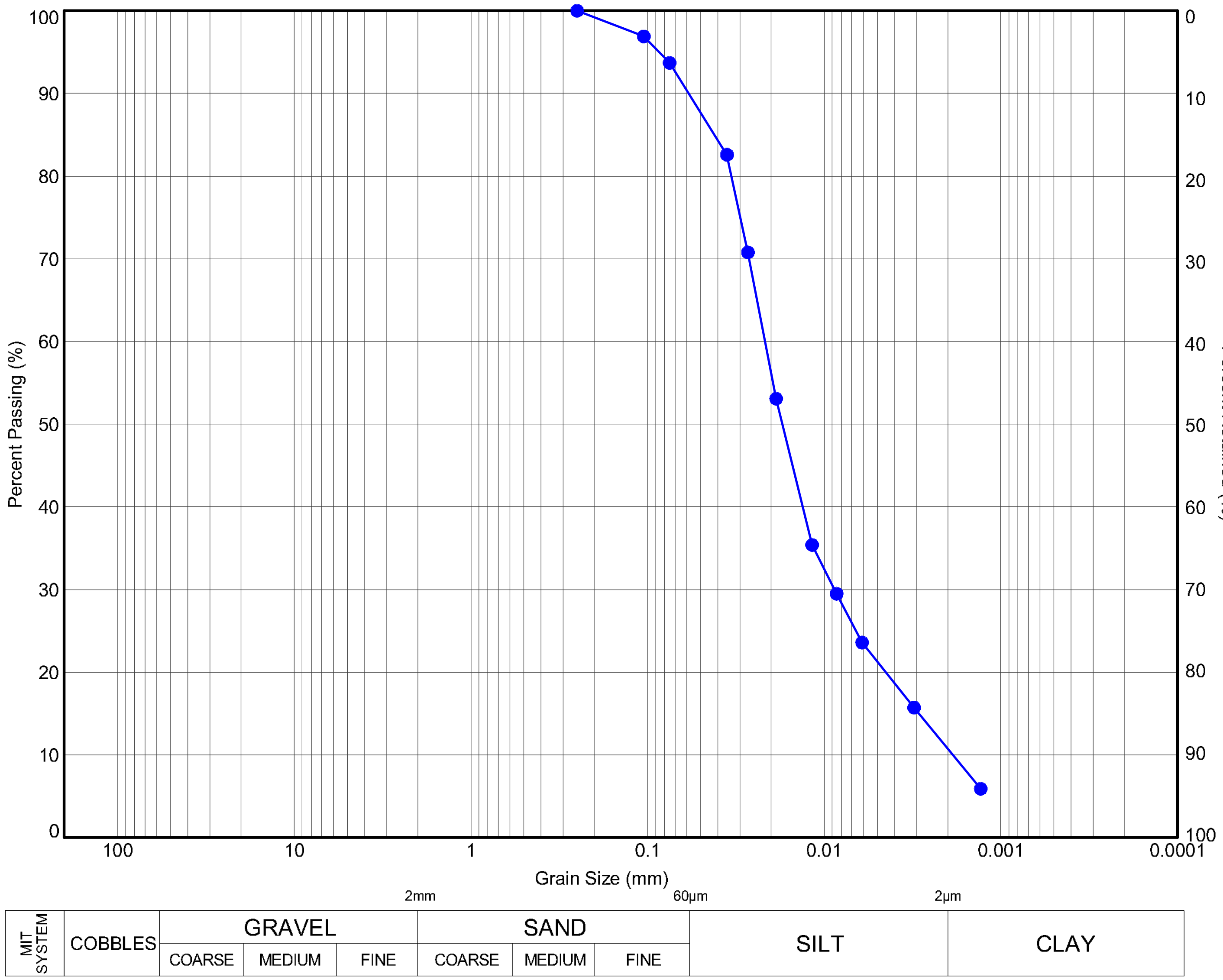
11 Indell Lane, Brampton Ontario L6T 3Y3
(905) 796-2650

Title:

**GRAIN SIZE DISTRIBUTION**
**SILT, SOME CLAY, TRACE SAND**

File No.:

**11-13-3052**



MIT SYSTEM

| | Hole ID | Sample | Depth (m) | Elev. (m) | Gravel (%) | Sand (%) | Silt (%) | Clay (%) | *(Fines, %)* |
|---|---|---|---|---|---|---|---|---|---|
| ● | **11** | SS7 | 6.2 | 274.0 | 0 | 9 | 80 | 11 | |

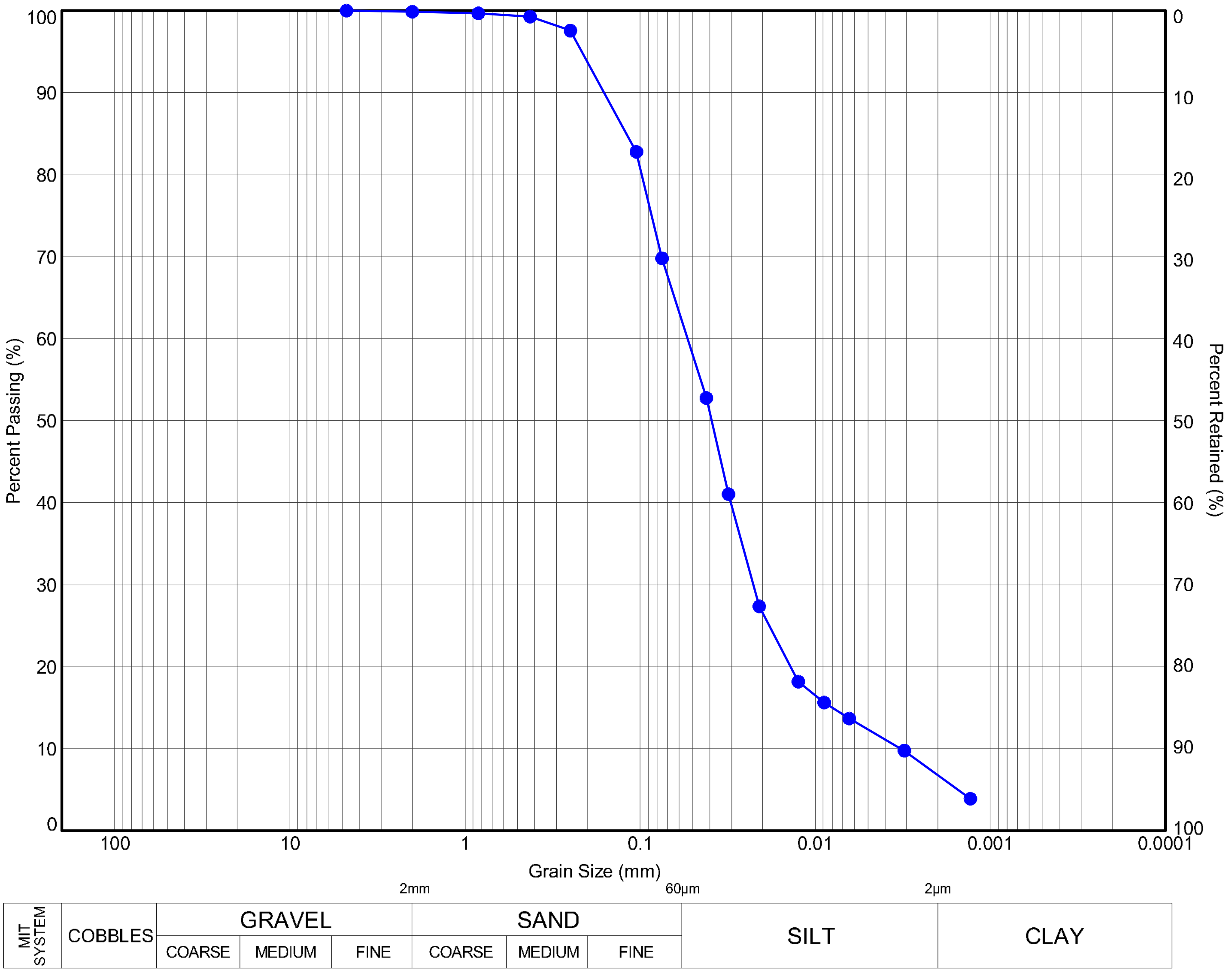
**Terraprobe**

11 Indell Lane, Brampton Ontario L6T 3Y3
(905) 796-2650

Title:

**GRAIN SIZE DISTRIBUTION**
**SILT, SOME CLAY, TRACE SAND**

File No.: **11-13-3052**



MIT SYSTEM

| | Hole ID | Sample | Depth (m) | Elev. (m) | Gravel (%) | Sand (%) | Silt (%) | Clay (%) | *(Fines, %)* |
|---|---|---|---|---|---|---|---|---|---|
| ● | **12** | SS3 | 1.8 | 283.5 | 0 | 36 | 57 | 7 | |

**Terraprobe**

11 Indell Lane, Brampton Ontario L6T 3Y3
(905) 796-2650

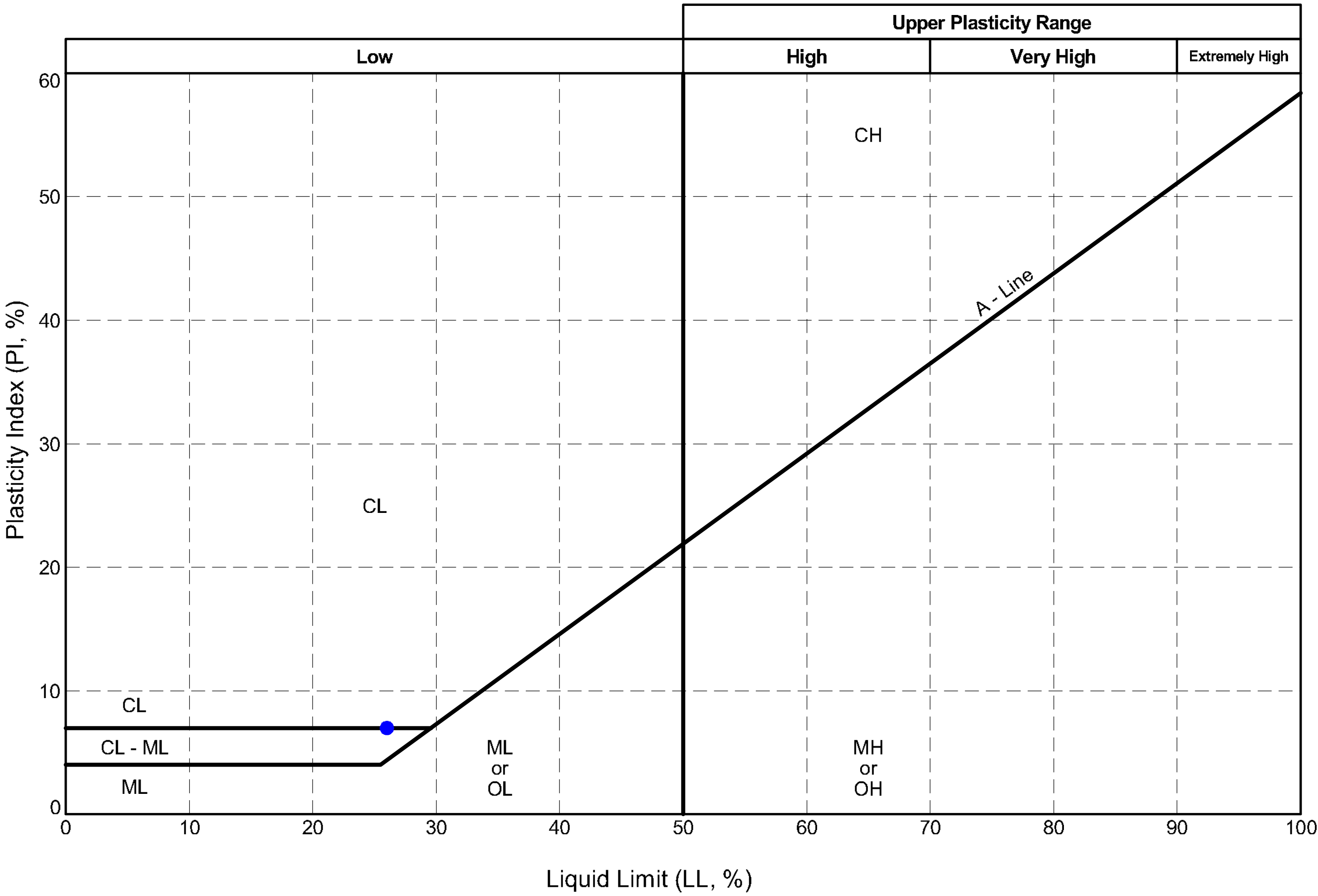
Title:

**GRAIN SIZE DISTRIBUTION**
**SILT AND SAND, TRACE CLAY**

File No.: **11-13-3052**

# ATTERBERG
# LIMITS
# TEST RESULTS

TERRAPROBE INC.



| | Borehole | Sample | Depth (m) | Elev. (m) | LL (%) | PL (%) | PI (%) | Description |
|---|---|---|---|---|---|---|---|---|
| ● | 1 | SS5 | 3.3 | 269.8 | 26 | 19 | 7 | SLIGHTLY PLASTIC, SLIGHT OR LOW COMPRESSIBILITY |

**Terraprobe**

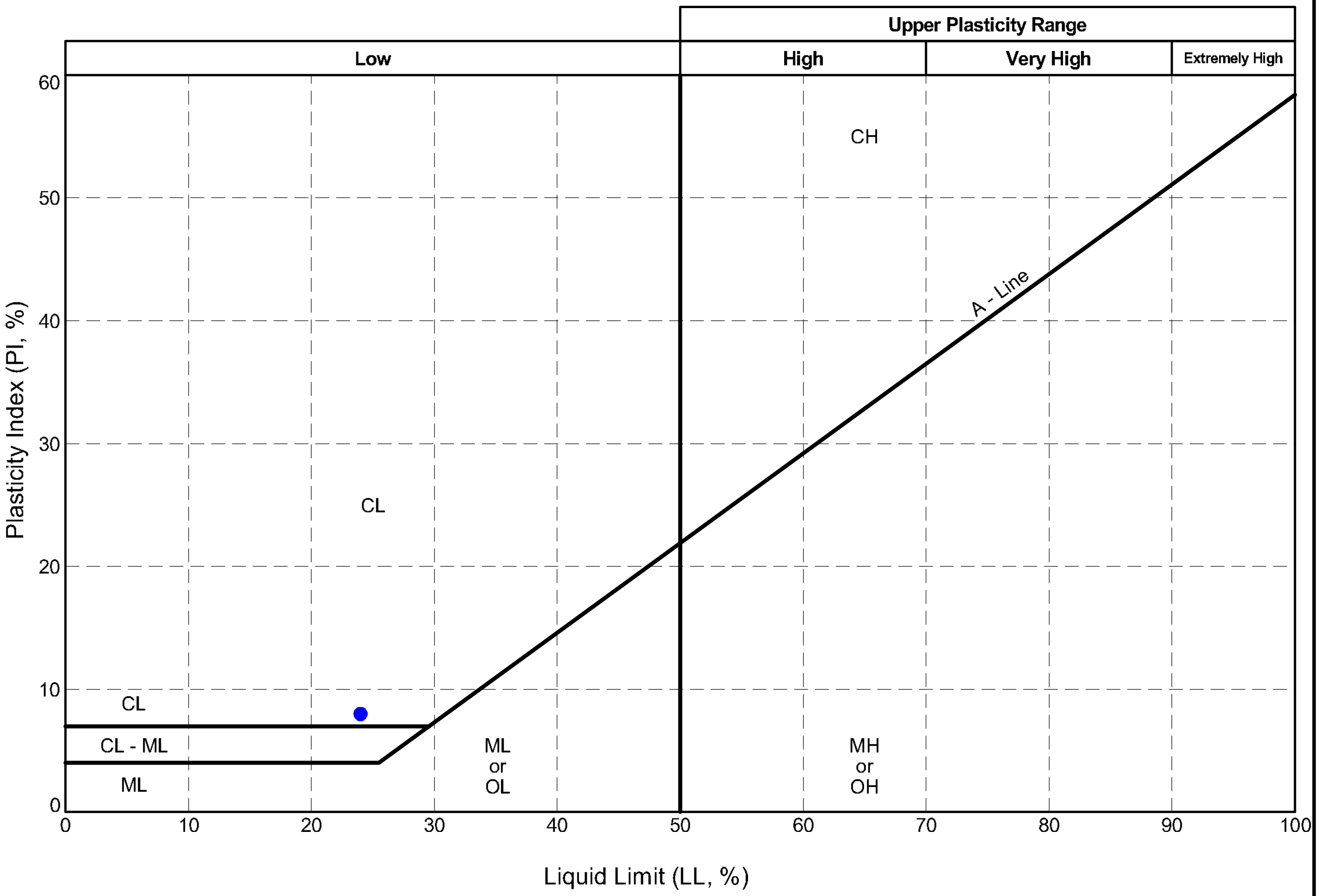
11 Indell Lane, Brampton Ontario L6T 3Y3
(905) 796-2650

Title:

## ATTERBERG LIMITS CHART

File No.:

**11-13-3052**



| | Borehole | Sample | Depth (m) | Elev. (m) | LL (%) | PL (%) | PI (%) | Description |
|---|---|---|---|---|---|---|---|---|
| ● | 4 | SS5 | 3.3 | 278.6 | 24 | 16 | 8 | SLIGHTLY PLASTIC |

**Terraprobe**

11 Indell Lane, Brampton Ontario L6T 3Y3
(905) 796-2650

Title:

## ATTERBERG LIMITS CHART

File No.:

**11-13-3052**

# FIGURES

TERRAPROBE INC.

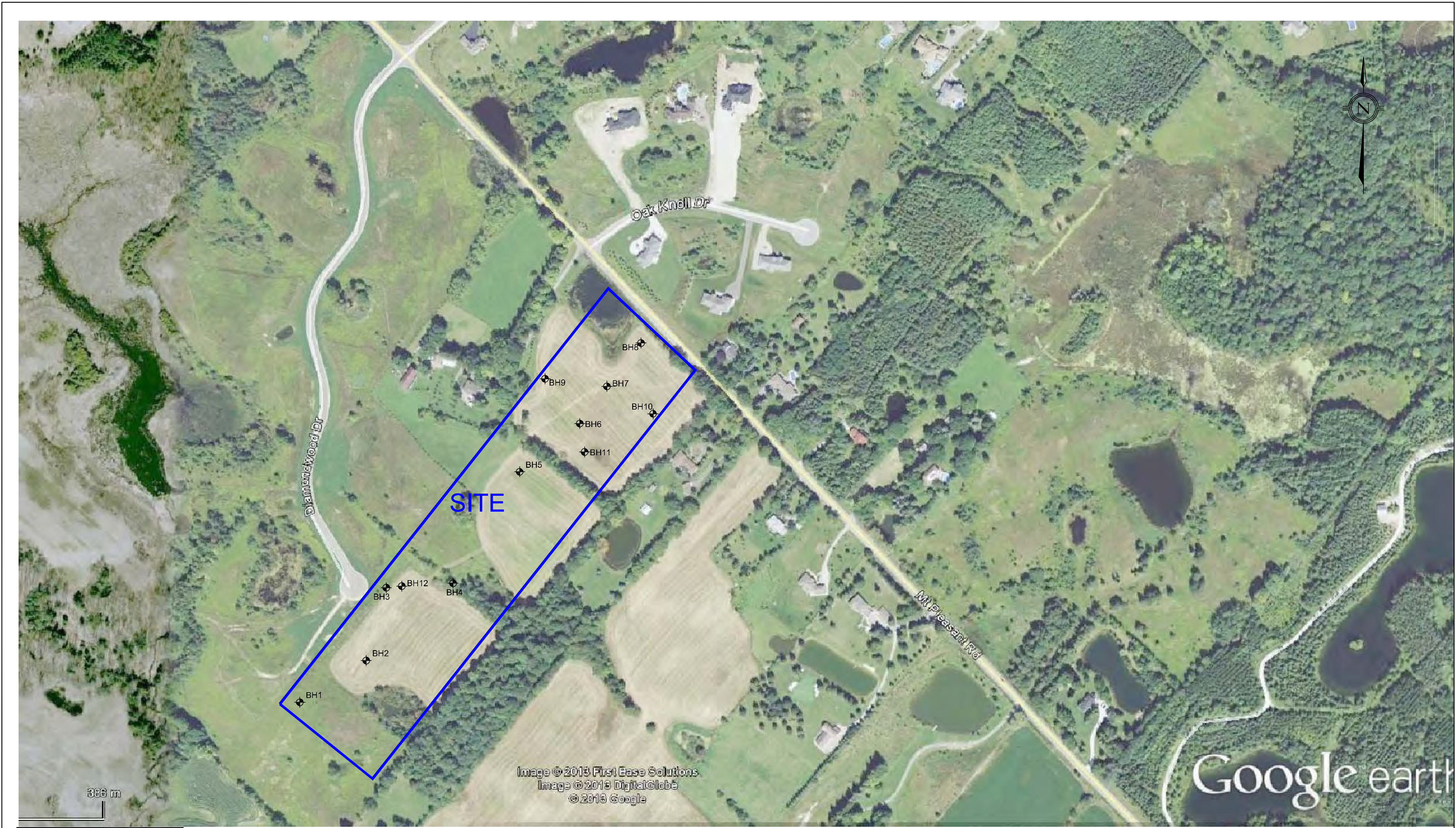


Image © 2013 First Base Solutions
Image © 2013 DigitalGlobe
© 2013 Google

LEGEND

⌖ Borehole Location

REFERENCE

Google Earth 2013

SCALE 50 25 0 25 50 75 100m

**Terraprobe**

11 Indell Lane, Brampton, Ontario, L6T 3Y3
Tel: (905) 796-2650 Fax: (905) 796-2250

| | |
|---|---|
| Title: | **AERIAL PHOTO** |
| File No. | 11-13-3052 |
| FIGURE : | 1A |

# APPENDIX C

# STORMWATER MANAGEMENT SUPPORTING CALCULATIONS

# Humber River Stormwater Management Quantity Control Release Rates

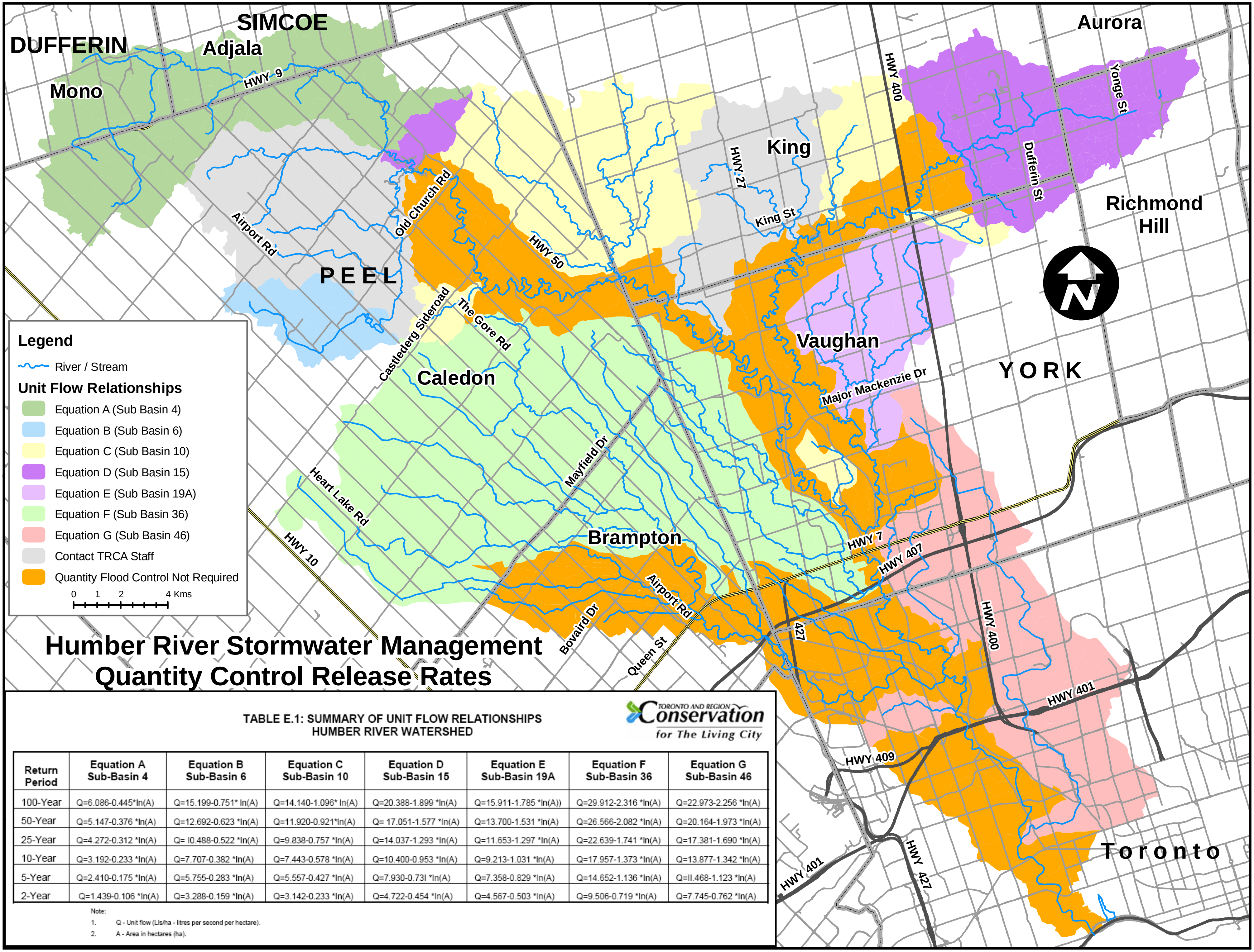


TABLE E.1: SUMMARY OF UNIT FLOW RELATIONSHIPS
HUMBER RIVER WATERSHED

TORONTO AND REGION Conservation for The Living City

| Return Period | Equation A Sub-Basin 4 | Equation B Sub-Basin 6 | Equation C Sub-Basin 10 | Equation D Sub-Basin 15 | Equation E Sub-Basin 19A | Equation F Sub-Basin 36 | Equation G Sub-Basin 46 |
|---|---|---|---|---|---|---|---|
| 100-Year | Q=6.086-0.445*In(A) | Q=15.199-0.751* In(A) | Q=14.140-1.096* In(A) | Q=20.388-1.899 *In(A) | Q=15.911-1.785 *In(A)) | Q=29.912-2.316 *In(A) | Q=22.973-2.256 *In(A) |
| 50-Year | Q=5.147-0.376 *In(A) | Q=12.692-0.623 *In(A) | Q=11.920-0.921*In(A) | Q= 17.051-1.577 *In(A) | Q=13.700-1.531 *In(A) | Q=26.566-2.082 *In(A) | Q=20.164-1.973 *In(A) |
| 25-Year | Q=4.272-0.312 *In(A) | Q= I0.488-0.522 *In(A) | Q=9.838-0.757 *In(A) | Q=14.037-1.293 *In(A) | Q=11.653-1.297 *In(A) | Q=22.639-1.741 *In(A) | Q=17.381-1.690 *In(A) |
| 10-Year | Q=3.192-0.233 *In(A) | Q=7.707-0.382 *In(A) | Q=7.443-0.578 *In(A) | Q=10.400-0.953 *In(A) | Q=9.213-1.031 *In(A) | Q=17.957-1.373 *In(A) | Q=13.877-1.342 *In(A) |
| 5-Year | Q=2.410-0.175 *In(A) | Q=5.755-0.283 *In(A) | Q=5.557-0.427 *In(A) | Q=7.930-0.73I *In(A) | Q=7.358-0.829 *In(A) | Q=14.652-1.136 *In(A) | Q=II.468-1.123 *In(A) |
| 2-Year | Q=1.439-0.106 *In(A) | Q=3.288-0.159 *In(A) | Q=3.142-0.233 *In(A) | Q=4.722-0.454 *In(A) | Q=4.567-0.503 *In(A) | Q=9.506-0.719 *In(A) | Q=7.745-0.762 *In(A) |

Note:

1. Q - Unit flow (Lls/ha - litres per second per hectare).
2. A - Area in hectares (ha).

## Table C.1.1

**LAURELPARK, SWMHYMO PARAMETERS**
**EXISTING CONDITIONS**

### NASHYD PARAMETERS

| Catchment | NHYD | DT min | Area ha | DWF cms | CN/C Group | CN/C | IA mm | N | TP hrs | Runoff Coeff. C | Slope (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **1** | **1** | 1 | 1.92 | 0 | BC | 76 | 10 | 3 | 0.14 | 0.35 | 10.00 |
| **2** | **2** | 1 | 1.60 | 0 | BC | 78 | 10 | 3 | 0.14 | 0.35 | 13.22 |
| **3** | **3** | 1 | 0.18 | 0 | BC | 75 | 10 | 3 | 0.09 | 0.35 | 13.21 |
| **4** | **4** | 1 | 2.60 | 0 | BC | 70 | 10 | 3 | 0.17 | 0.35 | 11.84 |
| **5** | **5** | 1 | 1.79 | 0 | BC | 68 | 10 | 3 | 0.13 | 0.35 | 12.03 |
| **6** | **6** | 1 | 2.58 | 0 | BC | 75 | 10 | 3 | 0.26 | 0.28 | 4.12 |
| **7** | **7** | 1 | 1.46 | 0 | BC | 83 | 10 | 3 | 0.09 | 0.35 | 9.22 |
| **8** | 8 | 1 | 0.38 | 0 | BC | 75 | 10 | 3 | 0.16 | 0.28 | 4.91 |
| **9** | 9 | 2 | 0.05 | 0 | BC | 75 | 10 | 3 | 0.06 | 0.36 | 15.51 |

Notes:
1. Assumed row crop with good drainage in BC soil category ->
   Reference: MTO Design Chart 1.09: Soil/Land Use Curve Numbers
2. Time to Peak (TP) was calculated using Airport Method. TP=2/3 of Time of Concentration.

