190-216 Arkell Road
Guelph, Ontario

Preliminary
Stormwater Management Report

Project Location:

190 - 216 Arkell Road
Guelph, Ontario

Prepared for:

Crescent Homes
3-180 Frobisher Drive
Waterloo, ON N2V 2A2

Prepared by:

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October 10, 2018
Revised: April 7, 2020

MTE File No.: 42063-104

Engineers, Scientists, Surveyors.

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1.0 Introduction

1.1 Overview

MTE Consultants Inc. (MTE) was retained by Crescent Homes to prepare a Functional Servicing Report in support of a Draft Plan of Subdivision Application. The lands that comprise the Draft Plan of Subdivision are made up of a number of properties, including: 190, 202, 210, and 216 Arkell Road, located in the City of Guelph. These lands are herein referred to as the 'subject lands.'

The subject lands are approximately 2.58ha. Refer to **Figure 1.1** for the location of the subject lands. The proposed development plans for the site include a residential subdivision with 24 townhouse units fronting onto a municipal right-of-way, two stacked townhouse condominium blocks, a park block, and a stormwater management (SWM) block. The proposed right-of-way will connect the existing Dawes Avenue northeast of the subject lands and to Arkell Road at its intersection with Summerfield Drive. Refer to the Draft Plan of Subdivision prepared by MHBC, dated March 18, 2020, in **Appendix A** for more details. Approximately one-third of the site cannot be developed due to the existing wetland and its setbacks.

This report presents stormwater quality, quantity, and erosion control measures that are proposed to be provided for the development. This report should be read in conjunction with the *190-216 Arkell Road – Functional Servicing Report*, prepared by MTE (April 7, 2020).

1.2 Background Information

The original Stormwater Management Report, prepared by MTE and dated October 10, 2018, was submitted to the City of Guelph (City) as part of Draft Plan approval process. After discussions with City staff, it was determined that the proposed road connections through the site would establish a municipal right-of-way, thereby warranting a Draft Plan of Subdivision Application. As such, various departments within the City have reviewed the original submission and provided comments to be addressed prior to Draft Plan approval.

1.3 Purpose of Study

The purpose of this report is to address the City comments and develop a comprehensive stormwater management strategy for the current development proposal that is acceptable to the City, the Grand River Conservation Authority (GRCA), and the Ministry of the Environment, Conservation and Parks (MECP).

1.4 Objectives

The objective of this stormwater management plan is to ensure that the proposed development includes the necessary controls to protect the hydrology and water quality of the receiving water systems. Furthermore, this plan also ensures that the proposed Draft Plan of Subdivision provides the necessary blocks and corridors for stormwater management measures. The primary objectives of this study are as follows:

- Establish criteria for the management of stormwater runoff from the study area;
- Recommend a comprehensive plan for controlling the quality and quantity of stormwater runoff from the study area;

- Perform a monthly infiltration and water balance to analyse the effect of the development on local water systems; and
- Prepare preliminary designs for the recommended stormwater management infrastructure.

2.0 Existing Conditions and Background Information

2.1 Topographical Information

The subject lands consist of approximately 2.70ha and are generally bounded by an existing wetland to the northwest, an existing residential development to the northeast, the Arkell Road right-of-way to the southeast, and an existing single family residential property to the southwest. The subject lands are legally described as Part of Lot 6, Puslinch Concession 8 in the City of Guelph. They are currently comprised of four residential properties. Municipal addresses for the individual lots are 190, 202, 210, and 216 Arkell Road. The existing homes will be vacated and demolished prior to development.

MTE conducted a detailed topographical survey of the subject lands in November 2016. Existing site conditions and topography for the subject lands are shown in **Figure 2.1**, as well as the enclosed **MTE Drawing 42063-104-EC1.1**.

The subject lands are relatively flat, with slopes generally ranging from 0.5% to 1.5%. Existing elevations within the lands range from 333.3m along the wetland boundary to approximately 335.0m along Arkell Road. Under pre-development conditions, surface runoff from the site flows northwesterly towards the wetland complex.

2.2 Pre-Development Conditions

The subject lands are located within the Torrance Creek Subwatershed. The western portion of the property is comprised of the Torrance Creek Wetland, which lies at the headwaters of a tributary to Torrance Creek. Approximately one-third of the northerly portion of the site either lies within the wetland complex or within the required 30.0m wetland setback.

As previously mentioned, the majority of the site is internally drained and surface runoff flows northwesterly from Arkell Road to the wetland feature. **Figure 2.2** provides an illustration of the pre-development catchment areas.

Based on existing conditions, the site was modelled as three separate catchments using the MIDUSS hydrologic modelling program. **Table 2.1** provides a brief description of the catchments and the design parameters used in the hydrologic modelling.

Hydrologic modelling details and results are further discussed in Section 5. A detailed copy of the pre-development catchment parameters and MIDUSS modelling output logs has been included in **Appendix B**.

Table 2.1 – Pre-Development Catchment Parameters

Catchment	Description	Area (ha)	% Impervious	Flow Length (m)	Slope (%)
101	Existing Residential Properties and Arkell Road boulevard	1.771	16.0	150.0	1.0
102	External Embankment (Dawes Ave.)	0.062	0.0	25.0	25.0
103	Existing Wetland and 30.0m Setback	0.862	0.0	90.0	1.0
	Total	**2.70**	**10.5**	**-**	**-**

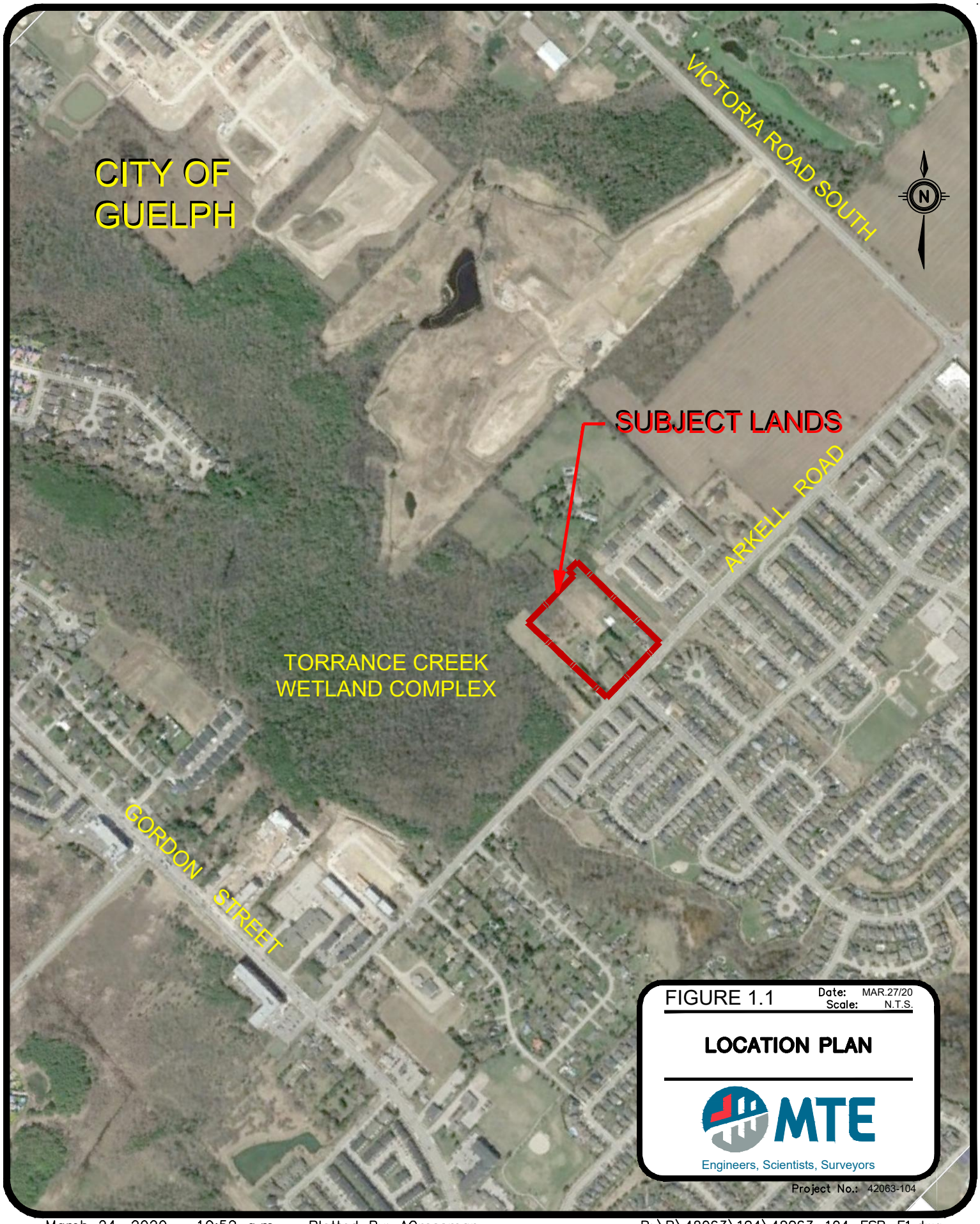

FIGURE 1.1

Date: MAR.27/20
Scale: N.T.S.

LOCATION PLAN

MTE
Engineers, Scientists, Surveyors

Project No.: 42063-104

March 24, 2020 — 10:52 a.m. — Plotted By: ACressman

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DAWES AVENUE

EXISTING SWM POND

EXISTING RESIDENTIAL

Ex. Asphalt Laneway

Ex. Asphalt Laneway

Ex. CL Road

APPROX. LOCATION OF 40.0m x 3.0m x 1.0m DEEP INFILTRATION GALLERY

Ex. 400ø WM (Approx. Location)

Ex. 200mmø SAN.

Ex. 200mmø SAN.

Ex. 200ø WM

Ex. 400ø WM (Approx. Location)

Ex. 200mmø SAN.

Ex. 400ø WM (Approx. Location)

Ex. 200mmø SAN.

Ex. 200ø WM

Ex. DCB T/G=337.50

Ex. WV

Ex. MH T/G=337.80

Ex. MH T/G=337.65

Ex. DCB T/G=337.47

Ex. MH T/G=337.79

Ex. MH T/G=337.90

Ex. MH T/G=335.43

Ex. MH T/G=335.01

Ex. MH T/G=334.91

Ex. MH T/G=334.84

Ex. MH T/G=334.79

335.0
334.5
334.0
336.5
336.0
335.5
333.5
333.0

MW4
Piezometer Elev.=333.
Mon Well Elev.=334.

[MP1-19]
Piezometer
Elev.=334.48

BH6
BH Elev.=333.996

[MW106-19]
Piezometer
Elev.=334.80

MW5
Piezometer Elev.=334.826
Mon Well Elev.=334.970

[MW105-19]
Piezometer
Elev.=334.76

MW2
Piezometer Elev.=335.041
Mon Well Elev.=335.160

[MW101-19]
Piezometer
Elev.=335.83

BH1
BH Elev.=334.559

MW
Mon Well Elev.=334.415
Piezometer Elev.=334.312

30m WETLAND SETBACK

15m WETLAND SETBACK

LIMIT OF WETLAND (APPROX.)

LEGEND

- SITE BOUNDARY
- LIMIT OF WETLAND
- 15m WETLAND SETBACK
- 30m WETLAND SETBACK
- 334.5 EXISTING CONTOUR
- EXISTING DIRECTION OF DRAINAGE
- EXISTING DRIPLINE
- EXISTING BUILDING
- EXISTING FENCE
- BOREHOLE
- MONITORING WELL

FIGURE 2.1

Date: JAN.10/20
Scale: 1:750

EXISTING CONDITIONS PLAN

MTE
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Project No.: 42063-104

March 30, 2020 — 4:35 p.m. — Plotted By: ACressman

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DAWES AVENUE

EXISTING SWM POND

ARKELL ROAD

SUMMERFIELD DRIVE

EXISTING RESIDENTIAL

Ex. Asphalt Laneway

102
0.062

101
1.771

103
0.862

30m WETLAND SETBACK

15m WETLAND SETBACK

LIMIT OF WETLAND (APPROX.)

APPROX. LOCATION OF 40.0m x 3.0m x 1.0m DEEP INFILTRATION GALLERY

Ex. 400ø IM (Approx. Location)

Ex. 200mmø SAN.

Ex. 200mmø WM

Ex. MH T/O=335.43

Ex. MH T/O=335.01

Ex. MH T/O=334.91

Ex. MH T/O=334.94

Ex. MH T/O=334.79

Ex. DCB T/O=337.50

Ex. MH T/O=337.80

Ex. MH T/O=337.65

Ex. DCB T/O=337.47

Ex. MH T/O=337.78

Ex. MH T/O=337.90

Ex. WV

Ex. WM

Ex. DCB

LEGEND

- SITE BOUNDARY
- LIMIT OF WETLAND
- 15m WETLAND SETBACK
- 30m WETLAND SETBACK
- 334.5 EXISTING CONTOUR
- EXISTING DRIPLINE
- EXISTING DIRECTION OF DRAINAGE
- CATCHMENT AREA
- 101 / 1.715 — SUB-CATCHMENT NUMBER / AREA (ha.)

FIGURE 2.2

Date: JAN.10/20
Scale: 1:750

PRE-DEVELOPMENT CATCHMENT AREAS

MTE
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Project No.: 42063-104

March 30, 2020 — 4:35 p.m. — Plotted By: ACressman

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2.3 Geotechnical Information

A geotechnical investigation for the property was carried out by Peto MacCallum Ltd. (Peto) in 2017. A total of six (6) boreholes were advanced to depths of approximately 6.6m - 8.1m. A final version of their report, entitled *Geotechnical Investigation Proposed Arkell Road Subdivision* dated October 1, 2018, was prepared. The assessment made recommendations pertaining to the site grading, road pavement structure, stormwater management facilities, and general house construction.

Based on the results of Peto's geotechnical investigation, the subsurface stratigraphy of the site generally consists of topsoil and some localized fill overlying native deposits of silt, sand, and gravel. A thick (~3.6m) layer of silt was encountered 2.2m below existing grades on the easterly portion of the site. For further geotechnical information, refer to Peto's geotechnical investigation in **Appendix F**.

2.4 Hydrogeological Information

A hydrogeological investigation was conducted by MTE starting in 2017. Monitoring wells were installed in four of the boreholes which were previously advanced by Peto.

MTE has conducted continuous groundwater monitoring since March of 2017. The highest groundwater elevations were observed in April of 2017 and ranged from an elevation of 334.0m in the northern portion of the site (MW4) to 333.2m in the southern portion of the site (MW2). These elevations represent depths of 0.9m above existing grade at MW4 and 1.1m below existing grade at MW2. The measured groundwater elevations indicate that the shallow groundwater flows from the north to the south (i.e. away from the wetland). For further hydrogeological information, refer to MTE's *190-216 Arkell Road Final Hydrogeological Investigation*, dated October 5, 2018, as well at the technical memo *Update to Hydrogeological Investigation Report as per City of Guelph Comments* dated January 9, 2020.

City of Guelph standards specify that the seasonal high groundwater elevation must maintain at least a 0.5m separation from the finished basement floor elevations. MTE has set the basement floor elevations above the seasonal high groundwater to achieve this separation. Please refer to **Appendix G** for a figure depicting the subject lands' composite high groundwater contours.

3.0 Stormwater Management Criteria

New developments are required to provide stormwater management in accordance with provincial and municipal policies. Relevant documents have been referenced in the design of the stormwater management plan for the subject site; including:

- GRCA Policies for the Administration of Ontario Regulation 150/06 (GRCA, 2015);
- Stormwater Management Planning and Design Manual (MOE, 2003);
- The Torrance Creek Subwatershed Study (TCSS) Management Strategy (GRCA, 1999);
- Design Principles for Stormwater Management (City of Guelph, 1996); and
- The City of Guelph's Development Engineering Manual (City of Guelph, 2019).

Based on the above policies and relevant documents, background reports, agency requirements, and site specific considerations, the following stormwater management criteria have been established for this study area:

- **Water Quality** – Provide an Enhanced (MOE, 2003) level of stormwater quality treatment prior to discharge to surface or groundwater systems.
- **Water Quantity and Erosion Control** – Control the peak flow rates for all storms up to and including the 100-year storm event to the allowable pre-development rates; preserve hydraulic and hydrologic functions. Provide erosion control by maintaining existing flow duration characteristics.
- **Water Balance**
  Infiltration – Maintain or exceed target groundwater volume inputs established within the TCSS through active and/or passive infiltration measures.

  Surface Water – Maintain existing surface water volume inputs into significant environmental features.

A brief discussion of each of these criteria is included in the following subsections.

3.1 Water Quality Control

The City's Engineering Design Guidelines and the TCSS state that all new developments shall provide an Enhanced (Level 1) level of quality treatment. The requirements for this level of quality control are established in Table 3.2 of the *Stormwater Management Planning and Design Manual* (MOE, 2003). The TCSS also identifies a water management objective of minimizing impacts to the receiving waterbody by establishing additional quality targets for development within the subwatershed, as follows:

- **Nutrients** – Total phosphorus should be 30ug/L or less; the use of grassed swales and buffer strips for direct drainage will reduce suspended solids and nutrients;
- **Dissolved Oxygen** – Dissolved oxygen (DO) concentration should not be less than 4mg/L during summer months. Reduction of temperature and nutrient concentrations will improve DO levels. Aeration of direct runoff may also be helpful; and
- **Temperature** – Temperatures within Torrance Creek should be below 25°C. New developments can mitigate temperature increases by maximizing infiltration, minimizing the use of surface ponds, and using underground drainage elements before discharging to surface water.

3.2 Water Quantity and Erosion Control

The primary objective of quantity control is to maintain hydraulic and hydrologic functions from existing conditions with regards to both surface and subsurface flows. As such, the Subwatershed Plan requires future development within the Torrance Creek Subwatershed to maintain post-development peak flows at existing levels for all storms up to and including the 100-year event. For the purpose of this analysis, controls for the Regional storm event will also be included. Furthermore, existing major flow paths are to be maintained to provide overland flow under major flood events.

The proposed erosion controls should provide at least a 24-hour drawdown period for the 25mm storm event, if necessary (given infiltration levels and water quality requirements), as established by the TCSS. This will ensure that the threshold flow duration will not exceed pre-development levels.

3.3 Water Balance

3.3.1 Infiltration to Groundwater

The City requires that Low Impact Design (LID) best management practices be used to mimic pre-development recharge rates. SWM measures such as bioswales, infiltration galleries, and buffer strips can be implemented, where required, to assist in to promotion of groundwater recharge. Additionally, simply increasing the amount of pervious landscaped areas throughout the subject lands will improve groundwater recharge by means of passive infiltration.

The TCSS divided the subwatershed into three stormwater management areas, with respect to groundwater recharge, and established specific infiltration targets for each. The subject lands fall within Area 2 (Arkell Road to Torrance Creek) and a minimum infiltration target of 150mm/year is recommended. Baseflow enhancement is encouraged on lands within this zone, especially if they are close to the creek.

3.3.2 Surface Runoff

The City requires a monthly surface runoff water balance analysis to maintain existing surface water volume inputs into significant environmental features (ie. the wetland).

3.4 Monitoring

As per the TCSS, both the performance of the proposed SWM facility and its effect on the adjacent wetland and shallow groundwater table must be monitored.

3.4.1 Facility Monitoring

Upon completion of construction, the SWM facility is to be inspected to ensure conformance to the design. Upon confirmation from Municipal staff that the facility is acceptable, it will be monitored for a period of 2 years under the ownership of the developer to confirm the performance of the facility meets the quantity and quality targets. Upon completion of the monitoring program, a monitoring report shall be submitted to the Municipality for approval prior to the assumption of the facility.

The SWM facility will be monitored for peak flow rates and flow durations, water levels and drawdown times, pollutant removal efficiency, and the quality/toxicity of the water discharging to the wetland complex. The facility shall also be monitored to determine how quickly sediment accumulates within the proposed oil/grit separator (OGS) unit and dry pond.

The facility performance should be compared to the theoretical (design) performance and any aberrations should be noted. Remedial action will be required if facility performance does not meet minimum requirements.

3.4.2 Groundwater Monitoring

Groundwater levels and quality shall be monitored. MTE has completed over 2 years of continuous monitoring of the groundwater levels; which will form the basis against which post-construction levels will be compared. It is recommended that groundwater samples be collected and tested for quality to provide a basis against which post-construction quality results may be compared. Post-construction quality samples should be taken from the shallow groundwater downstream of the SWM facility.

3.4.3 Wellhead Protection

The subject property is located near the City's Burke Well. Due to its close proximity, the southwestern portion of the subject lands fall within the well's 100.0m capture zone. As such, this area has been assigned a Wellhead Protection Area vulnerability score of 10. The remainder of the site; located outside of the 100.0m capture zone, is assigned a vulnerability score of 6 to 8. Therefore, it can be concluded that surface runoff and infiltrated runoff generated from the subject lands may need to be properly managed in order to protect the surrounding surface water and groundwater quality.

During the detailed design stage of development, as well as during the respective Site Plan Application processes of the two condominium blocks, adequate measures may need to be implemented to satisfy the criteria set forth by the Drinking Water Source Protection Program. An example of such measures would be to include a liner, either synthetic or clay, to protect the base of the SWM facility. This liner would serve to prevent chloride laden stormwater, present in the dry pond, from infiltrating directly to the groundwater below. Additionally, salt application and snow storage plans may need to include specific strategies to minimize adverse effects to the groundwater supply. In more severe cases, additional measures may include strict restrictions on specific land uses, construction or operational activities, or the use and storage of certain materials.

4.0 Proposed Development and SWM Strategy

4.1 Proposed Area Grading

The grading design of the site was controlled by many factors, which include: servicing constraints (both sanitary and storm), matching existing and proposed boundary grades around the perimeter of the property, ensuring major storm event overland flows are directed towards the existing road right-of-ways and to the proposed SWM facility, minimizing impacts to the adjacent environmental feature, as well as, reducing the cut/fill deficit for the development. A preliminary finished grade contour plan illustrating site grading, **MTE Drawing 42063-104-AG1.1** is enclosed.

The Draft Plan of Subdivision includes two multi-residential stacked townhome development blocks. For the purpose of this report, their current conceptual designs have been incorporated into the overall SWM strategy for the subject lands. This will allow SWM criteria to be established for the two blocks and provide flow targets to which the blocks' respective SPA processes will have to adhere. An interim grading scheme (i.e. excluding the proposed conceptual blocks) will capture as much surface runoff as possible in order to try and match the projected outcome from the ultimate build-out conditions.

4.2 Post-Development Conditions

The proposed SWM plan implements a dry pond SWM facility with a "treatment train" pre-treatment approach designed to accommodate stormwater runoff from the majority of the developed portions of the subject lands. The plan has been designed to meet the criteria presented in Section 3.0 of this report. An overview of the stormwater management plan is discussed below.

The proposed development lands are comprised of residential land uses, a park block, a road right-of-way and a proposed SWM facility block. Blocks 1 and 2 will be developed through respective Site Plan Application processes and will require SWM Briefs, as well as grading and servicing designs in support of SPA. This information will identify the stormwater management criteria for the block and how the stormwater control measures will adhere to the Draft Plan of Subdivision SWM criteria as established in this report.

The location of the proposed SWM facility, along with contributing drainage areas, is illustrated in **Figure 4.1**. Minor storm runoff from the controlled portions of the contributing areas will be conveyed through the proposed storm sewer system to the proposed SWM facility. Excess runoff from the major storms will flow overland to the SWM facility via the proposed right-of-way and designated overland flow routes. Refer to MTE's *190-216 Arkell Road Functional Servicing Report*, dated April 7, 2020, for further details of the storm sewer network.

The proposed SWM facility will utilize a dry pond design. Prior to releasing into the dry pond, flows will go through an upstream OGS unit and an enhanced dry swale. These measures will provide quality and quantity control of runoff prior to discharge into the adjacent Torrance Creek wetland. The contributing drainage area to the SWM facility (1.20ha) is separated into four catchments, and are described below (catchments 201 to 204).

Under post-development conditions, the subject lands were delineated into ten catchments. **Table 4.1** provides a brief description of each catchment area as well as the design parameters used in the hydrologic modelling. A detailed copy of the post-development catchment parameters and MIDUSS modelling output logs has been included in **Appendix C**.

Table 4.1 – Post-Development Catchment Parameters

Catchment	Description	Area (ha)	% Impervious	Flow Length (m)	Slope (%)
201	Street A + Street-fronting Townhomes	0.658	79.0	45.0	0.7
202	Block 1	0.263	85.0	30.0	2.0
203	Block 2	0.071	90.0	15.0	2.0
204	SWM Facility + adjacent embankments	0.207	80.0	10.0	5.0
205-1	Uncontrolled embankment to Arkell Road infiltration gallery	0.090	11.0	20.0	2.0
205-2	Uncontrolled embankment to Arkell Road, ultimately to wetland	0.134	35.0	35.0	4.0
206	Uncontrolled park + embankments to culvert/wetland	0.185	0.0	100.0	0.8
207	Uncontrolled rear yards to wetland	0.222	0.0	10.0	5.0
208	Torrance Creek wetland	0.862	0.0	90.0	1.0
	Total	**2.69**	**38.3**		

For the most part, stormwater runoff will drain internally through the use of constructed drainage swales and the proposed storm sewer network. However, it should be noted that runoff from a small portion of the subject lands will flow uncontrolled to the Arkell Road right-of-way. Based on an existing high point along Arkell Road; near the southwestern corner of the driveway entrance to the 202 Arkell Road property, the aforementioned runoff will be directed to two separate locations. On the eastern side of this high point (catchment 205-1), flow will be directed to the existing storm sewer network fronting 210 and 216 Arkell Road. This section of storm sewer is connected to an existing 40.0m long x 3.0m wide x 1.0m deep infiltration gallery located in the boulevard adjacent to the Arkell Meadows subdivision SWM facility. On the western side of the high point (catchment 205-2), flow will be directed to an existing side inlet catchbasin approximately 155.0m away, through a stone energy dissipator, and eventually into the Torrance Creek wetland complex. As such, flow generated from uncontrolled portions of the subject lands will ultimately contribute to recharging surface water inputs to the wetland feature and subsurface water inputs to the local groundwater table.

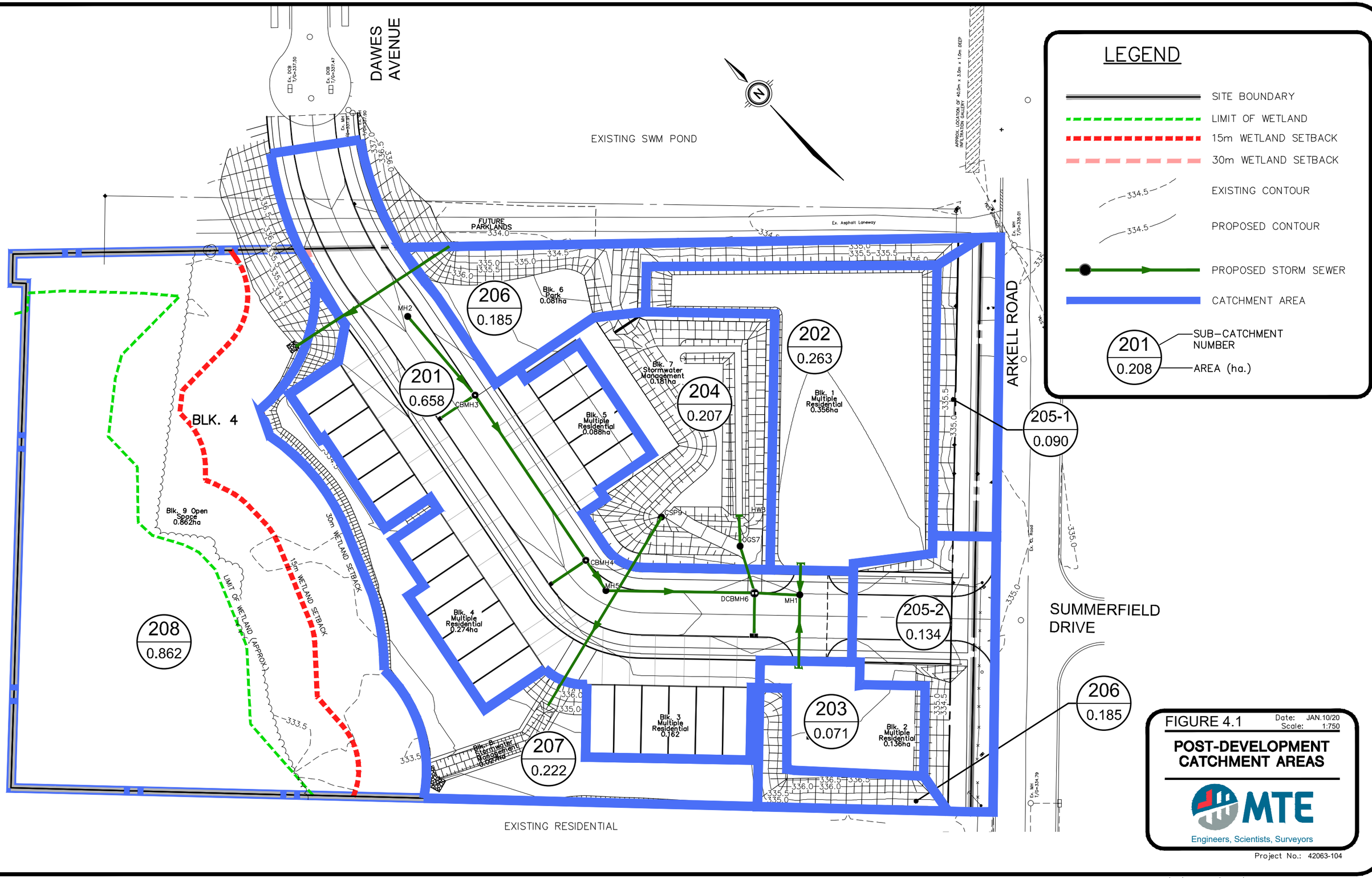

FIGURE 4.1

Date: JAN.10/20
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POST-DEVELOPMENT CATCHMENT AREAS

MTE
Engineers, Scientists, Surveyors

Project No.: 42063-104

April 7, 2020 — 6:50 p.m. — Plotted By: ACressman

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5.0 Stormwater Management Design

5.1 Hydrologic Modelling

As previously noted, a post-development hydrologic model was constructed, using the MIDUSS modelling software, to reflect the detailed drainage conditions proposed for the subject lands. This allows for the quantitative estimate of flows under the proposed development conditions. The proposed development conditions were modelled for the:

- Quality storm event (25mm depth, 4-hour Chicago distribution);
- 2, 5, 10, 25, 50, and 100-year return period rainfall events (3-hour Chicago distribution derived from the City's Intensity-Duration-Frequency (IDF) parameters); and
- Regional storm event (285mm depth, 48-hour Hurricane Hazel).

The IDF parameters, hydrologic parameters, and MIDUSS model output files for each of the pre- and post-development catchment areas are provided in **Appendix B** and **Appendix C**, respectively.

5.2 Water Quality

The proposed SWM scheme has been designed using a 'treatment train' approach. An OGS unit will be utilized to provide pre-treatment to runoff prior to discharging flows to the SWM facility. The facility will also incorporate a 50.0m long enhanced grass swale with a check dam which will offer benefits of dilution and settling of sediment prior to discharging flows to the dry pond cell. A planting scheme will be prepared that carefully selects plant species and their location in and around the pond and swale to stabilize banks, mitigate temperature increases, deter waterfowl from nesting within the area, and provide aesthetics and safety benefits.

Since the majority of annual rainfall occurs in storms less than or equal to a 25mm event, the majority of water borne sediment is also transported to the SWM facility in these less intense events.[1] Therefore, the OGS unit and enhanced grass swale are designed targeting the smaller flows.

The OGS unit is designed to treat runoff from minor events (i.e. events ≤ 25mm) before releasing flows to the SWM facility. Flows from events greater than the 25mm storm may by-pass the OGS unit. Per the City's standards, the proposed OGS (model EF6) unit has been verified by the Canadian Environmental Technology Verification Program and has been sized to provide at least 60% TSS removal. A detailed sizing report for the OGS unit is included in **Appendix D**.

Enhanced grass swales have been observed to provide up to 76% TSS removal, as described in the Toronto and Region Conservation Authority's (TRCA) *Low Impact Development Stormwater Management Planning and Design Guide* (2010).

The enhanced grass swale has been designed within the recommended parameters outlined in the TRCA's report to provide adequate quality control prior to discharge into the dry cell. Therefore, the enhanced grass swale is designed to satisfy the following conditions:

- A design velocity of 0.5 m/s or less during the 25mm-4hr Chicago storm event;
- The swale should convey the locally required design storm (5-year) at non-erosive velocities;

[1] From MOE-1994, Figure C.1: 62% less than 5mm, 78% less than 10mm, 90% less than 15mm, 95% less than 25mm

- Longitudinal slope less than 1.0%; and
- Side slopes of 3:1 or less.

MTE believes this 'treatment train' approach will provide the required Enhanced (Level 1) quality treatment as required by the City of Guelph and the Ministry of the Environment, Conservation and Parks.

The total drainage area for the proposed facility is 1.20ha at 81.1% imperviousness. According to Table 3.2 from MOE's 2003 stormwater management guidelines, the constructed dry pond requires 229.7m^3/ha of active storage, resulting in a required active storage of 275.4 m^3 for the subject lands.

Since the proposed SWM facility is a dry pond design, active storage detention time calculations must be performed. Typical minimum drawdown for the active storage in a dry pond is 24 hours for the 25mm-4hr event. The drainage area towards the proposed SWM facility is considered small (< 8ha), so the minimum detention time required is 12 hours. As described in Section 4.6.2 of the MOE SWM manual, a minimum orifice size of 50mm is acceptable when the primary outlet is a perforated CSP riser. With a 50mm diameter orifice placed at the bottom of the pond as well as the other proposed controls, a drawdown time of 30.8 hours is achieved.

The proposed SWM facility design characteristics are summarized in **Table 5.1**. Refer to **Appendix D** for the relevant design sheets and calculations (e.g. catchment parameters, imperviousness calculations, stage-storage discharge relationships, drawdown calculations, etc.). Refer to **Figure 5.1** to **Figure 5.4** for details of the proposed SWM facility.

Table 5.1 – Water Quality Control Details

General	Facility Characteristics
Stormwater Management Facility Type	Dry Pond
Required MECP Water Quality Protection	Enhanced (Level 1)
Total Contributing Area	1.20ha
Imperviousness	81.1%
Bottom Elevation (Dry Pond)	334.10m
Storage	
Quantity and Erosion Control	
Drawdown Volume (based on 25mm-4hr event)	118m^3
Approximate Drawdown Time (based on 25mm-4hr event)	30.8 hours
Peak Release Rate (based on 25mm-4hr event)	0.018m^3/s
Outlet Controls	
1500mm diameter Perforated CSP Riser Manhole	
Orifice 1 Diameter	50mm Vertical
Orifice 1 Elevation	334.10m
Orifice 2 Diameter	200mm Vertical
Orifice 2 Elevation	334.30m
Emergency Overflow Weir (Bottom Length / Side Slope)	2.0m / 4:1
Emergency Overflow Weir Elevation	335.20m

LEGEND

- PROPERTY BOUNDARY
- 334.5 — FINISHED GRADE CONTOURS
- (336.00) x — PROPOSED SPOT ELEVATIONS
- ROCK CHECK DAM (RCD)
- MAJOR OVERLAND FLOW ROUTE
- MAINTENANCE ACCESS
- ARTICULATED CONCRETE BLOCK MAT
- PROPOSED STORM SEWER
- 30m WETLAND SETBACK

Ex. Asphalt Laneway

(334.01)EX

2.0m EMERGENCY OVERFLOW WEIR (SEE FIGURE 5.3)

ROCK CHECK DAM PER OPSD 219.211 TOP OF SPILLWAY=334.35

SECTION A–A

N.T.S.

50m ENHANCED GRASS SWALE @ 0.5%

Blk. 7 Stormwater Management 0.181ha

DRY POND

Blk. 1 Multiple Residential 0.356ha

Blk. 5 Multiple Residential 0.088ha

CSP9-1500mmØ
50mmØ ORIFICE
INV=334.10
200mmØ ORIFICE
INV=334.30
(SEE FIGURE 5.2)

43.9m–375mmø STM. @ 0.50%

HW8
CONCRETE HEADWALL
PER OPSD 804.030
INV=334.350

7.4m–525mmø STM. @ 0.60%

10.5m–525mmø STM. @ 0.60%

6.9m–375mmø STM. @ 0.50%

32.8m–450mmø STM. @ 0.50%

8.0m–375mmø STM. @ 0.70%

50.4m–450mmø STM. @ 0.60%

10.0m–450mmø STM. @ 0.50%

16.1m–300mmø STM. @ 0.50%

CBMH4 · CB4.1 · CB3.1 · MH5 · DCBMH6 · MH1 · DCB6.1 · CSP9 · HW8 · OGS7

Ex. 300mmø STM.