## Table C.1.2

**LAURELPARK, WEIGHTED CN VALUES**
**PROPOSED CONDITIONS:**

### NASHYD PARAMETERS

| Sub-Basin | NHYD ID | DT min | Area ha | DWF cms | CN/C Group | Weighted CN | IA mm | N | TP hrs |
|---|---|---|---|---|---|---|---|---|---|
| A1 | A1 | 1 | 1.95 | 0 | BC | 78 | 10 | 3 | 0.22 |
| A2 | A2 | 1 | 1.65 | 0 | BC | 79 | 10 | 3 | 0.20 |
| A4 | A4 | 1 | 2.57 | 0 | BC | 70 | 10 | 3 | 0.17 |
| A5 | A5 | 1 | 1.70 | 0 | BC | 68 | 10 | 3 | 0.14 |
| A6 | A6 | 1 | 1.62 | 0 | BC | 77 | 10 | 3 | 0.20 |
| A7 | A7 | 1 | 1.66 | 0 | BC | 83 | 10 | 3 | 0.09 |
| A9 | A9 | 1 | 0.13 | 1 | BC | 75 | 10 | 3 | 0.07 |

### STANDHYD PARAMETERS

| Sub-Basin | NHYD ID | Area ha | CN | TIMP | XIMP | IAPer mm | SLPP % | LGP m | MNP | SCP min | IAimp mm | SLPI % | LGI m | MNI | SCI min |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A3 | A3 | 0.05 | 84 | 0.39 | 0.001 | 10 | 4.0% | 15 | 0.25 | 0 | 0.7 | 5.0% | 90 | 0.013 | 0 |
| A8 | A8 | 1.25 | 82 | 0.31 | 0.001 | 10 | 3.0% | 40 | 0.25 | 0 | 0.7 | 4.0% | 164 | 0.013 | 0 |

## Table C.1.3

### LAURELPARK, WEIGHTED CN VALUES

**EXISTING CONDITIONS:**

**NASHYD PARAMETERS**

| Catchment | NHYD | total Nashyd area (ha) | total Nashyd area (sq.m) | Pervious Grassed (sq.m) | Pond/ Wetland (sq.m) | Impervious (sq.m) | Pervious CN | Wetland CN | Impervious CN | Weighted CN |
|---|---|---|---|---|---|---|---|---|---|---|
| 1.0 | 1.0 | 1.92 | 19,243 | 18,481 | 603 | 159 | 75 | 100 | 98 | 76 |
| 2.0 | 2.0 | 1.60 | 16,018 | 13,839 | 2,179 | 0 | 75 | 100 | 98 | 78 |
| 3.0 | 3.0 | 0.18 | 1,791 | 1,791 |  | 0 | 75 | 100 | 98 | 75 |
| 4.0 | 4.0 | 2.60 | 26,040 | 23,116 | 2,924 | 0 | 66 | 100 | 98 | 70 |
| 5.0 | 5.0 | 1.79 | 17,886 | 17,057 | 669 | 161 | 66 | 100 | 98 | 68 |
| 6.0 | 6.0 | 2.58 | 25,823 | 25,823 |  | 0 | 75 | 100 | 98 | 75 |
| 7.0 | 7.0 | 1.46 | 14,598 | 9,793 | 4,685 | 120 | 75 | 100 | 98 | 83 |
| 8.0 | 8.0 | 0.38 | 3,832 | 3,832 |  | 0 | 75 | 100 | 98 | 75 |
| 9.0 | 9.0 | 0.05 | 536 | 536 |  | 0 | 75 | 100 | 98 | 75 |

**PROPOSED CONDITIONS:**

| Catchment | NHYD | total area (ha) | total area (sq.m) | Pervious Grassed (sq.m) | Pond/ Wetland (sq.m) | Impervious (sq.m) | Pervious CN | Wetland CN | Impervious CN | Weighted CN |
|---|---|---|---|---|---|---|---|---|---|---|
| A1 | A1 | 1.95 | 19,507 | 17,168 | 603 | 1,736 | 75 | 100 | 98 | 78 |
| A2 | A2 | 1.65 | 16,465 | 13,748 | 2,179 | 537 | 75 | 100 | 98 | 79 |
| A3 | A3 | 0.05 | 523 | 320 |  | 203 | 75 | 100 | 98 | 84 |
| A4 | A4 | 2.57 | 25,696 | 22,288 | 2,924 | 484 | 66 | 100 | 98 | 70 |
| A5 | A5 | 1.70 | 17,044 | 16,000 | 669 | 375 | 66 | 100 | 98 | 68 |
| A6 | A6 | 1.62 | 16,182 | 15,117 |  | 1,065 | 75 | 100 | 98 | 77 |
| A7 | A7 | 1.66 | 16,620 | 11,469 | 4,685 | 466 | 75 | 100 | 98 | 83 |
| A8 | A8 | 1.25 | 12,453 | 8,553 |  | 3,900 | 75 | 100 | 98 | 82 |
| A9 | A9 | 0.13 | 1,295 | 1,295 |  | 0 | 75 | 100 | 98 | 75 |

Notes:
1. Assumed row crop with good drainage in BC soil category -> CN range 75 to 8
   Reference: MTO Design Chart 1.09: Soil/Land Use Curve Number
2. Units: ha-hectares; sq.m-square meters

## Table C.1.4

### LAURELPARK, TIME TO PEAK CALCULATIONS

***Bransby Williams Method***

$$T_c = \frac{0.057L}{S^{0.2}A^{0.1}}$$

Where; $T_c$ = Time of Concentration (min.)
L = Length of watershed (m)
S = slope of watershed (%)
A = watershed area (ha.)

***Kirpich Formula***

$$T_c = \frac{0.06628L^{0.77}}{S^{0.385}}$$

Where; $T_c$ = Time of Concentration (hr.)
L = Length of watershed (km)
S = slope of watershed (m/m)

***Watt & Chow***

$$T_c = 0.0293(L/S^{0.5})^{0.79}$$

Where; $T_c$ = Time of Concentration (min.)
L = Length of watershed (m)
S = slope of watershed (m/m)

***Airport Method***

$$T_c = \frac{3.26(1.1-C)L^{0.5}}{S^{0.33}}$$

Where; $T_c$ = Time of Concentration (min.)
C = Runoff Coefficient
L = Length of watershed (m)
S = slope of watershed (%)

| Catchment | Catchment | | | | | $T_c$ | | | | | | | $T_p = {}^2/_3T_c$ | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Area (sq.m) | Area (ha.) | Length (m) | Runoff Coeff. C | Slope (%) | Bransby Williams (min.) | Bransby Williams (hr.) | Kirpich (hr.) | Watt & Chow (min.) | Watt & Chow (hr.) | Airport Method (min.) | Airport Method (hr.) | Bransby Williams (hr.) | Kirpich (hr.) | Watt & Chow (hr.) | Airport Method (hr.) | Airport Method (min) | Catchment |
| **EXISTING CONDITIONS (NASHYD)** | | | | | | | | | | | | | | | | | | |
| 1.0 | 19,243 | 1.92 | 123.16 | 0.35 | 10.00 | 4 | 0.1 | 0.0 | 3.3 | 0.1 | 12.69 | 0.21 | 0.05 | 0.03 | 0.04 | 0.14 | 8.5 | 1.0 |
| 2.0 | 16,018 | 1.60 | 136.02 | 0.35 | 13.22 | 4 | 0.1 | 0.0 | 3.2 | 0.1 | 12.16 | 0.20 | 0.05 | 0.03 | 0.04 | 0.14 | 8.1 | 2.0 |
| 3.0 | 1,791 | 0.18 | 55.83 | 0.35 | 13.21 | 2 | 0.0 | 0.0 | 1.6 | 0.0 | 7.80 | 0.13 | 0.03 | 0.02 | 0.02 | 0.09 | 5.2 | 3.0 |
| 4.0 | 26,040 | 2.60 | 193.39 | 0.35 | 11.84 | 6 | 0.1 | 0.0 | 4.4 | 0.1 | 15.04 | 0.25 | 0.07 | 0.04 | 0.05 | 0.17 | 10.0 | 4.0 |
| 5.0 | 17,886 | 1.79 | 117.37 | 0.35 | 12.03 | 4 | 0.1 | 0.0 | 2.9 | 0.0 | 11.66 | 0.19 | 0.04 | 0.03 | 0.03 | 0.13 | 7.8 | 5.0 |
| 6.0 | 25,823 | 2.58 | 194.36 | 0.28 | 4.12 | 8 | 0.1 | 0.1 | 6.6 | 0.1 | 23.36 | 0.39 | 0.08 | 0.06 | 0.07 | 0.26 | 15.6 | 6.0 |
| 7.0 | 14,598 | 1.46 | 48.79 | 0.35 | 9.22 | 2 | 0.0 | 0.0 | 1.6 | 0.0 | 8.20 | 0.14 | 0.02 | 0.02 | 0.02 | 0.09 | 5.5 | 7.0 |
| 8.0 | 3,832 | 0.38 | 81.41 | 0.28 | 4.91 | 4 | 0.1 | 0.0 | 3.1 | 0.1 | 14.26 | 0.24 | 0.04 | 0.03 | 0.03 | 0.16 | 9.5 | 8.0 |
| 9.0 | 536 | 0.05 | 25.79 | 0.36 | 15.51 | 1 | 0.0 | 0.0 | 0.8 | 0.0 | 4.96 | 0.08 | 0.01 | 0.01 | 0.01 | 0.06 | 3.3 | 9.0 |

Notes:
1. Assumed row crops land, good drainage, silt loam and hilly
2. Runoff coeff < 0.4 therefore used airport method

| Catchment | Catchment | | | | | $T_c$ | | | | | | | $T_p = {}^2/_3T_c$ | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Area (sq.m) | Area (ha.) | Length (m) | Runoff Coeff. C | Slope (%) | Bransby Williams (min.) | Bransby Williams (hr.) | Kirpich (hr.) | Watt & Chow (min.) | Watt & Chow (hr.) | Airport Method (min.) | Airport Method (hr.) | Bransby Williams (hr.) | Kirpich (hr.) | Watt & Chow (hr.) | Airport Method (hr.) | Airport Method (min) | Catchment |
| **PROPOSED CONDITIONS (NASHYD): Bioretention areas** | | | | | | | | | | | | | | | | | | |
| A1 | 19,507 | 1.95 | 151.55 | 0.28 | 4.55 | 6 | 0.1 | 0.1 | 5.2 | 0.1 | 19.96 | 0.33 | 0.07 | 0.05 | 0.06 | 0.22 | 13.3 | A1 |
| A2 | 16,465 | 1.65 | 141.87 | 0.28 | 5.42 | 5 | 0.1 | 0.0 | 4.6 | 0.1 | 18.23 | 0.30 | 0.06 | 0.05 | 0.05 | 0.20 | 12.2 | A2 |
| A4 | 25,696 | 2.57 | 191.20 | 0.35 | 11.18 | 6 | 0.1 | 0.0 | 4.4 | 0.1 | 15.24 | 0.25 | 0.07 | 0.04 | 0.05 | 0.17 | 10.2 | A4 |
| A5 | 17,044 | 1.70 | 139.08 | 0.35 | 12.03 | 5 | 0.1 | 0.0 | 3.3 | 0.1 | 12.69 | 0.21 | 0.05 | 0.03 | 0.04 | 0.14 | 8.5 | A5 |
| A6 | 16,182 | 1.62 | 145.69 | 0.28 | 5.49 | 6 | 0.1 | 0.0 | 4.7 | 0.1 | 18.39 | 0.31 | 0.06 | 0.05 | 0.05 | 0.20 | 12.3 | A6 |
| A7 | 16,620 | 1.66 | 48.79 | 0.35 | 9.22 | 2 | 0.0 | 0.0 | 1.6 | 0.0 | 8.20 | 0.14 | 0.02 | 0.02 | 0.02 | 0.09 | 5.5 | A7 |
| A9 | 1,295 | 0.13 | 35.83 | 0.35 | 14.79 | 1 | 0.0 | 0.0 | 1.1 | 0.0 | 6.02 | 0.10 | 0.02 | 0.01 | 0.01 | 0.07 | 4.0 | A9 |

## TABLE C.3

## SUMMARY OF PRE-DEVELOPMENT FLOW RATES, OUTLET FLOW RATES, STORAGE VOLUME USED, AND ASSOCIATED WATER LEVEL FOR THE 2 TO 100-YEAR DESIGN STORM

| SWM Block / Discharge Point | Sub-basin | Drainage Area (ha) | 2 Year Return Period | | | | 5 Year Return Period | | | | 10 Year Return Period | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Unit Flow Rate (cms) | Outlet Flow Rate (cms) | Storage Volume Used (cu.m) | Water Level Based on Vol. Used (m) | Unit Flow Rate (cms) | Outlet Flow Rate (cms) | Storage Volume Used (cu.m) | Water Level Based on Vol. Used (m) | Unit Flow Rate (cms) | Outlet Flow Rate (cms) | Storage Volume Used (cu.m) | Water Level Based on Vol. Used (m) |
| SWM Block 41 | 8A | 1.25 | 0.004 | 0.002 | 132 | 278.37 | 0.007 | 0.003 | 228 | 278.69 | 0.009 | 0.003 | 299 | 278.90 |

| SWM Block / Discharge Point | Sub-basin | Drainage Area (ha) | 25 Year Return Period | | | | 50 Year Return Period | | | | 100 Year Return Period | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Unit Flow Rate (cms) | Outlet Flow Rate (cms) | Storage Volume Used (cu.m) | Water Level Based on Vol. Used (m) | Unit Flow Rate (cms) | Outlet Flow Rate (cms) | Storage Volume Used (cu.m) | Water Level Based on Vol. Used (m) | Unit Flow Rate (cms) | Outlet Flow Rate (cms) | Storage Volume Used (cu.m) | Water Level Based on Vol. Used (m) |
| SWM Block 41 | 8A | 1.25 | 0.012 | 0.004 | 394 | 279.14 | 0.015 | 0.007 | 457 | 279.28 | 0.017 | 0.013 | 507 | 279.37 |

| Return Period | Unit Flow Equation (l/s/ha) |
|---|---|
| 100-year | Q =14.140 - 1.096 * ln (A) |
| 50-Year | Q =11.920 - 0.921 * ln (A) |
| 25-year | Q =9.838 - 0.757 * ln (A) |
| 10-year | Q =7.443 - 0.578 * ln (A) |
| 5-Year | Q =5.557 - 0.427 * ln (A) |
| 2-Year | Q =3.142 - 0.233 * ln (A) |

Notes:

1. Unit flow equation taken from Table E.1 Summary of Unit Flow Rate Relationships, Humber River Watershed, Equation C Sub-Basin 11, where Q=unit flow rate in l/s/ha, and A=area in hectares.
2. units: ha-hectares; cms-cubic meters per second; cu.m-cubic meters

**Laurel Park**
**Outlet Calculations for Bioretention Area**

For 40mm Orifice:
Q=Cd*A*sqrt(2*g*H)
Where: Cd = 0.62
A=Area of orifice (sq.m) {3.14r^2}
g=gravity (m/s)
H= Head above orifice invert (m)

For 22.5 degree V-Notch Weir
Q=987.8*H^2.5
Where: H=Head on weir (m)
Q=flow over weir (cmh)

**Drainage From: A7**

Orifice Diameter= 0.04 m

| Elev. | Q - 40mm orifice | Q- 22.5 V-notch | Total Q | Comments |
|---|---|---|---|---|
| (m) | cms | cms | cms | |
| 277.7 | 0 | 0 | 0 | |
| 278.00 | 0.0000 | 0.0000 | 0.0000 | Base elev. / pipe invert |
| 278.25 | 0.0017 | 0.0000 | 0.0017 | |
| 278.50 | 0.0024 | 0.0000 | 0.0024 | |
| 278.80 | 0.0031 | 0.0000 | 0.0031 | |
| 279.00 | 0.0034 | 0.0000 | 0.0034 | |
| 279.10 | 0.0036 | 0.0000 | 0.0036 | V-notch weir invert |
| 279.20 | 0.0038 | 0.0009 | 0.0046 | |
| 279.30 | 0.0039 | 0.0049 | 0.0088 | |
| 279.40 | 0.0041 | 0.0135 | 0.0176 | |
| 279.50 | 0.0042 | 0.0278 | 0.0320 | Top of Berm (top of headwall) |

| Unit flow rates: | |
|---|---|
| **100 year** | 0.0173 |
| **50 year** | 0.0146 |
| **25 year** | 0.0120 |
| **10 year** | 0.0091 |
| **5 year** | 0.0068 |
| **2 year** | 0.0038 |

**SWM Block:** **Drainage From: A7**
**Route Reservoir**

| Elev. | Total Q | Storage | Storage |
|---|---|---|---|
| (m) | cms | (ha-m) | (cu.m) |
| 277.7 | 0 | 0 | 0 |
| 278.00 | 0.0000 | 0.004 | 35.7 |
| 278.25 | 0.0017 | 0.008 | 84.1 |
| 278.50 | 0.0024 | 0.015 | 150.3 |
| 278.80 | 0.0031 | 0.025 | 253.4 |
| 279.00 | 0.0034 | 0.034 | 336.5 |
| 279.10 | 0.0036 | 0.038 | 382.3 |
| 279.20 | 0.0046 | 0.043 | 431.0 |
| 279.30 | 0.0088 | 0.048 | 482.5 |
| 279.40 | 0.0176 | 0.054 | 536.9 |
| 279.50 | 0.0320 | 0.059 | 594.2 |

Stage/Storage

| Elev. | Area | Volume | accum. Volume |
|---|---|---|---|
| (m) | (sq.m.) | (cu.m) | (cu.m) |
| 277.7 | 88 | 0 | 0 |
| 278 | 158 | 37 | 37 |
| 279 | 438 | 298 | 335 |
| 279.5 | 600 | 259 | 594 |
| | | | |
| | | | |

```
2     Metric units
*#******************************************************************************
*#  Project Name: [Laurel Park]    Project Number: [ 16-168 ]
*#  Date        : [2017-06-29]
*#  Modeller    : [    MYS    ]
*#  Company     : Calder Engineering Ltd.
*#  License #   :  3375279
*#******************************************************************************
*# Existing Conditions
*#******************************************************************************
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[0],  NRUN=[0]
*%                   [2Y6.STM]
*%-----------------|-----------------------------------------------------------|
READ STORM          STORM_FILENAME=["2Y6.STM"]
*%-----------------|-----------------------------------------------------------|
*# Node 1: Flow from Basin 1
*%-----------------|-----------------------------------------------------------|
CALIB NASHYD        ID=[ 1 ], NHYD=["1"], DT=[ 1 ]min, AREA=[ 1.92](ha),
                    DWF=[ 0 ](cms),  CN/C=[ 76 ], IA=[ 10 ](mm),
                    N=[  3 ], TP=[  0.14 ]hrs,
                    RAINFALL=[ ,  ,  ,  , ](mm/hr),  END=-1
*%-----------------|-----------------------------------------------------------|
*# Node 2: Flow from Basin 2
*%-----------------|-----------------------------------------------------------|
CALIB NASHYD        ID=[ 2 ], NHYD=["2"], DT=[ 1]min, AREA=[ 1.60](ha),
                    DWF=[ 0 ](cms),  CN/C=[ 78 ], IA=[ 10 ](mm),
                    N=[ 3  ], TP=[  0.14 ]hrs,
                    RAINFALL=[ ,  ,  ,  , ](mm/hr),  END=-1
*%-----------------|-----------------------------------------------------------|
*# Node 3: Flow from Basin 3
*%-----------------|-----------------------------------------------------------|
CALIB NASHYD        ID= [ 3 ], NHYD=["3"], DT=[ 1 ]min, AREA=[ 0.18  ](ha),
                    DWF=[ 0 ](cms),  CN/C=[75 ], IA=[ 10 ](mm),
                    N=[  3 ], TP=[ 0.09 ]hrs,
                    RAINFALL=[ ,  ,  ,  , ](mm/hr),  END=-1
*%-----------------|-----------------------------------------------------------|
*# Node 4: Flow from Basin 4 and 5
*%-----------------|-----------------------------------------------------------|
CALIB NASHYD        ID= [ 4 ], NHYD=["4"], DT=[ 1 ]min, AREA=[ 2.60  ](ha),
                    DWF=[ 0 ](cms),  CN/C=[70 ], IA=[ 10 ](mm),
                    N=[  3 ], TP=[ 0.17 ]hrs,
                    RAINFALL=[ ,  ,  ,  , ](mm/hr),  END=-1
*%-----------------|-----------------------------------------------------------|
CALIB NASHYD        ID= [ 5 ], NHYD=["5"], DT=[ 1 ]min, AREA=[ 1.79  ](ha),
                    DWF=[ 0 ](cms),  CN/C=[68], IA=[ 10 ](mm),
                    N=[  3 ], TP=[ 0.13  ]hrs,
                    RAINFALL=[ ,  ,  ,  , ](mm/hr),  END=-1
*%-----------------|-----------------------------------------------------------|
ADD HYD             IDsum=[ 6 ], NHYD=[ "N4"], IDs to add=[ 4+5 ]
*%-----------------|-----------------------------------------------------------|
*# Node 5: Flow from Basin 6
*%-----------------|-----------------------------------------------------------|
CALIB NASHYD        ID= [ 7 ], NHYD=["6"], DT=[ 1 ]min, AREA=[ 2.58  ](ha),
                    DWF=[ 0 ](cms),  CN/C=[75], IA=[ 10 ](mm),
                    N=[  3 ], TP=[ 0.26  ]hrs,
                    RAINFALL=[ ,  ,  ,  , ](mm/hr),  END=-1
*%-----------------|-----------------------------------------------------------|
*# Node 6: Flow from Basin 7
*%-----------------|-----------------------------------------------------------|
CALIB NASHYD        ID= [ 8 ], NHYD=["7"], DT=[ 1 ]min, AREA=[ 1.46 ](ha),
                    DWF=[ 0 ](cms),  CN/C=[83], IA=[ 10 ](mm),
                    N=[  3 ], TP=[ 0.09  ]hrs,
                    RAINFALL=[ ,  ,  ,  , ](mm/hr),  END=-1
*%-----------------|-----------------------------------------------------------|
*# Node 7: Flow from Basin 8
*%-----------------|-----------------------------------------------------------|
CALIB NASHYD        ID= [ 9 ], NHYD=["8"], DT=[ 1 ]min, AREA=[ 0.38  ](ha),
                    DWF=[ 0 ](cms),  CN/C=[75], IA=[ 10 ](mm),
                    N=[  3 ], TP=[ 0.16  ]hrs,
                    RAINFALL=[ ,  ,  ,  , ](mm/hr),  END=-1
*%-----------------|-----------------------------------------------------------|
*# Node 8: Flow from Basin 9
*%-----------------|-----------------------------------------------------------|
CALIB NASHYD        ID= [ 1 ], NHYD=["9"], DT=[ 1 ]min, AREA=[ 0.05  ](ha),
                    DWF=[ 0 ](cms),  CN/C=[75], IA=[ 10 ](mm),
                    N=[  3 ], TP=[ 0.06  ]hrs,
                    RAINFALL=[ ,  ,  ,  , ](mm/hr),  END=-1
*%-----------------|-----------------------------------------------------------|
FINISH
```

```
2     Metric units
*#******************************************************************************
*#  Project Name: [Laurel Park]    Project Number: [ 16-168 ]
*#  Date        : [2017-06-29]
*#  Modeller    : [    MYS    ]
*#  Company     : Calder Engineering Ltd.
*#  License #   :  3375279
*#******************************************************************************
*# Proposed Conditions (Preliminary Concept)-Routing
*#******************************************************************************
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[0],  NRUN=[0]
*%                   [2y6.STM]
*%-----------------|-----------------------------------------------------------|
READ STORM          STORM_FILENAME=["2y6.STM"]
*%-----------------|-----------------------------------------------------------|
*# Node 1: Flow from Basin 1
*%-----------------|-----------------------------------------------------------|
CALIB NASHYD        ID=[ 1 ], NHYD=["1A"], DT=[ 1 ]min, AREA=[ 1.95](ha),
                    DWF=[ 0 ](cms),  CN/C=[ 78 ], IA=[ 10 ](mm),
                    N=[  3 ], TP=[  0.22 ]hrs,
                    RAINFALL=[ ,  ,  ,  , ](mm/hr),  END=-1
*%-----------------|-----------------------------------------------------------|
*# Node 2: Flow from Basin 2
*%-----------------|-----------------------------------------------------------|
CALIB NASHYD        ID=[ 2 ], NHYD=["2A"], DT=[ 1 ]min, AREA=[ 1.65](ha),
                    DWF=[ 0 ](cms),  CN/C=[ 79 ], IA=[ 10 ](mm),
                    N=[  3 ], TP=[  0.20 ]hrs,
                    RAINFALL=[ ,  ,  ,  , ](mm/hr),  END=-1
*%-----------------|-----------------------------------------------------------|
*# Node 3: Flow from Basin 3
*%-----------------|-----------------------------------------------------------|
CALIB STANDHYD      ID=[3 ], NHYD=[" 3A"], DT=[ 1  ](min), AREA=[ 0.05   ](ha),
                    XIMP=[ 0.001  ], TIMP=[0.39   ], DWF=[ 0  ](cms), LOSS=[2],
                    SCS curve number CN=[ 84  ],
                    Pervious   surfaces: IAper=[ 10  ](mm), SLPP=[ 4  ](%),
                                         LGP=[ 15 ](m), MNP=[0.25  ], SCP=[0  ](
                    Impervious surfaces: IAimp=[ 0.7 ](mm), SLPI=[ 5 ](%),
                                         LGI=[ 90](m), MNI=[ 0.013 ], SCI=[ 0 ](
                    RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
*%-----------------|-----------------------------------------------------------|
*# Node 4: Flow from Basin 4 + 5
*%-----------------|-----------------------------------------------------------|
CALIB NASHYD        ID= [ 4 ], NHYD=["4A"], DT=[ 1 ]min, AREA=[ 2.57  ](ha),
                    DWF=[ 0 ](cms),  CN/C=[70 ], IA=[ 10 ](mm),
                    N=[  3 ], TP=[ 0.17 ]hrs,
                    RAINFALL=[ ,  ,  ,  , ](mm/hr),  END=-1
*%-----------------|-----------------------------------------------------------|
CALIB NASHYD        ID= [ 5 ], NHYD=["5A"], DT=[ 1 ]min, AREA=[ 1.70  ](ha),
                    DWF=[ 0 ](cms),  CN/C=[68], IA=[ 10 ](mm),
                    N=[  3 ], TP=[ 0.14  ]hrs,
                    RAINFALL=[ ,  ,  ,  , ](mm/hr),  END=-1
*%-----------------|-----------------------------------------------------------|
ADD HYD             IDsum=[ 6 ], NHYD=["N4"], IDs to add=[4+5 ]
*%-----------------|-----------------------------------------------------------|
*# Node 5: Flow from Basin 6
*%-----------------|-----------------------------------------------------------|
CALIB NASHYD        ID= [ 7 ], NHYD=["6A"], DT=[ 1 ]min, AREA=[ 1.62  ](ha),
                    DWF=[ 0 ](cms),  CN/C=[77], IA=[ 10 ](mm),
                    N=[  3 ], TP=[ 0.20  ]hrs,
                    RAINFALL=[ ,  ,  ,  , ](mm/hr),  END=-1
*%-----------------|-----------------------------------------------------------|
*# Node 6: Flow from Basin 7
*%-----------------|-----------------------------------------------------------|
CALIB NASHYD        ID= [ 8 ], NHYD=["7A"], DT=[ 1 ]min, AREA=[ 1.66  ](ha),
                    DWF=[ 0 ](cms),  CN/C=[83], IA=[ 10 ](mm),
                    N=[  3 ], TP=[ 0.09  ]hrs,
                    RAINFALL=[ ,  ,  ,  , ](mm/hr),  END=-1
*%-----------------|-----------------------------------------------------------|
*# Node 7: Flow from Basin 8
*%-----------------|-----------------------------------------------------------|
CALIB STANDHYD      ID=[9], NHYD=[" 8A"], DT=[ 1  ](min), AREA=[ 1.25   ](ha),
                    XIMP=[ 0.001  ], TIMP=[0.31   ], DWF=[ 0  ](cms), LOSS=[2],
                    SCS curve number CN=[ 82  ],
                    Pervious   surfaces: IAper=[ 10  ](mm), SLPP=[ 3.0  ](%),
                                         LGP=[ 40 ](m), MNP=[0.25  ], SCP=[0  ](
                    Impervious surfaces: IAimp=[ 0.7 ](mm), SLPI=[ 4 ](%),
                                         LGI=[ 164](m), MNI=[ 0.013 ], SCI=[ 0 ]
                    RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
*%-----------------|-----------------------------------------------------------|
ROUTE RESERVOIR     IDout=[ 1 ],   NHYD=["SWM-out" ],  IDin=[  9 ],
                    RDT=[ 1   ](min),
                          TABLE of ( OUTFLOW-STORAGE ) values
                                      (cms) - (ha-m)
                                    [   0.0 , 0.004 ]
                                    [ 0.0017, 0.008 ]
                                    [ 0.0024, 0.015 ]
                                    [ 0.0031, 0.025]
                                    [ 0.0034, 0.034 ]
                                    [ 0.0036, 0.038 ]
                                    [ 0.0046, 0.043]
                                    [ 0.0088, 0.048 ]
                                    [ 0.0176, 0.054 ]
                                    [ 0.0320, 0.059 ]
                                    [   -1  ,  -1  ]  (max twenty pts)
                          IDovf=[ 2  ], NHYDovf=["SWM-OVF" ]
*%-----------------|-----------------------------------------------------------|
*# Node 8: Flow from Basin 9
*%-----------------|-----------------------------------------------------------|
CALIB NASHYD        ID= [ 3 ], NHYD=["9A"], DT=[ 1 ]min, AREA=[ 0.13  ](ha),
                    DWF=[ 0 ](cms),  CN/C=[75], IA=[ 10 ](mm),
                    N=[  3 ], TP=[ 0.07  ]hrs,
                    RAINFALL=[ ,  ,  ,  , ](mm/hr),  END=-1
*%-----------------|-----------------------------------------------------------|
FINISH

```

```
================================================================================

   SSSSS  W   W  M   M  H   H  Y   Y  M   M   OOO        999    999    =========
   S      W W W  MM MM  H   H   Y Y   MM MM  O   O       9   9  9   9
   SSSSS  W W W  M M M  HHHHH    Y    M M M  O   O  ##  9   9  9   9   Ver  4.05
       S   W W   M   M  H   H    Y    M   M  O   O       9999   9999   Sept 2011
   SSSSS   W W   M   M  H   H    Y    M   M   OOO          9      9   =========
                                                        9   9  9   9   # 3375279
        StormWater Management HYdrologic Model           999    999    =========

 *******************************************************************************
 ***************************** SWMHYMO Ver/4.05  ******************************
 *********  A single event and continuous hydrologic simulation model  *********
 *********     based on the principles of HYMO and its successors      *********
 *********                OTTHYMO-83 and OTTHYMO-89.                  *********
 *******************************************************************************
 ********* Distributed by:  J.F. Sabourin and Associates Inc.          *********
 *********                  Ottawa,  Ontario: (613) 836-3884           *********
 *********                  Gatineau, Quebec: (819) 243-6858           *********
 *********                  E-Mail: swmhymo@jfsa.Com                   *********
 *******************************************************************************

 +++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
 +++++++++ Licensed user: Calder Engineering Ltd.                      +++++++++
 +++++++++                Bolton                SERIAL#:3375279        +++++++++
 +++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

 *******************************************************************************
 *********           ++++++ PROGRAM ARRAY DIMENSIONS ++++++            *********
 *********           Maximum value for ID numbers  :     10            *********
 *********           Max. number of rainfall points: 105408            *********
 *********           Max. number of flow points    : 105408            *********
 *******************************************************************************


 **********************   D E T A I L E D   O U T P U T   **********************
 *******************************************************************************
 *        DATE: 2017-06-29     TIME: 14:49:13     RUN COUNTER: 000785         *
 *******************************************************************************
 * Input   filename: C:\PROGRA~2\SWMHYMO\PROJECTS\Laurel\L-ex.dat              *
 * Output  filename: C:\PROGRA~2\SWMHYMO\PROJECTS\Laurel\L-ex.out              *
 * Summary filename: C:\PROGRA~2\SWMHYMO\PROJECTS\Laurel\L-ex.sum              *
 * User comments:                                                              *
 * 1:__________________________________________________________________________*
 * 2:__________________________________________________________________________*
 * 3:__________________________________________________________________________*
 *******************************************************************************

--------------------------------------------------------------------------------
001:0001------------------------------------------------------------------------
*#******************************************************************************
*#  Project Name: [Laurel Park]    Project Number: [ 16-168 ]
*#  Date        : [2017-06-29]
*#  Modeller    : [    MYS    ]
*#  Company     : Calder Engineering Ltd.
*#  License #   :  3375279
*#******************************************************************************
*# Existing Conditions
*#******************************************************************************
--------------------
| START            |  Project  dir.: C:\PROGRA~2\SWMHYMO\PROJECTS\Laurel\
--------------------  Rainfall dir.: C:\PROGRA~2\SWMHYMO\PROJECTS\Laurel\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 001
    NSTORM=   0
--------------------------------------------------------------------------------
001:0002------------------------------------------------------------------------
--------------------
| READ STORM       |    Filename: 2yr/6hr
| Ptotal=  36.00 mm|    Comments: 2yr/6hr
--------------------
              TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
               hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
               .25    .000 |   2.00  12.240 |   3.75   5.040 |   5.50    .720
               .50    .720 |   2.25  12.240 |   4.00   2.880 |   5.75    .720
               .75    .720 |   2.50  33.120 |   4.25   2.880 |   6.00    .720
              1.00    .720 |   2.75  33.120 |   4.50   1.440 |   6.25    .720
              1.25    .720 |   3.00   9.360 |   4.75   1.440 |
              1.50   4.320 |   3.25   9.360 |   5.00    .720 |
              1.75   4.320 |   3.50   5.040 |   5.25    .720 |

--------------------------------------------------------------------------------
001:0003------------------------------------------------------------------------
*# Node 1: Flow from Basin 1
----------------------
| CALIB NASHYD       |   Area    (ha)=    1.92   Curve Number   (CN)=76.00
| 01:1      DT= 1.00 |   Ia      (mm)=  10.000   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .140

     Unit Hyd Qpeak  (cms)=     .524

     PEAK FLOW       (cms)=     .036 (i)
     TIME TO PEAK    (hrs)=    2.800
     RUNOFF VOLUME    (mm)=    6.365
     TOTAL RAINFALL   (mm)=   36.000
     RUNOFF COEFFICIENT   =     .177

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
001:0004------------------------------------------------------------------------
*# Node 2: Flow from Basin 2
----------------------
| CALIB NASHYD       |   Area    (ha)=    1.60   Curve Number   (CN)=78.00
| 02:2      DT= 1.00 |   Ia      (mm)=  10.000   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .140

     Unit Hyd Qpeak  (cms)=     .437

     PEAK FLOW       (cms)=     .033 (i)
     TIME TO PEAK    (hrs)=    2.800
     RUNOFF VOLUME    (mm)=    6.923
     TOTAL RAINFALL   (mm)=   36.000
     RUNOFF COEFFICIENT   =     .192

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
001:0005------------------------------------------------------------------------
*# Node 3: Flow from Basin 3
----------------------
| CALIB NASHYD       |   Area    (ha)=     .18   Curve Number   (CN)=75.00
| 03:3      DT= 1.00 |   Ia      (mm)=  10.000   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .090

     Unit Hyd Qpeak  (cms)=     .076

     PEAK FLOW       (cms)=     .004 (i)
     TIME TO PEAK    (hrs)=    2.767
     RUNOFF VOLUME    (mm)=    6.107
     TOTAL RAINFALL   (mm)=   36.000
     RUNOFF COEFFICIENT   =     .170

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
001:0006------------------------------------------------------------------------
*# Node 4: Flow from Basin 4 and 5
----------------------
| CALIB NASHYD       |   Area    (ha)=    2.60   Curve Number   (CN)=70.00
| 04:4      DT= 1.00 |   Ia      (mm)=  10.000   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .170

     Unit Hyd Qpeak  (cms)=     .584

     PEAK FLOW       (cms)=     .035 (i)
     TIME TO PEAK    (hrs)=    2.833
     RUNOFF VOLUME    (mm)=    5.013
     TOTAL RAINFALL   (mm)=   36.000
     RUNOFF COEFFICIENT   =     .139

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
001:0007------------------------------------------------------------------------
----------------------
| CALIB NASHYD       |   Area    (ha)=    1.79   Curve Number   (CN)=68.00
| 05:5      DT= 1.00 |   Ia      (mm)=  10.000   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .130

     Unit Hyd Qpeak  (cms)=     .526

     PEAK FLOW       (cms)=     .025 (i)
     TIME TO PEAK    (hrs)=    2.800
     RUNOFF VOLUME    (mm)=    4.645
     TOTAL RAINFALL   (mm)=   36.000
     RUNOFF COEFFICIENT   =     .129

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
001:0008------------------------------------------------------------------------
------------------------
| ADD HYD (N4        ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
------------------------                  (ha)     (cms)   (hrs)   (mm)   (cms)
                     ID1 04:4              2.60     .035    2.83   5.01    .000
                    +ID2 05:5              1.79     .025    2.80   4.64    .000
                     ===========================================================
                     SUM 06:N4             4.39     .059    2.82   4.86    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
001:0009------------------------------------------------------------------------
*# Node 5: Flow from Basin 6
----------------------
| CALIB NASHYD       |   Area    (ha)=    2.58   Curve Number   (CN)=75.00
| 07:6      DT= 1.00 |   Ia      (mm)=  10.000   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .260

     Unit Hyd Qpeak  (cms)=     .379

     PEAK FLOW       (cms)=     .034 (i)
     TIME TO PEAK    (hrs)=    2.950
     RUNOFF VOLUME    (mm)=    6.108
     TOTAL RAINFALL   (mm)=   36.000
     RUNOFF COEFFICIENT   =     .170

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
001:0010------------------------------------------------------------------------
*# Node 6: Flow from Basin 7
----------------------
| CALIB NASHYD       |   Area    (ha)=    1.46   Curve Number   (CN)=83.00
| 08:7      DT= 1.00 |   Ia      (mm)=  10.000   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .090

     Unit Hyd Qpeak  (cms)=     .620

     PEAK FLOW       (cms)=     .044 (i)
     TIME TO PEAK    (hrs)=    2.767
     RUNOFF VOLUME    (mm)=    8.664
     TOTAL RAINFALL   (mm)=   36.000
     RUNOFF COEFFICIENT   =     .241

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
001:0011------------------------------------------------------------------------
*# Node 7: Flow from Basin 8
----------------------
| CALIB NASHYD       |   Area    (ha)=     .38   Curve Number   (CN)=75.00
| 09:8      DT= 1.00 |   Ia      (mm)=  10.000   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .160

     Unit Hyd Qpeak  (cms)=     .091

     PEAK FLOW       (cms)=     .006 (i)
     TIME TO PEAK    (hrs)=    2.833
     RUNOFF VOLUME    (mm)=    6.108
     TOTAL RAINFALL   (mm)=   36.000
     RUNOFF COEFFICIENT   =     .170

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
001:0012------------------------------------------------------------------------
*# Node 8: Flow from Basin 9
----------------------
| CALIB NASHYD       |   Area    (ha)=     .05   Curve Number   (CN)=75.00
| 01:9      DT= 1.00 |   Ia      (mm)=  10.000   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .060

     Unit Hyd Qpeak  (cms)=     .032

     PEAK FLOW       (cms)=     .001 (i)
     TIME TO PEAK    (hrs)=    2.750
     RUNOFF VOLUME    (mm)=    6.105
     TOTAL RAINFALL   (mm)=   36.000
     RUNOFF COEFFICIENT   =     .170

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
001:0013------------------------------------------------------------------------
      FINISH
--------------------------------------------------------------------------------
********************************************************************************
     WARNINGS / ERRORS / NOTES
     -------------------------
   Simulation ended on 2017-06-29     at 14:49:14
================================================================================


```

```
==============================================================================

   SSSSS  W   W  M   M  H   H  Y   Y  M   M   OOO       999   999   =========
   S      W W W  MM MM  H   H   Y Y   MM MM  O   O     9   9 9   9
   SSSSS  W W W  M M M  HHHHH    Y    M M M  O   O  ## 9   9 9   9   Ver  4.05
       S   W W   M   M  H   H    Y    M   M  O   O      9999  9999   Sept 2011
   SSSSS   W W   M   M  H   H    Y    M   M   OOO          9     9   =========
                                                       9   9 9   9   # 3375279
        StormWater Management HYdrologic Model          999   999    =========

 *****************************************************************************
 ***************************** SWMHYMO Ver/4.05  *****************************
 *********  A single event and continuous hydrologic simulation model *********
 *********     based on the principles of HYMO and its successors     *********
 *********                OTTHYMO-83 and OTTHYMO-89.                  *********
 *****************************************************************************
 ********* Distributed by:  J.F. Sabourin and Associates Inc.          *********
 *********                  Ottawa,  Ontario: (613) 836-3884          *********
 *********                  Gatineau, Quebec: (819) 243-6858          *********
 *********                  E-Mail: swmhymo@jfsa.Com                  *********
 *****************************************************************************

 +++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
 +++++++++ Licensed user: Calder Engineering Ltd.                     +++++++++
 +++++++++                Bolton               SERIAL#:3375279        +++++++++
 +++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

 *****************************************************************************
 *********            ++++++ PROGRAM ARRAY DIMENSIONS ++++++          *********
 *********            Maximum value for ID numbers  :     10          *********
 *********            Max. number of rainfall points: 105408          *********
 *********            Max. number of flow points    : 105408          *********
 *****************************************************************************


 **********************   D E T A I L E D   O U T P U T   *********************
 *****************************************************************************
 *         DATE: 2017-06-29     TIME: 14:48:44     RUN COUNTER: 000784        *
 *****************************************************************************
 * Input   filename: C:\PROGRA~2\SWMHYMO\PROJECTS\Laurel\L-ex.dat             *
 * Output  filename: C:\PROGRA~2\SWMHYMO\PROJECTS\Laurel\L-ex.out             *
 * Summary filename: C:\PROGRA~2\SWMHYMO\PROJECTS\Laurel\L-ex.sum             *
 * User comments:                                                             *
 * 1:_________________________________________________________________________*
 * 2:_________________________________________________________________________*
 * 3:_________________________________________________________________________*
 *****************************************************************************

------------------------------------------------------------------------------
001:0001----------------------------------------------------------------------
*#****************************************************************************
*#  Project Name: [Laurel Park]    Project Number: [ 16-168 ]
*#  Date        : [2017-06-29]
*#  Modeller    : [    MYS    ]
*#  Company     : Calder Engineering Ltd.
*#  License #   :  3375279
*#****************************************************************************
*# Existing Conditions
*#****************************************************************************
--------------------
| START              |  Project  dir.: C:\PROGRA~2\SWMHYMO\PROJECTS\Laurel\
--------------------  Rainfall dir.: C:\PROGRA~2\SWMHYMO\PROJECTS\Laurel\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 001
    NSTORM=   0
------------------------------------------------------------------------------
001:0002----------------------------------------------------------------------
--------------------
| READ STORM         |    Filename: 5yr/6hr
| Ptotal=  47.81 mm|    Comments: 5yr/6hr
--------------------
              TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
               hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
               .25    .000 |   2.00  16.250 |   3.75   6.690 |   5.50    .960
               .50    .960 |   2.25  16.250 |   4.00   3.820 |   5.75    .960
               .75    .960 |   2.50  43.980 |   4.25   3.820 |   6.00    .960
              1.00    .960 |   2.75  43.980 |   4.50   1.910 |   6.25    .960
              1.25    .960 |   3.00  12.430 |   4.75   1.910 |
              1.50   5.740 |   3.25  12.430 |   5.00    .960 |
              1.75   5.740 |   3.50   6.690 |   5.25    .960 |

------------------------------------------------------------------------------
001:0003----------------------------------------------------------------------
*# Node 1: Flow from Basin 1
----------------------
| CALIB NASHYD         |   Area    (ha)=    1.92   Curve Number   (CN)=76.00
| 01:1      DT= 1.00 |   Ia      (mm)=  10.000   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .140

     Unit Hyd Qpeak  (cms)=     .524

     PEAK FLOW       (cms)=     .071 (i)
     TIME TO PEAK    (hrs)=    2.800
     RUNOFF VOLUME    (mm)=   12.113
     TOTAL RAINFALL   (mm)=   47.810
     RUNOFF COEFFICIENT   =     .253

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

------------------------------------------------------------------------------
001:0004----------------------------------------------------------------------
*# Node 2: Flow from Basin 2
----------------------
| CALIB NASHYD         |   Area    (ha)=    1.60   Curve Number   (CN)=78.00
| 02:2      DT= 1.00 |   Ia      (mm)=  10.000   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .140

     Unit Hyd Qpeak  (cms)=     .437

     PEAK FLOW       (cms)=     .064 (i)
     TIME TO PEAK    (hrs)=    2.800
     RUNOFF VOLUME    (mm)=   13.061
     TOTAL RAINFALL   (mm)=   47.810
     RUNOFF COEFFICIENT   =     .273

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

------------------------------------------------------------------------------
001:0005----------------------------------------------------------------------
*# Node 3: Flow from Basin 3
----------------------
| CALIB NASHYD         |   Area    (ha)=     .18   Curve Number   (CN)=75.00
| 03:3      DT= 1.00 |   Ia      (mm)=  10.000   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .090

     Unit Hyd Qpeak  (cms)=     .076

     PEAK FLOW       (cms)=     .007 (i)
     TIME TO PEAK    (hrs)=    2.767
     RUNOFF VOLUME    (mm)=   11.671
     TOTAL RAINFALL   (mm)=   47.810
     RUNOFF COEFFICIENT   =     .244

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

------------------------------------------------------------------------------
001:0006----------------------------------------------------------------------
*# Node 4: Flow from Basin 4 and 5
----------------------
| CALIB NASHYD         |   Area    (ha)=    2.60   Curve Number   (CN)=70.00
| 04:4      DT= 1.00 |   Ia      (mm)=  10.000   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .170

     Unit Hyd Qpeak  (cms)=     .584

     PEAK FLOW       (cms)=     .070 (i)
     TIME TO PEAK    (hrs)=    2.817
     RUNOFF VOLUME    (mm)=    9.747
     TOTAL RAINFALL   (mm)=   47.810
     RUNOFF COEFFICIENT   =     .204

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

------------------------------------------------------------------------------
001:0007----------------------------------------------------------------------
----------------------
| CALIB NASHYD         |   Area    (ha)=    1.79   Curve Number   (CN)=68.00
| 05:5      DT= 1.00 |   Ia      (mm)=  10.000   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .130

     Unit Hyd Qpeak  (cms)=     .526

     PEAK FLOW       (cms)=     .050 (i)
     TIME TO PEAK    (hrs)=    2.800
     RUNOFF VOLUME    (mm)=    9.086
     TOTAL RAINFALL   (mm)=   47.810
     RUNOFF COEFFICIENT   =     .190

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

------------------------------------------------------------------------------
001:0008----------------------------------------------------------------------
------------------------
| ADD HYD (N4        ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
------------------------                  (ha)     (cms)   (hrs)   (mm)   (cms)
                     ID1 04:4             2.60      .070    2.82   9.75    .000
                    +ID2 05:5             1.79      .050    2.80   9.09    .000
                     ===========================================================
                     SUM 06:N4            4.39      .119    2.80   9.48    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

------------------------------------------------------------------------------
001:0009----------------------------------------------------------------------
*# Node 5: Flow from Basin 6
----------------------
| CALIB NASHYD         |   Area    (ha)=    2.58   Curve Number   (CN)=75.00
| 07:6      DT= 1.00 |   Ia      (mm)=  10.000   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .260

     Unit Hyd Qpeak  (cms)=     .379

     PEAK FLOW       (cms)=     .069 (i)
     TIME TO PEAK    (hrs)=    2.917
     RUNOFF VOLUME    (mm)=   11.672
     TOTAL RAINFALL   (mm)=   47.810
     RUNOFF COEFFICIENT   =     .244

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

------------------------------------------------------------------------------
001:0010----------------------------------------------------------------------
*# Node 6: Flow from Basin 7
----------------------
| CALIB NASHYD         |   Area    (ha)=    1.46   Curve Number   (CN)=83.00
| 08:7      DT= 1.00 |   Ia      (mm)=  10.000   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .090

     Unit Hyd Qpeak  (cms)=     .620

     PEAK FLOW       (cms)=     .081 (i)
     TIME TO PEAK    (hrs)=    2.767
     RUNOFF VOLUME    (mm)=   15.914
     TOTAL RAINFALL   (mm)=   47.810
     RUNOFF COEFFICIENT   =     .333

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

------------------------------------------------------------------------------
001:0011----------------------------------------------------------------------
*# Node 7: Flow from Basin 8
----------------------
| CALIB NASHYD         |   Area    (ha)=     .38   Curve Number   (CN)=75.00
| 09:8      DT= 1.00 |   Ia      (mm)=  10.000   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .160

     Unit Hyd Qpeak  (cms)=     .091

     PEAK FLOW       (cms)=     .013 (i)
     TIME TO PEAK    (hrs)=    2.817
     RUNOFF VOLUME    (mm)=   11.672
     TOTAL RAINFALL   (mm)=   47.810
     RUNOFF COEFFICIENT   =     .244

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

------------------------------------------------------------------------------
001:0012----------------------------------------------------------------------
*# Node 8: Flow from Basin 9
----------------------
| CALIB NASHYD         |   Area    (ha)=     .05   Curve Number   (CN)=75.00
| 01:9      DT= 1.00 |   Ia      (mm)=  10.000   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .060

     Unit Hyd Qpeak  (cms)=     .032

     PEAK FLOW       (cms)=     .002 (i)
     TIME TO PEAK    (hrs)=    2.750
     RUNOFF VOLUME    (mm)=   11.670
     TOTAL RAINFALL   (mm)=   47.810
     RUNOFF COEFFICIENT   =     .244

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

------------------------------------------------------------------------------
001:0013----------------------------------------------------------------------
      FINISH
------------------------------------------------------------------------------
******************************************************************************
     WARNINGS / ERRORS / NOTES
     -------------------------
   Simulation ended on 2017-06-29     at 14:48:44
==============================================================================


```

```
===============================================================================

   SSSSS  W   W  M   M  H   H  Y   Y  M   M   OOO       999   999    =========
   S      W W W  MM MM  H   H   Y Y   MM MM  O   O     9   9 9   9
   SSSSS  W W W  M M M  HHHHH    Y    M M M  O   O  ## 9   9 9   9   Ver  4.05
       S   W W   M   M  H   H    Y    M   M  O   O      9999  9999   Sept 2011
   SSSSS   W W   M   M  H   H    Y    M   M   OOO          9     9   =========
                                                       9   9 9   9   # 3375279
        StormWater Management HYdrologic Model          999   999    =========

 ******************************************************************************
 ***************************** SWMHYMO Ver/4.05  *****************************
 *********  A single event and continuous hydrologic simulation model  *********
 *********     based on the principles of HYMO and its successors      *********
 *********                 OTTHYMO-83 and OTTHYMO-89.                  *********
 ******************************************************************************
 ********* Distributed by:  J.F. Sabourin and Associates Inc.          *********
 *********                  Ottawa,  Ontario: (613) 836-3884           *********
 *********                  Gatineau, Quebec: (819) 243-6858           *********
 *********                  E-Mail: swmhymo@jfsa.Com                   *********
 ******************************************************************************

 ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
 +++++++++ Licensed user: Calder Engineering Ltd.                     +++++++++
 +++++++++                Bolton                SERIAL#:3375279       +++++++++
 ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

 ******************************************************************************
 *********           ++++++ PROGRAM ARRAY DIMENSIONS ++++++            *********
 *********           Maximum value for ID numbers  :     10            *********
 *********           Max. number of rainfall points: 105408            *********
 *********           Max. number of flow points    : 105408            *********
 ******************************************************************************


 **********************   D E T A I L E D   O U T P U T   *********************
 ******************************************************************************
 *        DATE: 2017-06-29     TIME: 14:48:14     RUN COUNTER: 000783         *
 ******************************************************************************
 * Input   filename: C:\PROGRA~2\SWMHYMO\PROJECTS\Laurel\L-ex.dat             *
 * Output  filename: C:\PROGRA~2\SWMHYMO\PROJECTS\Laurel\L-ex.out             *
 * Summary filename: C:\PROGRA~2\SWMHYMO\PROJECTS\Laurel\L-ex.sum             *
 * User comments:                                                             *
 * 1:_________________________________________________________________________*
 * 2:_________________________________________________________________________*
 * 3:_________________________________________________________________________*
 ******************************************************************************

-------------------------------------------------------------------------------
001:0001-----------------------------------------------------------------------
*#*****************************************************************************
*#  Project Name: [Laurel Park]    Project Number: [ 16-168 ]
*#  Date        : [2017-06-29]
*#  Modeller    : [    MYS    ]
*#  Company     : Calder Engineering Ltd.
*#  License #   :  3375279
*#*****************************************************************************
*# Existing Conditions
*#*****************************************************************************
--------------------
| START            |  Project  dir.: C:\PROGRA~2\SWMHYMO\PROJECTS\Laurel\
--------------------  Rainfall dir.: C:\PROGRA~2\SWMHYMO\PROJECTS\Laurel\
     TZERO =   .00 hrs on        0
     METOUT=   2 (output = METRIC)
     NRUN  = 001
     NSTORM=   0
-------------------------------------------------------------------------------
001:0002-----------------------------------------------------------------------
--------------------
| READ STORM       |    Filename: 10yr/6hr
| Ptotal=  55.69 mm|    Comments: 10yr/6hr
--------------------
              TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
               hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
               .25    .000 |   2.00  18.940 |   3.75   7.800 |   5.50   1.110
               .50   1.110 |   2.25  18.940 |   4.00   4.460 |   5.75   1.110
               .75   1.110 |   2.50  51.240 |   4.25   4.460 |   6.00   1.110
              1.00   1.110 |   2.75  51.240 |   4.50   2.230 |   6.25   1.110
              1.25   1.110 |   3.00  14.480 |   4.75   2.230 |
              1.50   6.680 |   3.25  14.480 |   5.00   1.110 |
              1.75   6.680 |   3.50   7.800 |   5.25   1.110 |

-------------------------------------------------------------------------------
001:0003-----------------------------------------------------------------------
*# Node 1: Flow from Basin 1
----------------------
| CALIB NASHYD       |   Area    (ha)=    1.92   Curve Number   (CN)=76.00
| 01:1      DT= 1.00 |   Ia      (mm)=  10.000   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .140

     Unit Hyd Qpeak  (cms)=     .524

     PEAK FLOW       (cms)=     .098 (i)
     TIME TO PEAK    (hrs)=    2.800
     RUNOFF VOLUME    (mm)=   16.581
     TOTAL RAINFALL   (mm)=   55.690
     RUNOFF COEFFICIENT   =     .298

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
001:0004-----------------------------------------------------------------------
*# Node 2: Flow from Basin 2
----------------------
| CALIB NASHYD       |   Area    (ha)=    1.60   Curve Number   (CN)=78.00
| 02:2      DT= 1.00 |   Ia      (mm)=  10.000   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .140

     Unit Hyd Qpeak  (cms)=     .437

     PEAK FLOW       (cms)=     .088 (i)
     TIME TO PEAK    (hrs)=    2.800
     RUNOFF VOLUME    (mm)=   17.792
     TOTAL RAINFALL   (mm)=   55.690
     RUNOFF COEFFICIENT   =     .319

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
001:0005-----------------------------------------------------------------------
*# Node 3: Flow from Basin 3
----------------------
| CALIB NASHYD       |   Area    (ha)=     .18   Curve Number   (CN)=75.00
| 03:3      DT= 1.00 |   Ia      (mm)=  10.000   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .090

     Unit Hyd Qpeak  (cms)=     .076

     PEAK FLOW       (cms)=     .010 (i)
     TIME TO PEAK    (hrs)=    2.767
     RUNOFF VOLUME    (mm)=   16.013
     TOTAL RAINFALL   (mm)=   55.690
     RUNOFF COEFFICIENT   =     .288

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
001:0006-----------------------------------------------------------------------
*# Node 4: Flow from Basin 4 and 5
----------------------
| CALIB NASHYD       |   Area    (ha)=    2.60   Curve Number   (CN)=70.00
| 04:4      DT= 1.00 |   Ia      (mm)=  10.000   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .170

     Unit Hyd Qpeak  (cms)=     .584

     PEAK FLOW       (cms)=     .099 (i)
     TIME TO PEAK    (hrs)=    2.817
     RUNOFF VOLUME    (mm)=   13.508
     TOTAL RAINFALL   (mm)=   55.690
     RUNOFF COEFFICIENT   =     .243

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
001:0007-----------------------------------------------------------------------
----------------------
| CALIB NASHYD       |   Area    (ha)=    1.79   Curve Number   (CN)=68.00
| 05:5      DT= 1.00 |   Ia      (mm)=  10.000   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .130

     Unit Hyd Qpeak  (cms)=     .526

     PEAK FLOW       (cms)=     .070 (i)
     TIME TO PEAK    (hrs)=    2.783
     RUNOFF VOLUME    (mm)=   12.635
     TOTAL RAINFALL   (mm)=   55.690
     RUNOFF COEFFICIENT   =     .227

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
001:0008-----------------------------------------------------------------------
------------------------
| ADD HYD (N4        ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
------------------------                  (ha)     (cms)   (hrs)   (mm)   (cms)
                     ID1 04:4             2.60      .099    2.82  13.51    .000
                    +ID2 05:5             1.79      .070    2.78  12.64    .000
                     ==========================================================
                     SUM 06:N4            4.39      .168    2.80  13.15    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
001:0009-----------------------------------------------------------------------
*# Node 5: Flow from Basin 6
----------------------
| CALIB NASHYD       |   Area    (ha)=    2.58   Curve Number   (CN)=75.00
| 07:6      DT= 1.00 |   Ia      (mm)=  10.000   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .260

     Unit Hyd Qpeak  (cms)=     .379

     PEAK FLOW       (cms)=     .096 (i)
     TIME TO PEAK    (hrs)=    2.900
     RUNOFF VOLUME    (mm)=   16.014
     TOTAL RAINFALL   (mm)=   55.690
     RUNOFF COEFFICIENT   =     .288

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
001:0010-----------------------------------------------------------------------
*# Node 6: Flow from Basin 7
----------------------
| CALIB NASHYD       |   Area    (ha)=    1.46   Curve Number   (CN)=83.00
| 08:7      DT= 1.00 |   Ia      (mm)=  10.000   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .090

     Unit Hyd Qpeak  (cms)=     .620

     PEAK FLOW       (cms)=     .108 (i)
     TIME TO PEAK    (hrs)=    2.767
     RUNOFF VOLUME    (mm)=   21.364
     TOTAL RAINFALL   (mm)=   55.690
     RUNOFF COEFFICIENT   =     .384

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
001:0011-----------------------------------------------------------------------
*# Node 7: Flow from Basin 8
----------------------
| CALIB NASHYD       |   Area    (ha)=     .38   Curve Number   (CN)=75.00
| 09:8      DT= 1.00 |   Ia      (mm)=  10.000   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .160

     Unit Hyd Qpeak  (cms)=     .091

     PEAK FLOW       (cms)=     .018 (i)
     TIME TO PEAK    (hrs)=    2.800
     RUNOFF VOLUME    (mm)=   16.014
     TOTAL RAINFALL   (mm)=   55.690
     RUNOFF COEFFICIENT   =     .288

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
001:0012-----------------------------------------------------------------------
*# Node 8: Flow from Basin 9
----------------------
| CALIB NASHYD       |   Area    (ha)=     .05   Curve Number   (CN)=75.00
| 01:9      DT= 1.00 |   Ia      (mm)=  10.000   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .060

     Unit Hyd Qpeak  (cms)=     .032

     PEAK FLOW       (cms)=     .003 (i)
     TIME TO PEAK    (hrs)=    2.750
     RUNOFF VOLUME    (mm)=   16.011
     TOTAL RAINFALL   (mm)=   55.690
     RUNOFF COEFFICIENT   =     .288

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
001:0013-----------------------------------------------------------------------
      FINISH
-------------------------------------------------------------------------------
*******************************************************************************
     WARNINGS / ERRORS / NOTES
     -------------------------
   Simulation ended on 2017-06-29     at 14:48:14
===============================================================================
```

```
===============================================================================

   SSSSS  W   W  M   M  H   H  Y   Y  M   M   OOO       999   999   =========
   S      W W W  MM MM  H   H   Y Y   MM MM  O   O     9   9  9   9
   SSSSS  W W W  M M M  HHHHH    Y    M M M  O   O  ## 9   9  9   9  Ver  4.05
       S   W W   M   M  H   H    Y    M   M  O   O      9999   9999  Sept 2011
   SSSSS   W W   M   M  H   H    Y    M   M   OOO          9      9  =========
                                                       9   9  9   9  # 3375279
        StormWater Management HYdrologic Model          999   999   =========

  *******************************************************************************
  ***************************** SWMHYMO Ver/4.05  ******************************
  *********  A single event and continuous hydrologic simulation model  *********
  *********     based on the principles of HYMO and its successors      *********
  *********                  OTTHYMO-83 and OTTHYMO-89.                 *********
  *******************************************************************************
  ********* Distributed by:  J.F. Sabourin and Associates Inc.          *********
  *********                  Ottawa,  Ontario: (613) 836-3884          *********
  *********                  Gatineau, Quebec: (819) 243-6858          *********
  *********                  E-Mail: swmhymo@jfsa.Com                  *********
  *******************************************************************************

  +++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
  +++++++++ Licensed user: Calder Engineering Ltd.                     +++++++++
  +++++++++                Bolton                SERIAL#:3375279       +++++++++
  +++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

  *******************************************************************************
  *********           ++++++ PROGRAM ARRAY DIMENSIONS ++++++          *********
  *********           Maximum value for ID numbers  :     10          *********
  *********           Max. number of rainfall points: 105408          *********
  *********           Max. number of flow points    : 105408          *********
  *******************************************************************************


  *********************   D E T A I L E D   O U T P U T   *********************
  *******************************************************************************
  *         DATE: 2017-06-29     TIME: 14:47:32     RUN COUNTER: 000782        *
  *******************************************************************************
  * Input   filename: C:\PROGRA~2\SWMHYMO\PROJECTS\Laurel\L-ex.dat             *
  * Output  filename: C:\PROGRA~2\SWMHYMO\PROJECTS\Laurel\L-ex.out             *
  * Summary filename: C:\PROGRA~2\SWMHYMO\PROJECTS\Laurel\L-ex.sum             *
  * User comments:                                                             *
  * 1:_________________________________________________________________________*
  * 2:_________________________________________________________________________*
  * 3:_________________________________________________________________________*
  *******************************************************************************

 --------------------------------------------------------------------------------
 001:0001------------------------------------------------------------------------
 *#******************************************************************************
 *#  Project Name: [Laurel Park]    Project Number: [ 16-168 ]
 *#  Date        : [2017-06-29]
 *#  Modeller    : [    MYS    ]
 *#  Company     : Calder Engineering Ltd.
 *#  License #   :  3375279
 *#******************************************************************************
 *# Existing Conditions
 *#******************************************************************************
 --------------------
 | START            |  Project  dir.: C:\PROGRA~2\SWMHYMO\PROJECTS\Laurel\
 --------------------  Rainfall dir.: C:\PROGRA~2\SWMHYMO\PROJECTS\Laurel\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 001
    NSTORM=   0
 --------------------------------------------------------------------------------
 001:0002------------------------------------------------------------------------
 --------------------
 | READ STORM       |    Filename: 25yr/6hr
 | 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
               .25    .000 |   2.00  22.300 |   3.75   9.180 |   5.50   1.310
               .50   1.310 |   2.25  22.300 |   4.00   5.250 |   5.75   1.310
               .75   1.310 |   2.50  60.350 |   4.25   5.250 |   6.00   1.310
              1.00   1.310 |   2.75  60.350 |   4.50   2.620 |   6.25   1.310
              1.25   1.310 |   3.00  17.060 |   4.75   2.620 |
              1.50   7.870 |   3.25  17.060 |   5.00   1.310 |
              1.75   7.870 |   3.50   9.180 |   5.25   1.310 |

 --------------------------------------------------------------------------------
 001:0003------------------------------------------------------------------------
 *# Node 1: Flow from Basin 1
 ----------------------
 | CALIB NASHYD       |   Area    (ha)=    1.92   Curve Number   (CN)=76.00
 | 01:1      DT= 1.00 |   Ia      (mm)=  10.000   # of Linear Res.(N)= 3.00
 ----------------------   U.H. Tp(hrs)=    .140

      Unit Hyd Qpeak  (cms)=     .524

      PEAK FLOW       (cms)=     .134 (i)
      TIME TO PEAK    (hrs)=    2.783
      RUNOFF VOLUME    (mm)=   22.756
      TOTAL RAINFALL   (mm)=   65.590
      RUNOFF COEFFICIENT   =     .347

      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

 --------------------------------------------------------------------------------
 001:0004------------------------------------------------------------------------
 *# Node 2: Flow from Basin 2
 ----------------------
 | CALIB NASHYD       |   Area    (ha)=    1.60   Curve Number   (CN)=78.00
 | 02:2      DT= 1.00 |   Ia      (mm)=  10.000   # of Linear Res.(N)= 3.00
 ----------------------   U.H. Tp(hrs)=    .140

      Unit Hyd Qpeak  (cms)=     .437

      PEAK FLOW       (cms)=     .120 (i)
      TIME TO PEAK    (hrs)=    2.783
      RUNOFF VOLUME    (mm)=   24.288
      TOTAL RAINFALL   (mm)=   65.590
      RUNOFF COEFFICIENT   =     .370

      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

 --------------------------------------------------------------------------------
 001:0005------------------------------------------------------------------------
 *# Node 3: Flow from Basin 3
 ----------------------
 | CALIB NASHYD       |   Area    (ha)=     .18   Curve Number   (CN)=75.00
 | 03:3      DT= 1.00 |   Ia      (mm)=  10.000   # of Linear Res.(N)= 3.00
 ----------------------   U.H. Tp(hrs)=    .090

      Unit Hyd Qpeak  (cms)=     .076

      PEAK FLOW       (cms)=     .013 (i)
      TIME TO PEAK    (hrs)=    2.767
      RUNOFF VOLUME    (mm)=   22.032
      TOTAL RAINFALL   (mm)=   65.590
      RUNOFF COEFFICIENT   =     .336

      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

 --------------------------------------------------------------------------------
 001:0006------------------------------------------------------------------------
 *# Node 4: Flow from Basin 4 and 5
 ----------------------
 | CALIB NASHYD       |   Area    (ha)=    2.60   Curve Number   (CN)=70.00
 | 04:4      DT= 1.00 |   Ia      (mm)=  10.000   # of Linear Res.(N)= 3.00
 ----------------------   U.H. Tp(hrs)=    .170

      Unit Hyd Qpeak  (cms)=     .584

      PEAK FLOW       (cms)=     .139 (i)
      TIME TO PEAK    (hrs)=    2.817
      RUNOFF VOLUME    (mm)=   18.792
      TOTAL RAINFALL   (mm)=   65.590
      RUNOFF COEFFICIENT   =     .287

      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

 --------------------------------------------------------------------------------
 001:0007------------------------------------------------------------------------
 ----------------------
 | CALIB NASHYD       |   Area    (ha)=    1.79   Curve Number   (CN)=68.00
 | 05:5      DT= 1.00 |   Ia      (mm)=  10.000   # of Linear Res.(N)= 3.00
 ----------------------   U.H. Tp(hrs)=    .130

      Unit Hyd Qpeak  (cms)=     .526

      PEAK FLOW       (cms)=     .098 (i)
      TIME TO PEAK    (hrs)=    2.783
      RUNOFF VOLUME    (mm)=   17.646
      TOTAL RAINFALL   (mm)=   65.590
      RUNOFF COEFFICIENT   =     .269

      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

 --------------------------------------------------------------------------------
 001:0008------------------------------------------------------------------------
 ------------------------
 | ADD HYD (N4        ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
 ------------------------                  (ha)     (cms)   (hrs)   (mm)   (cms)
                    ID1 04:4               2.60      .139    2.82  18.79    .000
                   +ID2 05:5               1.79      .098    2.78  17.65    .000
                    ============================================================
                    SUM 06:N4              4.39      .235    2.80  18.32    .000

    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

 --------------------------------------------------------------------------------
 001:0009------------------------------------------------------------------------
 *# Node 5: Flow from Basin 6
 ----------------------
 | CALIB NASHYD       |   Area    (ha)=    2.58   Curve Number   (CN)=75.00
 | 07:6      DT= 1.00 |   Ia      (mm)=  10.000   # of Linear Res.(N)= 3.00
 ----------------------   U.H. Tp(hrs)=    .260

      Unit Hyd Qpeak  (cms)=     .379

      PEAK FLOW       (cms)=     .135 (i)
      TIME TO PEAK    (hrs)=    2.900
      RUNOFF VOLUME    (mm)=   22.033
      TOTAL RAINFALL   (mm)=   65.590
      RUNOFF COEFFICIENT   =     .336

      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

 --------------------------------------------------------------------------------
 001:0010------------------------------------------------------------------------
 *# Node 6: Flow from Basin 7
 ----------------------
 | CALIB NASHYD       |   Area    (ha)=    1.46   Curve Number   (CN)=83.00
 | 08:7      DT= 1.00 |   Ia      (mm)=  10.000   # of Linear Res.(N)= 3.00
 ----------------------   U.H. Tp(hrs)=    .090

      Unit Hyd Qpeak  (cms)=     .620

      PEAK FLOW       (cms)=     .143 (i)
      TIME TO PEAK    (hrs)=    2.767
      RUNOFF VOLUME    (mm)=   28.716
      TOTAL RAINFALL   (mm)=   65.590
      RUNOFF COEFFICIENT   =     .438

      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

 --------------------------------------------------------------------------------
 001:0011------------------------------------------------------------------------
 *# Node 7: Flow from Basin 8
 ----------------------
 | CALIB NASHYD       |   Area    (ha)=     .38   Curve Number   (CN)=75.00
 | 09:8      DT= 1.00 |   Ia      (mm)=  10.000   # of Linear Res.(N)= 3.00
 ----------------------   U.H. Tp(hrs)=    .160

      Unit Hyd Qpeak  (cms)=     .091

      PEAK FLOW       (cms)=     .025 (i)
      TIME TO PEAK    (hrs)=    2.800
      RUNOFF VOLUME    (mm)=   22.032
      TOTAL RAINFALL   (mm)=   65.590
      RUNOFF COEFFICIENT   =     .336

      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

 --------------------------------------------------------------------------------
 001:0012------------------------------------------------------------------------
 *# Node 8: Flow from Basin 9
 ----------------------
 | CALIB NASHYD       |   Area    (ha)=     .05   Curve Number   (CN)=75.00
 | 01:9      DT= 1.00 |   Ia      (mm)=  10.000   # of Linear Res.(N)= 3.00
 ----------------------   U.H. Tp(hrs)=    .060

      Unit Hyd Qpeak  (cms)=     .032

      PEAK FLOW       (cms)=     .004 (i)
      TIME TO PEAK    (hrs)=    2.750
      RUNOFF VOLUME    (mm)=   22.030
      TOTAL RAINFALL   (mm)=   65.590
      RUNOFF COEFFICIENT   =     .336

      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

 --------------------------------------------------------------------------------
 001:0013------------------------------------------------------------------------
       FINISH
 --------------------------------------------------------------------------------
 ********************************************************************************
      WARNINGS / ERRORS / NOTES
      -------------------------
    Simulation ended on 2017-06-29     at 14:47:32
 ================================================================================