Ex. CB · Ex. EP · Ex. HP · Ex. RS · Fd. SIB · Ex. Bell Ped · Ex. WV · SHRUB · Ex. CL Road

ARKELL ROAD

FIGURE 5.1

Date: MAR.27/20
Scale: 1:400

190-216 ARKELL ROAD

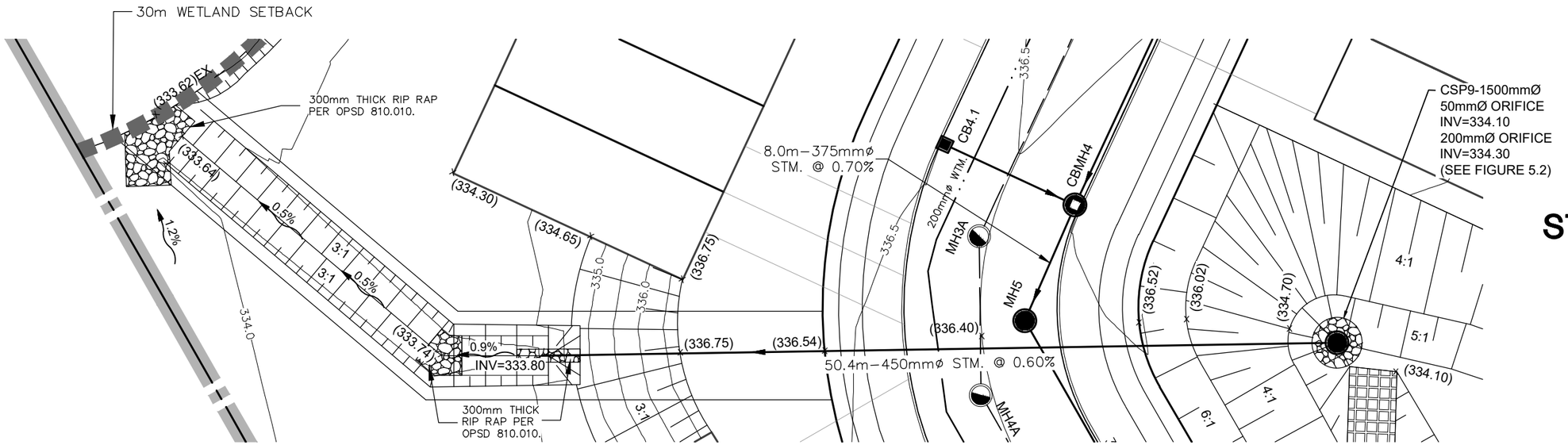
SWM FACILITY PLAN

MTE
Engineers, Scientists, Surveyors

Project No.: 42063-104

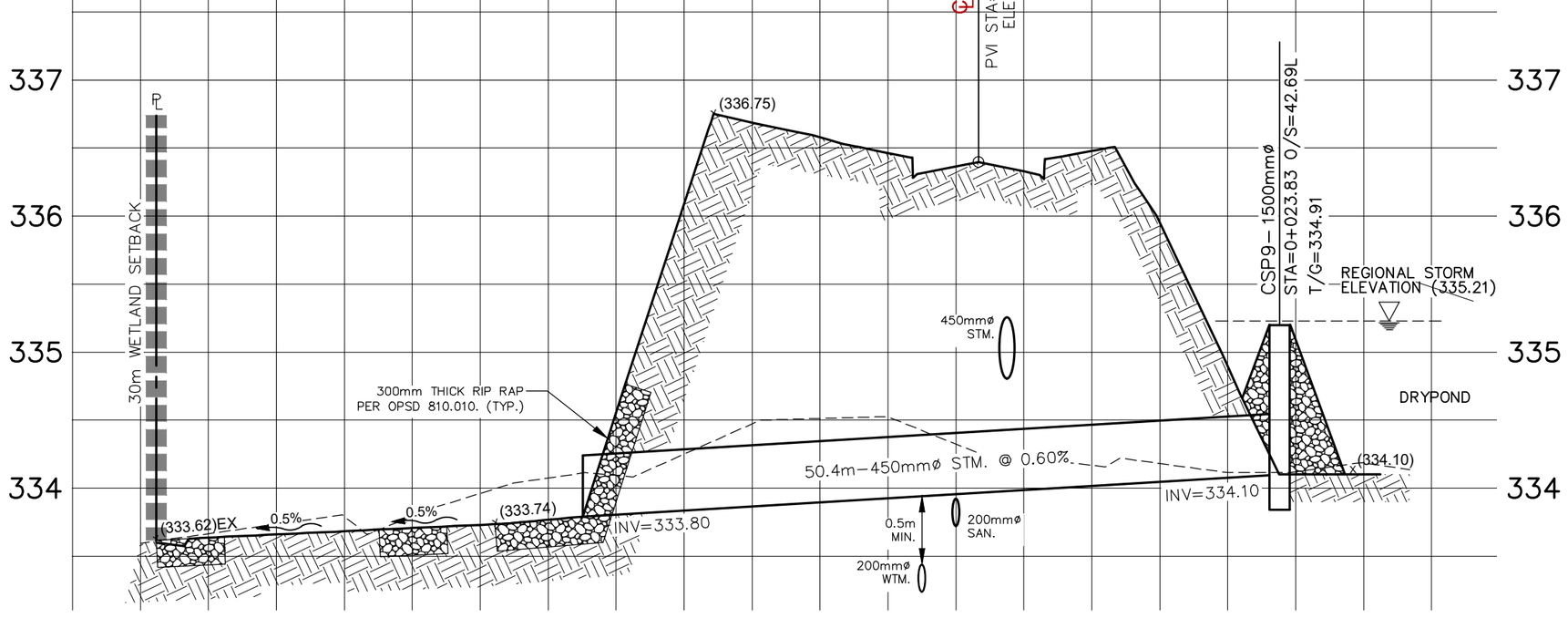
March 30, 2020 — 10:59 a.m. — Plotted By: KTaylor

P:\P\42063\104\42063-104-SWM4.dwg



STORM OUTLET PLAN

SCALE: 1:300



STORM OUTLET PROFILE

SCALE: H-1:400 V-1:40

FIGURE 5.2

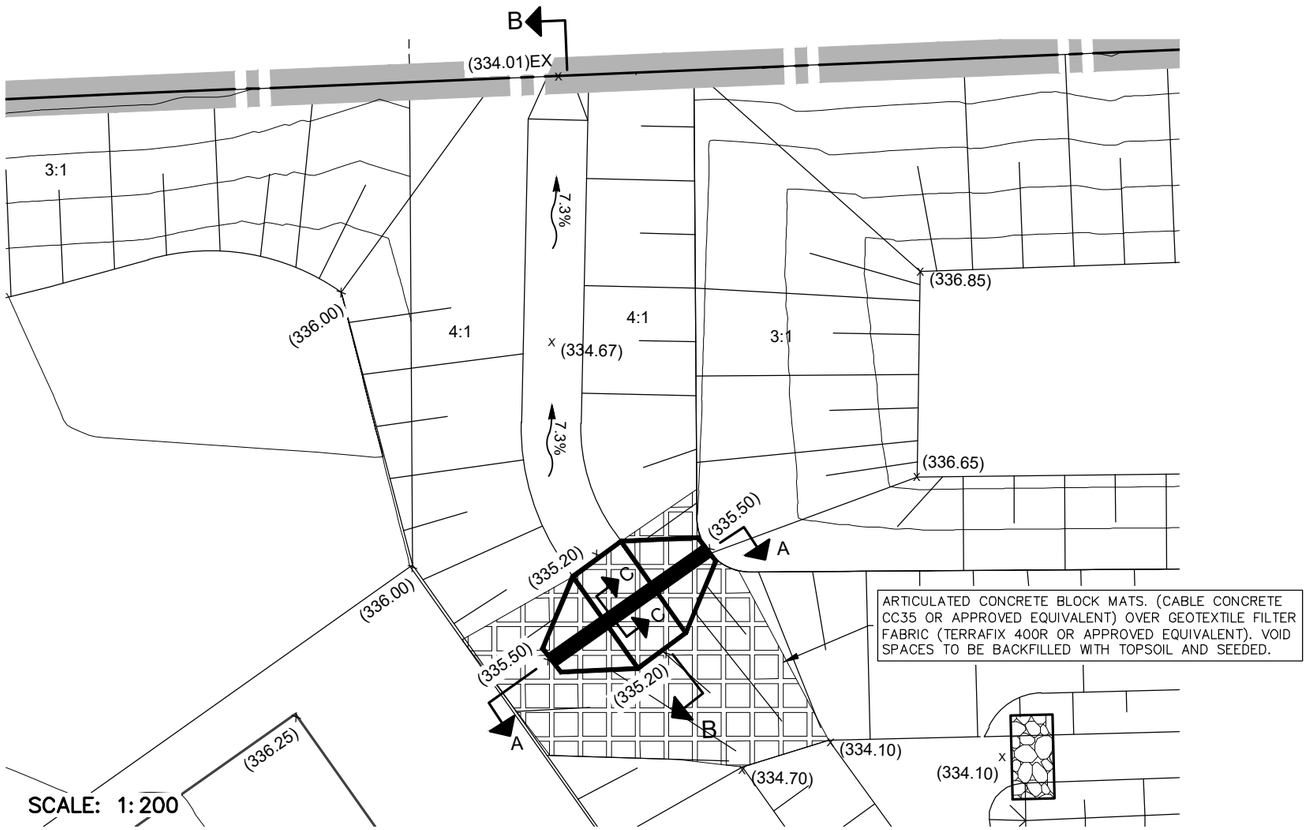
Date: MAR.27/20
Scale: AS NOTED

190-216 ARKELL ROAD

SWM FACILITY DETAILS 1

MTE
Engineers, Scientists, Surveyors

Project No.: 42063-104



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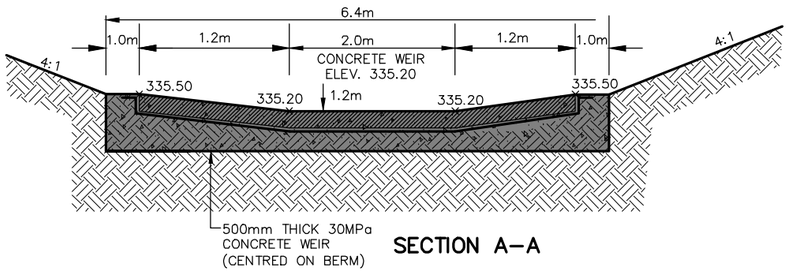
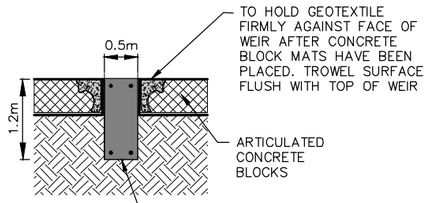
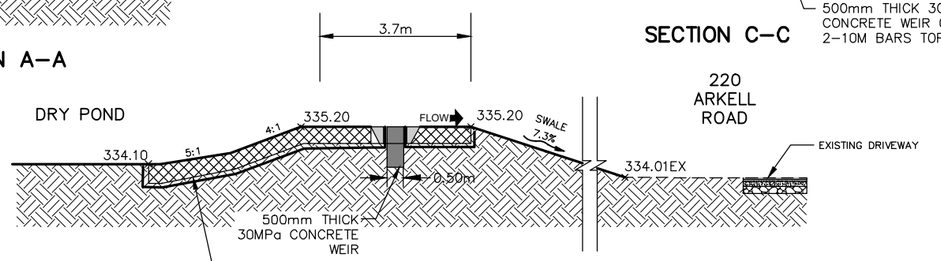


SECTION A–A



SECTION C–C



SECTION B–B

CONTRACTOR TO PROVIDE STAMPED SHOP DRAWINGS c/w REINFORCING DETAILS FOR CONCRETE WEIR

EMERGENCY OVERFLOW WEIR

N.T.S.

FIGURE 5.3

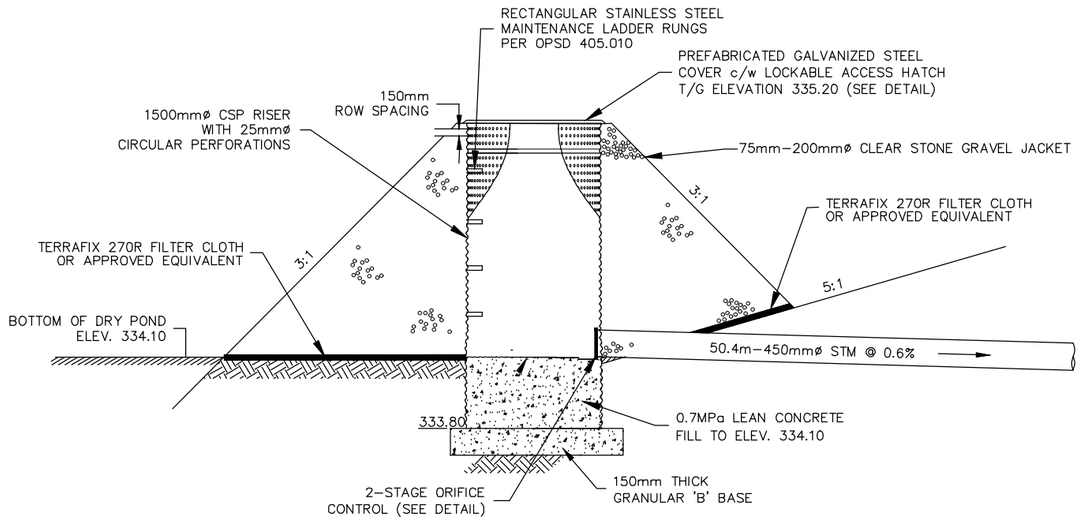
Date: MAR.27/20
Scale: N.T.S

190-216 ARKELL ROAD

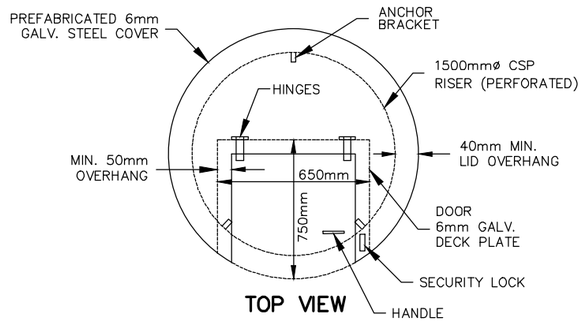
SWM FACILITY DETAILS 2

MTE
Engineers, Scientists, Surveyors

Project No.: 42063-104

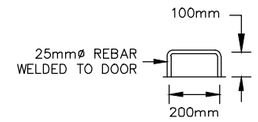


SECTION A–A

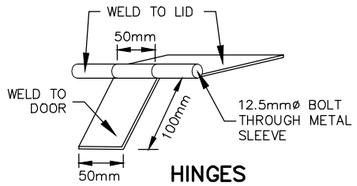


TOP VIEW

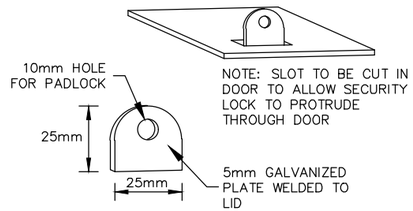
NOTE: CONTRACTOR SHALL SUPPLY A PAD LOCK ON THE STEEL COVER AND PROVIDE THE KEYS TO THE MUNICIPALITY AT THE TIME OF INSTALLATION



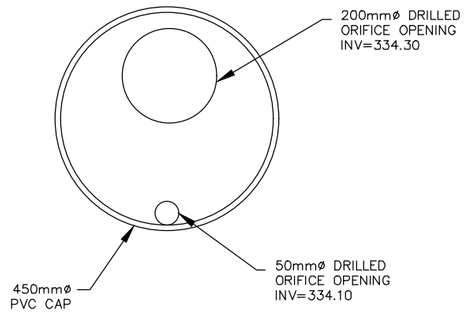
HANDLE



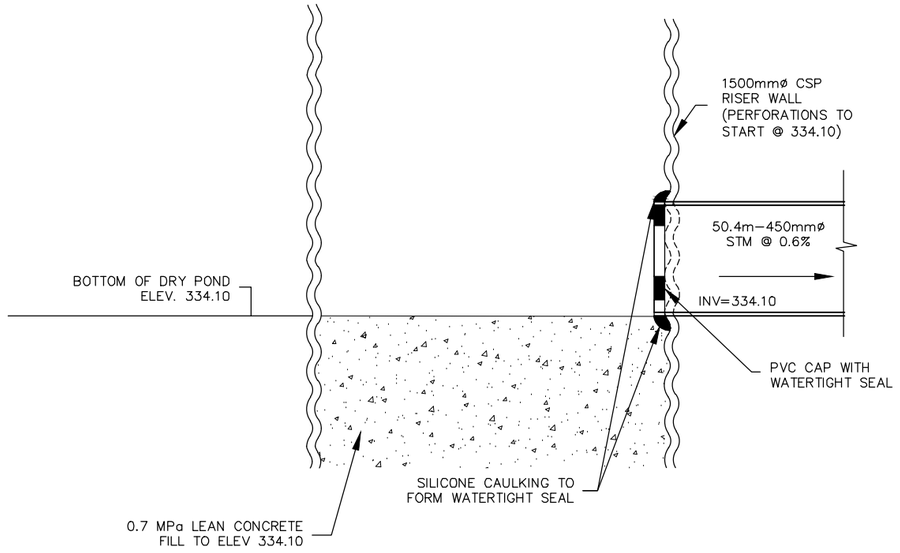
HINGES



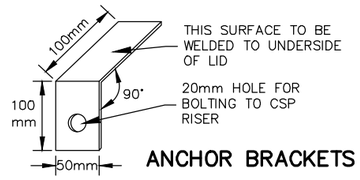
SECURITY LOCK



CSP RISER 9 DETAIL
N.T.S.



2 STAGE ORIFICE DETAIL



ANCHOR BRACKETS

NOTE : BRACKETS TO BE BOLTED TO RISER PIPE AND WELDED TO UNDERSIDE OF LID.

GALVANIZED STEEL COVER DETAIL FOR 1500mmø CSP RISER
N.T.S.

FIGURE 5.4 Date: MAR.27/20 Scale: N.T.S

190-216 ARKELL ROAD

SWM FACILITY DETAILS 3

MTE
Engineers, Scientists, Surveyors

Project No.: 42063-104

5.3 Water Quantity

Flows for all storm events will be conveyed to the proposed SWM facility by a combination of storm sewers and overland flow routes (road right-of-way and SWM facility access road). The post-development MIDUSS modelling output is included in **Appendix C**.

Discharge from the facility will be controlled via a multi-staged outlet located in a 1500mm diameter perforated CSP riser manhole proposed within the dry pond cell. This structure will house a 450mm cap with multiple orifice controls attached to a 450mm diameter outlet pipe. As illustrated in **Figure 5.4**, the multi-staged outlet consists of a 450mm diameter cap/orifice plate with a 50mm diameter orifice at an elevation of 334.10m, and a 200mm diameter orifice at an elevation of 334.40m.

The facility is designed to contain all storms up to and including the 100-year storm event. As such, a 2.0m wide emergency overflow weir is proposed to allow the Regional storm event to flow through the facility. This weir is set at an elevation of 335.20m. These flows are directed via a swale towards a 375mm culvert underneath Street A, and ultimately to the Torrance Creek Wetland.

A summary of the preliminary stage-storage-discharge relationship of the proposed SWM facility is shown in **Table 5.2** below.

Table 5.2 – Stage-Storage-Discharge Summary

Elevation (m)	Discharge (m3/s)	Volume (m3)	Remarks
334.10	0.000	0	Bottom of Dry Pond / 50mm Orifice Invert
334.20	0.0015	25	Contour
334.30	0.0023	59	200mm Orifice Invert
334.40	0.013	104	Contour
334.50	0.031	157	Contour
334.60	0.043	218	Contour
334.70	0.052	287	Contour
334.80	0.060	363	Contour
334.90	0.067	446	Contour
335.00	0.073	534	Contour
335.10	0.079	629	Contour
335.20	0.084	731	Emergency Overflow Weir
335.30	0.197	839	Contour
335.40	0.443	954	Contour
335.50	0.817	1075	Top of Pond

A summary of the peak flows and associated maximum ponding elevations from the SWM facility under the post-development conditions is provided in **Table 5.3** below. As previously mentioned, enough volume has been provided to store the 100-year storm event to maximum elevation of 335.01m.

Table 5.3 – Summary of Peak Flows and Maximum Ponding Elevations

Storm Event	Peak Outflow (m^3/s)	Maximum Ponding Volume (m^3)	Maximum Ponding Elevation (m)
25mm Storm Event	0.018	119	334.43
2-Year Storm Event	0.033	168	334.52
5-Year Storm Event	0.047	251	334.65
10-Year Storm Event	0.055	316	334.74
25-Year Storm Event	0.063	399	334.84
50-Year Storm Event	0.068	469	334.93
100-Year Storm Event	0.074	546	335.01
Regional Storm Event	0.098	745	355.21

A summary of the peak flows for the pre- and post-development conditions is summarized in **Table 5.4**. The MIDUSS output for the quantity control can be found in **Appendix C**.

Table 5.4 – Pre and Post-Development Peak Runoff Rates (m^3/s)

Drainage Area	25mm	2-year	5-year	10-year	25-year	50-year	100-year	Regional
Pre-Development								
101	0.034	0.059	0.081	0.102	0.121	0.138	0.155	0.174
102	0.000	0.000	0.000	0.001	0.001	0.002	0.003	0.006
103	0.001	0.004	0.013	0.023	0.039	0.055	0.074	0.119
Total to Wetland	**0.034**	**0.059**	**0.083**	**0.106**	**0.128**	**0.150**	**0.174**	**0.297**
Post-Development								
201	0.069	0.107	0.144	0.177	0.211	0.243	0.277	0.095
202	0.032	0.048	0.067	0.084	0.099	0.113	0.128	0.037
203	0.010	0.015	0.020	0.025	0.029	0.033	0.037	0.010
204	0.026	0.040	0.053	0.066	0.076	0.086	0.097	0.028
SWMF Outflow[1]	*0.018*	*0.033*	*0.047*	*0.055*	*0.063*	*0.068*	*0.074*	*0.098*
205-1	0.001	0.002	0.003	0.004	0.004	0.005	0.006	0.009
205-2[2]	0.007	0.010	0.014	0.018	0.021	0.024	0.027	0.015
Total to Arkell	*0.008*	*0.012*	*0.017*	*0.022*	*0.025*	*0.029*	*0.033*	*0.024*
206[3]	0.000	0.000	0.000	0.000	0.000	0.001	0.001	0.014
207[4]	0.000	0.000	0.001	0.002	0.005	0.008	0.011	0.022
208[5]	0.001	0.004	0.013	0.023	0.039	0.055	0.074	0.119
Total to Wetland ([1] + [2] + [3] + [4] + [5])	**0.019**	**0.036**	**0.062**	**0.082**	**0.109**	**0.132**	**0.161**	**0.244**

*Note: The sums may not add up arithmetically. They are based on the timing and sum of hydrographs taken directly from MIDUSS.

5.4 Monthly Water Balance

A monthly water budget calculation has been conducted to assess potential hydrologic impacts the proposed development may have on the existing wetland. As there will be little change to the area within the 30m wetland setback, this area (pre-development catchment 103/post-development catchment 208) was excluded from the water budget calculation. Focus has been given to assess the impacts caused by the development area. Refer to **Figures 2.2 & 4.1** for pre and post-development catchments used in the analyses.

Annual precipitation for the subject lands was estimated to be approximately 923.2mm/year, based on data gathered at the Guelph Arboretum weather station between 1971 and 2000. Evapotranspiration, runoff and infiltration/recharge rates for pre- and post-development conditions were estimated using the Thornthwaite and Mather method (1957).

5.4.1 Infiltration to Groundwater

Under pre-development conditions, infiltrated water contributes to the shallow groundwater table, which flows southwesterly towards the nearby Burke Well.

As previously mentioned, the TCSS divided the subwatershed into three stormwater management areas, with respect to groundwater recharge, and established specific infiltration targets for each area. The subject lands fall within Area 2 (Arkell Road to Torrance Creek); for which a minimum infiltration target of 150mm/year is required for any new development within this area. As such, for this preliminary analysis, it was assumed that the infiltration target to be met under post-development conditions would be the one set forth by the TCSS and not the volume of water being infiltrated during the existing conditions.

Under pre-development conditions, it was calculated that the development area (1.83 ha) has imperviousness of approximately 15.5%. The development area has passive infiltration of 4,415 m^3/year. Under post-development conditions, the development area has imperviousness of 56.3%, and passive infiltration of 3,049m^3/year. Although this results in a 1,365m^3/year deficit of infiltration from pre-development conditions, 3,049m^3/year of water over the development area equates to an equivalent infiltration rate of approximately 166.6mm/year. Therefore, even as the total impervious area is increased due to development, the 150mm/year criteria set by the TCSS can still be met. Refer to the Water Balance Analysis in **Appendix E** for more details.

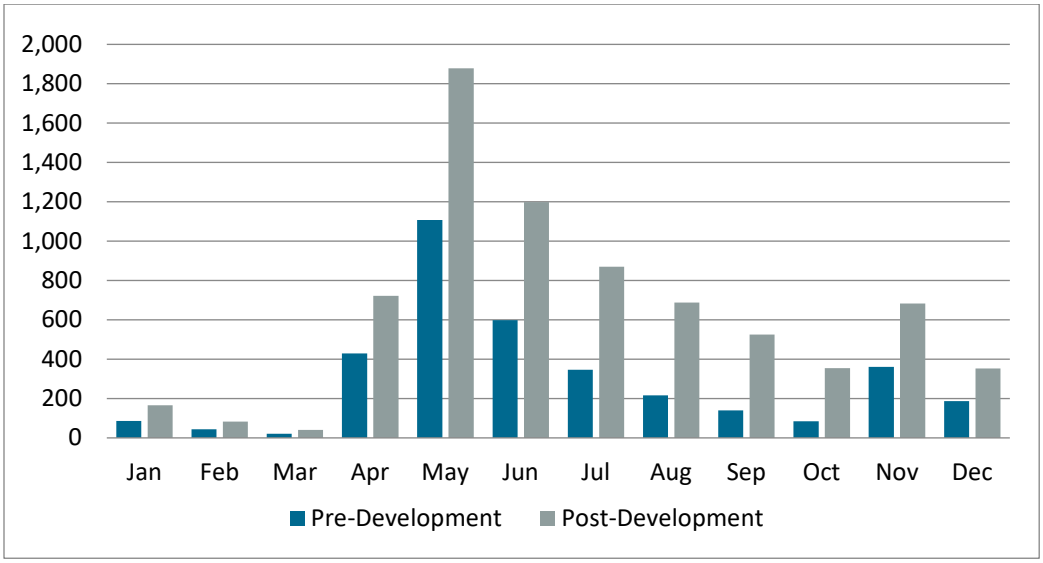
Based on the conclusions made above, the existing high groundwater conditions throughout the site, and the restrictive grading scheme of the subject site, the use of infiltration galleries may lead to issues relating to such things as: cover and depth of shallow galleries; insufficient separation to shallow groundwater, high potential for groundwater mounding near proposed gallery locations, etc. As such, no active infiltration measures (e.g. infiltration galleries) have been currently proposed under post-development conditions.

5.4.2 Surface Runoff to Wetland

Under pre-development conditions, the subject lands drain to the northwest and provide surface water inputs to the adjacent Torrance Creek wetland complex.

Under pre-development conditions, it was calculated that the development area (1.83ha) has imperviousness of approximately 15.5%. Approximately 3,619m^3/year of runoff drains to the wetland in the pre-development condition. On a monthly basis, pre-development volumes are maintained or exceeded.

Figure 5.5 – Pre & Post-Development Monthly Runoff Volume to Wetland (m^3)



Under post-development conditions, the total development area that drains to the wetland is approximately 1.74ha. Catchment 205-1 (0.09ha) will drain to Arkell Road without control. The increased impervious areas under post-development conditions result in an increased annual runoff volume to the adjacent wetland. Approximately 7,563m^3/year will be directed to the wetland under post-development conditions, which equates to a surplus of 3,944m^3/year of surface runoff to the wetland complex.

5.5 Erosion Assessment

The TCSS recommended that any newly proposed development throughout the watershed should implement a SWM solution that provides at least a 24-hour drawdown for the volume generated during the 25mm storm event; to ensure that threshold flow durations do not exceed pre-development levels. The proposed SWM facility has been designed to provide approximately 31-hour drawdown time on the 25mm storm event volume. The drawdown calculations are provided in **Appendix D.**

5.6 Landscape Design

A landscape design for the proposed SWM facility will be completed during the final design stage of the development. The reasons for landscaping these types of facilities are aesthetics, erosion protection and long term bank stability, temperature increase mitigation, deterring waterfowl from nesting along their banks, and to limit pedestrian access into the permanent pool components. To that end, the facility will be designed in accordance to the City's stormwater management policies and guidelines for aesthetics, landscaping, and safety of stormwater management facilities.

5.7 Temperature Mitigation

The TCSS requires that the monitored temperature of the creek not exceed 25^{o}C. Dry Pond designs historically provide better mitigation against temperature increase than standard Wet Pond and Wetland designs. The length-to-width ratio of the pond, as well as the flow length from the enhanced grass swale to the primary pond outlet, have been maximized to avoid large open areas of water. This also allows for a larger area of the pond to be shaded by riparian vegetation.

Detailed temperature mitigation calculations will be performed at the detailed design phase to determine if the current stormwater management design is satisfactory to achieve the required temperatures. If temperature monitoring of the Torrance Creek Wetland indicate that observed temperatures exceed 25^{o}C, additional temperature mitigation measures may be explored and implemented if required (ex. enhanced grass swales, cooling trenches, etc.).

6.0 Monitoring Program

A monitoring program will be implemented, which will serve to ensure that the stormwater management plan proposed within this report is implemented and performing at an acceptable level.

6.1 During Development Monitoring Program

This stage will begin at the commencement of area grading of the subdivision and will continue until 100% full buildout of the subdivision (i.e. road is urbanized, buildings are constructed, lots are sodded/landscaped, and open spaces are stabilized) of the subdivision. Monitoring of the stormwater management facility will include:

- Standard inspection of vegetation, structures, and general operation of hydraulic controls (observations of drawdown) within the stormwater management facility once installed. These inspections are to occur seasonally and typically after a significant rainfall event.
- Regular inspection and maintenance of erosion and sediment control measures around and within the stormwater management facility.

Standard inspection and maintenance of the SWM facility will be provided throughout the "During Development" period.

6.2 Post-Development Monitoring Program

This period of the monitoring will begin following 100% full buildout of the subdivision. The purpose of this stage of the monitoring is to ensure that the SWM facility continues to operate as designed. Monitoring during this stage will include:

- Standard inspection of vegetation, structures, and general operation of hydraulic controls (observations of drawdown) within the stormwater management facility. These

inspections are to occur seasonally and typically after a significant rainfall event; until assumption of the facility by the City.

It is recommended that, following completion of the developer's portion of the post-development monitoring program and assumption of the SWM facility by the City, the City continues with a post-development inspection and maintenance program to ensure the long term effectiveness of the proposed SWM facility.

7.0 Erosion and Sediment Control Measures

Precautions will be taken during construction to limit erosion and sedimentation. Erosion and Sediment Control Plans will be prepared and provided during the detailed design stage. The plans will illustrate the erosion and sediment control measures to be implemented during construction, which will limit impacts associated with site development.

Typically, the recommended construction sequence for erosion and sediment control measures are as follows:

- Placement of all sediment control fencing where required,
- Stripping and strategic placement of topsoil stockpiles. Placement of sediment control fencing around all stockpile areas.
- Construction of temporary sediment control ponds, which will serve as sedimentation basins for the site during construction.
- Construction of temporary swales to direct runoff to sedimentation basins, with rock check dams as required to control velocities.
- Re-vegetation of completed areas as soon as possible after construction, including those areas not slated for construction within 60 days.

Where rock check dams are proposed to promote sedimentation and reduce velocities, clean aggregate is to be placed perpendicular to the direction of flow in the swale, with a small volume of excavation on the upstream side to provide storage for accumulated sediment.

Sediment control fencing shall consist of filter fabric attached to page wire fencing and sealed at ground level. It will be installed at the perimeter of the work areas and intermittently on sloped areas where required. Sediment control fencing will be placed around all topsoil stockpiles.

Storage consistent with the GRCA's requirement of 125m^3/ha of live and dead storage respectively (total 250m^3/ha), will be provided. This storage will be provided to ensure that suspended material will have ample time to settle out. In addition, the sediment basin will be sized with sufficient capacity to allow flows to pass without breaching. Once the active construction and grading activities have been completed, the sedimentation basins can be cleaned out.

Access to topsoil or fill storage areas will be located on the upstream side of storage piles. This practice will ensure continuity of the sediment control fencing in the downslope direction; which is most vulnerable to erosion and sediment deposition. Further, topsoil and hydroseed will be placed on all exposed areas following the completion of grading activities.

It is recommended that during construction, monitoring and inspection of the erosion and sediment controls be conducted to ensure the satisfactory performance of these measures. Reporting of the inspection and monitoring results should be distributed to the City and GRCA. If it is found that the erosion and sediment control measures are not working adequately, they shall be augmented to the satisfaction of the City and the GRCA, based on field decisions.

8.0 Conclusions and Recommendations

Based on the foregoing analysis, it is concluded that:

- The stormwater management strategy herein outlined will provide the subject lands with appropriate levels of quality, quantity, and erosion controls to meet the criteria set out by the *Torrance Creek Subwatershed Study Management Strategy*, the City of Guelph, and the Grand River Conservation Authority;
- Enhanced quality control of stormwater runoff can be provided by the proposed stormwater management strategy; which includes: a dry pond cell, an ETV certified EF6 OGS unit, and an enhanced grass swale;
- Quantity control targets for post-development peak flows rates to the adjacent wetland can be achieved in the proposed stormwater management facility for all storm events up to and including the Regional storm event;
- Infiltration targets defined within the TCSS can be satisfactorily met through the use of passive infiltration;
- Monthly surface water contributions to the wetland will be maintained or exceeded; and
- Post-development erosion will be mitigated by the use of extended detention of the 25mm storm event.

The findings of this report and the above conclusions lead to the following recommendations:

- Upon completion of detailed design, a quality/quantity control stormwater management facility be constructed to provide control of stormwater as described in Sections 4.0 and 5.0 of this report; and
- That sediment and erosion controls during construction will be implemented as described in Section 7.0 of this report.

All of which is respectfully submitted,

MTE Consultants Inc.

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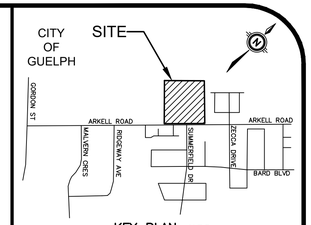
MTE FILE PATH:

LEGEND

- SITE BOUNDARY
- WETLAND BOUNDARY
- 15m WETLAND SETBACK
- 30m WETLAND SETBACK
- 326 — EXISTING CONTOURS
- Ex. Drop Curb — EXISTING CURB
- EXISTING DRIPLINE
- EXISTING DIRECTION OF DRAINAGE/SWALE
- EXISTING BUILDING
- (TOP) / (BOTTOM) — EXISTING EMBANKMENT (SLOPE AS NOTED)
- Ex. 300mmø SAN. / Ex. MH — EXISTING SANITARY SEWER
- Ex. 200mmø WTM. / Ex. HYD. SET — EXISTING WATERMAIN
- Ex. 375mmø STM. / Ex. MH — EXISTING STORM SEWER
- EXISTING RETAINING WALL
- EXISTING FENCE
- EXISTING PIEZOMETER
- EXISTING BOREHOLE/ MONITORING WELL

CITY OF GUELPH — SITE



KEY PLAN N.T.S.

GEODETIC BM ELEV. = 335.455m
CITY OF GUELPH
#255 BURKE WELL PUMP HOUSE

SITE BENCHMARK ELEV. = 335.455m
SEE ABOVE

NOTE TO CONTRACTOR :

DO NOT SCALE DRAWINGS.

CONTRACTORS MUST CHECK AND VERIFY ALL DIMENSIONS AND REPORT ANY DISCREPANCIES TO THE ENGINEER BEFORE PROCEEDING WITH THE WORK.

THE OWNER/ARCHITECT/CONTRACTOR IS ADVISED THAT M.T.E. CONSULTANTS INC. CANNOT CERTIFY ANY COMPONENT OF THE SITE WORKS NOT INSPECTED DURING CONSTRUCTION. IT IS THE RESPONSIBILITY OF THE GENERAL CONTRACTOR TO NOTIFY M.T.E. CONSULTANTS INC. PRIOR TO COMMENCEMENT OF CONSTRUCTION TO ARRANGE FOR INSPECTION.