```

```
================================================================================

   SSSSS  W   W  M   M  H   H  Y   Y  M   M   OOO        999    999    =========
   S      W W W  MM MM  H   H   Y Y   MM MM  O   O      9   9  9   9
   SSSSS  W W W  M M M  HHHHH    Y    M M M  O   O  ##  9   9  9   9   Ver  4.05
       S   W W  M   M  H   H    Y    M   M  O   O       9999  9999   Sept 2011
   SSSSS   W W  M   M  H   H    Y    M   M   OOO          9      9   =========
                                                        9   9  9   9   # 3375279
        StormWater Management HYdrologic Model           999    999    =========

 *******************************************************************************
 ***************************** SWMHYMO Ver/4.05  ******************************
 *********  A single event and continuous hydrologic simulation model  *********
 *********     based on the principles of HYMO and its successors      *********
 *********                OTTHYMO-83 and OTTHYMO-89.                   *********
 *******************************************************************************
 ********* Distributed by:  J.F. Sabourin and Associates Inc.          *********
 *********                  Ottawa,  Ontario: (613) 836-3884           *********
 *********                  Gatineau, Quebec: (819) 243-6858           *********
 *********                  E-Mail: swmhymo@jfsa.Com                   *********
 *******************************************************************************

 +++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
 +++++++++ Licensed user: Calder Engineering Ltd.                     +++++++++
 +++++++++                Bolton                 SERIAL#:3375279      +++++++++
 +++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

 *******************************************************************************
 *********           ++++++ PROGRAM ARRAY DIMENSIONS ++++++           *********
 *********           Maximum value for ID numbers  :     10           *********
 *********           Max. number of rainfall points: 105408           *********
 *********           Max. number of flow points    : 105408           *********
 *******************************************************************************


 **********************  D E T A I L E D   O U T P U T  **********************
 *******************************************************************************
 *         DATE: 2017-06-29     TIME: 14:46:54     RUN COUNTER: 000781        *
 *******************************************************************************
 * Input   filename: C:\PROGRA~2\SWMHYMO\PROJECTS\Laurel\L-ex.dat             *
 * Output  filename: C:\PROGRA~2\SWMHYMO\PROJECTS\Laurel\L-ex.out             *
 * Summary filename: C:\PROGRA~2\SWMHYMO\PROJECTS\Laurel\L-ex.sum             *
 * User comments:                                                             *
 * 1:__________________________________________________________________________*
 * 2:__________________________________________________________________________*
 * 3:__________________________________________________________________________*
 *******************************************************************************

--------------------------------------------------------------------------------
001:0001------------------------------------------------------------------------
*#******************************************************************************
*#  Project Name: [Laurel Park]    Project Number: [ 16-168 ]
*#  Date        : [2017-06-29]
*#  Modeller    : [    MYS    ]
*#  Company     : Calder Engineering Ltd.
*#  License #   :  3375279
*#******************************************************************************
*# Existing Conditions
*#******************************************************************************
--------------------
| START            |  Project  dir.: C:\PROGRA~2\SWMHYMO\PROJECTS\Laurel\
--------------------  Rainfall dir.: C:\PROGRA~2\SWMHYMO\PROJECTS\Laurel\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 001
    NSTORM=   0
--------------------------------------------------------------------------------
001:0002------------------------------------------------------------------------
--------------------
| READ STORM       |    Filename: 50yr/6hr
| 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
               .25    .000 |   2.00  24.820 |   3.75  10.220 |   5.50   1.460
               .50   1.460 |   2.25  24.820 |   4.00   5.840 |   5.75   1.460
               .75   1.460 |   2.50  67.160 |   4.25   5.840 |   6.00   1.460
              1.00   1.460 |   2.75  67.160 |   4.50   2.920 |   6.25   1.460
              1.25   1.460 |   3.00  18.980 |   4.75   2.920 |
              1.50   8.760 |   3.25  18.980 |   5.00   1.460 |
              1.75   8.760 |   3.50  10.220 |   5.25   1.460 |

--------------------------------------------------------------------------------
001:0003------------------------------------------------------------------------
*# Node 1: Flow from Basin 1
---------------------
| CALIB NASHYD      |   Area    (ha)=    1.92   Curve Number   (CN)=76.00
| 01:1      DT= 1.00 |   Ia      (mm)=  10.000   # of Linear Res.(N)= 3.00
---------------------   U.H. Tp(hrs)=    .140

     Unit Hyd Qpeak  (cms)=     .524

     PEAK FLOW       (cms)=     .164 (i)
     TIME TO PEAK    (hrs)=    2.783
     RUNOFF VOLUME    (mm)=   27.714
     TOTAL RAINFALL   (mm)=   73.000
     RUNOFF COEFFICIENT   =     .380

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
001:0004------------------------------------------------------------------------
*# Node 2: Flow from Basin 2
---------------------
| CALIB NASHYD      |   Area    (ha)=    1.60   Curve Number   (CN)=78.00
| 02:2      DT= 1.00 |   Ia      (mm)=  10.000   # of Linear Res.(N)= 3.00
---------------------   U.H. Tp(hrs)=    .140

     Unit Hyd Qpeak  (cms)=     .437

     PEAK FLOW       (cms)=     .146 (i)
     TIME TO PEAK    (hrs)=    2.783
     RUNOFF VOLUME    (mm)=   29.478
     TOTAL RAINFALL   (mm)=   73.000
     RUNOFF COEFFICIENT   =     .404

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
001:0005------------------------------------------------------------------------
*# Node 3: Flow from Basin 3
---------------------
| CALIB NASHYD      |   Area    (ha)=     .18   Curve Number   (CN)=75.00
| 03:3      DT= 1.00 |   Ia      (mm)=  10.000   # of Linear Res.(N)= 3.00
---------------------   U.H. Tp(hrs)=    .090

     Unit Hyd Qpeak  (cms)=     .076

     PEAK FLOW       (cms)=     .016 (i)
     TIME TO PEAK    (hrs)=    2.767
     RUNOFF VOLUME    (mm)=   26.877
     TOTAL RAINFALL   (mm)=   73.000
     RUNOFF COEFFICIENT   =     .368

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
001:0006------------------------------------------------------------------------
*# Node 4: Flow from Basin 4 and 5
---------------------
| CALIB NASHYD      |   Area    (ha)=    2.60   Curve Number   (CN)=70.00
| 04:4      DT= 1.00 |   Ia      (mm)=  10.000   # of Linear Res.(N)= 3.00
---------------------   U.H. Tp(hrs)=    .170

     Unit Hyd Qpeak  (cms)=     .584

     PEAK FLOW       (cms)=     .171 (i)
     TIME TO PEAK    (hrs)=    2.817
     RUNOFF VOLUME    (mm)=   23.095
     TOTAL RAINFALL   (mm)=   73.000
     RUNOFF COEFFICIENT   =     .316

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
001:0007------------------------------------------------------------------------
---------------------
| CALIB NASHYD      |   Area    (ha)=    1.79   Curve Number   (CN)=68.00
| 05:5      DT= 1.00 |   Ia      (mm)=  10.000   # of Linear Res.(N)= 3.00
---------------------   U.H. Tp(hrs)=    .130

     Unit Hyd Qpeak  (cms)=     .526

     PEAK FLOW       (cms)=     .120 (i)
     TIME TO PEAK    (hrs)=    2.783
     RUNOFF VOLUME    (mm)=   21.744
     TOTAL RAINFALL   (mm)=   73.000
     RUNOFF COEFFICIENT   =     .298

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
001:0008------------------------------------------------------------------------
------------------------
| ADD HYD (N4        ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
------------------------                  (ha)     (cms)   (hrs)   (mm)   (cms)
                     ID1 04:4             2.60      .171    2.82  23.09    .000
                    +ID2 05:5             1.79      .120    2.78  21.74    .000
                     ===========================================================
                     SUM 06:N4            4.39      .290    2.80  22.54    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
001:0009------------------------------------------------------------------------
*# Node 5: Flow from Basin 6
---------------------
| CALIB NASHYD      |   Area    (ha)=    2.58   Curve Number   (CN)=75.00
| 07:6      DT= 1.00 |   Ia      (mm)=  10.000   # of Linear Res.(N)= 3.00
---------------------   U.H. Tp(hrs)=    .260

     Unit Hyd Qpeak  (cms)=     .379

     PEAK FLOW       (cms)=     .166 (i)
     TIME TO PEAK    (hrs)=    2.883
     RUNOFF VOLUME    (mm)=   26.878
     TOTAL RAINFALL   (mm)=   73.000
     RUNOFF COEFFICIENT   =     .368

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
001:0010------------------------------------------------------------------------
*# Node 6: Flow from Basin 7
---------------------
| CALIB NASHYD      |   Area    (ha)=    1.46   Curve Number   (CN)=83.00
| 08:7      DT= 1.00 |   Ia      (mm)=  10.000   # of Linear Res.(N)= 3.00
---------------------   U.H. Tp(hrs)=    .090

     Unit Hyd Qpeak  (cms)=     .620

     PEAK FLOW       (cms)=     .170 (i)
     TIME TO PEAK    (hrs)=    2.767
     RUNOFF VOLUME    (mm)=   34.506
     TOTAL RAINFALL   (mm)=   73.000
     RUNOFF COEFFICIENT   =     .473

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
001:0011------------------------------------------------------------------------
*# Node 7: Flow from Basin 8
---------------------
| CALIB NASHYD      |   Area    (ha)=     .38   Curve Number   (CN)=75.00
| 09:8      DT= 1.00 |   Ia      (mm)=  10.000   # of Linear Res.(N)= 3.00
---------------------   U.H. Tp(hrs)=    .160

     Unit Hyd Qpeak  (cms)=     .091

     PEAK FLOW       (cms)=     .030 (i)
     TIME TO PEAK    (hrs)=    2.800
     RUNOFF VOLUME    (mm)=   26.877
     TOTAL RAINFALL   (mm)=   73.000
     RUNOFF COEFFICIENT   =     .368

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
001:0012------------------------------------------------------------------------
*# Node 8: Flow from Basin 9
---------------------
| CALIB NASHYD      |   Area    (ha)=     .05   Curve Number   (CN)=75.00
| 01:9      DT= 1.00 |   Ia      (mm)=  10.000   # of Linear Res.(N)= 3.00
---------------------   U.H. Tp(hrs)=    .060

     Unit Hyd Qpeak  (cms)=     .032

     PEAK FLOW       (cms)=     .005 (i)
     TIME TO PEAK    (hrs)=    2.750
     RUNOFF VOLUME    (mm)=   26.875
     TOTAL RAINFALL   (mm)=   73.000
     RUNOFF COEFFICIENT   =     .368

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
001:0013------------------------------------------------------------------------
      FINISH
--------------------------------------------------------------------------------
********************************************************************************
     WARNINGS / ERRORS / NOTES
     -------------------------
   Simulation ended on 2017-06-29     at 14:46:54
================================================================================