No.	REVISION	BY	DATE
8.			
7.			
6.			
5.			
4.			
3.			
2.			
1.	ISSUED FOR DRAFT PLAN APPROVAL	IXC	APR.3/20

MTE
Engineers, Scientists, Surveyors
519-743-6500

OWNER
CRESCENT HAVEN HOMES INC.
180 FROBISHER DRIVE UNIT 3 WATERLOO

PROJECT
ARKELL ROAD PROPERTIES
216 ARKELL ROAD GUELPH

DRAWING
EXISTING CONDITIONS PLAN

Project Manager: I.CEKIC	Project No.: 42063-104
Design By: CJC/AJC	Checked By: VAL
Drawn By: SXP/KAT	Checked By: AJC
Surveyed By: MTE	Drawing No.: EC1.1
Date: Dec.04/19	
Scale: 1:400	Sheet 1 of 1

March 31, 2020 - 8:53:39 AM - Plotted By: Alex Cressman

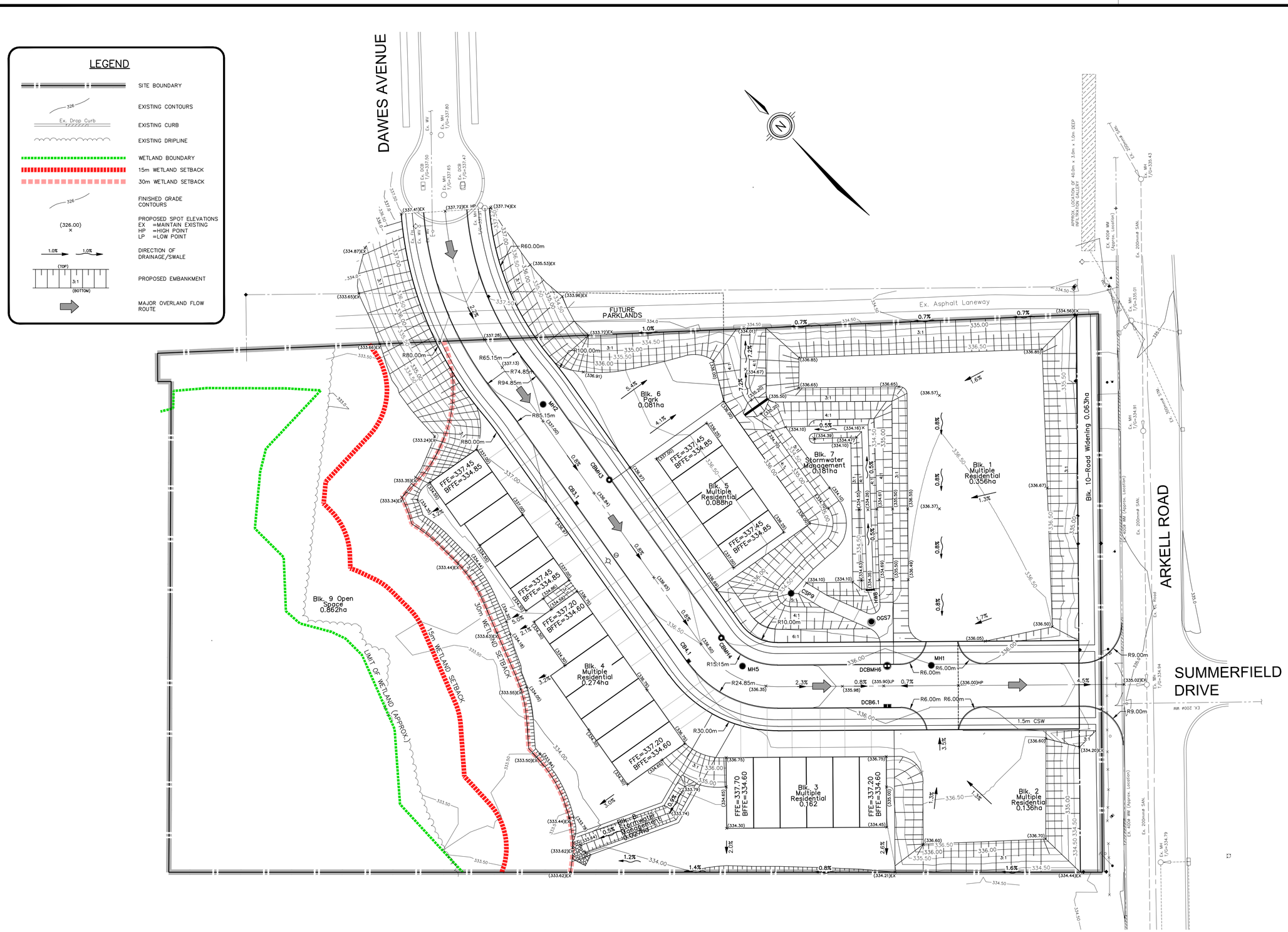
P:\P\42063\104\42063-104-AG1

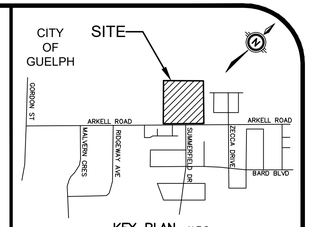
MTE PLOT PATH:

March 31, 2020 - 8:54:37 AM - Plotted By: Alex Cressman

LEGEND

- SITE BOUNDARY
- EXISTING CONTOURS (326)
- EXISTING CURB (Ex. Drop Curb)
- EXISTING DRIPLINE
- WETLAND BOUNDARY
- 15m WETLAND SETBACK
- 30m WETLAND SETBACK
- FINISHED GRADE CONTOURS (326)
- PROPOSED SPOT ELEVATIONS (326.00) EX =MAINTAIN EXISTING, HP =HIGH POINT, LP =LOW POINT
- DIRECTION OF DRAINAGE/SWALE (1.0% (TOP) 3:1 (BOTTOM) 1.0%)
- PROPOSED EMBANKMENT
- MAJOR OVERLAND FLOW ROUTE





GEODETIC BM ELEV. = 335.455m
CITY OF GUELPH
#255 BURKE WELL PUMP HOUSE

SITE BENCHMARK ELEV. = 335.455m
SEE ABOVE

NOTE TO CONTRACTOR :

DO NOT SCALE DRAWINGS.

CONTRACTORS MUST CHECK AND VERIFY ALL DIMENSIONS AND REPORT ANY DISCREPANCIES TO THE ENGINEER BEFORE PROCEEDING WITH THE WORK.

ALL DRAWINGS REMAIN THE PROPERTY OF THE ENGINEER AND SHALL NOT BE REPRODUCED OR REUSED WITHOUT THE ENGINEER'S WRITTEN PERMISSION.

THE OWNER/ARCHITECT/CONTRACTOR IS ADVISED THAT M.T.E. CONSULTANTS INC. CANNOT CERTIFY ANY COMPONENT OF THE SITE WORKS NOT INSPECTED DURING CONSTRUCTION. IT IS THE RESPONSIBILITY OF THE GENERAL CONTRACTOR TO NOTIFY M.T.E. CONSULTANTS INC. PRIOR TO COMMENCEMENT OF CONSTRUCTION TO ARRANGE FOR INSPECTION.

No.	REVISION	BY	DATE
8.			
7.			
6.			
5.			
4.			
3.			
2.			
1.	ISSUED FOR DRAFT PLAN APPROVAL	IKC	APR.03/20

MTE
Engineers, Scientists, Surveyors
519-743-6500

OWNER
CRESCENT HAVEN HOMES INC.
180 FROBISHER DRIVE UNIT 3 WATERLOO

PROJECT
ARKELL ROAD PROPERTIES
216 ARKELL ROAD GUELPH

DRAWING
AREA GRADING PLAN

Project Manager	I.CEKIC	Project No.	42063-104
Design By	AJC	Checked By	VAL
Drawn By	SXP/KAT	Checked By	AJC
Surveyed By	MTE	Drawing No.	AG1.1
Date	Mar.30/20		
Scale	1:400	Sheet 1 of 1	

Appendix F

Geotechnical Report

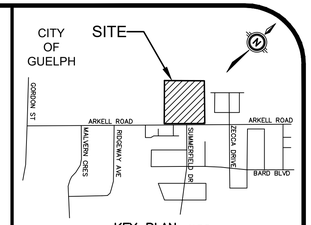
P:\P\42063\104\42063-104-EC1

MTE FILE PATH:

LEGEND

- SITE BOUNDARY
- WETLAND BOUNDARY
- 15m WETLAND SETBACK
- 30m WETLAND SETBACK
- 326 — EXISTING CONTOURS
- Ex. Drop Curb — EXISTING CURB
- EXISTING DRIPLINE
- EXISTING DIRECTION OF DRAINAGE/SWALE
- EXISTING BUILDING
- (TOP) / (BOTTOM) — EXISTING EMBANKMENT (SLOPE AS NOTED)
- Ex. 300mmø SAN. / Ex. MH — EXISTING SANITARY SEWER
- Ex. 200mmø WTM. / Ex. HYD. SET — EXISTING WATERMAIN
- Ex. 375mmø STM. / Ex. MH — EXISTING STORM SEWER
- EXISTING RETAINING WALL
- EXISTING FENCE
- EXISTING PIEZOMETER
- EXISTING BOREHOLE/ MONITORING WELL

CITY OF GUELPH — SITE



KEY PLAN N.T.S.

GEODETIC BM ELEV. = 335.455m
CITY OF GUELPH
#255 BURKE WELL PUMP HOUSE

SITE BENCHMARK ELEV. = 335.455m
SEE ABOVE

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No.	REVISION	BY	DATE
8.			
7.			
6.			
5.			
4.			
3.			
2.			
1.	ISSUED FOR DRAFT PLAN APPROVAL	IXC	APR.3/20

MTE
Engineers, Scientists, Surveyors
519-743-6500

OWNER
CRESCENT HAVEN HOMES INC.
180 FROBISHER DRIVE UNIT 3 WATERLOO

PROJECT
ARKELL ROAD PROPERTIES
216 ARKELL ROAD GUELPH

DRAWING
EXISTING CONDITIONS PLAN

Project Manager: I.CEKIC	Project No.: 42063-104
Design By: CJC/AJC	Checked By: VAL
Drawn By: SXP/KAT	Checked By: AJC
Surveyed By: MTE	Drawing No.: EC1.1
Date: Dec.04/19	
Scale: 1:400	Sheet 1 of 1

March 31, 2020 - 8:53:39 AM - Plotted By: Alex Cressman

P:\P\42063\104\42063-104-AG1

MTE PLOT PATH:

March 31, 2020 - 8:54:37 AM - Plotted By: Alex Cressman

LEGEND

- SITE BOUNDARY
- EXISTING CONTOURS (326)
- EXISTING CURB (Ex. Drop Curb)
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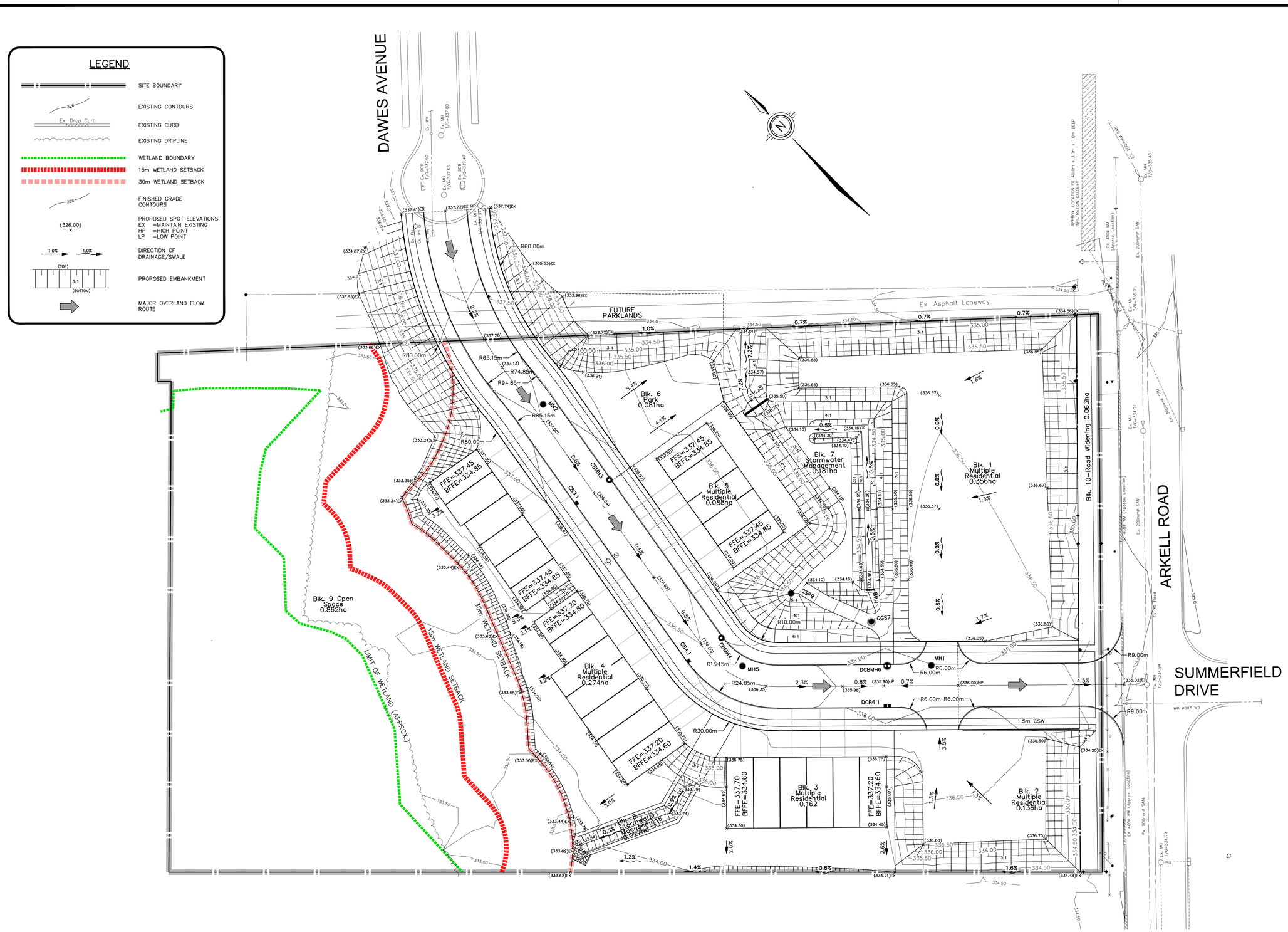
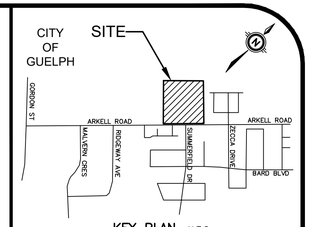
- DIRECTION OF DRAINAGE/SWALE (1.0% (TOP) 3:1 (BOTTOM) 1.0%)
- PROPOSED EMBANKMENT
- MAJOR OVERLAND FLOW ROUTE





GEODETIC BM ELEV. = 335.455m
CITY OF GUELPH
#255 BURKE WELL PUMP HOUSE

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SEE ABOVE

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No.	REVISION	BY	DATE
8.			
7.			
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4.			
3.			
2.			
1.	ISSUED FOR DRAFT PLAN APPROVAL	IKC	APR.03/20

MTE
Engineers, Scientists, Surveyors
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OWNER
CRESCENT HAVEN HOMES INC.
180 FROBISHER DRIVE UNIT 3 WATERLOO

PROJECT
ARKELL ROAD PROPERTIES
216 ARKELL ROAD GUELPH

DRAWING
AREA GRADING PLAN

Project Manager	I.CEKIC	Project No.	42063-104
Design By	AJC	Checked By	VAL
Drawn By	SXP/KAT	Checked By	AJC
Surveyed By	MTE	Drawing No.	AG1.1
Date	Mar.30/20		
Scale	1:400	Sheet 1 of 1	

Appendix A

Draft Plan of Subdivision (Reduced)

DRAFT PLAN OF SUBDIVISION

Legal Description
PART OF LOT 6, CONCESSION 8, GEOGRAPHICAL TOWNSHIP OF PUSLINCH,
CITY OF GUELPH

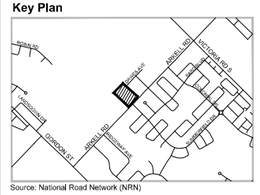
Owner's Certificate
I HEREBY AUTHORIZE MACNAUGHTON HERMSEN BRITTON CLARKSON PLANNING LIMITED TO SUBMIT THIS PLAN FOR APPROVAL.

DATE:_____

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

DATE:_____

Key Plan



Additional 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. MULTIPLE RESIDENTIAL, OPEN SPACE		
E. AS SHOWN	F. AS SHOWN	G. AS SHOWN
H. MUNICIPAL WATER SUPPLY	I. LOAM	J. AS SHOWN
K. ALL SERVICES AS REQUIRED	L. AS SHOWN	

Area Schedule **61T_____**

Description	Lots/Blocks	Units	Area (ha)
Multiple Residential	1-5	72	1.015
Park	6		0.082
Stormwater Management	7, 8		0.207
Open Space	9		0.862
Road Widening	10		0.063
Roads			0.347
Total	**10**	**72**	**2.577**

Notes
1. All dimensions are in metres unless otherwise shown
2. Dripline Limits - Natural Resource Solutions Inc. (NRSI) June, 2016
3. Wetland Limits - Natural Resource Solutions Inc. (NRSI) August, 2016
4. Property boundary is approximate, based on MTE Existing Conditions Plan and Wellington County Survey plans 61R-773, 61R-2819
5. Surrounding parcel boundaries are approximate/ taken from Vumap (First Base Solutions) aerial imagery
6. Unit yield based on Conceptual Site Plan prepared by MHBC Planning
7. Building footprints outside of subject lands gathered from City of Guelph open data

Revision No.	Date	Issued / Revision	By
10.	March 18, 2020	SWM revision;	G.C.
9.	January 6, 2020	Update/ Issued for Review;	G.C.
8.	December 11, 2019	Update/ Issued for Review;	G.C.
7.	October 9, 2019	Update/ Issued for Review;	G.C.
6.	July 8, 2019	Update/ Issued for Review;	G.C.
5.	December 6, 2018	Update/ Issued for Review;	G.C.
3.	September 12, 2018	Update/ Issued for Review;	G.C.
2.	July 4, 2017	Update/ Issued for Review;	G.C.
1.	March 13, 2017	Issued for Review;	G.C.

MHBC PLANNING URBAN DESIGN & LANDSCAPE ARCHITECTURE
200-540 BINGEMANS CENTRE DR, KITCHENER, ON. N2B 3X9 | P: 519.576.3650 F: 519.576.0121 | WWW.MHBCPLAN.COM

Approval Stamp

Date January 6, 2020
File No. 15246A
Plan Scale 1:400 (36x24)
Drawn By G.C.
Checked By D.A.
Project Arkell Road - Guelph
Other

Applicant
Crescent Homes
151 Curzon Crescent
Guelph, ON. N1K 0B3
P: 647.523.6487

File Name **DRAFT PLAN**
Dwg No. 1 of 1
Scale Bar 2.5 0 5 10 25m

K:\15246A-Crescent Homes-Arkell Road-Guelph\DP\Draft Plan March 18 2020.dwg

Appendix B

Existing Conditions Catchment Parameters and MIDUSS Modelling

190-216 ARKELL ROAD
STORMWATER MANAGEMENT
Guelph, Ontario

Project Number:	42063-104
Date:	March 19, 2020
Design By:	AJC
File:	Q:\42063\104\SWM\March 2020\42063-104 Master SWM Facility Design Sheet.xlsx

HYDROLOGIC PARAMETERS
Pre-Development Conditions

Sub-Catchment Number	Area	Overland Slope	Overland Length	SCS Curve Number			Percent Impervious	Land Use	Comment
				Pervious (AMC II)	Pervious (AMC III)	Impervious			
	(ha)	*(%)*	*(m)*				*(%)*		
101	1.771	1.0	150	49	69	98	16.0	Ex. Residential*	
102	0.062	25.0	25	49	69	98	0.0	External Embankment*	
103	0.862	1.0	90	70	84	98	0.0	Wetland/Forest	
Total	**2.70**						**10.5**		

* CN calculated using Equivalent CN calculation

IDF PARAMETERS
City of Guelph

Frequency (Years)	a	b	c	Comment
2	743	6.0	0.7989	
5	1,593	11.0	0.8789	
10	2,221	12.0	0.9080	
25	3,158	15.0	0.9355	
50	3,886	16.0	0.9495	
100	4,688	17.0	0.9624	

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"               MIDUSS created                        Sunday, February 7, 2010"
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"               Licensee name:                                              A"
"               Company                                             Microsoft"
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"        5.000   Time Step"
"      240.000   Max. Storm length"
"     1500.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"           1   Chicago storm"
"      509.000   Coefficient A"
"        6.000   Constant B"
"        0.799   Exponent C"
"        0.400   Fraction R"
"      240.000   Duration"
"        1.000   Time step multiplier"
"             Maximum intensity           71.966    mm/hr"
"             Total depth                 25.028    mm"
"           6   025hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 101"
"           1   Triangular SCS"
"           1   Equal length"
"           1   SCS method"
"         101   Catchment 101 - Ex. Residential"
"       16.000   % Impervious"
"        1.771   Total Area"
"      150.000   Flow length"
"        1.000   Overland Slope"
"        1.488   Pervious Area"
"      150.000   Pervious length"
"        1.000   Pervious slope"
"        0.283   Impervious Area"
"      150.000   Impervious length"
"        1.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       49.000   Pervious SCS Curve No."
"        0.000   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"       26.437   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.807   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.034     0.000     0.000     0.000 c.m/sec"
"             Catchment 101          Pervious   Impervious Total Area "
"             Surface Area           1.488      0.283      1.771      hectare"
"             Time of concentration      ---    8.561      8.561      minutes"
"             Time to Centroid       0.000      130.657    130.657    minutes"
"             Rainfall depth         25.028     25.028     25.028     mm"
"             Rainfall volume        372.32     70.92      443.24     c.m"
"             Rainfall losses        25.028     4.829      21.796     mm"
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"             Runoff volume          0.00       57.23      57.23      c.m"
"             Runoff coefficient     0.000      0.807      0.129      "
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"           8   Copy to Outflow"
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"           6   Combine "
"           1   Node #"
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" 33          CATCHMENT 102"
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"           1   Equal length"
"           1   SCS method"
"         102   Catchment 102"
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"       0.062   Total Area"
"      25.000   Flow length"
"      25.000   Overland Slope"
"       0.062   Pervious Area"
"      25.000   Pervious length"
"      25.000   Pervious slope"
"       0.000   Impervious Area"
"      25.000   Impervious length"
"      25.000   Impervious slope"
"       0.250   Pervious Manning 'n'"
"      49.000   Pervious SCS Curve No."
"       0.000   Pervious Runoff coefficient"
"       0.100   Pervious Ia/S coefficient"
"      26.437   Pervious Initial abstraction"
"       0.015   Impervious Manning 'n'"
"      98.000   Impervious SCS Curve No."
"       0.000   Impervious Runoff coefficient"
"       0.100   Impervious Ia/S coefficient"
"       0.518   Impervious Initial abstraction"
"                    0.000     0.000     0.034     0.034 c.m/sec"
"             Catchment 102          Pervious   Impervious Total Area "
"             Surface Area           0.062      0.000      0.062      hectare"
"             Time of concentration      ---    1.112      1.112      minutes"
"             Time to Centroid       0.000      118.835    118.835    minutes"
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"             Rainfall volume        15.52      0.00       15.52      c.m"
"             Rainfall losses        25.028     5.333      25.028     mm"
"             Runoff depth           0.000      19.695     0.000      mm"
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"           4   Add Runoff "
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"           6   Combine "
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"           1   Equal length"
"           1   SCS method"
"         103   Catchment 103 - Wetland"
"       0.000   % Impervious"
"       0.862   Total Area"
"      90.000   Flow length"
"       1.000   Overland Slope"
"       0.862   Pervious Area"
```

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"       90.000   Pervious length"
"        1.000   Pervious slope"
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"       90.000   Impervious length"
"        1.000   Impervious slope"
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"       70.000   Pervious SCS Curve No."
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"        0.100   Pervious Ia/S coefficient"
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"       98.000   Impervious SCS Curve No."
"        0.000   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                  0.001     0.000     0.000     0.034 c.m/sec"
"             Catchment 103          Pervious   Impervious Total Area "
"             Surface Area           0.862      0.000      0.862      hectare"
"             Time of concentration  131.880    6.301      131.878    minutes"
"             Time to Centroid       295.300    127.158    295.298    minutes"
"             Rainfall depth         25.028     25.028     25.028     mm"
"             Rainfall volume        215.74     0.00       215.74     c.m"
"             Rainfall losses        23.402     4.941      23.402     mm"
"             Runoff depth           1.626      20.087     1.626      mm"
"             Runoff volume          14.02      0.00       14.02      c.m"
"             Runoff coefficient     0.065      0.000      0.065      "
"             Maximum flow           0.001      0.000      0.001      c.m/sec"
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"            4   Add Runoff "
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" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                    0.001     0.001     0.001     0.034"
" 40          HYDROGRAPH   Combine    1"
"            6   Combine "
"            1   Node #"
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"             Total Catchment area                     2.695    hectare"
"             Total Impervious area                    0.283    hectare"
"             Total % impervious                      10.514"
" 19          EXIT"
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"            1   Chicago storm"
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"         6.000   Constant B"
"         0.799   Exponent C"
"         0.400   Fraction R"
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"         1.000   Time step multiplier"
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"            1   Equal length"
"            1   SCS method"
"          101   Catchment 101 - Ex. Residential"
"        16.000   % Impervious"
"         1.771   Total Area"
"       150.000   Flow length"
"         1.000   Overland Slope"
"         1.488   Pervious Area"
"       150.000   Pervious length"
"         1.000   Pervious slope"
"         0.283   Impervious Area"
"       150.000   Impervious length"
"         1.000   Impervious slope"
"         0.250   Pervious Manning 'n'"
"        49.000   Pervious SCS Curve No."
"         0.007   Pervious Runoff coefficient"
"         0.100   Pervious Ia/S coefficient"
"        26.437   Pervious Initial abstraction"
"         0.015   Impervious Manning 'n'"
"        98.000   Impervious SCS Curve No."
"         0.846   Impervious Runoff coefficient"
"         0.100   Impervious Ia/S coefficient"
"         0.518   Impervious Initial abstraction"
"                   0.059     0.000     0.000     0.000 c.m/sec"
"              Catchment 101          Pervious   Impervious Total Area "
"              Surface Area           1.488      0.283      1.771      hectare"
"              Time of concentration  499.294    7.145      26.399     minutes"
"              Time to Centroid       521.457    98.793     115.329    minutes"
"              Rainfall depth         34.259     34.259     34.259     mm"
"              Rainfall volume        509.64     97.08      606.72     c.m"
"              Rainfall losses        34.034     5.275      29.432     mm"
"              Runoff depth           0.225      28.984     4.826      mm"
"              Runoff volume          3.34       82.13      85.47      c.m"
"              Runoff coefficient     0.007      0.846      0.141      "
"              Maximum flow           0.000      0.059      0.059      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"             4   Add Runoff "
"                     0.059     0.059     0.000     0.000"
" 40          HYDROGRAPH Copy to Outflow"
"             8   Copy to Outflow"
"                     0.059     0.059     0.059     0.000"
" 40          HYDROGRAPH   Combine    1"
"             6   Combine "
"             1   Node #"
```

```
"               Wetland"
"             Maximum flow                  0.059    c.m/sec"
"             Hydrograph volume            85.472    c.m"
"                    0.059     0.059     0.059     0.059"
" 40          HYDROGRAPH Start - New Tributary"
"           2   Start - New Tributary"
"                    0.059     0.000     0.059     0.059"
" 33          CATCHMENT 102"
"           1   Triangular SCS"
"           1   Equal length"
"           1   SCS method"
"         102   Catchment 102"
"       0.000   % Impervious"
"       0.062   Total Area"
"      25.000   Flow length"
"      25.000   Overland Slope"
"       0.062   Pervious Area"
"      25.000   Pervious length"
"      25.000   Pervious slope"
"       0.000   Impervious Area"
"      25.000   Impervious length"
"      25.000   Impervious slope"
"       0.250   Pervious Manning 'n'"
"      49.000   Pervious SCS Curve No."
"       0.007   Pervious Runoff coefficient"
"       0.100   Pervious Ia/S coefficient"
"      26.437   Pervious Initial abstraction"
"       0.015   Impervious Manning 'n'"
"      98.000   Impervious SCS Curve No."
"       0.000   Impervious Runoff coefficient"
"       0.100   Impervious Ia/S coefficient"
"       0.518   Impervious Initial abstraction"
"                    0.000     0.000     0.059     0.059 c.m/sec"
"             Catchment 102          Pervious   Impervious Total Area "
"             Surface Area           0.062      0.000      0.062      hectare"
"             Time of concentration  64.876     0.928      64.868     minutes"
"             Time to Centroid       189.703    89.201     189.691    minutes"
"             Rainfall depth         34.259     34.259     34.259     mm"
"             Rainfall volume        21.24      0.00       21.24      c.m"
"             Rainfall losses        34.034     6.149      34.034     mm"
"             Runoff depth           0.225      28.110     0.225      mm"
"             Runoff volume          0.14       0.00       0.14       c.m"
"             Runoff coefficient     0.007      0.000      0.007      "
"             Maximum flow           0.000      0.000      0.000      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                    0.000     0.000     0.059     0.059"
" 40          HYDROGRAPH Copy to Outflow"
"           8   Copy to Outflow"
"                    0.000     0.000     0.000     0.059"
" 40          HYDROGRAPH   Combine    1"
"           6   Combine "
"           1   Node #"
"               Wetland"
"             Maximum flow                  0.059    c.m/sec"
"             Hydrograph volume            85.611    c.m"
"                    0.000     0.000     0.000     0.059"
" 40          HYDROGRAPH Start - New Tributary"
"           2   Start - New Tributary"
"                    0.000     0.000     0.000     0.059"
" 33          CATCHMENT 103"
"           1   Triangular SCS"
"           1   Equal length"
"           1   SCS method"
"         103   Catchment 103 - Wetland"
"       0.000   % Impervious"
"       0.862   Total Area"
"      90.000   Flow length"
"       1.000   Overland Slope"
"       0.862   Pervious Area"
"      90.000   Pervious length"
"       1.000   Pervious slope"
"       0.000   Impervious Area"
"      90.000   Impervious length"
"       1.000   Impervious slope"
"       0.250   Pervious Manning 'n'"
"      70.000   Pervious SCS Curve No."
"       0.121   Pervious Runoff coefficient"
"       0.100   Pervious Ia/S coefficient"
"      10.886   Pervious Initial abstraction"
"       0.015   Impervious Manning 'n'"
"      98.000   Impervious SCS Curve No."
"       0.000   Impervious Runoff coefficient"
"       0.100   Impervious Ia/S coefficient"
"       0.518   Impervious Initial abstraction"
"                    0.004     0.000     0.000     0.059 c.m/sec"
"             Catchment 103          Pervious   Impervious Total Area "
"             Surface Area           0.862      0.000      0.862      hectare"
"             Time of concentration  80.413     5.259      80.412     minutes"
"             Time to Centroid       195.942    95.913     195.941    minutes"
"             Rainfall depth         34.259     34.259     34.259     mm"
"             Rainfall volume        295.31     0.00       295.31     c.m"
"             Rainfall losses        30.128     5.108      30.128     mm"
"             Runoff depth           4.131      29.150     4.131      mm"
"             Runoff volume          35.61      0.00       35.61      c.m"
"             Runoff coefficient     0.121      0.000      0.121      "
"             Maximum flow           0.004      0.000      0.004      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                    0.004     0.004     0.000     0.059"
" 40          HYDROGRAPH Copy to Outflow"
"           8   Copy to Outflow"
"                    0.004     0.004     0.004     0.059"
" 40          HYDROGRAPH   Combine    1"
"           6   Combine "
"           1   Node #"
"               Wetland"
"             Maximum flow                  0.059    c.m/sec"
"             Hydrograph volume           121.220    c.m"
"                    0.004     0.004     0.004     0.059"
" 40          HYDROGRAPH   Confluence    1"
"           7   Confluence "
"           1   Node #"
"               Wetland"
"             Maximum flow                  0.059    c.m/sec"
"             Hydrograph volume           121.220    c.m"
"                    0.004     0.059     0.004     0.000"
" 38          START/RE-START TOTALS 1"
"           3   Runoff Totals on EXIT"
"             Total Catchment area                      2.695    hectare"
"             Total Impervious area                     0.283    hectare"
"             Total % impervious                       10.514"
" 19          EXIT"
```

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"               MIDUSS Output ------------------------------------------------>"
"               MIDUSS version                          Version 2.25  rev. 473"
"               MIDUSS created                        Sunday, February 7, 2010"
"          10   Units used:                                          ie METRIC"
"               Job folder:            Q:\42063\104\SWM\March 2020\MIDUSS\PRE"
"               Output filename:                                    5yr-PRE.in"
"               Licensee name:                                               A"
"               Company                                             Microsoft"
"               Date & Time last used:                3/25/2020 at 4:13:03 PM"
" 31          TIME PARAMETERS"
"        5.000   Time Step"
"      180.000   Max. Storm length"
"     1500.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"           1   Chicago storm"
"     1593.000   Coefficient A"
"       11.000   Constant B"
"        0.879   Exponent C"
"        0.400   Fraction R"
"      180.000   Duration"
"        1.000   Time step multiplier"
"             Maximum intensity          139.250    mm/hr"
"             Total depth                 47.240    mm"
"           6   005hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 101"
"           1   Triangular SCS"
"           1   Equal length"
"           1   SCS method"
"         101   Catchment 101 - Ex. Residential"
"       16.000   % Impervious"
"        1.771   Total Area"
"      150.000   Flow length"
"        1.000   Overland Slope"
"        1.488   Pervious Area"
"      150.000   Pervious length"
"        1.000   Pervious slope"
"        0.283   Impervious Area"
"      150.000   Impervious length"
"        1.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       49.000   Pervious SCS Curve No."
"        0.032   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"       26.437   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.883   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.081     0.000     0.000     0.000 c.m/sec"
"             Catchment 101          Pervious   Impervious Total Area "
"             Surface Area           1.488      0.283      1.771      hectare"
"             Time of concentration  186.369    6.404      35.263     minutes"
"             Time to Centroid       300.041    95.300     128.131    minutes"
"             Rainfall depth         47.240     47.240     47.240     mm"
"             Rainfall volume        702.76     133.86     836.62     c.m"
"             Rainfall losses        45.722     5.522      39.290     mm"
"             Runoff depth           1.518      41.717     7.950      mm"
"             Runoff volume          22.58      118.21     140.79     c.m"
"             Runoff coefficient     0.032      0.883      0.168      "
"             Maximum flow           0.001      0.081      0.081      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                    0.081     0.081     0.000     0.000"
" 40          HYDROGRAPH Copy to Outflow"
"           8   Copy to Outflow"
"                    0.081     0.081     0.081     0.000"
" 40          HYDROGRAPH   Combine    1"
"           6   Combine "
"           1   Node #"
"               Wetland"
"             Maximum flow                  0.081    c.m/sec"
"             Hydrograph volume           140.786    c.m"
"                    0.081     0.081     0.081     0.081"
" 40          HYDROGRAPH Start - New Tributary"
"           2   Start - New Tributary"
"                    0.081     0.000     0.081     0.081"
" 33          CATCHMENT 102"
"           1   Triangular SCS"
"           1   Equal length"
"           1   SCS method"
"         102   Catchment 102"
"       0.000   % Impervious"
"       0.062   Total Area"
"      25.000   Flow length"
"      25.000   Overland Slope"
"       0.062   Pervious Area"
"      25.000   Pervious length"
"      25.000   Pervious slope"
"       0.000   Impervious Area"
"      25.000   Impervious length"
"      25.000   Impervious slope"
"       0.250   Pervious Manning 'n'"
"      49.000   Pervious SCS Curve No."
"       0.032   Pervious Runoff coefficient"
"       0.100   Pervious Ia/S coefficient"
"      26.437   Pervious Initial abstraction"
"       0.015   Impervious Manning 'n'"
"      98.000   Impervious SCS Curve No."
"       0.000   Impervious Runoff coefficient"
"       0.100   Impervious Ia/S coefficient"
"       0.518   Impervious Initial abstraction"
"                    0.000     0.000     0.081     0.081 c.m/sec"
"             Catchment 102          Pervious   Impervious Total Area "
"             Surface Area           0.062      0.000      0.062      hectare"
"             Time of concentration  24.216     0.832      24.215     minutes"
"             Time to Centroid       139.790    87.184     139.788    minutes"
"             Rainfall depth         47.240     47.240     47.240     mm"
"             Rainfall volume        29.29      0.00       29.29      c.m"
"             Rainfall losses        45.724     7.191      45.724     mm"
"             Runoff depth           1.516      40.049     1.516      mm"
"             Runoff volume          0.94       0.00       0.94       c.m"
"             Runoff coefficient     0.032      0.000      0.032      "
"             Maximum flow           0.000      0.000      0.000      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                    0.000     0.000     0.081     0.081"
" 40          HYDROGRAPH Copy to Outflow"
"           8   Copy to Outflow"
"                    0.000     0.000     0.000     0.081"
" 40          HYDROGRAPH   Combine    1"
"           6   Combine "
"           1   Node #"
"               Wetland"
"             Maximum flow                  0.081    c.m/sec"
"             Hydrograph volume           141.726    c.m"
"                    0.000     0.000     0.000     0.081"
" 40          HYDROGRAPH Start - New Tributary"
"           2   Start - New Tributary"
"                    0.000     0.000     0.000     0.081"
" 33          CATCHMENT 103"
"           1   Triangular SCS"
"           1   Equal length"
"           1   SCS method"
"         103   Catchment 103 - Wetland"
"       0.000   % Impervious"
"       0.862   Total Area"
"      90.000   Flow length"
"       1.000   Overland Slope"
"       0.862   Pervious Area"
```