```

```
================================================================================

   SSSSS  W   W  M   M  H   H  Y   Y  M   M   OOO       999    999    =========
   S      W W W  MM MM  H   H   Y Y   MM MM  O   O     9   9  9   9
   SSSSS  W W W  M M M  HHHHH    Y    M M M  O   O  ##  9   9  9   9   Ver  4.05
       S   W W   M   M  H   H    Y    M   M  O   O       9999   9999   Sept 2011
   SSSSS   W W   M   M  H   H    Y    M   M   OOO          9      9   =========
                                                        9   9  9   9   # 3375279
        StormWater Management HYdrologic Model           999    999    =========

 *******************************************************************************
 ***************************** SWMHYMO Ver/4.05  ******************************
 *********  A single event and continuous hydrologic simulation model  *********
 *********     based on the principles of HYMO and its successors      *********
 *********                OTTHYMO-83 and OTTHYMO-89.                   *********
 *******************************************************************************
 ********* Distributed by:  J.F. Sabourin and Associates Inc.          *********
 *********                  Ottawa,  Ontario: (613) 836-3884           *********
 *********                  Gatineau, Quebec: (819) 243-6858           *********
 *********                  E-Mail: swmhymo@jfsa.Com                   *********
 *******************************************************************************

 +++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
 +++++++++ Licensed user: Calder Engineering Ltd.                     +++++++++
 +++++++++                Bolton                 SERIAL#:3375279       +++++++++
 +++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

 *******************************************************************************
 *********          ++++++ PROGRAM ARRAY DIMENSIONS ++++++             *********
 *********          Maximum value for ID numbers  :     10             *********
 *********          Max. number of rainfall points: 105408             *********
 *********          Max. number of flow points    : 105408             *********
 *******************************************************************************


 *********************  D E T A I L E D   O U T P U T  *********************
 *******************************************************************************
 *        DATE: 2017-06-29     TIME: 14:45:01     RUN COUNTER: 000779         *
 *******************************************************************************
 * Input   filename: C:\PROGRA~2\SWMHYMO\PROJECTS\Laurel\L-ex.dat              *
 * Output  filename: C:\PROGRA~2\SWMHYMO\PROJECTS\Laurel\L-ex.out              *
 * Summary filename: C:\PROGRA~2\SWMHYMO\PROJECTS\Laurel\L-ex.sum              *
 * User comments:                                                              *
 * 1:__________________________________________________________________________*
 * 2:__________________________________________________________________________*
 * 3:__________________________________________________________________________*
 *******************************************************************************

--------------------------------------------------------------------------------
001:0001------------------------------------------------------------------------
*#******************************************************************************
*#  Project Name: [Laurel Park]    Project Number: [ 16-168 ]
*#  Date        : [2017-06-29]
*#  Modeller    : [    MYS    ]
*#  Company     : Calder Engineering Ltd.
*#  License #   :  3375279
*#******************************************************************************
*# Existing Conditions
*#******************************************************************************
--------------------
| START            |  Project  dir.: C:\PROGRA~2\SWMHYMO\PROJECTS\Laurel\
--------------------  Rainfall dir.: C:\PROGRA~2\SWMHYMO\PROJECTS\Laurel\
    TZERO =   .00 hrs on       0
    METOUT=   2 (output = METRIC)
    NRUN  = 001
    NSTORM=   0
--------------------------------------------------------------------------------
001:0002------------------------------------------------------------------------
--------------------
| READ STORM       |    Filename: 100yr/6hr
| Ptotal=  80.31 mm|    Comments: 100yr/6hr
--------------------
               TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
                hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
                .25    .000 |   2.00  27.300 |   3.75  11.240 |   5.50   1.610
                .50   1.610 |   2.25  27.300 |   4.00   6.420 |   5.75   1.610
                .75   1.610 |   2.50  73.880 |   4.25   6.420 |   6.00   1.610
               1.00   1.610 |   2.75  73.880 |   4.50   3.210 |   6.25   1.610
               1.25   1.610 |   3.00  20.880 |   4.75   3.210 |
               1.50   9.640 |   3.25  20.880 |   5.00   1.610 |
               1.75   9.640 |   3.50  11.240 |   5.25   1.610 |

--------------------------------------------------------------------------------
001:0003------------------------------------------------------------------------
*# Node 1: Flow from Basin 1
---------------------
| CALIB NASHYD       |   Area    (ha)=    1.92   Curve Number   (CN)=76.00
| 01:1      DT= 1.00 |   Ia      (mm)=  10.000   # of Linear Res.(N)= 3.00
---------------------    U.H. Tp(hrs)=    .140

     Unit Hyd Qpeak  (cms)=     .524

     PEAK FLOW       (cms)=     .194 (i)
     TIME TO PEAK    (hrs)=    2.783
     RUNOFF VOLUME    (mm)=   32.842
     TOTAL RAINFALL   (mm)=   80.310
     RUNOFF COEFFICIENT   =     .409

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
001:0004------------------------------------------------------------------------
*# Node 2: Flow from Basin 2
---------------------
| CALIB NASHYD       |   Area    (ha)=    1.60   Curve Number   (CN)=78.00
| 02:2      DT= 1.00 |   Ia      (mm)=  10.000   # of Linear Res.(N)= 3.00
---------------------    U.H. Tp(hrs)=    .140

     Unit Hyd Qpeak  (cms)=     .437

     PEAK FLOW       (cms)=     .172 (i)
     TIME TO PEAK    (hrs)=    2.783
     RUNOFF VOLUME    (mm)=   34.825
     TOTAL RAINFALL   (mm)=   80.310
     RUNOFF COEFFICIENT   =     .434

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
001:0005------------------------------------------------------------------------
*# Node 3: Flow from Basin 3
---------------------
| CALIB NASHYD       |   Area    (ha)=     .18   Curve Number   (CN)=75.00
| 03:3      DT= 1.00 |   Ia      (mm)=  10.000   # of Linear Res.(N)= 3.00
---------------------    U.H. Tp(hrs)=    .090

     Unit Hyd Qpeak  (cms)=     .076

     PEAK FLOW       (cms)=     .019 (i)
     TIME TO PEAK    (hrs)=    2.767
     RUNOFF VOLUME    (mm)=   31.897
     TOTAL RAINFALL   (mm)=   80.310
     RUNOFF COEFFICIENT   =     .397

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
001:0006------------------------------------------------------------------------
*# Node 4: Flow from Basin 4 and 5
---------------------
| CALIB NASHYD       |   Area    (ha)=    2.60   Curve Number   (CN)=70.00
| 04:4      DT= 1.00 |   Ia      (mm)=  10.000   # of Linear Res.(N)= 3.00
---------------------    U.H. Tp(hrs)=    .170

     Unit Hyd Qpeak  (cms)=     .584

     PEAK FLOW       (cms)=     .205 (i)
     TIME TO PEAK    (hrs)=    2.817
     RUNOFF VOLUME    (mm)=   27.591
     TOTAL RAINFALL   (mm)=   80.310
     RUNOFF COEFFICIENT   =     .344

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
001:0007------------------------------------------------------------------------
---------------------
| CALIB NASHYD       |   Area    (ha)=    1.79   Curve Number   (CN)=68.00
| 05:5      DT= 1.00 |   Ia      (mm)=  10.000   # of Linear Res.(N)= 3.00
---------------------    U.H. Tp(hrs)=    .130

     Unit Hyd Qpeak  (cms)=     .526

     PEAK FLOW       (cms)=     .144 (i)
     TIME TO PEAK    (hrs)=    2.783
     RUNOFF VOLUME    (mm)=   26.040
     TOTAL RAINFALL   (mm)=   80.310
     RUNOFF COEFFICIENT   =     .324

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
001:0008------------------------------------------------------------------------
-----------------------
| ADD HYD (N4        ) | ID: NHYD        AREA     QPEAK   TPEAK   R.V.    DWF
-----------------------                  (ha)     (cms)   (hrs)   (mm)   (cms)
                     ID1 04:4            2.60      .205    2.82  27.59    .000
                    +ID2 05:5            1.79      .144    2.78  26.04    .000
                     ==========================================================
                     SUM 06:N4           4.39      .348    2.80  26.96    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
001:0009------------------------------------------------------------------------
*# Node 5: Flow from Basin 6
---------------------
| CALIB NASHYD       |   Area    (ha)=    2.58   Curve Number   (CN)=75.00
| 07:6      DT= 1.00 |   Ia      (mm)=  10.000   # of Linear Res.(N)= 3.00
---------------------    U.H. Tp(hrs)=    .260

     Unit Hyd Qpeak  (cms)=     .379

     PEAK FLOW       (cms)=     .198 (i)
     TIME TO PEAK    (hrs)=    2.883
     RUNOFF VOLUME    (mm)=   31.898
     TOTAL RAINFALL   (mm)=   80.310
     RUNOFF COEFFICIENT   =     .397

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
001:0010------------------------------------------------------------------------
*# Node 6: Flow from Basin 7
---------------------
| CALIB NASHYD       |   Area    (ha)=    1.46   Curve Number   (CN)=83.00
| 08:7      DT= 1.00 |   Ia      (mm)=  10.000   # of Linear Res.(N)= 3.00
---------------------    U.H. Tp(hrs)=    .090

     Unit Hyd Qpeak  (cms)=     .620

     PEAK FLOW       (cms)=     .198 (i)
     TIME TO PEAK    (hrs)=    2.767
     RUNOFF VOLUME    (mm)=   40.410
     TOTAL RAINFALL   (mm)=   80.310
     RUNOFF COEFFICIENT   =     .503

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
001:0011------------------------------------------------------------------------
*# Node 7: Flow from Basin 8
---------------------
| CALIB NASHYD       |   Area    (ha)=     .38   Curve Number   (CN)=75.00
| 09:8      DT= 1.00 |   Ia      (mm)=  10.000   # of Linear Res.(N)= 3.00
---------------------    U.H. Tp(hrs)=    .160

     Unit Hyd Qpeak  (cms)=     .091

     PEAK FLOW       (cms)=     .036 (i)
     TIME TO PEAK    (hrs)=    2.800
     RUNOFF VOLUME    (mm)=   31.898
     TOTAL RAINFALL   (mm)=   80.310
     RUNOFF COEFFICIENT   =     .397

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
001:0012------------------------------------------------------------------------
*# Node 8: Flow from Basin 9
---------------------
| CALIB NASHYD       |   Area    (ha)=     .05   Curve Number   (CN)=75.00
| 01:9      DT= 1.00 |   Ia      (mm)=  10.000   # of Linear Res.(N)= 3.00
---------------------    U.H. Tp(hrs)=    .060

     Unit Hyd Qpeak  (cms)=     .032

     PEAK FLOW       (cms)=     .006 (i)
     TIME TO PEAK    (hrs)=    2.750
     RUNOFF VOLUME    (mm)=   31.896
     TOTAL RAINFALL   (mm)=   80.310
     RUNOFF COEFFICIENT   =     .397

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
001:0013------------------------------------------------------------------------
      FINISH
--------------------------------------------------------------------------------
********************************************************************************
     WARNINGS / ERRORS / NOTES
     -------------------------
   Simulation ended on 2017-06-29     at 14:45:02
================================================================================
```

```
===============================================================================

   SSSSS  W   W  M   M  H   H  Y   Y  M   M   OOO       999   999   =========
   S      W W W  MM MM  H   H   Y Y   MM MM  O   O     9   9 9   9
   SSSSS  W W W  M M M  HHHHH    Y    M M M  O   O  ## 9   9 9   9  Ver  4.05
       S   W W   M   M  H   H    Y    M   M  O   O      9999  9999  Sept 2011
   SSSSS   W W   M   M  H   H    Y    M   M   OOO          9     9  =========
                                                       9   9 9   9  # 3375279
        StormWater Management HYdrologic Model          999   999   =========

 ******************************************************************************
 ***************************** SWMHYMO Ver/4.05  ******************************
 *********  A single event and continuous hydrologic simulation model  *********
 *********     based on the principles of HYMO and its successors      *********
 *********                OTTHYMO-83 and OTTHYMO-89.                   *********
 ******************************************************************************
 ********* Distributed by:  J.F. Sabourin and Associates Inc.          *********
 *********                  Ottawa,  Ontario: (613) 836-3884           *********
 *********                  Gatineau, Quebec: (819) 243-6858           *********
 *********                  E-Mail: swmhymo@jfsa.Com                   *********
 ******************************************************************************

 ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
 +++++++++ Licensed user: Calder Engineering Ltd.                     +++++++++
 +++++++++                Bolton                SERIAL#:3375279       +++++++++
 ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

 ******************************************************************************
 *********          ++++++ PROGRAM ARRAY DIMENSIONS ++++++            *********
 *********          Maximum value for ID numbers  :     10            *********
 *********          Max. number of rainfall points: 105408            *********
 *********          Max. number of flow points    : 105408            *********
 ******************************************************************************


 *********************   D E T A I L E D   O U T P U T   *********************
 ******************************************************************************
 *        DATE: 2017-06-29     TIME: 16:17:14     RUN COUNTER: 000791        *
 ******************************************************************************
 * Input   filename: C:\PROGRA~2\SWMHYMO\PROJECTS\Laurel\L-PR.dat             *
 * Output  filename: C:\PROGRA~2\SWMHYMO\PROJECTS\Laurel\L-PR.out             *
 * Summary filename: C:\PROGRA~2\SWMHYMO\PROJECTS\Laurel\L-PR.sum             *
 * User comments:                                                             *
 * 1:_________________________________________________________________________*
 * 2:_________________________________________________________________________*
 * 3:_________________________________________________________________________*
 ******************************************************************************

-------------------------------------------------------------------------------
001:0001-----------------------------------------------------------------------
*#*****************************************************************************
*#  Project Name: [Laurel Park]    Project Number: [ 16-168 ]
*#  Date        : [2017-06-29]
*#  Modeller    : [    MYS    ]
*#  Company     : Calder Engineering Ltd.
*#  License #   :  3375279
*#*****************************************************************************
*# Proposed Conditions (Preliminary Concept)-Routing
*#*****************************************************************************
--------------------
| START            |  Project  dir.: C:\PROGRA~2\SWMHYMO\PROJECTS\Laurel\
--------------------  Rainfall dir.: C:\PROGRA~2\SWMHYMO\PROJECTS\Laurel\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 001
    NSTORM=   0
-------------------------------------------------------------------------------
001:0002-----------------------------------------------------------------------
--------------------
| READ STORM       |    Filename: 2yr/6hr
| Ptotal=  36.00 mm|    Comments: 2yr/6hr
--------------------
              TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
               hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
               .25    .000 |   2.00  12.240 |   3.75   5.040 |   5.50    .720
               .50    .720 |   2.25  12.240 |   4.00   2.880 |   5.75    .720
               .75    .720 |   2.50  33.120 |   4.25   2.880 |   6.00    .720
              1.00    .720 |   2.75  33.120 |   4.50   1.440 |   6.25    .720
              1.25    .720 |   3.00   9.360 |   4.75   1.440 |
              1.50   4.320 |   3.25   9.360 |   5.00    .720 |
              1.75   4.320 |   3.50   5.040 |   5.25    .720 |

-------------------------------------------------------------------------------
001:0003-----------------------------------------------------------------------
*# Node 1: Flow from Basin 1
----------------------
| CALIB NASHYD       |   Area    (ha)=    1.95   Curve Number   (CN)=78.00
| 01:1A     DT= 1.00 |   Ia      (mm)=  10.000   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .220

     Unit Hyd Qpeak  (cms)=     .339

     PEAK FLOW       (cms)=     .032 (i)
     TIME TO PEAK    (hrs)=    2.883
     RUNOFF VOLUME    (mm)=    6.923
     TOTAL RAINFALL   (mm)=   36.000
     RUNOFF COEFFICIENT   =     .192

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
001:0004-----------------------------------------------------------------------
*# Node 2: Flow from Basin 2
----------------------
| CALIB NASHYD       |   Area    (ha)=    1.65   Curve Number   (CN)=79.00
| 02:2A     DT= 1.00 |   Ia      (mm)=  10.000   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .200

     Unit Hyd Qpeak  (cms)=     .315

     PEAK FLOW       (cms)=     .030 (i)
     TIME TO PEAK    (hrs)=    2.867
     RUNOFF VOLUME    (mm)=    7.228
     TOTAL RAINFALL   (mm)=   36.000
     RUNOFF COEFFICIENT   =     .201

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
001:0005-----------------------------------------------------------------------
*# Node 3: Flow from Basin 3
----------------------
| CALIB STANDHYD     |   Area    (ha)=     .05
| 03: 3A    DT= 1.00 |   Total Imp(%)=   39.00   Dir. Conn.(%)=     .10
----------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .02          .03
     Dep. Storage     (mm)=        .70        10.00
     Average Slope     (%)=       5.00         4.00
     Length            (m)=      90.00        15.00
     Mannings n          =       .013         .250

     Max.eff.Inten.(mm/hr)=      33.12        32.83
                over (min)        2.00         7.00
     Storage Coeff.  (min)=       2.30 (ii)    7.27 (ii)
     Unit Hyd. Tpeak (min)=       2.00         7.00
     Unit Hyd. peak  (cms)=        .54          .16
                                                          *TOTALS*
     PEAK FLOW       (cms)=        .00          .00           .002 (iii)
     TIME TO PEAK    (hrs)=       2.37         2.77          2.767
     RUNOFF VOLUME    (mm)=      35.30        15.04         15.056
     TOTAL RAINFALL   (mm)=      36.00        36.00         36.000
     RUNOFF COEFFICIENT   =        .98          .42           .418

       (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.

-------------------------------------------------------------------------------
001:0006-----------------------------------------------------------------------
*# Node 4: Flow from Basin 4 + 5
----------------------
| CALIB NASHYD       |   Area    (ha)=    2.57   Curve Number   (CN)=70.00
| 04:4A     DT= 1.00 |   Ia      (mm)=  10.000   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .170

     Unit Hyd Qpeak  (cms)=     .577

     PEAK FLOW       (cms)=     .034 (i)
     TIME TO PEAK    (hrs)=    2.833
     RUNOFF VOLUME    (mm)=    5.013
     TOTAL RAINFALL   (mm)=   36.000
     RUNOFF COEFFICIENT   =     .139

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
001:0007-----------------------------------------------------------------------
----------------------
| CALIB NASHYD       |   Area    (ha)=    1.70   Curve Number   (CN)=68.00
| 05:5A     DT= 1.00 |   Ia      (mm)=  10.000   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .140

     Unit Hyd Qpeak  (cms)=     .464

     PEAK FLOW       (cms)=     .023 (i)
     TIME TO PEAK    (hrs)=    2.817
     RUNOFF VOLUME    (mm)=    4.645
     TOTAL RAINFALL   (mm)=   36.000
     RUNOFF COEFFICIENT   =     .129

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
001:0008-----------------------------------------------------------------------
------------------------
| ADD HYD (N4        ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
------------------------                  (ha)     (cms)   (hrs)   (mm)   (cms)
                    ID1 04:4A             2.57      .034    2.83   5.01    .000
                   +ID2 05:5A             1.70      .023    2.82   4.64    .000
                    =========================================================
                    SUM 06:N4             4.27      .057    2.82   4.87    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
001:0009-----------------------------------------------------------------------
*# Node 5: Flow from Basin 6
----------------------
| CALIB NASHYD       |   Area    (ha)=    1.62   Curve Number   (CN)=77.00
| 07:6A     DT= 1.00 |   Ia      (mm)=  10.000   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .200

     Unit Hyd Qpeak  (cms)=     .309

     PEAK FLOW       (cms)=     .027 (i)
     TIME TO PEAK    (hrs)=    2.867
     RUNOFF VOLUME    (mm)=    6.636
     TOTAL RAINFALL   (mm)=   36.000
     RUNOFF COEFFICIENT   =     .184

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
001:0010-----------------------------------------------------------------------
*# Node 6: Flow from Basin 7
----------------------
| CALIB NASHYD       |   Area    (ha)=    1.66   Curve Number   (CN)=83.00
| 08:7A     DT= 1.00 |   Ia      (mm)=  10.000   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .090

     Unit Hyd Qpeak  (cms)=     .704

     PEAK FLOW       (cms)=     .050 (i)
     TIME TO PEAK    (hrs)=    2.767
     RUNOFF VOLUME    (mm)=    8.664
     TOTAL RAINFALL   (mm)=   36.000
     RUNOFF COEFFICIENT   =     .241

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
001:0011-----------------------------------------------------------------------
*# Node 7: Flow from Basin 8
----------------------
| CALIB STANDHYD     |   Area    (ha)=    1.25
| 09: 8A    DT= 1.00 |   Total Imp(%)=   31.00   Dir. Conn.(%)=     .10
----------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .39          .86
     Dep. Storage     (mm)=        .70        10.00
     Average Slope     (%)=       4.00         3.00
     Length            (m)=     164.00        40.00
     Mannings n          =       .013         .250

     Max.eff.Inten.(mm/hr)=      33.12        22.50
                over (min)        4.00        15.00
     Storage Coeff.  (min)=       3.53 (ii)   14.88 (ii)
     Unit Hyd. Tpeak (min)=       4.00        15.00
     Unit Hyd. peak  (cms)=        .31          .08
                                                          *TOTALS*
     PEAK FLOW       (cms)=        .00          .04           .038 (iii)
     TIME TO PEAK    (hrs)=       2.62         2.90          2.900
     RUNOFF VOLUME    (mm)=      35.30        12.52         12.543
     TOTAL RAINFALL   (mm)=      36.00        36.00         36.000
     RUNOFF COEFFICIENT   =        .98          .35           .348

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  82.0    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.

-------------------------------------------------------------------------------
001:0012-----------------------------------------------------------------------
---------------------
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
|  IN>09:( 8A   )   |
| OUT<01:(SWM-ou)   |    =========  OUTLFOW STORAGE TABLE  =========
---------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
```

```
                           (cms)    (ha.m.)   |    (cms)    (ha.m.)
                            .000  .4000E-02   |     .004  .3800E-01
                            .002  .8000E-02   |     .005  .4300E-01
                            .002  .1500E-01   |     .009  .4800E-01
                            .003  .2500E-01   |     .018  .5400E-01
                            .003  .3400E-01   |     .032  .5900E-01

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     --------------------       (ha)     (cms)     (hrs)       (mm)
     INFLOW >09: ( 8A   )       1.25      .038     2.900     12.543
     OUTFLOW<01: (SWM-ou)       1.25      .002     5.233      9.343
    OVERFLOW<02: (SWM-OV)        .00      .000      .000       .000

                   TOTAL NUMBER OF SIMULATED OVERFLOWS  =        0
                   CUMULATIVE TIME OF OVERFLOWS  (hours)=      .00
                   PERCENTAGE OF TIME OVERFLOWING    (%)=      .00


                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=    5.884
                   TIME SHIFT OF PEAK FLOW         (min)=   140.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=.1319E-01

      *** WARNING: Outflow volume is less than inflow volume.
--------------------------------------------------------------------------------
001:0013------------------------------------------------------------------------
*# Node 8: Flow from Basin 9
----------------------
| CALIB NASHYD       |   Area    (ha)=     .13   Curve Number   (CN)=75.00
| 03:9A     DT= 1.00 |   Ia      (mm)=  10.000   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .070

     Unit Hyd Qpeak  (cms)=     .071

     PEAK FLOW       (cms)=     .003 (i)
     TIME TO PEAK    (hrs)=    2.767
     RUNOFF VOLUME    (mm)=    6.107
     TOTAL RAINFALL   (mm)=   36.000
     RUNOFF COEFFICIENT   =     .170

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
001:0014------------------------------------------------------------------------
      FINISH
--------------------------------------------------------------------------------
********************************************************************************
     WARNINGS / ERRORS / NOTES
     -------------------------
 001:0012 ROUTE RESERVOIR
      *** WARNING: Outflow volume is less than inflow volume.
   Simulation ended on 2017-06-29     at 16:17:14
================================================================================


```

```
================================================================================

   SSSSS  W   W  M   M  H   H  Y   Y  M   M   OOO       999   999    =========
   S      W W W  MM MM  H   H   Y Y   MM MM  O   O     9   9 9   9
   SSSSS  W W W  M M M  HHHHH    Y    M M M  O   O ## 9   9 9   9   Ver  4.05
       S   W W   M   M  H   H    Y    M   M  O   O      9999  9999   Sept 2011
   SSSSS   W W   M   M  H   H    Y    M   M   OOO          9     9   =========
                                                      9   9 9   9   # 3375279
        StormWater Management HYdrologic Model         999   999    =========

 *******************************************************************************
 ***************************** SWMHYMO Ver/4.05  ******************************
 *********  A single event and continuous hydrologic simulation model  *********
 *********     based on the principles of HYMO and its successors      *********
 *********                OTTHYMO-83 and OTTHYMO-89.                   *********
 *******************************************************************************
 ********* Distributed by:  J.F. Sabourin and Associates Inc.          *********
 *********                  Ottawa,  Ontario: (613) 836-3884           *********
 *********                  Gatineau, Quebec: (819) 243-6858           *********
 *********                  E-Mail: swmhymo@jfsa.Com                   *********
 *******************************************************************************

 +++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
 +++++++++ Licensed user: Calder Engineering Ltd.                     +++++++++
 +++++++++                Bolton                 SERIAL#:3375279      +++++++++
 +++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

 *******************************************************************************
 *********           ++++++ PROGRAM ARRAY DIMENSIONS ++++++           *********
 *********           Maximum value for ID numbers  :     10           *********
 *********           Max. number of rainfall points: 105408           *********
 *********           Max. number of flow points    : 105408           *********
 *******************************************************************************


 *********************   D E T A I L E D   O U T P U T   *********************
 *******************************************************************************
 *        DATE: 2017-06-29     TIME: 16:16:37     RUN COUNTER: 000790          *
 *******************************************************************************
 * Input   filename: C:\PROGRA~2\SWMHYMO\PROJECTS\Laurel\L-PR.dat              *
 * Output  filename: C:\PROGRA~2\SWMHYMO\PROJECTS\Laurel\L-PR.out              *
 * Summary filename: C:\PROGRA~2\SWMHYMO\PROJECTS\Laurel\L-PR.sum              *
 * User comments:                                                              *
 * 1:__________________________________________________________________________*
 * 2:__________________________________________________________________________*
 * 3:__________________________________________________________________________*
 *******************************************************************************

--------------------------------------------------------------------------------
001:0001------------------------------------------------------------------------
*#******************************************************************************
*#  Project Name: [Laurel Park]    Project Number: [ 16-168 ]
*#  Date        : [2017-06-29]
*#  Modeller    : [    MYS    ]
*#  Company     : Calder Engineering Ltd.
*#  License #   :  3375279
*#******************************************************************************
*# Proposed Conditions (Preliminary Concept)-Routing
*#******************************************************************************
--------------------
| START            |  Project  dir.: C:\PROGRA~2\SWMHYMO\PROJECTS\Laurel\
--------------------  Rainfall dir.: C:\PROGRA~2\SWMHYMO\PROJECTS\Laurel\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 001
    NSTORM=   0
--------------------------------------------------------------------------------
001:0002------------------------------------------------------------------------
--------------------
| READ STORM       |    Filename: 5yr/6hr
| Ptotal=  47.81 mm|    Comments: 5yr/6hr
--------------------
              TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
               hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
               .25    .000 |   2.00  16.250 |   3.75   6.690 |   5.50    .960
               .50    .960 |   2.25  16.250 |   4.00   3.820 |   5.75    .960
               .75    .960 |   2.50  43.980 |   4.25   3.820 |   6.00    .960
              1.00    .960 |   2.75  43.980 |   4.50   1.910 |   6.25    .960
              1.25    .960 |   3.00  12.430 |   4.75   1.910 |
              1.50   5.740 |   3.25  12.430 |   5.00    .960 |
              1.75   5.740 |   3.50   6.690 |   5.25    .960 |

--------------------------------------------------------------------------------
001:0003------------------------------------------------------------------------
*# Node 1: Flow from Basin 1
----------------------
| CALIB NASHYD       |   Area    (ha)=    1.95   Curve Number   (CN)=78.00
| 01:1A     DT= 1.00 |   Ia      (mm)=  10.000   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .220

     Unit Hyd Qpeak  (cms)=     .339

     PEAK FLOW       (cms)=     .064 (i)
     TIME TO PEAK    (hrs)=    2.867
     RUNOFF VOLUME    (mm)=   13.061
     TOTAL RAINFALL   (mm)=   47.810
     RUNOFF COEFFICIENT   =     .273

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
001:0004------------------------------------------------------------------------
*# Node 2: Flow from Basin 2
----------------------
| CALIB NASHYD       |   Area    (ha)=    1.65   Curve Number   (CN)=79.00
| 02:2A     DT= 1.00 |   Ia      (mm)=  10.000   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .200

     Unit Hyd Qpeak  (cms)=     .315

     PEAK FLOW       (cms)=     .059 (i)
     TIME TO PEAK    (hrs)=    2.850
     RUNOFF VOLUME    (mm)=   13.573
     TOTAL RAINFALL   (mm)=   47.810
     RUNOFF COEFFICIENT   =     .284

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
001:0005------------------------------------------------------------------------
*# Node 3: Flow from Basin 3
----------------------
| CALIB STANDHYD     |   Area    (ha)=     .05
| 03: 3A    DT= 1.00 |   Total Imp(%)=   39.00   Dir. Conn.(%)=     .10
----------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .02          .03
     Dep. Storage     (mm)=        .70        10.00
     Average Slope     (%)=       5.00         4.00
     Length            (m)=      90.00        15.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      43.98        51.35
                over (min)        2.00         6.00
     Storage Coeff.  (min)=       2.06 (ii)    6.21 (ii)
     Unit Hyd. Tpeak (min)=       2.00         6.00
     Unit Hyd. peak  (cms)=        .56          .18
                                                                *TOTALS*
     PEAK FLOW       (cms)=        .00          .00               .004 (iii)
     TIME TO PEAK    (hrs)=       2.72         2.77              2.767
     RUNOFF VOLUME    (mm)=      47.11        24.41             24.434
     TOTAL RAINFALL   (mm)=      47.81        47.81             47.810
     RUNOFF COEFFICIENT   =        .99          .51               .511

       (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.

--------------------------------------------------------------------------------
001:0006------------------------------------------------------------------------
*# Node 4: Flow from Basin 4 + 5
----------------------
| CALIB NASHYD       |   Area    (ha)=    2.57   Curve Number   (CN)=70.00
| 04:4A     DT= 1.00 |   Ia      (mm)=  10.000   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .170

     Unit Hyd Qpeak  (cms)=     .577

     PEAK FLOW       (cms)=     .070 (i)
     TIME TO PEAK    (hrs)=    2.817
     RUNOFF VOLUME    (mm)=    9.747
     TOTAL RAINFALL   (mm)=   47.810
     RUNOFF COEFFICIENT   =     .204

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
001:0007------------------------------------------------------------------------
----------------------
| CALIB NASHYD       |   Area    (ha)=    1.70   Curve Number   (CN)=68.00
| 05:5A     DT= 1.00 |   Ia      (mm)=  10.000   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .140

     Unit Hyd Qpeak  (cms)=     .464

     PEAK FLOW       (cms)=     .046 (i)
     TIME TO PEAK    (hrs)=    2.800
     RUNOFF VOLUME    (mm)=    9.086
     TOTAL RAINFALL   (mm)=   47.810
     RUNOFF COEFFICIENT   =     .190

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
001:0008------------------------------------------------------------------------
------------------------
| ADD HYD (N4        ) | ID: NHYD        AREA     QPEAK   TPEAK   R.V.    DWF
------------------------                 (ha)     (cms)   (hrs)   (mm)   (cms)
                     ID1 04:4A            2.57     .070    2.82   9.75    .000
                    +ID2 05:5A            1.70     .046    2.80   9.09    .000
                     =========================================================
                     SUM 06:N4            4.27     .115    2.82   9.48    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
001:0009------------------------------------------------------------------------
*# Node 5: Flow from Basin 6
----------------------
| CALIB NASHYD       |   Area    (ha)=    1.62   Curve Number   (CN)=77.00
| 07:6A     DT= 1.00 |   Ia      (mm)=  10.000   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .200

     Unit Hyd Qpeak  (cms)=     .309

     PEAK FLOW       (cms)=     .054 (i)
     TIME TO PEAK    (hrs)=    2.850
     RUNOFF VOLUME    (mm)=   12.575
     TOTAL RAINFALL   (mm)=   47.810
     RUNOFF COEFFICIENT   =     .263

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
001:0010------------------------------------------------------------------------
*# Node 6: Flow from Basin 7
----------------------
| CALIB NASHYD       |   Area    (ha)=    1.66   Curve Number   (CN)=83.00
| 08:7A     DT= 1.00 |   Ia      (mm)=  10.000   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .090

     Unit Hyd Qpeak  (cms)=     .704

     PEAK FLOW       (cms)=     .092 (i)
     TIME TO PEAK    (hrs)=    2.767
     RUNOFF VOLUME    (mm)=   15.914
     TOTAL RAINFALL   (mm)=   47.810
     RUNOFF COEFFICIENT   =     .333

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
001:0011------------------------------------------------------------------------
*# Node 7: Flow from Basin 8
----------------------
| CALIB STANDHYD     |   Area    (ha)=    1.25
| 09: 8A    DT= 1.00 |   Total Imp(%)=   31.00   Dir. Conn.(%)=     .10
----------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .39          .86
     Dep. Storage     (mm)=        .70        10.00
     Average Slope     (%)=       4.00         3.00
     Length            (m)=     164.00        40.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      43.98        38.29
                over (min)        3.00        12.00
     Storage Coeff.  (min)=       3.15 (ii)   12.33 (ii)
     Unit Hyd. Tpeak (min)=       3.00        12.00
     Unit Hyd. peak  (cms)=        .36          .09
                                                                *TOTALS*
     PEAK FLOW       (cms)=        .00          .07               .070 (iii)
     TIME TO PEAK    (hrs)=       2.75         2.83              2.833
     RUNOFF VOLUME    (mm)=      47.11        21.07             21.094
     TOTAL RAINFALL   (mm)=      47.81        47.81             47.810
     RUNOFF COEFFICIENT   =        .99          .44               .441

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  82.0    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.

--------------------------------------------------------------------------------
001:0012------------------------------------------------------------------------
--------------------
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
|  IN>09:( 8A   )   |
| OUT<01:(SWM-ou)   |    =========  OUTLFOW STORAGE TABLE  =========
--------------------     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
```

```
                           (cms)    (ha.m.)   |    (cms)    (ha.m.)
                            .000  .4000E-02   |     .004  .3800E-01
                            .002  .8000E-02   |     .005  .4300E-01
                            .002  .1500E-01   |     .009  .4800E-01
                            .003  .2500E-01   |     .018  .5400E-01
                            .003  .3400E-01   |     .032  .5900E-01

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     --------------------       (ha)     (cms)     (hrs)       (mm)
     INFLOW >09: ( 8A   )       1.25      .070     2.833     21.094
     OUTFLOW<01: (SWM-ou)       1.25      .003     5.267     17.893
    OVERFLOW<02: (SWM-OV)        .00      .000      .000       .000

                   TOTAL NUMBER OF SIMULATED OVERFLOWS  =        0
                   CUMULATIVE TIME OF OVERFLOWS  (hours)=      .00
                   PERCENTAGE OF TIME OVERFLOWING    (%)=      .00


                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=    4.176
                   TIME SHIFT OF PEAK FLOW         (min)=   146.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=.2277E-01

      *** WARNING: Outflow volume is less than inflow volume.
--------------------------------------------------------------------------------
001:0013------------------------------------------------------------------------
*# Node 8: Flow from Basin 9
----------------------
| CALIB NASHYD       |   Area    (ha)=     .13   Curve Number   (CN)=75.00
| 03:9A     DT= 1.00 |   Ia      (mm)=  10.000   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .070

     Unit Hyd Qpeak  (cms)=     .071

     PEAK FLOW       (cms)=     .005 (i)
     TIME TO PEAK    (hrs)=    2.750
     RUNOFF VOLUME    (mm)=   11.671
     TOTAL RAINFALL   (mm)=   47.810
     RUNOFF COEFFICIENT   =     .244

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
001:0014------------------------------------------------------------------------
      FINISH
--------------------------------------------------------------------------------
********************************************************************************
     WARNINGS / ERRORS / NOTES
     -------------------------
 001:0012 ROUTE RESERVOIR
      *** WARNING: Outflow volume is less than inflow volume.
   Simulation ended on 2017-06-29     at 16:16:37
================================================================================