```
"       90.000   Pervious length"
"        1.000   Pervious slope"
"        0.000   Impervious Area"
"       90.000   Impervious length"
"        1.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       70.000   Pervious SCS Curve No."
"        0.193   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"       10.886   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.000   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                  0.013     0.000     0.000     0.081 c.m/sec"
"             Catchment 103          Pervious   Impervious Total Area "
"             Surface Area           0.862      0.000      0.862      hectare"
"             Time of concentration  53.818     4.714      53.818     minutes"
"             Time to Centroid       163.731    92.856     163.731    minutes"
"             Rainfall depth         47.240     47.240     47.240     mm"
"             Rainfall volume        407.21     0.00       407.21     c.m"
"             Rainfall losses        38.142     5.539      38.142     mm"
"             Runoff depth           9.098      41.700     9.098      mm"
"             Runoff volume          78.42      0.00       78.42      c.m"
"             Runoff coefficient     0.193      0.000      0.193      "
"             Maximum flow           0.013      0.000      0.013      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                  0.013     0.013     0.000     0.081"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                  0.013     0.013     0.013     0.081"
" 40          HYDROGRAPH   Combine    1"
"            6   Combine "
"            1   Node #"
"                Wetland"
"             Maximum flow                 0.083    c.m/sec"
"             Hydrograph volume          220.150    c.m"
"                  0.013     0.013     0.013     0.083"
" 40          HYDROGRAPH   Confluence    1"
"            7   Confluence "
"            1   Node #"
"                Wetland"
"             Maximum flow                 0.083    c.m/sec"
"             Hydrograph volume          220.150    c.m"
"                  0.013     0.083     0.013     0.000"
" 38          START/RE-START TOTALS 1"
"            3   Runoff Totals on EXIT"
"             Total Catchment area                    2.695    hectare"
"             Total Impervious area                   0.283    hectare"
"             Total % impervious                     10.514"
" 19          EXIT"
```

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"                MIDUSS Output ----------------------------------------------->"
"                MIDUSS version                        Version 2.25  rev. 473"
"                MIDUSS created                      Sunday, February 7, 2010"
"           10   Units used:                                          ie METRIC"
"                Job folder:           Q:\42063\104\SWM\March 2020\MIDUSS\PRE"
"                Output filename:                                  10yr-PRE.in"
"                Licensee name:                                             A"
"                Company                                           Microsoft"
"                Date & Time last used:              3/25/2020 at 4:13:40 PM"
" 31          TIME PARAMETERS"
"         5.000   Time Step"
"       180.000   Max. Storm length"
"      1500.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"            1   Chicago storm"
"      2221.000   Coefficient A"
"        12.000   Constant B"
"         0.908   Exponent C"
"         0.400   Fraction R"
"       180.000   Duration"
"         1.000   Time step multiplier"
"              Maximum intensity          169.551    mm/hr"
"              Total depth                 56.290    mm"
"             6   010hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 101"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          101   Catchment 101 - Ex. Residential"
"        16.000   % Impervious"
"         1.771   Total Area"
"       150.000   Flow length"
"         1.000   Overland Slope"
"         1.488   Pervious Area"
"       150.000   Pervious length"
"         1.000   Pervious slope"
"         0.283   Impervious Area"
"       150.000   Impervious length"
"         1.000   Impervious slope"
"         0.250   Pervious Manning 'n'"
"        49.000   Pervious SCS Curve No."
"         0.054   Pervious Runoff coefficient"
"         0.100   Pervious Ia/S coefficient"
"        26.437   Pervious Initial abstraction"
"         0.015   Impervious Manning 'n'"
"        98.000   Impervious SCS Curve No."
"         0.902   Impervious Runoff coefficient"
"         0.100   Impervious Ia/S coefficient"
"         0.518   Impervious Initial abstraction"
"                   0.102     0.000     0.000     0.000 c.m/sec"
"              Catchment 101          Pervious   Impervious Total Area "
"              Surface Area           1.488      0.283      1.771      hectare"
"              Time of concentration  127.184    5.891      34.814     minutes"
"              Time to Centroid       246.751    93.536     130.071    minutes"
"              Rainfall depth         56.290     56.290     56.290     mm"
"              Rainfall volume        837.39     159.50     996.90     c.m"
"              Rainfall losses        53.261     5.504      45.620     mm"
"              Runoff depth           3.029      50.786     10.670     mm"
"              Runoff volume          45.06      143.91     188.97     c.m"
"              Runoff coefficient     0.054      0.902      0.190      "
"              Maximum flow           0.004      0.102      0.102      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                   0.102     0.102     0.000     0.000"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                   0.102     0.102     0.102     0.000"
" 40          HYDROGRAPH   Combine    1"
"            6   Combine "
"            1   Node #"
```

```
"               Wetland"
"             Maximum flow                  0.102    c.m/sec"
"             Hydrograph volume           188.968    c.m"
"                    0.102     0.102     0.102     0.102"
" 40          HYDROGRAPH Start - New Tributary"
"             2   Start - New Tributary"
"                    0.102     0.000     0.102     0.102"
" 33          CATCHMENT 102"
"             1   Triangular SCS"
"             1   Equal length"
"             1   SCS method"
"           102   Catchment 102"
"         0.000   % Impervious"
"         0.062   Total Area"
"        25.000   Flow length"
"        25.000   Overland Slope"
"         0.062   Pervious Area"
"        25.000   Pervious length"
"        25.000   Pervious slope"
"         0.000   Impervious Area"
"        25.000   Impervious length"
"        25.000   Impervious slope"
"         0.250   Pervious Manning 'n'"
"        49.000   Pervious SCS Curve No."
"         0.054   Pervious Runoff coefficient"
"         0.100   Pervious Ia/S coefficient"
"        26.437   Pervious Initial abstraction"
"         0.015   Impervious Manning 'n'"
"        98.000   Impervious SCS Curve No."
"         0.000   Impervious Runoff coefficient"
"         0.100   Impervious Ia/S coefficient"
"         0.518   Impervious Initial abstraction"
"                    0.001     0.000     0.102     0.102 c.m/sec"
"             Catchment 102          Pervious   Impervious Total Area "
"             Surface Area           0.062      0.000      0.062      hectare"
"             Time of concentration  16.526     0.765      16.525     minutes"
"             Time to Centroid       126.713    86.179     126.713    minutes"
"             Rainfall depth         56.290     56.290     56.290     mm"
"             Rainfall volume        34.90      0.00       34.90      c.m"
"             Rainfall losses        53.267     8.138      53.267     mm"
"             Runoff depth           3.023      48.152     3.023      mm"
"             Runoff volume          1.87       0.00       1.87       c.m"
"             Runoff coefficient     0.054      0.000      0.054      "
"             Maximum flow           0.001      0.000      0.001      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"             4   Add Runoff "
"                    0.001     0.001     0.102     0.102"
" 40          HYDROGRAPH Copy to Outflow"
"             8   Copy to Outflow"
"                    0.001     0.001     0.001     0.102"
" 40          HYDROGRAPH   Combine    1"
"             6   Combine "
"             1   Node #"
"                 Wetland"
"             Maximum flow                  0.102    c.m/sec"
"             Hydrograph volume           190.843    c.m"
"                    0.001     0.001     0.001     0.102"
" 40          HYDROGRAPH Start - New Tributary"
"             2   Start - New Tributary"
"                    0.001     0.000     0.001     0.102"
" 33          CATCHMENT 103"
"             1   Triangular SCS"
"             1   Equal length"
"             1   SCS method"
"           103   Catchment 103 - Wetland"
"         0.000   % Impervious"
"         0.862   Total Area"
"        90.000   Flow length"
"         1.000   Overland Slope"
"         0.862   Pervious Area"
"        90.000   Pervious length"
"         1.000   Pervious slope"
"         0.000   Impervious Area"
"        90.000   Impervious length"
"         1.000   Impervious slope"
"         0.250   Pervious Manning 'n'"
"        70.000   Pervious SCS Curve No."
"         0.237   Pervious Runoff coefficient"
"         0.100   Pervious Ia/S coefficient"
"        10.886   Pervious Initial abstraction"
"         0.015   Impervious Manning 'n'"
"        98.000   Impervious SCS Curve No."
"         0.000   Impervious Runoff coefficient"
"         0.100   Impervious Ia/S coefficient"
"         0.518   Impervious Initial abstraction"
"                    0.023     0.000     0.001     0.102 c.m/sec"
"             Catchment 103          Pervious   Impervious Total Area "
"             Surface Area           0.862      0.000      0.862      hectare"
"             Time of concentration  44.026     4.336      44.026     minutes"
"             Time to Centroid       150.997    91.294     150.996    minutes"
"             Rainfall depth         56.290     56.290     56.290     mm"
"             Rainfall volume        485.22     0.00       485.22     c.m"
"             Rainfall losses        42.934     5.730      42.934     mm"
"             Runoff depth           13.356     50.560     13.356     mm"
"             Runoff volume          115.13     0.00       115.13     c.m"
"             Runoff coefficient     0.237      0.000      0.237      "
"             Maximum flow           0.023      0.000      0.023      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"             4   Add Runoff "
"                    0.023     0.023     0.001     0.102"
" 40          HYDROGRAPH Copy to Outflow"
"             8   Copy to Outflow"
"                    0.023     0.023     0.023     0.102"
" 40          HYDROGRAPH   Combine    1"
"             6   Combine "
"             1   Node #"
"                 Wetland"
"             Maximum flow                  0.106    c.m/sec"
"             Hydrograph volume           305.973    c.m"
"                    0.023     0.023     0.023     0.106"
" 40          HYDROGRAPH   Confluence    1"
"             7   Confluence "
"             1   Node #"
"                 Wetland"
"             Maximum flow                  0.106    c.m/sec"
"             Hydrograph volume           305.973    c.m"
"                    0.023     0.106     0.023     0.000"
" 38          START/RE-START TOTALS 1"
"             3   Runoff Totals on EXIT"
"             Total Catchment area                      2.695    hectare"
"             Total Impervious area                     0.283    hectare"
"             Total % impervious                       10.514"
" 19          EXIT"
```

```
"               MIDUSS Output ------------------------------------------------>"
"               MIDUSS version                          Version 2.25  rev. 473"
"               MIDUSS created                        Sunday, February 7, 2010"
"          10   Units used:                                          ie METRIC"
"               Job folder:            Q:\42063\104\SWM\March 2020\MIDUSS\PRE"
"               Output filename:                                   25yr-PRE.in"
"               Licensee name:                                               A"
"               Company                                              Microsoft"
"               Date & Time last used:                3/25/2020 at 4:14:17 PM"
" 31          TIME PARAMETERS"
"        5.000   Time Step"
"      180.000   Max. Storm length"
"     1500.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"           1   Chicago storm"
"     3158.000   Coefficient A"
"       15.000   Constant B"
"        0.936   Exponent C"
"        0.400   Fraction R"
"      180.000   Duration"
"        1.000   Time step multiplier"
"             Maximum intensity          191.271    mm/hr"
"             Total depth                 68.087    mm"
"             6   025hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 101"
"             1   Triangular SCS"
"             1   Equal length"
"             1   SCS method"
"           101   Catchment 101 - Ex. Residential"
"        16.000   % Impervious"
"         1.771   Total Area"
"      150.000   Flow length"
"         1.000   Overland Slope"
"         1.488   Pervious Area"
"      150.000   Pervious length"
"         1.000   Pervious slope"
"         0.283   Impervious Area"
"      150.000   Impervious length"
"         1.000   Impervious slope"
"         0.250   Pervious Manning 'n'"
"        49.000   Pervious SCS Curve No."
"         0.083   Pervious Runoff coefficient"
"         0.100   Pervious Ia/S coefficient"
"        26.437   Pervious Initial abstraction"
"         0.015   Impervious Manning 'n'"
"        98.000   Impervious SCS Curve No."
"         0.916   Impervious Runoff coefficient"
"         0.100   Impervious Ia/S coefficient"
"         0.518   Impervious Initial abstraction"
"                     0.121     0.000     0.000     0.000 c.m/sec"
"              Catchment 101          Pervious   Impervious Total Area "
"              Surface Area           1.488      0.283      1.771      hectare"
"              Time of concentration  94.092     5.592      34.188     minutes"
"              Time to Centroid       210.505    92.481     130.617    minutes"
"              Rainfall depth         68.087     68.087     68.087     mm"
"              Rainfall volume        1012.88    192.93     1205.81    c.m"
"              Rainfall losses        62.419     5.752      53.352     mm"
"              Runoff depth           5.668      62.335     14.735     mm"
"              Runoff volume          84.32      176.63     260.95     c.m"
"              Runoff coefficient     0.083      0.916      0.216      "
"              Maximum flow           0.009      0.120      0.121      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"             4   Add Runoff "
"                     0.121     0.121     0.000     0.000"
" 40          HYDROGRAPH Copy to Outflow"
"             8   Copy to Outflow"
"                     0.121     0.121     0.121     0.000"
" 40          HYDROGRAPH   Combine    1"
"             6   Combine "
"             1   Node #"
"                 Wetland"
"              Maximum flow                  0.121    c.m/sec"
"              Hydrograph volume           260.951    c.m"
"                     0.121     0.121     0.121     0.121"
" 40          HYDROGRAPH Start - New Tributary"
"             2   Start - New Tributary"
"                     0.121     0.000     0.121     0.121"
" 33          CATCHMENT 102"
"             1   Triangular SCS"
"             1   Equal length"
"             1   SCS method"
"           102   Catchment 102"
"         0.000   % Impervious"
"         0.062   Total Area"
"        25.000   Flow length"
"        25.000   Overland Slope"
"         0.062   Pervious Area"
"        25.000   Pervious length"
"        25.000   Pervious slope"
"         0.000   Impervious Area"
"        25.000   Impervious length"
"        25.000   Impervious slope"
"         0.250   Pervious Manning 'n'"
"        49.000   Pervious SCS Curve No."
"         0.083   Pervious Runoff coefficient"
"         0.100   Pervious Ia/S coefficient"
"        26.437   Pervious Initial abstraction"
"         0.015   Impervious Manning 'n'"
"        98.000   Impervious SCS Curve No."
"         0.000   Impervious Runoff coefficient"
"         0.100   Impervious Ia/S coefficient"
"         0.518   Impervious Initial abstraction"
"                     0.001     0.000     0.121     0.121 c.m/sec"
"              Catchment 102          Pervious   Impervious Total Area "
"              Surface Area           0.062      0.000      0.062      hectare"
"              Time of concentration  12.226     0.727      12.226     minutes"
"              Time to Centroid       118.555    85.716     118.555    minutes"
"              Rainfall depth         68.087     68.087     68.087     mm"
"              Rainfall volume        42.21      0.00       42.21      c.m"
"              Rainfall losses        62.437     9.227      62.436     mm"
"              Runoff depth           5.650      58.859     5.650      mm"
"              Runoff volume          3.50       0.00       3.50       c.m"
"              Runoff coefficient     0.083      0.000      0.083      "
"              Maximum flow           0.001      0.000      0.001      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"             4   Add Runoff "
"                     0.001     0.001     0.121     0.121"
" 40          HYDROGRAPH Copy to Outflow"
"             8   Copy to Outflow"
"                     0.001     0.001     0.001     0.121"
" 40          HYDROGRAPH   Combine    1"
"             6   Combine "
"             1   Node #"
"                 Wetland"
"              Maximum flow                  0.121    c.m/sec"
"              Hydrograph volume           264.454    c.m"
"                     0.001     0.001     0.001     0.121"
" 40          HYDROGRAPH Start - New Tributary"
"             2   Start - New Tributary"
"                     0.001     0.000     0.001     0.121"
" 33          CATCHMENT 103"
"             1   Triangular SCS"
"             1   Equal length"
"             1   SCS method"
"           103   Catchment 103 - Wetland"
"         0.000   % Impervious"
"         0.862   Total Area"
"        90.000   Flow length"
"         1.000   Overland Slope"
"         0.862   Pervious Area"
```

```
"       90.000   Pervious length"
"        1.000   Pervious slope"
"        0.000   Impervious Area"
"       90.000   Impervious length"
"        1.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       70.000   Pervious SCS Curve No."
"        0.289   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"       10.886   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.000   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                  0.039     0.000     0.001     0.121 c.m/sec"
"             Catchment 103          Pervious   Impervious Total Area "
"             Surface Area           0.862      0.000      0.862      hectare"
"             Time of concentration  37.760     4.116      37.760     minutes"
"             Time to Centroid       141.982    90.424     141.982    minutes"
"             Rainfall depth         68.087     68.087     68.087     mm"
"             Rainfall volume        586.91     0.00       586.91     c.m"
"             Rainfall losses        48.395     6.029      48.395     mm"
"             Runoff depth           19.692     62.058     19.692     mm"
"             Runoff volume          169.74     0.00       169.74     c.m"
"             Runoff coefficient     0.289      0.000      0.289      "
"             Maximum flow           0.039      0.000      0.039      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                  0.039     0.039     0.001     0.121"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                  0.039     0.039     0.039     0.121"
" 40          HYDROGRAPH   Combine    1"
"            6   Combine "
"            1   Node #"
"                Wetland"
"             Maximum flow                  0.128    c.m/sec"
"             Hydrograph volume           434.195    c.m"
"                  0.039     0.039     0.039     0.128"
" 40          HYDROGRAPH   Confluence    1"
"            7   Confluence "
"            1   Node #"
"                Wetland"
"             Maximum flow                  0.128    c.m/sec"
"             Hydrograph volume           434.195    c.m"
"                  0.039     0.128     0.039     0.000"
" 38          START/RE-START TOTALS 1"
"            3   Runoff Totals on EXIT"
"             Total Catchment area                      2.695    hectare"
"             Total Impervious area                     0.283    hectare"
"             Total % impervious                       10.514"
" 19          EXIT"
```

```
"                MIDUSS Output ------------------------------------------------>"
"                MIDUSS version                          Version 2.25  rev. 473"
"                MIDUSS created                        Sunday, February 7, 2010"
"           10   Units used:                                          ie METRIC"
"                Job folder:            Q:\42063\104\SWM\March 2020\MIDUSS\PRE"
"                Output filename:                                  50yr-PRE.in"
"                Licensee name:                                              A"
"                Company                                            Microsoft"
"                Date & Time last used:                3/25/2020 at 4:14:56 PM"
" 31          TIME PARAMETERS"
"         5.000   Time Step"
"       180.000   Max. Storm length"
"      1500.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"            1   Chicago storm"
"      3886.000   Coefficient A"
"        16.000   Constant B"
"         0.950   Exponent C"
"         0.400   Fraction R"
"       180.000   Duration"
"         1.000   Time step multiplier"
"              Maximum intensity           215.474    mm/hr"
"              Total depth                  77.443    mm"
"            6   050hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 101"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          101   Catchment 101 - Ex. Residential"
"        16.000   % Impervious"
"         1.771   Total Area"
"       150.000   Flow length"
"         1.000   Overland Slope"
"         1.488   Pervious Area"
"       150.000   Pervious length"