```

```
================================================================================

   SSSSS  W   W  M   M  H   H  Y   Y  M   M   OOO        999    999    =========
   S      W W W  MM MM  H   H   Y Y   MM MM  O   O      9   9  9   9
   SSSSS  W W W  M M M  HHHHH    Y    M M M  O   O  ##  9   9  9   9   Ver  4.05
       S   W W   M   M  H   H    Y    M   M  O   O       9999   9999   Sept 2011
   SSSSS   W W   M   M  H   H    Y    M   M   OOO           9      9   =========
                                                        9   9  9   9   # 3375279
        StormWater Management HYdrologic Model           999    999    =========

 *******************************************************************************
 ***************************** SWMHYMO Ver/4.05  ******************************
 *********  A single event and continuous hydrologic simulation model  *********
 *********     based on the principles of HYMO and its successors      *********
 *********                OTTHYMO-83 and OTTHYMO-89.                  *********
 *******************************************************************************
 ********* Distributed by:  J.F. Sabourin and Associates Inc.          *********
 *********                  Ottawa,  Ontario: (613) 836-3884           *********
 *********                  Gatineau, Quebec: (819) 243-6858           *********
 *********                  E-Mail: swmhymo@jfsa.Com                   *********
 *******************************************************************************

 +++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
 +++++++++ Licensed user: Calder Engineering Ltd.                      +++++++++
 +++++++++                Bolton                SERIAL#:3375279        +++++++++
 +++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

 *******************************************************************************
 *********           ++++++ PROGRAM ARRAY DIMENSIONS ++++++            *********
 *********           Maximum value for ID numbers  :     10            *********
 *********           Max. number of rainfall points: 105408            *********
 *********           Max. number of flow points    : 105408            *********
 *******************************************************************************


 **********************   D E T A I L E D   O U T P U T   **********************
 *******************************************************************************
 *        DATE: 2017-06-29     TIME: 16:16:04     RUN COUNTER: 000789         *
 *******************************************************************************
 * Input   filename: C:\PROGRA~2\SWMHYMO\PROJECTS\Laurel\L-PR.dat              *
 * Output  filename: C:\PROGRA~2\SWMHYMO\PROJECTS\Laurel\L-PR.out              *
 * Summary filename: C:\PROGRA~2\SWMHYMO\PROJECTS\Laurel\L-PR.sum              *
 * User comments:                                                              *
 * 1:__________________________________________________________________________*
 * 2:__________________________________________________________________________*
 * 3:__________________________________________________________________________*
 *******************************************************************************

--------------------------------------------------------------------------------
001:0001------------------------------------------------------------------------
*#******************************************************************************
*#  Project Name: [Laurel Park]    Project Number: [ 16-168 ]
*#  Date        : [2017-06-29]
*#  Modeller    : [    MYS    ]
*#  Company     : Calder Engineering Ltd.
*#  License #   :  3375279
*#******************************************************************************
*# Proposed Conditions (Preliminary Concept)-Routing
*#******************************************************************************
--------------------
| START              |  Project  dir.: C:\PROGRA~2\SWMHYMO\PROJECTS\Laurel\
--------------------  Rainfall dir.: C:\PROGRA~2\SWMHYMO\PROJECTS\Laurel\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 001
    NSTORM=   0
--------------------------------------------------------------------------------
001:0002------------------------------------------------------------------------
--------------------
| READ STORM        |    Filename: 10yr/6hr
| Ptotal=  55.69 mm|    Comments: 10yr/6hr
--------------------
              TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
               hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
               .25    .000 |   2.00  18.940 |   3.75   7.800 |   5.50   1.110
               .50   1.110 |   2.25  18.940 |   4.00   4.460 |   5.75   1.110
               .75   1.110 |   2.50  51.240 |   4.25   4.460 |   6.00   1.110
              1.00   1.110 |   2.75  51.240 |   4.50   2.230 |   6.25   1.110
              1.25   1.110 |   3.00  14.480 |   4.75   2.230 |
              1.50   6.680 |   3.25  14.480 |   5.00   1.110 |
              1.75   6.680 |   3.50   7.800 |   5.25   1.110 |

--------------------------------------------------------------------------------
001:0003------------------------------------------------------------------------
*# Node 1: Flow from Basin 1
----------------------
| CALIB NASHYD       |   Area    (ha)=    1.95   Curve Number   (CN)=78.00
| 01:1A     DT= 1.00 |   Ia      (mm)=  10.000   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .220

     Unit Hyd Qpeak  (cms)=     .339

     PEAK FLOW       (cms)=     .089 (i)
     TIME TO PEAK    (hrs)=    2.867
     RUNOFF VOLUME    (mm)=   17.792
     TOTAL RAINFALL   (mm)=   55.690
     RUNOFF COEFFICIENT   =     .319

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
001:0004------------------------------------------------------------------------
*# Node 2: Flow from Basin 2
----------------------
| CALIB NASHYD       |   Area    (ha)=    1.65   Curve Number   (CN)=79.00
| 02:2A     DT= 1.00 |   Ia      (mm)=  10.000   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .200

     Unit Hyd Qpeak  (cms)=     .315

     PEAK FLOW       (cms)=     .082 (i)
     TIME TO PEAK    (hrs)=    2.833
     RUNOFF VOLUME    (mm)=   18.440
     TOTAL RAINFALL   (mm)=   55.690
     RUNOFF COEFFICIENT   =     .331

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
001:0005------------------------------------------------------------------------
*# Node 3: Flow from Basin 3
----------------------
| CALIB STANDHYD     |   Area    (ha)=     .05
| 03: 3A    DT= 1.00 |   Total Imp(%)=   39.00   Dir. Conn.(%)=     .10
----------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .02          .03
     Dep. Storage     (mm)=        .70        10.00
     Average Slope     (%)=       5.00         4.00
     Length            (m)=      90.00        15.00
     Mannings n          =        .013         .250

     Max.eff.Inten.(mm/hr)=      51.24        63.81
                over (min)        2.00         6.00
     Storage Coeff.  (min)=       1.93 (ii)    5.74 (ii)
     Unit Hyd. Tpeak (min)=       2.00         6.00
     Unit Hyd. peak  (cms)=        .58          .19
                                                           *TOTALS*
     PEAK FLOW       (cms)=        .00          .01           .005 (iii)
     TIME TO PEAK    (hrs)=       2.52         2.75          2.750
     RUNOFF VOLUME    (mm)=      54.99        31.07         31.095
     TOTAL RAINFALL   (mm)=      55.69        55.69         55.690
     RUNOFF COEFFICIENT   =        .99          .56           .558

       (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.

--------------------------------------------------------------------------------
001:0006------------------------------------------------------------------------
*# Node 4: Flow from Basin 4 + 5
----------------------
| CALIB NASHYD       |   Area    (ha)=    2.57   Curve Number   (CN)=70.00
| 04:4A     DT= 1.00 |   Ia      (mm)=  10.000   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .170

     Unit Hyd Qpeak  (cms)=     .577

     PEAK FLOW       (cms)=     .098 (i)
     TIME TO PEAK    (hrs)=    2.817
     RUNOFF VOLUME    (mm)=   13.508
     TOTAL RAINFALL   (mm)=   55.690
     RUNOFF COEFFICIENT   =     .243

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
001:0007------------------------------------------------------------------------
----------------------
| CALIB NASHYD       |   Area    (ha)=    1.70   Curve Number   (CN)=68.00
| 05:5A     DT= 1.00 |   Ia      (mm)=  10.000   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .140

     Unit Hyd Qpeak  (cms)=     .464

     PEAK FLOW       (cms)=     .065 (i)
     TIME TO PEAK    (hrs)=    2.800
     RUNOFF VOLUME    (mm)=   12.635
     TOTAL RAINFALL   (mm)=   55.690
     RUNOFF COEFFICIENT   =     .227

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
001:0008------------------------------------------------------------------------
------------------------
| ADD HYD (N4        ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
------------------------                  (ha)     (cms)   (hrs)   (mm)   (cms)
                     ID1 04:4A             2.57     .098    2.82  13.51    .000
                    +ID2 05:5A             1.70     .065    2.80  12.64    .000
                     ===========================================================
                     SUM 06:N4             4.27     .162    2.80  13.16    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
001:0009------------------------------------------------------------------------
*# Node 5: Flow from Basin 6
----------------------
| CALIB NASHYD       |   Area    (ha)=    1.62   Curve Number   (CN)=77.00
| 07:6A     DT= 1.00 |   Ia      (mm)=  10.000   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .200

     Unit Hyd Qpeak  (cms)=     .309

     PEAK FLOW       (cms)=     .074 (i)
     TIME TO PEAK    (hrs)=    2.833
     RUNOFF VOLUME    (mm)=   17.173
     TOTAL RAINFALL   (mm)=   55.690
     RUNOFF COEFFICIENT   =     .308

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
001:0010------------------------------------------------------------------------
*# Node 6: Flow from Basin 7
----------------------
| CALIB NASHYD       |   Area    (ha)=    1.66   Curve Number   (CN)=83.00
| 08:7A     DT= 1.00 |   Ia      (mm)=  10.000   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .090

     Unit Hyd Qpeak  (cms)=     .704

     PEAK FLOW       (cms)=     .123 (i)
     TIME TO PEAK    (hrs)=    2.767
     RUNOFF VOLUME    (mm)=   21.364
     TOTAL RAINFALL   (mm)=   55.690
     RUNOFF COEFFICIENT   =     .384

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
001:0011------------------------------------------------------------------------
*# Node 7: Flow from Basin 8
----------------------
| CALIB STANDHYD     |   Area    (ha)=    1.25
| 09: 8A    DT= 1.00 |   Total Imp(%)=   31.00   Dir. Conn.(%)=     .10
----------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .39          .86
     Dep. Storage     (mm)=        .70        10.00
     Average Slope     (%)=       4.00         3.00
     Length            (m)=     164.00        40.00
     Mannings n          =        .013         .250

     Max.eff.Inten.(mm/hr)=      51.24        49.14
                over (min)        3.00        11.00
     Storage Coeff.  (min)=       2.96 (ii)   11.27 (ii)
     Unit Hyd. Tpeak (min)=       3.00        11.00
     Unit Hyd. peak  (cms)=        .38          .10
                                                           *TOTALS*
     PEAK FLOW       (cms)=        .00          .09           .095 (iii)
     TIME TO PEAK    (hrs)=       2.58         2.82          2.817
     RUNOFF VOLUME    (mm)=      54.99        27.26         27.290
     TOTAL RAINFALL   (mm)=      55.69        55.69         55.690
     RUNOFF COEFFICIENT   =        .99          .49           .490

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  82.0    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.

--------------------------------------------------------------------------------
001:0012------------------------------------------------------------------------
---------------------
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
|  IN>09:( 8A   )   |
| OUT<01:(SWM-ou)   |    =========  OUTLFOW STORAGE TABLE  =========
---------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
```

```
                           (cms)    (ha.m.)   |    (cms)    (ha.m.)
                            .000  .4000E-02   |     .004  .3800E-01
                            .002  .8000E-02   |     .005  .4300E-01
                            .002  .1500E-01   |     .009  .4800E-01
                            .003  .2500E-01   |     .018  .5400E-01
                            .003  .3400E-01   |     .032  .5900E-01

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     --------------------       (ha)     (cms)     (hrs)       (mm)
     INFLOW >09: ( 8A   )       1.25      .095     2.817     27.290
     OUTFLOW<01: (SWM-ou)       1.25      .003     5.417     24.090
    OVERFLOW<02: (SWM-OV)        .00      .000      .000       .000

                   TOTAL NUMBER OF SIMULATED OVERFLOWS  =        0
                   CUMULATIVE TIME OF OVERFLOWS  (hours)=      .00
                   PERCENTAGE OF TIME OVERFLOWING    (%)=      .00


                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=    3.451
                   TIME SHIFT OF PEAK FLOW         (min)=   156.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=.2990E-01

      *** WARNING: Outflow volume is less than inflow volume.
--------------------------------------------------------------------------------
001:0013------------------------------------------------------------------------
*# Node 8: Flow from Basin 9
----------------------
| CALIB NASHYD       |   Area    (ha)=     .13   Curve Number   (CN)=75.00
| 03:9A     DT= 1.00 |   Ia      (mm)=  10.000   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .070

     Unit Hyd Qpeak  (cms)=     .071

     PEAK FLOW       (cms)=      .007 (i)
     TIME TO PEAK    (hrs)=    2.750
     RUNOFF VOLUME    (mm)=   16.013
     TOTAL RAINFALL   (mm)=   55.690
     RUNOFF COEFFICIENT   =     .288

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
001:0014------------------------------------------------------------------------
      FINISH
--------------------------------------------------------------------------------
********************************************************************************
     WARNINGS / ERRORS / NOTES
     -------------------------
 001:0012 ROUTE RESERVOIR
      *** WARNING: Outflow volume is less than inflow volume.
   Simulation ended on 2017-06-29     at 16:16:04
================================================================================


```

```
===============================================================================

   SSSSS  W   W  M   M  H   H  Y   Y  M   M   OOO       999   999   =========
   S      W W W  MM MM  H   H   Y Y   MM MM  O   O     9   9 9   9
   SSSSS  W W W  M M M  HHHHH    Y    M M M  O   O  ## 9   9 9   9   Ver  4.05
       S   W W   M   M  H   H    Y    M   M  O   O      9999  9999   Sept 2011
   SSSSS   W W   M   M  H   H    Y    M   M   OOO          9     9   =========
                                                     9   9 9   9   # 3375279
        StormWater Management HYdrologic Model          999   999    =========

 ******************************************************************************
 ***************************** SWMHYMO Ver/4.05  *****************************
 *********  A single event and continuous hydrologic simulation model  *********
 *********     based on the principles of HYMO and its successors      *********
 *********                OTTHYMO-83 and OTTHYMO-89.                   *********
 ******************************************************************************
 ********* Distributed by:  J.F. Sabourin and Associates Inc.          *********
 *********                  Ottawa,  Ontario: (613) 836-3884          *********
 *********                  Gatineau, Quebec: (819) 243-6858          *********
 *********                  E-Mail: swmhymo@jfsa.Com                  *********
 ******************************************************************************

 ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
 +++++++++ Licensed user: Calder Engineering Ltd.                     +++++++++
 +++++++++                Bolton                SERIAL#:3375279       +++++++++
 ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

 ******************************************************************************
 *********           ++++++ PROGRAM ARRAY DIMENSIONS ++++++           *********
 *********           Maximum value for ID numbers  :     10           *********
 *********           Max. number of rainfall points: 105408           *********
 *********           Max. number of flow points    : 105408           *********
 ******************************************************************************


 **********************  D E T A I L E D   O U T P U T   **********************
 ******************************************************************************
 *        DATE: 2017-06-29     TIME: 16:15:28     RUN COUNTER: 000788        *
 ******************************************************************************
 * Input   filename: C:\PROGRA~2\SWMHYMO\PROJECTS\Laurel\L-PR.dat             *
 * Output  filename: C:\PROGRA~2\SWMHYMO\PROJECTS\Laurel\L-PR.out             *
 * Summary filename: C:\PROGRA~2\SWMHYMO\PROJECTS\Laurel\L-PR.sum             *
 * User comments:                                                             *
 * 1:_________________________________________________________________________*
 * 2:_________________________________________________________________________*
 * 3:_________________________________________________________________________*
 ******************************************************************************

-------------------------------------------------------------------------------
001:0001-----------------------------------------------------------------------
*#*****************************************************************************
*#  Project Name: [Laurel Park]    Project Number: [ 16-168 ]
*#  Date        : [2017-06-29]
*#  Modeller    : [    MYS    ]
*#  Company     : Calder Engineering Ltd.
*#  License #   :  3375279
*#*****************************************************************************
*# Proposed Conditions (Preliminary Concept)-Routing
*#*****************************************************************************
--------------------
| START             |  Project  dir.: C:\PROGRA~2\SWMHYMO\PROJECTS\Laurel\
--------------------  Rainfall dir.: C:\PROGRA~2\SWMHYMO\PROJECTS\Laurel\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 001
    NSTORM=   0
-------------------------------------------------------------------------------
001:0002-----------------------------------------------------------------------
--------------------
| READ STORM        |    Filename: 25yr/6hr
| 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
               .25    .000 |   2.00  22.300 |   3.75   9.180 |   5.50   1.310
               .50   1.310 |   2.25  22.300 |   4.00   5.250 |   5.75   1.310
               .75   1.310 |   2.50  60.350 |   4.25   5.250 |   6.00   1.310
              1.00   1.310 |   2.75  60.350 |   4.50   2.620 |   6.25   1.310
              1.25   1.310 |   3.00  17.060 |   4.75   2.620 |
              1.50   7.870 |   3.25  17.060 |   5.00   1.310 |
              1.75   7.870 |   3.50   9.180 |   5.25   1.310 |

-------------------------------------------------------------------------------
001:0003-----------------------------------------------------------------------
*# Node 1: Flow from Basin 1
----------------------
| CALIB NASHYD       |   Area    (ha)=    1.95   Curve Number   (CN)=78.00
| 01:1A     DT= 1.00 |   Ia      (mm)=  10.000   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .220

     Unit Hyd Qpeak  (cms)=     .339

     PEAK FLOW       (cms)=     .123 (i)
     TIME TO PEAK    (hrs)=    2.850
     RUNOFF VOLUME    (mm)=   24.288
     TOTAL RAINFALL   (mm)=   65.590
     RUNOFF COEFFICIENT   =     .370

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
001:0004-----------------------------------------------------------------------
*# Node 2: Flow from Basin 2
----------------------
| CALIB NASHYD       |   Area    (ha)=    1.65   Curve Number   (CN)=79.00
| 02:2A     DT= 1.00 |   Ia      (mm)=  10.000   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .200

     Unit Hyd Qpeak  (cms)=     .315

     PEAK FLOW       (cms)=     .113 (i)
     TIME TO PEAK    (hrs)=    2.833
     RUNOFF VOLUME    (mm)=   25.102
     TOTAL RAINFALL   (mm)=   65.590
     RUNOFF COEFFICIENT   =     .383

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
001:0005-----------------------------------------------------------------------
*# Node 3: Flow from Basin 3
----------------------
| CALIB STANDHYD     |   Area    (ha)=     .05
| 03: 3A    DT= 1.00 |   Total Imp(%)=   39.00   Dir. Conn.(%)=     .10
----------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .02          .03
     Dep. Storage     (mm)=        .70        10.00
     Average Slope     (%)=       5.00         4.00
     Length            (m)=      90.00        15.00
     Mannings n          =       .013         .250

     Max.eff.Inten.(mm/hr)=      60.35        79.87
                over (min)        2.00         5.00
     Storage Coeff.  (min)=       1.81 (ii)    5.29 (ii)
     Unit Hyd. Tpeak (min)=       2.00         5.00
     Unit Hyd. peak  (cms)=        .61          .22
                                                          *TOTALS*
     PEAK FLOW       (cms)=        .00          .01          .006 (iii)
     TIME TO PEAK    (hrs)=       2.53         2.75         2.750
     RUNOFF VOLUME    (mm)=      64.89        39.74        39.770
     TOTAL RAINFALL   (mm)=      65.59        65.59        65.590
     RUNOFF COEFFICIENT   =        .99          .61          .606

       (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.

-------------------------------------------------------------------------------
001:0006-----------------------------------------------------------------------
*# Node 4: Flow from Basin 4 + 5
----------------------
| CALIB NASHYD       |   Area    (ha)=    2.57   Curve Number   (CN)=70.00
| 04:4A     DT= 1.00 |   Ia      (mm)=  10.000   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .170

     Unit Hyd Qpeak  (cms)=     .577

     PEAK FLOW       (cms)=     .137 (i)
     TIME TO PEAK    (hrs)=    2.817
     RUNOFF VOLUME    (mm)=   18.792
     TOTAL RAINFALL   (mm)=   65.590
     RUNOFF COEFFICIENT   =     .287

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
001:0007-----------------------------------------------------------------------
----------------------
| CALIB NASHYD       |   Area    (ha)=    1.70   Curve Number   (CN)=68.00
| 05:5A     DT= 1.00 |   Ia      (mm)=  10.000   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .140

     Unit Hyd Qpeak  (cms)=     .464

     PEAK FLOW       (cms)=     .091 (i)
     TIME TO PEAK    (hrs)=    2.800
     RUNOFF VOLUME    (mm)=   17.646
     TOTAL RAINFALL   (mm)=   65.590
     RUNOFF COEFFICIENT   =     .269

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
001:0008-----------------------------------------------------------------------
-----------------------
| ADD HYD (N4        ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
-----------------------                  (ha)     (cms)   (hrs)   (mm)   (cms)
                     ID1 04:4A            2.57     .137    2.82  18.79    .000
                    +ID2 05:5A            1.70     .091    2.80  17.65    .000
                     =========================================================
                     SUM 06:N4            4.27     .227    2.80  18.34    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
001:0009-----------------------------------------------------------------------
*# Node 5: Flow from Basin 6
----------------------
| CALIB NASHYD       |   Area    (ha)=    1.62   Curve Number   (CN)=77.00
| 07:6A     DT= 1.00 |   Ia      (mm)=  10.000   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .200

     Unit Hyd Qpeak  (cms)=     .309

     PEAK FLOW       (cms)=     .103 (i)
     TIME TO PEAK    (hrs)=    2.833
     RUNOFF VOLUME    (mm)=   23.507
     TOTAL RAINFALL   (mm)=   65.590
     RUNOFF COEFFICIENT   =     .358

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
001:0010-----------------------------------------------------------------------
*# Node 6: Flow from Basin 7
----------------------
| CALIB NASHYD       |   Area    (ha)=    1.66   Curve Number   (CN)=83.00
| 08:7A     DT= 1.00 |   Ia      (mm)=  10.000   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .090

     Unit Hyd Qpeak  (cms)=     .704

     PEAK FLOW       (cms)=     .163 (i)
     TIME TO PEAK    (hrs)=    2.767
     RUNOFF VOLUME    (mm)=   28.716
     TOTAL RAINFALL   (mm)=   65.590
     RUNOFF COEFFICIENT   =     .438

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
001:0011-----------------------------------------------------------------------
*# Node 7: Flow from Basin 8
----------------------
| CALIB STANDHYD     |   Area    (ha)=    1.25
| 09: 8A    DT= 1.00 |   Total Imp(%)=   31.00   Dir. Conn.(%)=     .10
----------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .39          .86
     Dep. Storage     (mm)=        .70        10.00
     Average Slope     (%)=       4.00         3.00
     Length            (m)=     164.00        40.00
     Mannings n          =       .013         .250

     Max.eff.Inten.(mm/hr)=      60.35        63.04
                over (min)        3.00        10.00
     Storage Coeff.  (min)=       2.78 (ii)   10.29 (ii)
     Unit Hyd. Tpeak (min)=       3.00        10.00
     Unit Hyd. peak  (cms)=        .40          .11
                                                          *TOTALS*
     PEAK FLOW       (cms)=        .00          .13          .127 (iii)
     TIME TO PEAK    (hrs)=       2.63         2.80         2.800
     RUNOFF VOLUME    (mm)=      64.89        35.43        35.461
     TOTAL RAINFALL   (mm)=      65.59        65.59        65.590
     RUNOFF COEFFICIENT   =        .99          .54          .541

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  82.0    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.

-------------------------------------------------------------------------------
001:0012-----------------------------------------------------------------------
---------------------
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
|  IN>09:( 8A   )   |
| OUT<01:(SWM-ou)   |    =========  OUTLFOW STORAGE TABLE  =========
---------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
```

```
                           (cms)    (ha.m.)   |    (cms)    (ha.m.)
                            .000  .4000E-02   |     .004  .3800E-01
                            .002  .8000E-02   |     .005  .4300E-01
                            .002  .1500E-01   |     .009  .4800E-01
                            .003  .2500E-01   |     .018  .5400E-01
                            .003  .3400E-01   |     .032  .5900E-01

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     --------------------       (ha)     (cms)     (hrs)       (mm)
     INFLOW >09: ( 8A   )       1.25      .127     2.800     35.461
     OUTFLOW<01: (SWM-ou)       1.25      .004     5.583     32.261
    OVERFLOW<02: (SWM-OV)        .00      .000      .000       .000

                   TOTAL NUMBER OF SIMULATED OVERFLOWS  =        0
                   CUMULATIVE TIME OF OVERFLOWS  (hours)=      .00
                   PERCENTAGE OF TIME OVERFLOWING    (%)=      .00


                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=    3.062
                   TIME SHIFT OF PEAK FLOW         (min)=   167.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=.3937E-01

      *** WARNING: Outflow volume is less than inflow volume.
--------------------------------------------------------------------------------
001:0013------------------------------------------------------------------------
*# Node 8: Flow from Basin 9
----------------------
| CALIB NASHYD       |   Area    (ha)=     .13   Curve Number   (CN)=75.00
| 03:9A     DT= 1.00 |   Ia      (mm)=  10.000   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .070

     Unit Hyd Qpeak  (cms)=     .071

     PEAK FLOW       (cms)=     .010 (i)
     TIME TO PEAK    (hrs)=    2.750
     RUNOFF VOLUME    (mm)=   22.031
     TOTAL RAINFALL   (mm)=   65.590
     RUNOFF COEFFICIENT   =     .336

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
001:0014------------------------------------------------------------------------
      FINISH
--------------------------------------------------------------------------------
********************************************************************************
     WARNINGS / ERRORS / NOTES
     -------------------------
 001:0012 ROUTE RESERVOIR
      *** WARNING: Outflow volume is less than inflow volume.
   Simulation ended on 2017-06-29     at 16:15:28
================================================================================
```

```
================================================================================

  SSSSS  W   W  M   M  H   H  Y   Y  M   M   OOO        999    999    =========
  S      W W W  MM MM  H   H   Y Y   MM MM  O   O      9   9  9   9
  SSSSS  W W W  M M M  HHHHH    Y    M M M  O   O  ##  9   9  9   9   Ver  4.05
      S   W W   M   M  H   H    Y    M   M  O   O       9999   9999   Sept 2011
  SSSSS   W W   M   M  H   H    Y    M   M   OOO           9      9   =========
                                                       9   9  9   9   # 3375279
       StormWater Management HYdrologic Model           999    999    =========

 ********************************************************************************
 **************************** SWMHYMO Ver/4.05  *******************************
 *********  A single event and continuous hydrologic simulation model  *********
 *********     based on the principles of HYMO and its successors      *********
 *********                OTTHYMO-83 and OTTHYMO-89.                   *********
 ********************************************************************************
 ********* Distributed by:  J.F. Sabourin and Associates Inc.          *********
 *********                  Ottawa,  Ontario: (613) 836-3884           *********
 *********                  Gatineau, Quebec: (819) 243-6858           *********
 *********                  E-Mail: swmhymo@jfsa.Com                   *********
 ********************************************************************************

 ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
 +++++++++ Licensed user: Calder Engineering Ltd.                      +++++++++
 +++++++++                Bolton                SERIAL#:3375279        +++++++++
 ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

 ********************************************************************************
 *********          ++++++ PROGRAM ARRAY DIMENSIONS ++++++             *********
 *********          Maximum value for ID numbers  :    10              *********
 *********          Max. number of rainfall points: 105408             *********
 *********          Max. number of flow points    : 105408             *********
 ********************************************************************************


 *********************  D E T A I L E D   O U T P U T  *********************
 ********************************************************************************
 *        DATE: 2017-06-29     TIME: 16:14:42     RUN COUNTER: 000787         *
 ********************************************************************************
 * Input   filename: C:\PROGRA~2\SWMHYMO\PROJECTS\Laurel\L-PR.dat              *
 * Output  filename: C:\PROGRA~2\SWMHYMO\PROJECTS\Laurel\L-PR.out              *
 * Summary filename: C:\PROGRA~2\SWMHYMO\PROJECTS\Laurel\L-PR.sum              *
 * User comments:                                                              *
 * 1:__________________________________________________________________________*
 * 2:__________________________________________________________________________*
 * 3:__________________________________________________________________________*
 ********************************************************************************

--------------------------------------------------------------------------------
001:0001------------------------------------------------------------------------
*#******************************************************************************
*#  Project Name: [Laurel Park]    Project Number: [ 16-168 ]
*#  Date        : [2017-06-29]
*#  Modeller    : [    MYS    ]
*#  Company     : Calder Engineering Ltd.
*#  License #   :  3375279
*#******************************************************************************
*# Proposed Conditions (Preliminary Concept)-Routing
*#******************************************************************************
--------------------
| START            |  Project  dir.: C:\PROGRA~2\SWMHYMO\PROJECTS\Laurel\
--------------------  Rainfall dir.: C:\PROGRA~2\SWMHYMO\PROJECTS\Laurel\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 001
    NSTORM=   0
--------------------------------------------------------------------------------
001:0002------------------------------------------------------------------------
--------------------
| READ STORM       |    Filename: 50yr/6hr
| 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
                .25    .000 |   2.00  24.820 |   3.75  10.220 |   5.50   1.460
                .50   1.460 |   2.25  24.820 |   4.00   5.840 |   5.75   1.460
                .75   1.460 |   2.50  67.160 |   4.25   5.840 |   6.00   1.460
               1.00   1.460 |   2.75  67.160 |   4.50   2.920 |   6.25   1.460
               1.25   1.460 |   3.00  18.980 |   4.75   2.920 |
               1.50   8.760 |   3.25  18.980 |   5.00   1.460 |
               1.75   8.760 |   3.50  10.220 |   5.25   1.460 |

--------------------------------------------------------------------------------
001:0003------------------------------------------------------------------------
*# Node 1: Flow from Basin 1
----------------------
| CALIB NASHYD       |   Area    (ha)=    1.95   Curve Number   (CN)=78.00
| 01:1A     DT= 1.00 |   Ia      (mm)=  10.000   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .220

     Unit Hyd Qpeak  (cms)=     .339

     PEAK FLOW       (cms)=     .151 (i)
     TIME TO PEAK    (hrs)=    2.850
     RUNOFF VOLUME    (mm)=   29.478
     TOTAL RAINFALL   (mm)=   73.000
     RUNOFF COEFFICIENT   =     .404

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
001:0004------------------------------------------------------------------------
*# Node 2: Flow from Basin 2
----------------------
| CALIB NASHYD       |   Area    (ha)=    1.65   Curve Number   (CN)=79.00
| 02:2A     DT= 1.00 |   Ia      (mm)=  10.000   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .200

     Unit Hyd Qpeak  (cms)=     .315

     PEAK FLOW       (cms)=     .138 (i)
     TIME TO PEAK    (hrs)=    2.833
     RUNOFF VOLUME    (mm)=   30.409
     TOTAL RAINFALL   (mm)=   73.000
     RUNOFF COEFFICIENT   =     .417

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
001:0005------------------------------------------------------------------------
*# Node 3: Flow from Basin 3
----------------------
| CALIB STANDHYD     |   Area    (ha)=     .05
| 03: 3A    DT= 1.00 |   Total Imp(%)=   39.00   Dir. Conn.(%)=     .10
----------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .02          .03
     Dep. Storage     (mm)=        .70        10.00
     Average Slope     (%)=       5.00         4.00
     Length            (m)=      90.00        15.00
     Mannings n          =       .013         .250

     Max.eff.Inten.(mm/hr)=      67.16        91.68
                over (min)        2.00         5.00
     Storage Coeff.  (min)=       1.74 (ii)    5.03 (ii)
     Unit Hyd. Tpeak (min)=       2.00         5.00
     Unit Hyd. peak  (cms)=        .62          .23
                                                              *TOTALS*
     PEAK FLOW       (cms)=        .00          .01             .007 (iii)
     TIME TO PEAK    (hrs)=       2.75         2.75            2.750
     RUNOFF VOLUME    (mm)=      72.30        46.40           46.428
     TOTAL RAINFALL   (mm)=      73.00        73.00           73.000
     RUNOFF COEFFICIENT   =        .99          .64             .636

       (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.

--------------------------------------------------------------------------------
001:0006------------------------------------------------------------------------
*# Node 4: Flow from Basin 4 + 5
----------------------
| CALIB NASHYD       |   Area    (ha)=    2.57   Curve Number   (CN)=70.00
| 04:4A     DT= 1.00 |   Ia      (mm)=  10.000   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .170

     Unit Hyd Qpeak  (cms)=     .577

     PEAK FLOW       (cms)=     .169 (i)
     TIME TO PEAK    (hrs)=    2.817
     RUNOFF VOLUME    (mm)=   23.095
     TOTAL RAINFALL   (mm)=   73.000
     RUNOFF COEFFICIENT   =     .316

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
001:0007------------------------------------------------------------------------
----------------------
| CALIB NASHYD       |   Area    (ha)=    1.70   Curve Number   (CN)=68.00
| 05:5A     DT= 1.00 |   Ia      (mm)=  10.000   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .140

     Unit Hyd Qpeak  (cms)=     .464

     PEAK FLOW       (cms)=     .112 (i)
     TIME TO PEAK    (hrs)=    2.783
     RUNOFF VOLUME    (mm)=   21.744
     TOTAL RAINFALL   (mm)=   73.000
     RUNOFF COEFFICIENT   =     .298

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
001:0008------------------------------------------------------------------------
------------------------
| ADD HYD (N4        ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
------------------------                  (ha)     (cms)   (hrs)   (mm)   (cms)
                      ID1 04:4A            2.57     .169    2.82  23.09    .000
                     +ID2 05:5A            1.70     .112    2.78  21.74    .000
                      =========================================================
                      SUM 06:N4            4.27     .280    2.80  22.56    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
001:0009------------------------------------------------------------------------
*# Node 5: Flow from Basin 6
----------------------
| CALIB NASHYD       |   Area    (ha)=    1.62   Curve Number   (CN)=77.00
| 07:6A     DT= 1.00 |   Ia      (mm)=  10.000   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .200

     Unit Hyd Qpeak  (cms)=     .309

     PEAK FLOW       (cms)=     .126 (i)
     TIME TO PEAK    (hrs)=    2.833
     RUNOFF VOLUME    (mm)=   28.580
     TOTAL RAINFALL   (mm)=   73.000
     RUNOFF COEFFICIENT   =     .392

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
001:0010------------------------------------------------------------------------
*# Node 6: Flow from Basin 7
----------------------
| CALIB NASHYD       |   Area    (ha)=    1.66   Curve Number   (CN)=83.00
| 08:7A     DT= 1.00 |   Ia      (mm)=  10.000   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .090

     Unit Hyd Qpeak  (cms)=     .704

     PEAK FLOW       (cms)=     .194 (i)
     TIME TO PEAK    (hrs)=    2.767
     RUNOFF VOLUME    (mm)=   34.506
     TOTAL RAINFALL   (mm)=   73.000
     RUNOFF COEFFICIENT   =     .473

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
001:0011------------------------------------------------------------------------
*# Node 7: Flow from Basin 8
----------------------
| CALIB STANDHYD     |   Area    (ha)=    1.25
| 09: 8A    DT= 1.00 |   Total Imp(%)=   31.00   Dir. Conn.(%)=     .10
----------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .39          .86
     Dep. Storage     (mm)=        .70        10.00
     Average Slope     (%)=       4.00         3.00
     Length            (m)=     164.00        40.00
     Mannings n          =       .013         .250

     Max.eff.Inten.(mm/hr)=      67.16        73.31
                over (min)        3.00        10.00
     Storage Coeff.  (min)=       2.66 (ii)    9.74 (ii)
     Unit Hyd. Tpeak (min)=       3.00        10.00
     Unit Hyd. peak  (cms)=        .41          .12
                                                              *TOTALS*
     PEAK FLOW       (cms)=        .00          .15             .150 (iii)
     TIME TO PEAK    (hrs)=       2.75         2.78            2.783
     RUNOFF VOLUME    (mm)=      72.30        41.76           41.791
     TOTAL RAINFALL   (mm)=      73.00        73.00           73.000
     RUNOFF COEFFICIENT   =        .99          .57             .572

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  82.0    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.

--------------------------------------------------------------------------------
001:0012------------------------------------------------------------------------
--------------------
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
|  IN>09:( 8A   )   |
| OUT<01:(SWM-ou)   |    =========  OUTFLOW STORAGE TABLE  =========
--------------------     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
```

```
                           (cms)    (ha.m.)   |    (cms)    (ha.m.)
                            .000  .4000E-02   |     .004  .3800E-01
                            .002  .8000E-02   |     .005  .4300E-01
                            .002  .1500E-01   |     .009  .4800E-01
                            .003  .2500E-01   |     .018  .5400E-01
                            .003  .3400E-01   |     .032  .5900E-01

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     --------------------       (ha)     (cms)     (hrs)       (mm)
     INFLOW >09: ( 8A   )       1.25      .150     2.783     41.791
     OUTFLOW<01: (SWM-ou)       1.25      .007     4.950     38.591
    OVERFLOW<02: (SWM-OV)        .00      .000      .000       .000

                   TOTAL NUMBER OF SIMULATED OVERFLOWS  =        0
                   CUMULATIVE TIME OF OVERFLOWS  (hours)=      .00
                   PERCENTAGE OF TIME OVERFLOWING    (%)=      .00


                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=    4.585
                   TIME SHIFT OF PEAK FLOW         (min)=   130.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=.4574E-01

      *** WARNING: Outflow volume is less than inflow volume.
--------------------------------------------------------------------------------
001:0013------------------------------------------------------------------------
*# Node 8: Flow from Basin 9
----------------------
| CALIB NASHYD       |   Area    (ha)=     .13   Curve Number   (CN)=75.00
| 03:9A     DT= 1.00 |   Ia      (mm)=  10.000   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .070

     Unit Hyd Qpeak  (cms)=     .071

     PEAK FLOW       (cms)=     .012 (i)
     TIME TO PEAK    (hrs)=    2.750
     RUNOFF VOLUME    (mm)=   26.877
     TOTAL RAINFALL   (mm)=   73.000
     RUNOFF COEFFICIENT   =     .368

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
001:0014------------------------------------------------------------------------
      FINISH
--------------------------------------------------------------------------------
********************************************************************************
     WARNINGS / ERRORS / NOTES
     -------------------------
 001:0012 ROUTE RESERVOIR
      *** WARNING: Outflow volume is less than inflow volume.
   Simulation ended on 2017-06-29     at 16:14:42
================================================================================


```

```
================================================================================

   SSSSS  W   W  M   M  H   H  Y   Y  M   M   OOO        999    999    =========
   S      W W W  MM MM  H   H   Y Y   MM MM  O   O      9   9  9   9
   SSSSS  W W W  M M M  HHHHH    Y    M M M  O   O  ##  9   9  9   9   Ver  4.05
       S   W W   M   M  H   H    Y    M   M  O   O       9999   9999   Sept 2011
   SSSSS   W W   M   M  H   H    Y    M   M   OOO           9      9   =========
                                                        9   9  9   9   # 3375279
        StormWater Management HYdrologic Model           999    999    =========

 *******************************************************************************
 ***************************** SWMHYMO Ver/4.05  ******************************
 *********  A single event and continuous hydrologic simulation model  *********
 *********     based on the principles of HYMO and its successors      *********
 *********                 OTTHYMO-83 and OTTHYMO-89.                  *********
 *******************************************************************************
 ********* Distributed by:  J.F. Sabourin and Associates Inc.          *********
 *********                  Ottawa,  Ontario: (613) 836-3884           *********
 *********                  Gatineau, Quebec: (819) 243-6858           *********
 *********                  E-Mail: swmhymo@jfsa.Com                   *********
 *******************************************************************************

 +++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
 +++++++++ Licensed user: Calder Engineering Ltd.                      +++++++++
 +++++++++                Bolton                SERIAL#:3375279        +++++++++
 +++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

 *******************************************************************************
 *********           ++++++ PROGRAM ARRAY DIMENSIONS ++++++            *********
 *********           Maximum value for ID numbers  :     10            *********
 *********           Max. number of rainfall points: 105408            *********
 *********           Max. number of flow points    : 105408            *********
 *******************************************************************************


 **********************   D E T A I L E D   O U T P U T   **********************
 *******************************************************************************
 *        DATE: 2017-06-29     TIME: 15:01:06     RUN COUNTER: 000786         *
 *******************************************************************************
 * Input   filename: C:\PROGRA~2\SWMHYMO\PROJECTS\Laurel\L-PR.dat              *
 * Output  filename: C:\PROGRA~2\SWMHYMO\PROJECTS\Laurel\L-PR.out              *
 * Summary filename: C:\PROGRA~2\SWMHYMO\PROJECTS\Laurel\L-PR.sum              *
 * User comments:                                                              *
 * 1:__________________________________________________________________________*
 * 2:__________________________________________________________________________*
 * 3:__________________________________________________________________________*
 *******************************************************************************

--------------------------------------------------------------------------------
001:0001------------------------------------------------------------------------
*#******************************************************************************
*#  Project Name: [Laurel Park]    Project Number: [ 16-168 ]
*#  Date        : [2017-06-29]
*#  Modeller    : [    MYS    ]
*#  Company     : Calder Engineering Ltd.
*#  License #   :  3375279
*#******************************************************************************
*# Proposed Conditions (Preliminary Concept)-Routing
*#******************************************************************************
--------------------
| START            |  Project  dir.: C:\PROGRA~2\SWMHYMO\PROJECTS\Laurel\
--------------------  Rainfall dir.: C:\PROGRA~2\SWMHYMO\PROJECTS\Laurel\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 001
    NSTORM=   0
--------------------------------------------------------------------------------
001:0002------------------------------------------------------------------------
--------------------
| READ STORM       |    Filename: 100yr/6hr
| Ptotal=  80.31 mm|    Comments: 100yr/6hr
--------------------
              TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
               hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
               .25    .000 |   2.00  27.300 |   3.75  11.240 |   5.50   1.610
               .50   1.610 |   2.25  27.300 |   4.00   6.420 |   5.75   1.610
               .75   1.610 |   2.50  73.880 |   4.25   6.420 |   6.00   1.610
              1.00   1.610 |   2.75  73.880 |   4.50   3.210 |   6.25   1.610
              1.25   1.610 |   3.00  20.880 |   4.75   3.210 |
              1.50   9.640 |   3.25  20.880 |   5.00   1.610 |
              1.75   9.640 |   3.50  11.240 |   5.25   1.610 |

--------------------------------------------------------------------------------
001:0003------------------------------------------------------------------------
*# Node 1: Flow from Basin 1
----------------------
| CALIB NASHYD       |   Area    (ha)=    1.95   Curve Number   (CN)=78.00
| 01:1A     DT= 1.00 |   Ia      (mm)=  10.000   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .220

     Unit Hyd Qpeak  (cms)=     .339

     PEAK FLOW       (cms)=     .179 (i)
     TIME TO PEAK    (hrs)=    2.850
     RUNOFF VOLUME    (mm)=   34.825
     TOTAL RAINFALL   (mm)=   80.310
     RUNOFF COEFFICIENT   =     .434

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
001:0004------------------------------------------------------------------------
*# Node 2: Flow from Basin 2
----------------------
| CALIB NASHYD       |   Area    (ha)=    1.65   Curve Number   (CN)=79.00
| 02:2A     DT= 1.00 |   Ia      (mm)=  10.000   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .200

     Unit Hyd Qpeak  (cms)=     .315

     PEAK FLOW       (cms)=     .163 (i)
     TIME TO PEAK    (hrs)=    2.833
     RUNOFF VOLUME    (mm)=   35.867
     TOTAL RAINFALL   (mm)=   80.310
     RUNOFF COEFFICIENT   =     .447

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
001:0005------------------------------------------------------------------------
*# Node 3: Flow from Basin 3
----------------------
| CALIB STANDHYD     |   Area    (ha)=     .05
| 03: 3A    DT= 1.00 |   Total Imp(%)=   39.00   Dir. Conn.(%)=     .10
----------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .02          .03
     Dep. Storage     (mm)=        .70        10.00
     Average Slope     (%)=       5.00         4.00
     Length            (m)=      90.00        15.00
     Mannings n          =       .013         .250

     Max.eff.Inten.(mm/hr)=      73.88       103.33
                over (min)        2.00         5.00
     Storage Coeff.  (min)=       1.67 (ii)    4.81 (ii)
     Unit Hyd. Tpeak (min)=       2.00         5.00
     Unit Hyd. peak  (cms)=        .63          .23
                                                           *TOTALS*
     PEAK FLOW       (cms)=        .00          .01          .008 (iii)
     TIME TO PEAK    (hrs)=       2.70         2.75         2.750
     RUNOFF VOLUME    (mm)=      79.61        53.07        53.100
     TOTAL RAINFALL   (mm)=      80.31        80.31        80.310
     RUNOFF COEFFICIENT   =        .99          .66          .661

       (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.

--------------------------------------------------------------------------------
001:0006------------------------------------------------------------------------
*# Node 4: Flow from Basin 4 + 5
----------------------
| CALIB NASHYD       |   Area    (ha)=    2.57   Curve Number   (CN)=70.00
| 04:4A     DT= 1.00 |   Ia      (mm)=  10.000   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .170

     Unit Hyd Qpeak  (cms)=     .577

     PEAK FLOW       (cms)=     .202 (i)
     TIME TO PEAK    (hrs)=    2.817
     RUNOFF VOLUME    (mm)=   27.591
     TOTAL RAINFALL   (mm)=   80.310
     RUNOFF COEFFICIENT   =     .344

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
001:0007------------------------------------------------------------------------
----------------------
| CALIB NASHYD       |   Area    (ha)=    1.70   Curve Number   (CN)=68.00
| 05:5A     DT= 1.00 |   Ia      (mm)=  10.000   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .140

     Unit Hyd Qpeak  (cms)=     .464

     PEAK FLOW       (cms)=     .134 (i)
     TIME TO PEAK    (hrs)=    2.783
     RUNOFF VOLUME    (mm)=   26.040
     TOTAL RAINFALL   (mm)=   80.310
     RUNOFF COEFFICIENT   =     .324

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
001:0008------------------------------------------------------------------------
------------------------
| ADD HYD (N4        ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
------------------------                  (ha)     (cms)   (hrs)   (mm)   (cms)
                     ID1 04:4A             2.57     .202    2.82  27.59    .000
                    +ID2 05:5A             1.70     .134    2.78  26.04    .000
                     ===========================================================
                     SUM 06:N4             4.27     .336    2.80  26.97    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
001:0009------------------------------------------------------------------------
*# Node 5: Flow from Basin 6
----------------------
| CALIB NASHYD       |   Area    (ha)=    1.62   Curve Number   (CN)=77.00
| 07:6A     DT= 1.00 |   Ia      (mm)=  10.000   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .200

     Unit Hyd Qpeak  (cms)=     .309

     PEAK FLOW       (cms)=     .150 (i)
     TIME TO PEAK    (hrs)=    2.833
     RUNOFF VOLUME    (mm)=   33.818
     TOTAL RAINFALL   (mm)=   80.310
     RUNOFF COEFFICIENT   =     .421

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
001:0010------------------------------------------------------------------------
*# Node 6: Flow from Basin 7
----------------------
| CALIB NASHYD       |   Area    (ha)=    1.66   Curve Number   (CN)=83.00
| 08:7A     DT= 1.00 |   Ia      (mm)=  10.000   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .090

     Unit Hyd Qpeak  (cms)=     .704

     PEAK FLOW       (cms)=     .225 (i)
     TIME TO PEAK    (hrs)=    2.767
     RUNOFF VOLUME    (mm)=   40.410
     TOTAL RAINFALL   (mm)=   80.310
     RUNOFF COEFFICIENT   =     .503

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
001:0011------------------------------------------------------------------------
*# Node 7: Flow from Basin 8
----------------------
| CALIB STANDHYD     |   Area    (ha)=    1.25
| 09: 8A    DT= 1.00 |   Total Imp(%)=   31.00   Dir. Conn.(%)=     .10
----------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .39          .86
     Dep. Storage     (mm)=        .70        10.00
     Average Slope     (%)=       4.00         3.00
     Length            (m)=     164.00        40.00
     Mannings n          =       .013         .250

     Max.eff.Inten.(mm/hr)=      73.88        83.88
                over (min)        3.00         9.00
     Storage Coeff.  (min)=       2.56 (ii)    9.26 (ii)
     Unit Hyd. Tpeak (min)=       3.00         9.00
     Unit Hyd. peak  (cms)=        .42          .12
                                                           *TOTALS*
     PEAK FLOW       (cms)=        .00          .18          .176 (iii)
     TIME TO PEAK    (hrs)=       2.72         2.78         2.783
     RUNOFF VOLUME    (mm)=      79.61        48.14        48.176
     TOTAL RAINFALL   (mm)=      80.31        80.31        80.310
     RUNOFF COEFFICIENT   =        .99          .60          .600

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  82.0    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.

--------------------------------------------------------------------------------
001:0012------------------------------------------------------------------------
---------------------
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
|  IN>09:( 8A   )   |
| OUT<01:(SWM-ou)   |    =========  OUTLFOW STORAGE TABLE  =========
---------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
```

```
                           (cms)    (ha.m.)   |    (cms)    (ha.m.)
                            .000  .4000E-02   |     .004  .3800E-01
                            .002  .8000E-02   |     .005  .4300E-01
                            .002  .1500E-01   |     .009  .4800E-01
                            .003  .2500E-01   |     .018  .5400E-01
                            .003  .3400E-01   |     .032  .5900E-01

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     --------------------       (ha)     (cms)     (hrs)       (mm)
     INFLOW >09: ( 8A   )       1.25      .176     2.783     48.176
     OUTFLOW<01: (SWM-ou)       1.25      .013     4.517     44.976
    OVERFLOW<02: (SWM-OV)        .00      .000      .000       .000

                   TOTAL NUMBER OF SIMULATED OVERFLOWS  =        0
                   CUMULATIVE TIME OF OVERFLOWS  (hours)=      .00
                   PERCENTAGE OF TIME OVERFLOWING    (%)=      .00


                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=    7.285
                   TIME SHIFT OF PEAK FLOW         (min)=   104.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=.5074E-01

      *** WARNING: Outflow volume is less than inflow volume.
--------------------------------------------------------------------------------
001:0013------------------------------------------------------------------------
*# Node 8: Flow from Basin 9
----------------------
| CALIB NASHYD       |   Area    (ha)=     .13   Curve Number   (CN)=75.00
| 03:9A     DT= 1.00 |   Ia      (mm)=  10.000   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .070

     Unit Hyd Qpeak  (cms)=     .071

     PEAK FLOW       (cms)=     .014 (i)
     TIME TO PEAK    (hrs)=    2.750
     RUNOFF VOLUME    (mm)=   31.897
     TOTAL RAINFALL   (mm)=   80.310
     RUNOFF COEFFICIENT   =     .397

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
001:0014------------------------------------------------------------------------
      FINISH
--------------------------------------------------------------------------------
********************************************************************************
     WARNINGS / ERRORS / NOTES
     -------------------------
 001:0012 ROUTE RESERVOIR
      *** WARNING: Outflow volume is less than inflow volume.
   Simulation ended on 2017-06-29     at 15:01:06
================================================================================
```

# APPENDIX D

# LID CONCEPT DETAILS

CVC/TRCA LOW IMPACT DEVELOPMENT
PLANNING AND DESIGN GUIDE - FACT SHEET

# BIORETENTION

## GENERAL DESCRIPTION

As a stormwater filter and infiltration practice, bioretention temporarily stores, treats and infiltrates runoff. Depending on native soil infiltration rate and physical constraints, the system may be designed without an underdrain for full infiltration, with an underdrain for partial infiltration, or with an impermeable liner and underdrain for filtration only (i.e., a biofilter). The primary component of the practice is the filter bed which is a mixture of sand, fines and organic material. Other elements include a mulch ground cover and plants adapted to the conditions of a stormwater practice. Bioretention is designed to capture small storm events or the water quality storage requirement. An overflow or bypass is necessary to pass large storm event flows. Bioretention can be adapted to fit into many different development contexts and provide a convenient area for snow storage and treatment.

## DESIGN GUIDANCE

### SOIL CHARACTERISTICS

Bioretention can be constructed over any soil type, but hydrologic soil group A and B are best for achieving water balance goals. If possible, bioretention should be sited in the areas of the development with the highest native soil infiltration rates. Bioretention in soils with infiltration rates less than 15 mm/hr will require an underdrain. Designers should verify the native soil infiltration rate at the proposed location and depth through measurement of hydraulic conductivity under field saturated conditions.

### GEOMETRY & SITE LAYOUT

Key geometry and site layout factors include:

- The minimum footprint of the filter bed area is based on the drainage area. Typical drainage areas to bioretention are between 100 m2 to 0.5 hectares. The maximum recommended drainage area is 0.8 hectares. Typical ratios of impervious drainage area to treatment facility area range from 5:1 to 15:1.
- Bioretention can be configured to fit into many locations and shapes. However, cells that are narrow may concentrate flow as it spreads throughout the cell and result in erosion.
- The filter bed surface should be level to encourage stormwater to spread out evenly over the surface.

### PRE-TREATMENT

Pretreatment prevents premature clogging by capturing coarse sediment particles before they reach the filter bed. Where the runoff source area produces little sediment, such as roofs, bioretention can function effectively without pretreatment. To treat parking area or road runoff, a two-cell design that incorporates a forebay is recommended. Pretreatment practices that may be feasible, depending on the method of conveyance and the availability of space include:

- *Two-cell design (channel flow):* Forebay ponding volume should account for 25% of the water quality storage requirement and be designed with a 2:1 length to width ratio.
- *Vegetated filter strip (sheet flow):* Should be a minimum of three (3) metres in width. If smaller strips are used, more frequent maintenance of the filter bed can be anticipated.
- *Gravel diaphragm (sheet flow):* A small trench filled with pea gravel, which is perpendicular to the flow path between the edge of the pavement and the bioretention practice will promote settling out of sediment and maintain sheet flow into the facility. A drop of 50-150 mm into the gravel diaphragm can be used to dissipate energy and promote settling.
- *Rip rap and/or dense vegetation (channel flow):* Suitable for small bioretention cells with drainage areas less than 100 square metres.

### GRAVEL STORAGE LAYER

- DEPTH: Should be a minimum of 300 mm deep and sized to provide the required storage volume. Granular material should be 50 mm diameter clear stone.
- PEA GRAVEL CHOKING LAYER: A 100 mm deep layer of pea gravel (3 to 10 mm diameter clear stone) should be placed on top of the coarse gravel storage layer as a choking layer separating it from the overlying filter media bed.

### FILTER MEDIA

- COMPOSITION: To ensure a consistent and homogeneous bed, filter media should come pre-mixed from an approved vendor.
- DEPTH: Recommended depth is between 1.0 and 1.25 m. However in constrained applications, pollutant removal benefits may be achieved in beds as shallow as 500 mm. If trees are to be included in the design, bed depth must be at least 1.0 m.
- MULCH: A 75 mm layer of mulch on the surface of the filter bed enhances plant survival, suppresses weed growth and pretreats runoff before it reaches the filter bed.

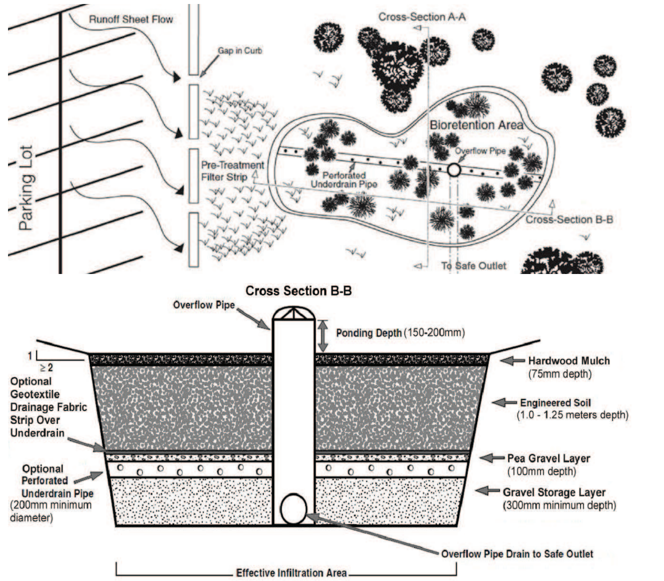
### CONVEYANCE AND OVERFLOW

Bioretention can be designed to be inline or offline from the drainage system. Inline bioretention accepts all flow from a drainage area and conveys larger event flows through an overflow outlet. Overflow structures must be sized to safely convey larger storm events out of the facility. The invert of the overflow should be placed at the maximum water surface elevation of the bioretention area, which is typically 150-250 mm above the filter bed surface.

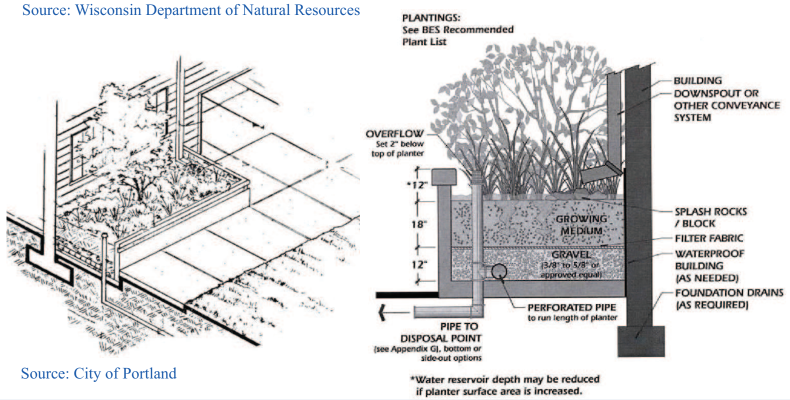
Offline bioretention practices use flow splitters or bypass channels that only allow the required water quality storage volume to enter the facility. This may be achieved with a pipe, weir, or curb opening sized for the target flow, but in conjunction, create a bypass channel so that higher flows do not pass over the surface of the filter bed. Using a weir or curb opening minimizes clogging and reduces maintenance frequency.


Source: Minnesota Businesses for Clean Water


Source: City of Portland



Source: Wisconsin Department of Natural Resources



Source: City of Portland

## ABILITY TO MEET SWM OBJECTIVES

| BMP | Water Balance Benefit | Water Quality Improvement | Stream Channel Erosion Control Benefits |
|---|---|---|---|
| Bioretention with no underdrain | Yes | Yes - size for water quality storage requirement | Partial - based on available storage volume and infiltration rates |
| Bioretention with underdrain | Partial - based on available storage volume beneath the underdrain and soil infiltration rate | Yes - size for water quality storage requirement | Partial - based on available storage volume beneath the underdrain and soil infiltration rate |
| Bioretention with underdrain and impermeable liner | Partial - some volume reduction through evapotranspiration | Yes - size for water quality storage requirement | Partial - some volume reduction through evapotranspiration |

### UNDERDRAIN

- Only needed where native soil infiltration rate is less than 15 mm/hr (hydraulic conductivity of less than 1x10-6 cm/s).
- Should consist of a perforated pipe embedded in the coarse gravel storage layer at least 100 mm above the bottom.
- A strip of geotextile filter fabric placed between the filter media and pea gravel choking layer over the perforated pipe is optional to help prevent fine soil particles from entering the underdrain.
- A vertical standpipe connected to the underdrain can be used as a cleanout and monitoring well.

### MONITORING WELLS

A capped vertical stand pipe consisting of an anchored 100 to 150 mm diameter perforated pipe with a lockable cap installed to the bottom of the facility is recommended for monitoring drainage time between storms.

## GENERAL SPECIFICATIONS

| Material | Specification | Quantity |
|---|---|---|
| Filter Media Composition | Filter Media Soil Mixture to contain:<br>• 85 to 88% sand<br>• 8 to 12% soil fines<br>• 3 to 5% organic matter (leaf compost)<br>Other Criteria:<br>• Phosphorus soil test index (P-Index) value between 10 to 30 ppm<br>• Cationic exchange capacity (CEC) greater than 10 meq/100 g<br>• Free of stones, stumps, roots and other large debris<br>• pH between 5.5 to 7.5<br>• Infiltration rate greater than 25 mm/hr | Recommended depth is between 1.0 and 1.25 metres. |
| Mulch Layer | Shredded hardwood bark mulch | A 75 mm layer on the surface of the filter bed |
| Geotextile | Material specifications should conform to Ontario Provincial Standard Specification (OPSS) 1860 for Class II geotextile fabrics.<br>Should be woven monofilament or non-woven needle punched fabrics. Woven slit film and non-woven heat bonded fabrics should not be used as they are prone to clogging.<br>For further guidance see CVC/TRCA LID SWM Planning and Design Guide, Table 4.5.5. | Strip over the perforated pipe underdrain (if present) between the filter media bed and gravel storage layer (stone reservoir) |
| Gravel | Washed 50 mm diameter clear stone should be used to surround the underdrain and for the gravel storage layer<br>Washed 3 to 10 mm diameter clear stone should be used for pea gravel choking layer. | Volume based on dimensions, assuming a void space ratio of 0.4. |
| Underdrain | Perforated HDPE or equivalent, minimum 100 mm diameter, 200 mm recommended. | • Perforated pipe for length of cell.<br>• Non-perforated pipe as needed to connect with storm drain system.<br>• One or more caps.<br>• T's for underdrain configuration |

## CONSTRUCTION CONSIDERATIONS

Ideally, bioretention sites should remain outside the limit of disturbance until construction of the bioretention begins to prevent soil compaction by heavy equipment. Locations should not be used as sediment basins during construction, as the concentration of fines will prevent post-construction infiltration. To prevent sediment from clogging the surface of a bioretention cell, stormwater should be diverted away from the bioretention until the drainage area is fully stabilized.

For further guidance regarding key steps during construction, see the CVC/TRCA LID SWM Planning and Design Guide, Section 4.5.2 - Construction Considerations)

## OPERATION AND MAINTENANCE

Bioretention requires routine inspection and maintenance of the landscaping as well as periodic inspection for less frequent maintenance needs or remedial maintenance. Generally, routine maintenance will be the same as for any other landscaped area; weeding, pruning, and litter removal. Regular watering may be required during the first two years until vegetation is established.

For the first two years following construction the facility should be inspected at least quarterly and after every major storm event (> 25 mm). Subsequently, inspections should be conducted in the spring and fall of each year and after major storm events. Inspect for vegetation density (at least 80% coverage), damage by foot or vehicular traffic, channelization, accumulation of debris, trash and sediment, and structural damage to pretreatment devices.

Trash and debris should be removed from pretreatment devices, the bioretention area surface and inlet and outlets at least twice annually. Other maintenance activities include reapplying mulch, pruning, weeding replacing dead vegetation and repairing eroded areas as needed. Remove accumulated sediment on the bioretention area surface when dry and exceeding 25 mm depth.

## SITE CONSIDERATIONS

### Wellhead Protection

Facilities receiving road or parking lot runoff should not be located within two (2) year time-of-travel wellhead protection areas.

### Available Space

Reserve open areas of about 10 to 20% of the size of the contributing drainage area.

### Site Topography

Contributing slopes should be between 1 to 5%. The surface of the filter bed should be flat to allow flow to spread out. A stepped multi-cell design can also be used.

### Available Head

If an underdrain is used, then 1 to 1.5 metres elevation difference is needed between the inflow point and the downstream storm drain invert.

### Water Table

A minimum of one (1) metre separating the seasonally high water table or top of bedrock elevation and the bottom of the practice is necessary.

### Soils

Bioretention can be located over any soil type, but hydrologic soil group A and B soils are best for achieving water balance benefits. Facilities should be located in portions of the site with the highest native soil infiltration rates. Where infiltration rates are less than 15 mm/hr (hydraulic conductivity less than 1x10-6 cm/s) an underdrain is required. Native soil infiltration rate at the proposed facility location and depth should be confirmed through measurement of hydraulic conductivity under field saturated conditions.

### Drainage Area & Runoff Volume

Typical contributing drainage areas are between 100 m2 to 0.5 hectares. The maximum recommended contributing drainage area is 0.8 hectares. Typical ratios of impervious drainage area to treatment facility area range from 5:1 to 15:1.

### Pollution Hot Spot Runoff

To protect groundwater from possible contamination, runoff from pollution hot spots should not be treated by bioretention facilities designed for full or partial infiltration. Facilities designed with an impermeable liner (filtration only facilities) can be used to treat runoff from pollution hot spots.

### Proximity to Underground Utilities

Designers should consult local utility design guidance for the horizontal and vertical clearances required between storm drains, ditches, and surface water bodies.

### Overhead Wires

Check whether the future tree canopy height in the bioretention area will interfere with existing overhead phone and power lines.

### Setback from Buildings

If an impermeable liner is used, no setback is needed. If not, a four (4) metre setback from building foundations should be applied.

TORONTO AND REGION Conservation for The Living City
CVC CREDIT VALLEY CONSERVATION

FOR FURTHER DETAILS SEE SECTION 4.5 OF THE CVC/TRCA LID SWM GUIDE

# APPENDIX E

# ENGINEERING DRAWINGS

# TABLE E.1 5 YEAR STORM DESIGN SHEET

| Location | | | Drainage Area | | | | Runoff | | | Pipe Flow | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Street | From MH | To MH | A (ha) | C | A x C | Acc. A x C | Tc (min) | I (mm/hr) | Q (L/s) | Pipe Length (m) | Pipe Diameter (m) | Pipe Slope (%) | Full Flow Capacity (L/s) | Full Flow Velocity (m/s) | Time of flow (min.) | % full |
| | | | | | | | | | | | | | | | | |
| Street A | DICB1 | MH1 | 0.75 | 0.35 | 0.2625 | 0.2625 | 15.00 | 90.91 | 66.29 | 31.0 | 0.450 | 0.50 | 201.6 | 1.3 | 0.41 | 32.9% |
| Block 5 | MH1 | Block 5 | 0.00 | 0.00 | 0 | 0.2625 | 15.41 | 89.67 | 65.39 | 7.0 | 0.450 | 0.50 | 201.6 | 1.3 | 0.09 | 32.4% |
| | | | | | | | | | | | | | | | | |

Notes

Manning's n = 0.013

$$I = \frac{A}{(t_c + B)^C}$$

where:
A= 1593
B= 11
C= 0.8789

CONSULTANT: Calder Engineering Ltd.
PROJECT: Laurelpark Subdiviison
PROJECT NO: 16-168
LOCATION: Town of Caledon

TOWN OF CALEDON

Calder Engineering Ltd.

# TABLE E.2 100 YEAR STORM DESIGN SHEET

| Location | | | Drainage Area | | | | Runoff | | | Pipe Flow | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Street | From MH | To MH | A (ha) | C | A x C | Acc. A x C | Tc (min) | I (mm/hr) | Q (L/s) | Pipe Length (m) | Pipe Diameter (m) | Pipe Slope (%) | Full Flow Capacity (L/s) | Full Flow Velocity (m/s) | Time of flow (min.) | % full |
| | | | | | | | | | | | | | | | | |
| Street A | DICB1 | MH1 | 0.75 | 0.35 | 0.2625 | 0.2625 | 15.00 | 166.89 | 121.69 | 31.0 | 0.450 | 0.50 | 201.6 | 1.3 | 0.41 | 60.4% |
| Block 5 | MH1 | Block 5 | 0.00 | 0.00 | 0 | 0.2625 | 15.41 | 164.87 | 120.22 | 7.0 | 0.450 | 0.50 | 201.6 | 1.3 | 0.09 | 59.6% |
| | | | | | | | | | | | | | | | | |

Notes

Manning's n = 0.013

$$I = \frac{A}{(t_c + B)^C}$$

where:

A= 4688

B= 17

C= 0.9624

CONSULTANT: Calder Engineering Ltd.
PROJECT: Laurelpark Subdivision
PROJECT NO: 16-168
LOCATION: Town of Caledon

TOWN OF CALEDON

Calder
Engineering Ltd.

# TABLE E.3 100 YEAR STORM DESIGN SHEET - ROAD GRASSED SWALES

| Location | | | Drainage Area | | | | Runoff | | | Pipe Flow | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Street | From STA | To STA | A (ha) | C | A x C | Acc. A x C | Tc (min) | I (mm/hr) | Q (L/s) | Ditch Length (m) | Side of Road | Ditch Slope (%) | Full Flow Capacity (L/s) | Flow Velocity (m/s) | Flow Depth (m) | % Full Capacity |
| Street A (North) | 0+130 | 0+060 | 0.750 | 0.35 | 0.263 | 0.263 | 10.00 | 196.54 | 143.31 | 70.0 | N | 0.75 | 1,632.5 | 0.73 | 0.22 | 8.8% |
| Street A (North) | 0+060 | 0+012 | 0.750 | 0.35 | 0.263 | 0.263 | 10.00 | 196.54 | 143.31 | 48.0 | N | 1.85 | 2,563.9 | 1.03 | 0.19 | 5.6% |
| | | | | | | | | | | | | | | | | |
| Street A (South) | 0+107 | 0+060 | 0.250 | 0.35 | 0.088 | 0.088 | 10.00 | 196.54 | 47.77 | 47.0 | S | 0.75 | 1,632.5 | 0.56 | 0.15 | 2.9% |
| Street A (South) | 0+060 | 0+012 | 0.250 | 0.35 | 0.088 | 0.088 | 10.00 | 196.54 | 47.77 | 48.0 | S | 1.85 | 2,563.9 | 0.78 | 0.12 | 1.9% |
| | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | |

Notes

Manning's n = 0.040

$$I = \frac{A}{(t_c + B)^C}$$

where:

| | |
|---|---|
| A= | 4688 |
| B= | 17 |
| C= | 0.9624 |

CONSULTANT: Calder Engineering Ltd.
PROJECT: Laurelpark Subdivision
PROJECT NO: 16-168
LOCATION: Town of Caledon

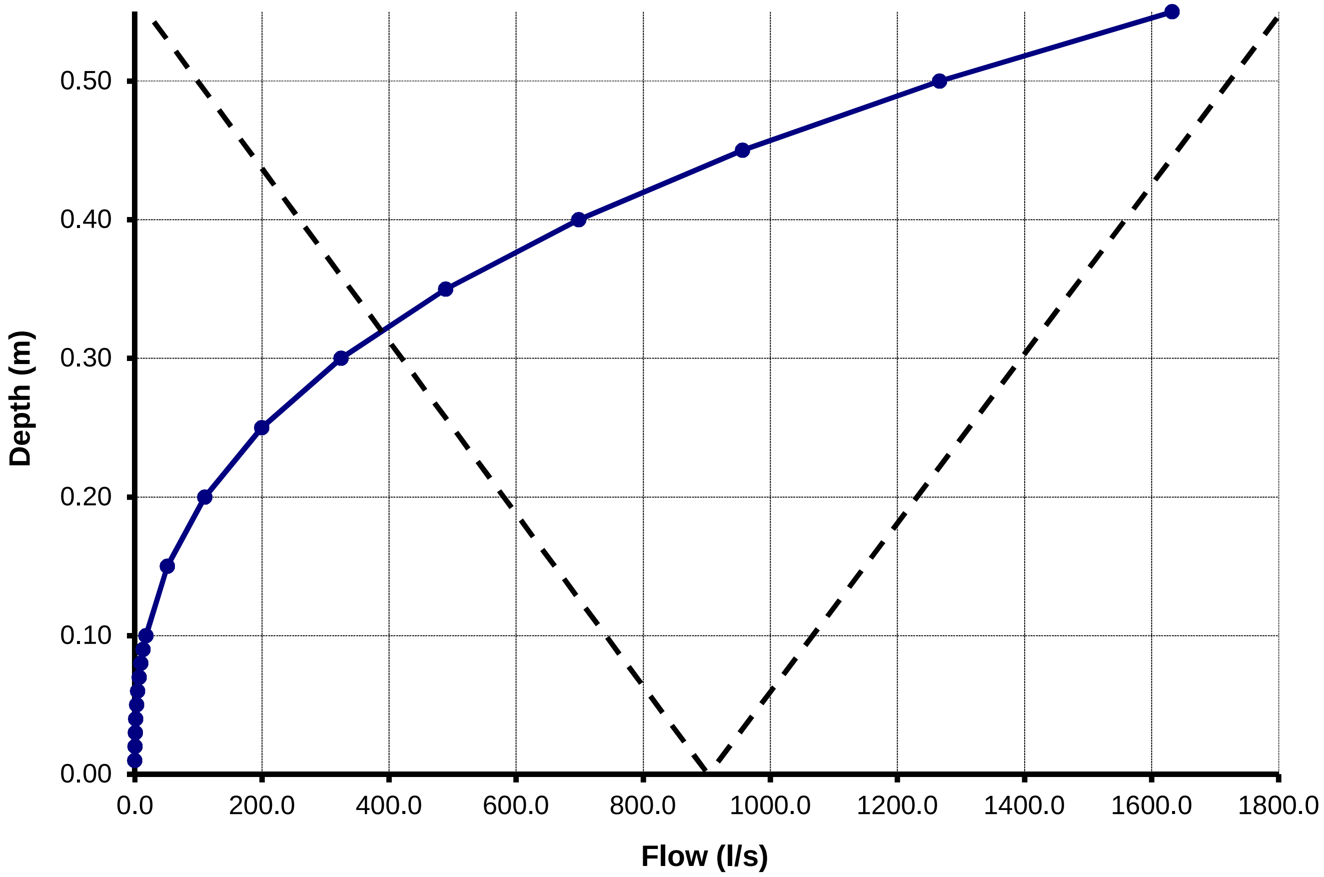
# *Rating Curve for Triangular Swale*

**Project:** **LAURELPARK SUBDIVISION**

**Mannings Equation:**
Q = (A * R^0.667 * S^0.5) / n

**Side Slope Factor (Z):** **4 :1**  **Slope (s):** **0.750%**  **Roughness (n):** **0.040**

| **Depth (m)** | **Flow (l/s)** | Velocity (m/s) | Area A | Wet. Perim. P | Hydrl. Rad. R | Top Width T | Hydr. Depth D | Froude No. F | Type of Flow |
|---|---|---|---|---|---|---|---|---|---|
| **0.010** | **0.0** | 0.093 | 0.000 | 0.082 | 0.009 | 0.080 | 0.005 | 0.421 | *sub-critical* |
| **0.020** | **0.2** | 0.148 | 0.002 | 0.165 | 0.018 | 0.160 | 0.010 | 0.473 | *sub-critical* |
| **0.030** | **0.7** | 0.194 | 0.004 | 0.247 | 0.027 | 0.240 | 0.015 | 0.506 | *sub-critical* |
| **0.040** | **1.5** | 0.235 | 0.006 | 0.330 | 0.036 | 0.320 | 0.020 | 0.531 | *sub-critical* |
| **0.050** | **2.7** | 0.273 | 0.010 | 0.412 | 0.045 | 0.400 | 0.025 | 0.551 | *sub-critical* |
| **0.060** | **4.4** | 0.308 | 0.014 | 0.495 | 0.054 | 0.480 | 0.030 | 0.568 | *sub-critical* |
| **0.070** | **6.7** | 0.341 | 0.020 | 0.577 | 0.063 | 0.560 | 0.035 | 0.583 | *sub-critical* |
| **0.080** | **9.6** | 0.373 | 0.026 | 0.660 | 0.072 | 0.640 | 0.040 | 0.596 | *sub-critical* |
| **0.090** | **13.1** | 0.404 | 0.032 | 0.742 | 0.080 | 0.720 | 0.045 | 0.607 | *sub-critical* |
| **0.100** | **17.3** | 0.433 | 0.040 | 0.825 | 0.089 | 0.800 | 0.050 | 0.618 | *sub-critical* |
| **0.150** | **51.1** | 0.567 | 0.090 | 1.237 | 0.134 | 1.200 | 0.075 | 0.661 | *sub-critical* |
| **0.200** | **110.0** | 0.687 | 0.160 | 1.649 | 0.179 | 1.600 | 0.100 | 0.694 | *sub-critical* |
| **0.250** | **199.4** | 0.798 | 0.250 | 2.062 | 0.224 | 2.000 | 0.125 | 0.720 | *sub-critical* |
| **0.300** | **324.2** | 0.901 | 0.360 | 2.474 | 0.268 | 2.400 | 0.150 | 0.742 | *sub-critical* |
| **0.350** | **489.1** | 0.998 | 0.490 | 2.886 | 0.313 | 2.800 | 0.175 | 0.762 | *sub-critical* |
| **0.400** | **698.3** | 1.091 | 0.640 | 3.298 | 0.358 | 3.200 | 0.200 | 0.779 | *sub-critical* |
| **0.450** | **956.0** | 1.180 | 0.810 | 3.711 | 0.402 | 3.600 | 0.225 | 0.794 | *sub-critical* |
| **0.500** | **1,266.1** | 1.266 | 1.000 | 4.123 | 0.447 | 4.000 | 0.250 | 0.808 | *sub-critical* |
| **0.550** | **1,632.5** | 1.349 | 1.210 | 4.535 | 0.492 | 4.400 | 0.275 | 0.821 | *sub-critical* |



# *Rating Curve for Triangular Swale*

**Project:** **LAURELPARK SUBDIVISION**

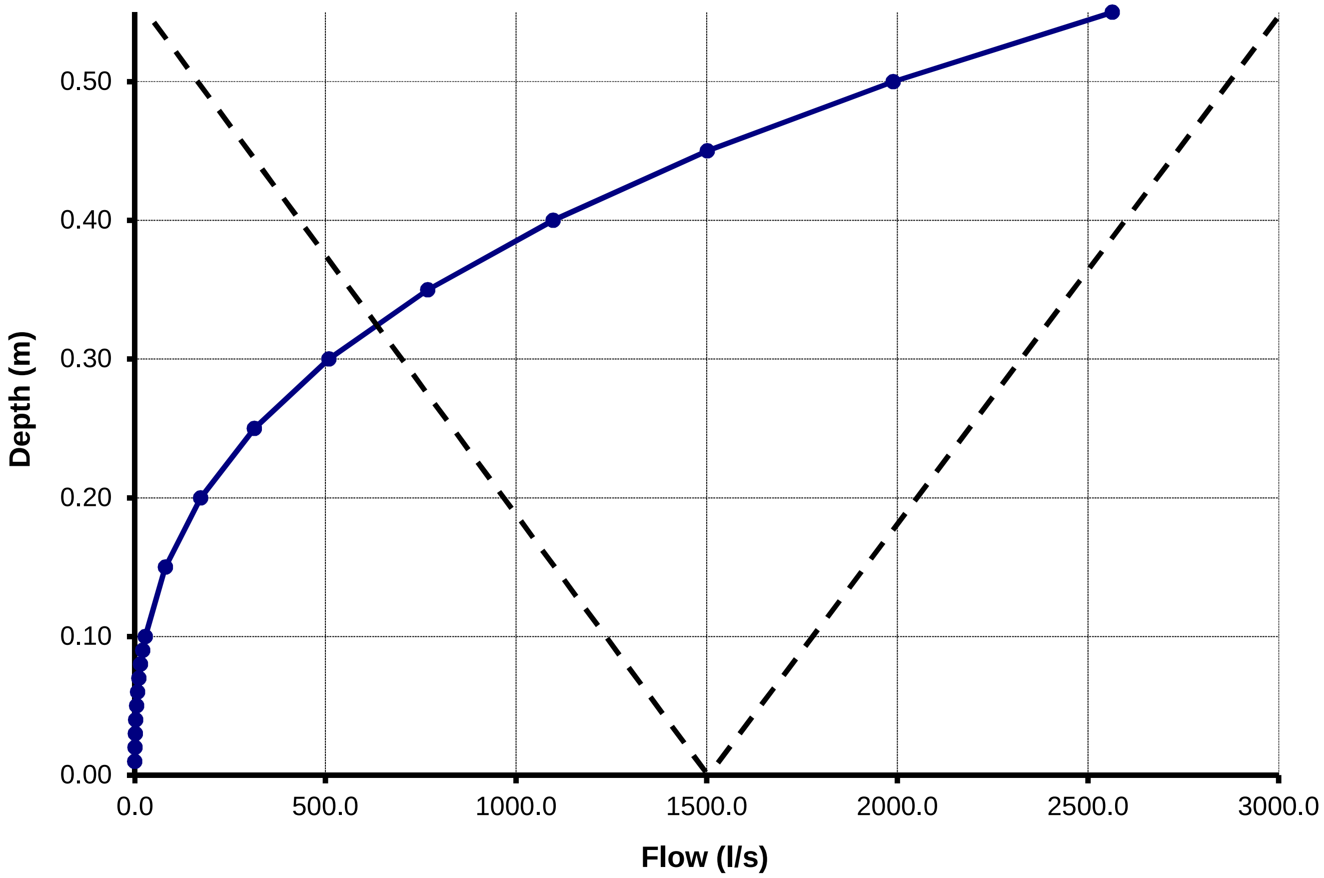
**Mannings Equation:**
Q = (A * R^0.667 * S^0.5) / n

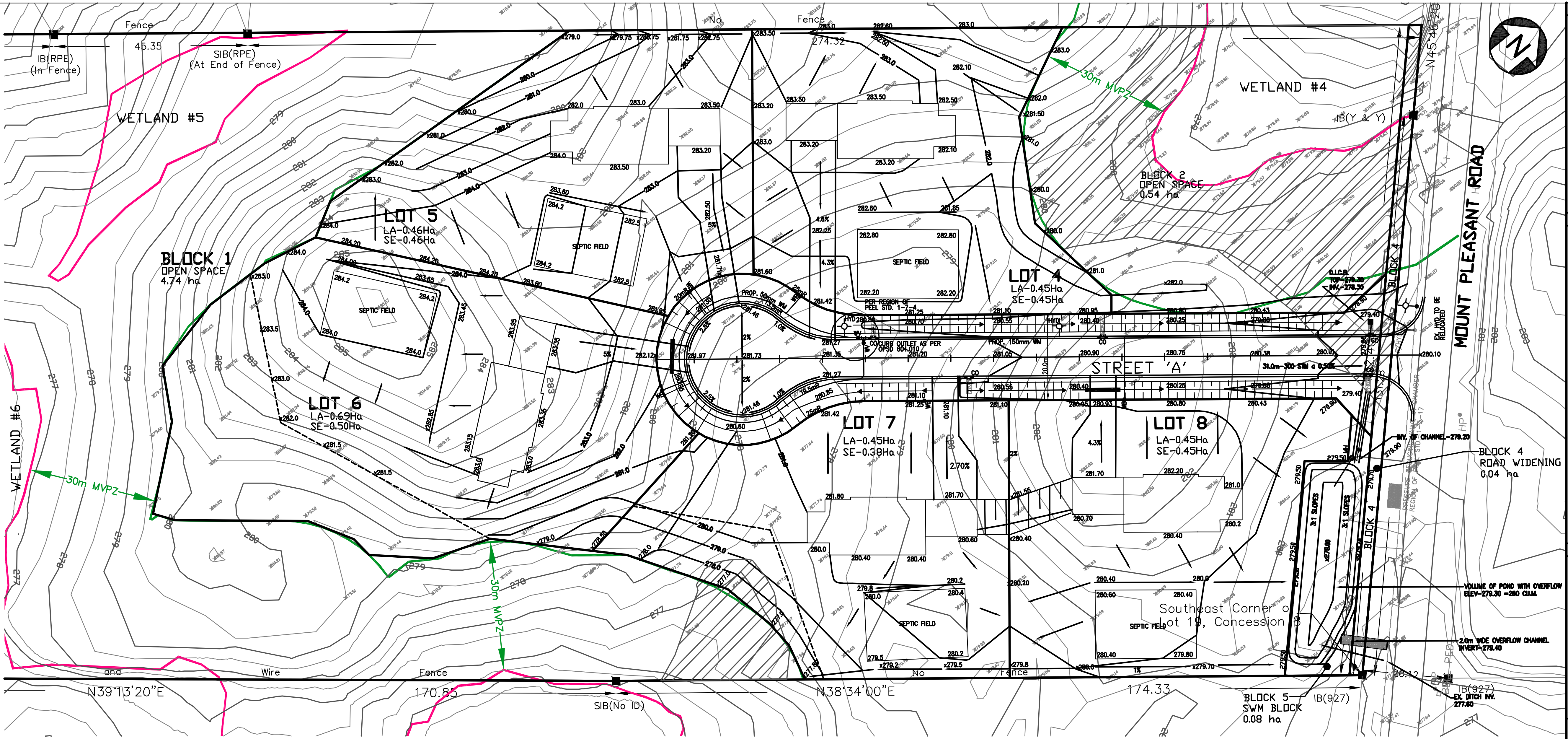
**Side Slope Factor (Z):** **4 :1**

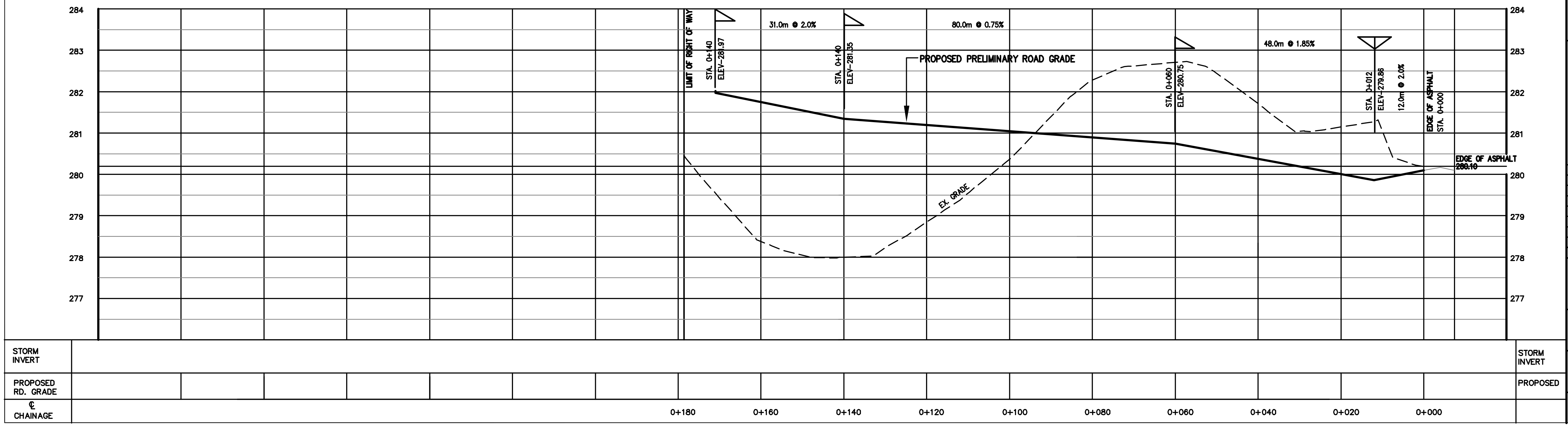
**Slope (s):** **1.850%**

**Roughness (n):** **0.040**

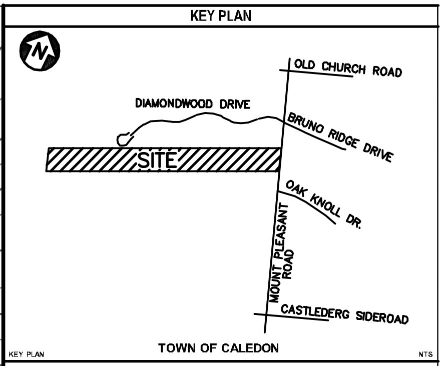
| **Depth (m)** | **Flow (l/s)** | Velocity (m/s) | Area A | Wet. Perim. P | Hydrl. Rad. R | Top Width T | Hydr. Depth D | Froude No. F | Type of Flow |
|---|---|---|---|---|---|---|---|---|---|
| **0.010** | **0.1** | 0.146 | 0.000 | 0.082 | 0.009 | 0.080 | 0.005 | 0.661 | *sub-critical* |
| **0.020** | **0.4** | 0.233 | 0.002 | 0.165 | 0.018 | 0.160 | 0.010 | 0.742 | *sub-critical* |
| **0.030** | **1.1** | 0.305 | 0.004 | 0.247 | 0.027 | 0.240 | 0.015 | 0.794 | *sub-critical* |
| **0.040** | **2.4** | 0.369 | 0.006 | 0.330 | 0.036 | 0.320 | 0.020 | 0.833 | *sub-critical* |
| **0.050** | **4.3** | 0.428 | 0.010 | 0.412 | 0.045 | 0.400 | 0.025 | 0.865 | *sub-critical* |
| **0.060** | **7.0** | 0.484 | 0.014 | 0.495 | 0.054 | 0.480 | 0.030 | 0.892 | *sub-critical* |
| **0.070** | **10.5** | 0.536 | 0.020 | 0.577 | 0.063 | 0.560 | 0.035 | 0.915 | *sub-critical* |
| **0.080** | **15.0** | 0.586 | 0.026 | 0.660 | 0.072 | 0.640 | 0.040 | 0.936 | *sub-critical* |
| **0.090** | **20.5** | 0.634 | 0.032 | 0.742 | 0.080 | 0.720 | 0.045 | 0.954 | *sub-critical* |
| **0.100** | **27.2** | 0.680 | 0.040 | 0.825 | 0.089 | 0.800 | 0.050 | 0.971 | *sub-critical* |
| **0.150** | **80.2** | 0.891 | 0.090 | 1.237 | 0.134 | 1.200 | 0.075 | 1.039 | *super-critical* |
| **0.200** | **172.7** | 1.079 | 0.160 | 1.649 | 0.179 | 1.600 | 0.100 | 1.090 | *super-critical* |
| **0.250** | **313.2** | 1.253 | 0.250 | 2.062 | 0.224 | 2.000 | 0.125 | 1.131 | *super-critical* |
| **0.300** | **509.2** | 1.415 | 0.360 | 2.474 | 0.268 | 2.400 | 0.150 | 1.166 | *super-critical* |
| **0.350** | **768.2** | 1.568 | 0.490 | 2.886 | 0.313 | 2.800 | 0.175 | 1.196 | *super-critical* |
| **0.400** | **1,096.7** | 1.714 | 0.640 | 3.298 | 0.358 | 3.200 | 0.200 | 1.223 | *super-critical* |
| **0.450** | **1,501.4** | 1.854 | 0.810 | 3.711 | 0.402 | 3.600 | 0.225 | 1.248 | *super-critical* |
| **0.500** | **1,988.5** | 1.988 | 1.000 | 4.123 | 0.447 | 4.000 | 0.250 | 1.270 | *super-critical* |
| **0.550** | **2,563.9** | 2.119 | 1.210 | 4.535 | 0.492 | 4.400 | 0.275 | 1.290 | *super-critical* |







## KEY PLAN



## LEGEND

| | |
|---|---|
| x280.79 | EX. ELEVATION |
| 279.90 | PROP. ELEVATION |
| 🟥 | KEY NATURAL HERITAGE FEATURE |
| 🟩 | KEY NATURAL HERITAGE FEATURE 30m MINIMUM VEGETATION PROTECTION ZONE (MVPZ) |
| ▨ | ENVIRONMENTAL ZONE 2 |

## GENERAL NOTES

1. THE INFORMATION SHOWN HEREIN IS PRELIMINARY AND SUBJECT TO DETAIL DESIGN.
2. CONTOURS GENERATED FOR ORTHOPHOTOGRAPHY DEVELOPED IN THE SPRING OF 2002 AND SURVEYED ELEVATIONS BY CALDER ENGINEERING LTD. (2017) AND EPLETT WOROBEC RAIKES SURVEYING LTD. (2015). ACTUAL ELEVATIONS MAY VARY FROM THOSE SHOWN.
3. EZ2 ZONE LIMITS INFERRED FROM INFORMATION PROVIDED BY AZIMUTH ENVIRONMENTAL CONSULTANTS INC. DATED NOVEMBER 2016.

**Calder Engineering Ltd.**
T 905-857-7600 E calder@caldereng.com W www.caldereng.com

DESIGNED BY

APPROVED BY

| Nº | Date | Revisions | Dwn. | Dsg'd. | Chk'd. |
|---|---|---|---|---|---|
| Ⓐ | 15/MAR/2017 | ISSUED FOR GENERAL COORDINATION | KNC | DH | RJW |

Client:

LAURELPARK INC.

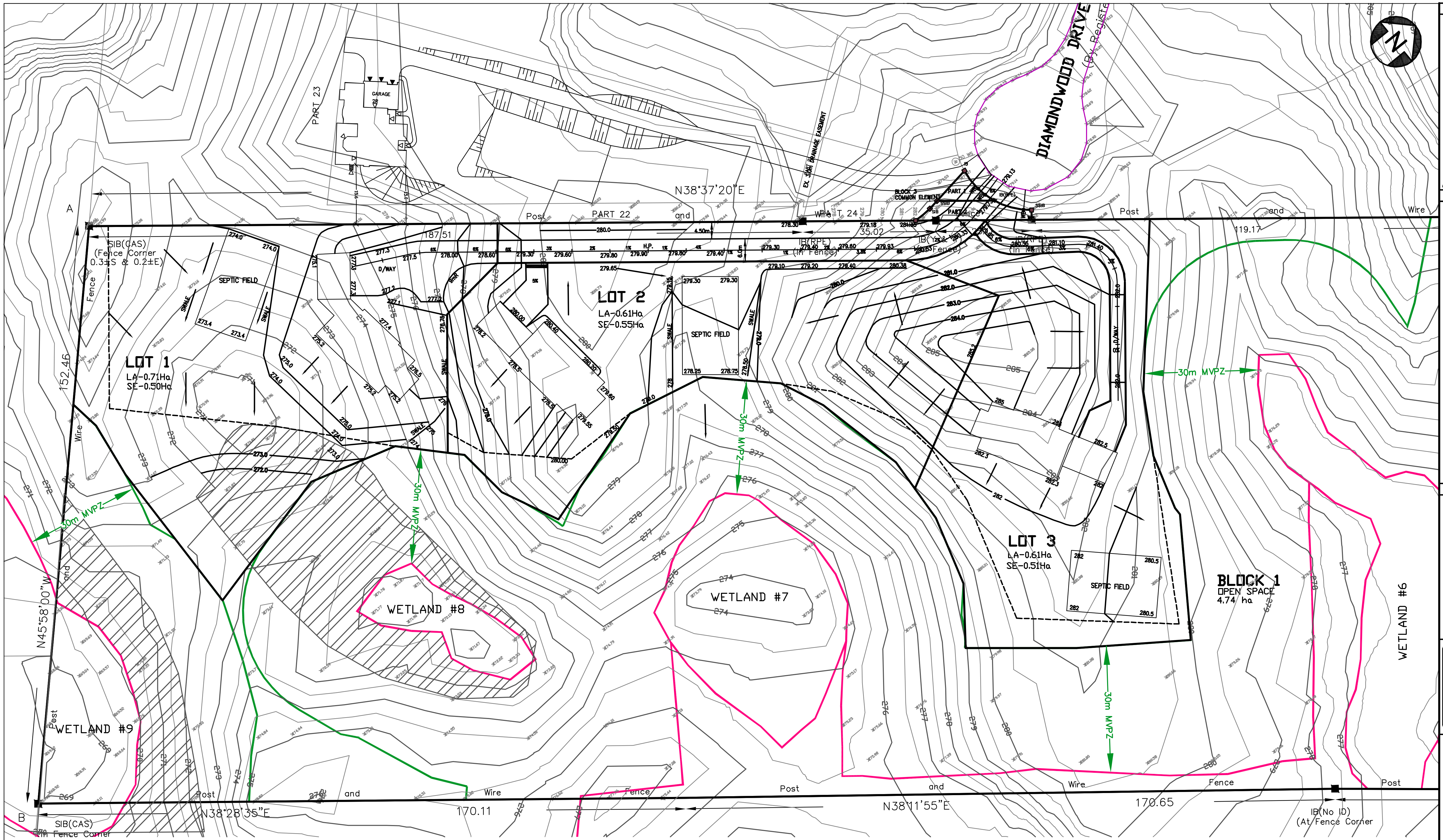
Project Name:

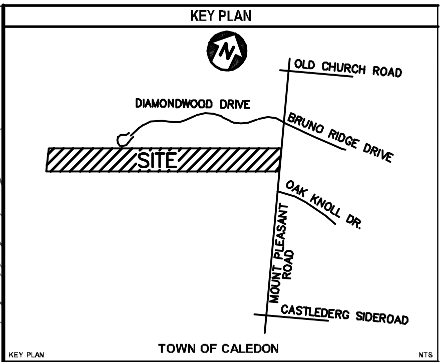
LAURELPARK SUBDIVISION
PART OF EAST HALF OF LOT 19, CONCESSION 8
TOWN OF CALEDON, REGION OF PEEL

Title Name:

PRELIMINARY GRADING PLAN
SHEET 1 OF 2

Drawing Nº: 16-168-A-1
Sheet Nº: 1 OF 2
Scale: H 1:500 V 1:50
Rev. Nº: Ⓐ





## LEGEND

| | |
|---|---|
| 280.79 | EX. ELEVATION |
| 279.90 | PROP. ELEVATION |
| 🟥 | KEY NATURAL HERITAGE FEATURE |
| 🟩 | KEY NATURAL HERITAGE FEATURE 30m MINIMUM VEGETATION PROTECTION ZONE (MVPZ) |
| ▨ | ENVIRONMENTAL ZONE 2 |

## GENERAL NOTES

1. THE INFORMATION SHOWN HEREIN IS PRELIMINARY AND SUBJECT TO DETAIL DESIGN.
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**Calder Engineering Ltd.**
T 905-857-7600 E calder@caldereng.com W www.caldereng.com

DESIGNED BY

APPROVED BY

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| Ⓐ | 15/MAR/2017 | ISSUED FOR GENERAL COORDINATION | KNC | DH | RJW |
| N° | Date | Revisions | Dwn. | Dsg'd. | Chk'd. |

Client:

LAURELPARK INC.

Project Name:

LAURELPARK SUBDIVISION
PART OF EAST HALF OF LOT 19, CONCESSION 8
TOWN OF CALEDON, REGION OF PEEL

Title Name:

PRELIMINARY GRADING PLAN
SHEET 2 OF 2

Drawing N°: 16-168-A-2
Sheet N°: 2 OF 2
Scale: 1:500
Rev. N°: Ⓐ