"         1.000   Pervious slope"
"         0.283   Impervious Area"
"       150.000   Impervious length"
"         1.000   Impervious slope"
"         0.250   Pervious Manning 'n'"
"        49.000   Pervious SCS Curve No."
"         0.107   Pervious Runoff coefficient"
"         0.100   Pervious Ia/S coefficient"
"        26.437   Pervious Initial abstraction"
"         0.015   Impervious Manning 'n'"
"        98.000   Impervious SCS Curve No."
"         0.922   Impervious Runoff coefficient"
"         0.100   Impervious Ia/S coefficient"
"         0.518   Impervious Initial abstraction"
"                   0.138     0.000     0.000     0.000 c.m/sec"
"              Catchment 101          Pervious   Impervious Total Area "
"              Surface Area           1.488      0.283      1.771      hectare"
"              Time of concentration  79.262     5.320      33.226     minutes"
"              Time to Centroid       192.188    91.697     129.622    minutes"
"              Rainfall depth         77.443     77.443     77.443     mm"
"              Rainfall volume        1152.07    219.44     1371.51    c.m"
"              Rainfall losses        69.195     6.006      59.085     mm"
"              Runoff depth           8.248      71.437     18.358     mm"
"              Runoff volume          122.70     202.42     325.12     c.m"
"              Runoff coefficient     0.107      0.922      0.237      "
"              Maximum flow           0.016      0.137      0.138      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                   0.138     0.138     0.000     0.000"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                   0.138     0.138     0.138     0.000"
" 40          HYDROGRAPH   Combine    1"
"            6   Combine "
"            1   Node #"
```

```
"               Wetland"
"             Maximum flow                  0.138    c.m/sec"
"             Hydrograph volume           325.125    c.m"
"                    0.138     0.138     0.138     0.138"
" 40          HYDROGRAPH Start - New Tributary"
"             2   Start - New Tributary"
"                    0.138     0.000     0.138     0.138"
" 33          CATCHMENT 102"
"             1   Triangular SCS"
"             1   Equal length"
"             1   SCS method"
"           102   Catchment 102"
"         0.000   % Impervious"
"         0.062   Total Area"
"        25.000   Flow length"
"        25.000   Overland Slope"
"         0.062   Pervious Area"
"        25.000   Pervious length"
"        25.000   Pervious slope"
"         0.000   Impervious Area"
"        25.000   Impervious length"
"        25.000   Impervious slope"
"         0.250   Pervious Manning 'n'"
"        49.000   Pervious SCS Curve No."
"         0.106   Pervious Runoff coefficient"
"         0.100   Pervious Ia/S coefficient"
"        26.437   Pervious Initial abstraction"
"         0.015   Impervious Manning 'n'"
"        98.000   Impervious SCS Curve No."
"         0.000   Impervious Runoff coefficient"
"         0.100   Impervious Ia/S coefficient"
"         0.518   Impervious Initial abstraction"
"                    0.002     0.000     0.138     0.138 c.m/sec"
"               Catchment 102          Pervious   Impervious Total Area "
"               Surface Area           0.062      0.000      0.062      hectare"
"               Time of concentration  10.299     0.691      10.299     minutes"
"               Time to Centroid       114.162    85.316     114.161    minutes"
"               Rainfall depth         77.443     77.443     77.443     mm"
"               Rainfall volume        48.01      0.00       48.01      c.m"
"               Rainfall losses        69.230     10.260     69.230     mm"
"               Runoff depth           8.212      67.183     8.212      mm"
"               Runoff volume          5.09       0.00       5.09       c.m"
"               Runoff coefficient     0.106      0.000      0.106      "
"               Maximum flow           0.002      0.000      0.002      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"             4   Add Runoff "
"                    0.002     0.002     0.138     0.138"
" 40          HYDROGRAPH Copy to Outflow"
"             8   Copy to Outflow"
"                    0.002     0.002     0.002     0.138"
" 40          HYDROGRAPH   Combine    1"
"             6   Combine "
"             1   Node #"
"                 Wetland"
"               Maximum flow                  0.138    c.m/sec"
"               Hydrograph volume           330.216    c.m"
"                    0.002     0.002     0.002     0.138"
" 40          HYDROGRAPH Start - New Tributary"
"             2   Start - New Tributary"
"                    0.002     0.000     0.002     0.138"
" 33          CATCHMENT 103"
"             1   Triangular SCS"
"             1   Equal length"
"             1   SCS method"
"           103   Catchment 103 - Wetland"
"         0.000   % Impervious"
"         0.862   Total Area"
"        90.000   Flow length"
"         1.000   Overland Slope"
"         0.862   Pervious Area"
"        90.000   Pervious length"
"         1.000   Pervious slope"
"         0.000   Impervious Area"
"        90.000   Impervious length"
"         1.000   Impervious slope"
"         0.250   Pervious Manning 'n'"
"        70.000   Pervious SCS Curve No."
"         0.326   Pervious Runoff coefficient"
"         0.100   Pervious Ia/S coefficient"
"        10.886   Pervious Initial abstraction"
"         0.015   Impervious Manning 'n'"
"        98.000   Impervious SCS Curve No."
"         0.000   Impervious Runoff coefficient"
"         0.100   Impervious Ia/S coefficient"
"         0.518   Impervious Initial abstraction"
"                    0.055     0.000     0.002     0.138 c.m/sec"
"               Catchment 103          Pervious   Impervious Total Area "
"               Surface Area           0.862      0.000      0.862      hectare"
"               Time of concentration  33.846     3.916      33.846     minutes"
"               Time to Centroid       136.399    89.753     136.399    minutes"
"               Rainfall depth         77.443     77.443     77.443     mm"
"               Rainfall volume        667.56     0.00       667.56     c.m"
"               Rainfall losses        52.197     6.410      52.197     mm"
"               Runoff depth           25.246     71.032     25.246     mm"
"               Runoff volume          217.62     0.00       217.62     c.m"
"               Runoff coefficient     0.326      0.000      0.326      "
"               Maximum flow           0.055      0.000      0.055      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"             4   Add Runoff "
"                    0.055     0.055     0.002     0.138"
" 40          HYDROGRAPH Copy to Outflow"
"             8   Copy to Outflow"
"                    0.055     0.055     0.055     0.138"
" 40          HYDROGRAPH   Combine    1"
"             6   Combine "
"             1   Node #"
"                 Wetland"
"               Maximum flow                  0.150    c.m/sec"
"               Hydrograph volume           547.836    c.m"
"                    0.055     0.055     0.055     0.150"
" 40          HYDROGRAPH   Confluence    1"
"             7   Confluence "
"             1   Node #"
"                 Wetland"
"               Maximum flow                  0.150    c.m/sec"
"               Hydrograph volume           547.836    c.m"
"                    0.055     0.150     0.055     0.000"
" 38          START/RE-START TOTALS 1"
"             3   Runoff Totals on EXIT"
"               Total Catchment area                      2.695    hectare"
"               Total Impervious area                     0.283    hectare"
"               Total % impervious                       10.514"
" 19          EXIT"
```

```
"               MIDUSS Output ------------------------------------------------>"
"               MIDUSS version                          Version 2.25  rev. 473"
"               MIDUSS created                        Sunday, February 7, 2010"
"          10   Units used:                                          ie METRIC"
"               Job folder:            Q:\42063\104\SWM\March 2020\MIDUSS\PRE"
"               Output filename:                                  100yr-PRE.in"
"               Licensee name:                                               A"
"               Company                                              Microsoft"
"               Date & Time last used:                 3/25/2020 at 4:15:42 PM"
" 31          TIME PARAMETERS"
"        5.000   Time Step"
"      180.000   Max. Storm length"
"     1500.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"           1   Chicago storm"
"     4688.000   Coefficient A"
"       17.000   Constant B"
"        0.962   Exponent C"
"        0.400   Fraction R"
"      180.000   Duration"
"        1.000   Time step multiplier"
"             Maximum intensity          239.650    mm/hr"
"             Total depth                 87.263    mm"
"           6   100hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 101"
"             1   Triangular SCS"
"             1   Equal length"
"             1   SCS method"
"           101   Catchment 101 - Ex. Residential"
"        16.000   % Impervious"
"         1.771   Total Area"
"       150.000   Flow length"
"         1.000   Overland Slope"
"         1.488   Pervious Area"
"       150.000   Pervious length"
"         1.000   Pervious slope"
"         0.283   Impervious Area"
"       150.000   Impervious length"
"         1.000   Impervious slope"
"         0.250   Pervious Manning 'n'"
"        49.000   Pervious SCS Curve No."
"         0.130   Pervious Runoff coefficient"
"         0.100   Pervious Ia/S coefficient"
"        26.437   Pervious Initial abstraction"
"         0.015   Impervious Manning 'n'"
"        98.000   Impervious SCS Curve No."
"         0.930   Impervious Runoff coefficient"
"         0.100   Impervious Ia/S coefficient"
"         0.518   Impervious Initial abstraction"
"                   0.155     0.000     0.000     0.000 c.m/sec"
"             Catchment 101          Pervious   Impervious Total Area "
"             Surface Area           1.488      0.283      1.771      hectare"
"             Time of concentration  69.055     5.091      32.205     minutes"
"             Time to Centroid       178.766    91.046     128.230    minutes"
"             Rainfall depth         87.263     87.263     87.263     mm"
"             Rainfall volume        1298.17    247.27     1545.44    c.m"
"             Rainfall losses        75.888     6.094      64.721     mm"
"             Runoff depth           11.376     81.170     22.543     mm"
"             Runoff volume          169.23     230.00     399.23     c.m"
"             Runoff coefficient     0.130      0.930      0.258      "
"             Maximum flow           0.025      0.153      0.155      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"             4   Add Runoff "
"                   0.155     0.155     0.000     0.000"
" 40          HYDROGRAPH Copy to Outflow"
"             8   Copy to Outflow"
"                   0.155     0.155     0.155     0.000"
" 40          HYDROGRAPH   Combine    1"
"             6   Combine "
"             1   Node #"
"                 Wetland"
"             Maximum flow                  0.155    c.m/sec"
"             Hydrograph volume           399.232    c.m"
"                   0.155     0.155     0.155     0.155"
" 40          HYDROGRAPH Start - New Tributary"
"             2   Start - New Tributary"
"                   0.155     0.000     0.155     0.155"
" 33          CATCHMENT 102"
"             1   Triangular SCS"
"             1   Equal length"
"             1   SCS method"
"           102   Catchment 102"
"         0.000   % Impervious"
"         0.062   Total Area"
"        25.000   Flow length"
"        25.000   Overland Slope"
"         0.062   Pervious Area"
"        25.000   Pervious length"
"        25.000   Pervious slope"
"         0.000   Impervious Area"
"        25.000   Impervious length"
"        25.000   Impervious slope"
"         0.250   Pervious Manning 'n'"
"        49.000   Pervious SCS Curve No."
"         0.130   Pervious Runoff coefficient"
"         0.100   Pervious Ia/S coefficient"
"        26.437   Pervious Initial abstraction"
"         0.015   Impervious Manning 'n'"
"        98.000   Impervious SCS Curve No."
"         0.000   Impervious Runoff coefficient"
"         0.100   Impervious Ia/S coefficient"
"         0.518   Impervious Initial abstraction"
"                   0.003     0.000     0.155     0.155 c.m/sec"
"             Catchment 102          Pervious   Impervious Total Area "
"             Surface Area           0.062      0.000      0.062      hectare"
"             Time of concentration  8.973      0.661      8.973      minutes"
"             Time to Centroid       110.960    85.008     110.960    minutes"
"             Rainfall depth         87.263     87.263     87.263     mm"
"             Rainfall volume        54.10      0.00       54.10      c.m"
"             Rainfall losses        75.956     11.400     75.956     mm"
"             Runoff depth           11.307     75.863     11.307     mm"
"             Runoff volume          7.01       0.00       7.01       c.m"
"             Runoff coefficient     0.130      0.000      0.130      "
"             Maximum flow           0.003      0.000      0.003      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"             4   Add Runoff "
"                   0.003     0.003     0.155     0.155"
" 40          HYDROGRAPH Copy to Outflow"
"             8   Copy to Outflow"
"                   0.003     0.003     0.003     0.155"
" 40          HYDROGRAPH   Combine    1"
"             6   Combine "
"             1   Node #"
"                 Wetland"
"             Maximum flow                  0.156    c.m/sec"
"             Hydrograph volume           406.242    c.m"
"                   0.003     0.003     0.003     0.156"
" 40          HYDROGRAPH Start - New Tributary"
"             2   Start - New Tributary"
"                   0.003     0.000     0.003     0.156"
" 33          CATCHMENT 103"
"             1   Triangular SCS"
"             1   Equal length"
"             1   SCS method"
"           103   Catchment 103 - Wetland"
"         0.000   % Impervious"
"         0.862   Total Area"
"        90.000   Flow length"
"         1.000   Overland Slope"
"         0.862   Pervious Area"
```

```
"       90.000   Pervious length"
"        1.000   Pervious slope"
"        0.000   Impervious Area"
"       90.000   Impervious length"
"        1.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       70.000   Pervious SCS Curve No."
"        0.361   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"       10.886   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.000   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                  0.074     0.000     0.003     0.156 c.m/sec"
"             Catchment 103          Pervious   Impervious Total Area "
"             Surface Area           0.862      0.000      0.862      hectare"
"             Time of concentration  30.815     3.747      30.815     minutes"
"             Time to Centroid       132.018    89.195     132.018    minutes"
"             Rainfall depth         87.263     87.263     87.263     mm"
"             Rainfall volume        752.21     0.00       752.21     c.m"
"             Rainfall losses        55.779     6.989      55.779     mm"
"             Runoff depth           31.484     80.275     31.484     mm"
"             Runoff volume          271.40     0.00       271.40     c.m"
"             Runoff coefficient     0.361      0.000      0.361      "
"             Maximum flow           0.074      0.000      0.074      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.074     0.074     0.003     0.156"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                    0.074     0.074     0.074     0.156"
" 40          HYDROGRAPH   Combine    1"
"            6   Combine "
"            1   Node #"
"                Wetland"
"             Maximum flow                  0.174    c.m/sec"
"             Hydrograph volume           677.643    c.m"
"                    0.074     0.074     0.074     0.174"
" 40          HYDROGRAPH   Confluence    1"
"            7   Confluence "
"            1   Node #"
"                Wetland"
"             Maximum flow                  0.174    c.m/sec"
"             Hydrograph volume           677.643    c.m"
"                    0.074     0.174     0.074     0.000"
" 38          START/RE-START TOTALS 1"
"            3   Runoff Totals on EXIT"
"             Total Catchment area                      2.695    hectare"
"             Total Impervious area                     0.283    hectare"
"             Total % impervious                       10.514"
" 19          EXIT"
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"                MIDUSS Output ------------------------------------------------>"
"                MIDUSS version                          Version 2.25  rev. 473"
"                MIDUSS created                        Sunday, February 7, 2010"
"           10   Units used:                                          ie METRIC"
"                Job folder:            Q:\42063\104\SWM\March 2020\MIDUSS\PRE"
"                Output filename:                                  REG-PRE.in"
"                Licensee name:                                             A"
"                Company                                           Microsoft"
"                Date & Time last used:                3/25/2020 at 4:16:20 PM"
" 31          TIME PARAMETERS"
"         5.000   Time Step"
"      2880.000   Max. Storm length"
"      9000.000   Max. Hydrograph"
" 32          STORM Mass Curve"
"            3   Mass Curve"
"       285.000   Rainfall depth"
"      2880.000   Duration"
"            38   Q:\TOOLS\SWM\Hazel entire 48 hours.mrd   Hurricane Hazel (entire 48 h)"
"              Maximum intensity           53.012    mm/hr"
"              Total depth               285.000    mm"
"            8   99999hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 101"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          101   Catchment 101 - Ex. Residential"
"        16.000   % Impervious"
"         1.771   Total Area"
"       150.000   Flow length"
"         1.000   Overland Slope"
"         1.488   Pervious Area"
"       150.000   Pervious length"
"         1.000   Pervious slope"
"         0.283   Impervious Area"
"       150.000   Impervious length"
"         1.000   Impervious slope"
"         0.250   Pervious Manning 'n'"
"        49.000   Pervious SCS Curve No."
"         0.449   Pervious Runoff coefficient"
"         0.100   Pervious Ia/S coefficient"
"        26.437   Pervious Initial abstraction"
"         0.015   Impervious Manning 'n'"
"        98.000   Impervious SCS Curve No."
"         0.975   Impervious Runoff coefficient"
"         0.100   Impervious Ia/S coefficient"
"         0.518   Impervious Initial abstraction"
"                   0.174     0.000     0.000     0.000 c.m/sec"
"              Catchment 101          Pervious   Impervious Total Area "
"              Surface Area           1.488      0.283      1.771      hectare"
"              Time of concentration  58.245     9.248      43.899     minutes"
"              Time to Centroid       2686.078   2277.996   2566.594   minutes"
"              Rainfall depth         285.000    285.000    285.000    mm"
"              Rainfall volume        4239.77    807.58     5047.35    c.m"
"              Rainfall losses        157.177    7.166      133.175    mm"
"              Runoff depth           127.823    277.834    151.825    mm"
"              Runoff volume          1901.54    787.27     2688.82    c.m"
"              Runoff coefficient     0.449      0.975      0.533      "
"              Maximum flow           0.144      0.044      0.174      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"             4   Add Runoff "
"                     0.174     0.174     0.000     0.000"
" 40          HYDROGRAPH Copy to Outflow"
"             8   Copy to Outflow"
"                     0.174     0.174     0.174     0.000"
" 40          HYDROGRAPH   Combine    1"
"             6   Combine "
"             1   Node #"
"                 Wetland"
"              Maximum flow                  0.174    c.m/sec"
"              Hydrograph volume          2688.815    c.m"
```

```
"                   0.174     0.174     0.174     0.174"
" 40          HYDROGRAPH Start - New Tributary"
"           2   Start - New Tributary"
"                   0.174     0.000     0.174     0.174"
" 33          CATCHMENT 102"
"           1   Triangular SCS"
"           1   Equal length"
"           1   SCS method"
"         102   Catchment 102"
"       0.000   % Impervious"
"       0.062   Total Area"
"      25.000   Flow length"
"      25.000   Overland Slope"
"       0.062   Pervious Area"
"      25.000   Pervious length"
"      25.000   Pervious slope"
"       0.000   Impervious Area"
"      25.000   Impervious length"
"      25.000   Impervious slope"
"       0.250   Pervious Manning 'n'"
"      49.000   Pervious SCS Curve No."
"       0.447   Pervious Runoff coefficient"
"       0.100   Pervious Ia/S coefficient"
"      26.437   Pervious Initial abstraction"
"       0.015   Impervious Manning 'n'"
"      98.000   Impervious SCS Curve No."
"       0.000   Impervious Runoff coefficient"
"       0.100   Impervious Ia/S coefficient"
"       0.518   Impervious Initial abstraction"
"                   0.006     0.000     0.174     0.174 c.m/sec"
"            Catchment 102          Pervious   Impervious Total Area "
"            Surface Area           0.062      0.000      0.062      hectare"
"            Time of concentration  7.568      1.202      7.568      minutes"
"            Time to Centroid       2619.752   2264.440   2619.753   minutes"
"            Rainfall depth         285.000    285.000    285.000    mm"
"            Rainfall volume        176.70     0.00       176.70     c.m"
"            Rainfall losses        157.478    10.266     157.478    mm"
"            Runoff depth           127.522    274.734    127.522    mm"
"            Runoff volume          79.06      0.00       79.06      c.m"
"            Runoff coefficient     0.447      0.000      0.447      "
"            Maximum flow           0.006      0.000      0.006      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                   0.006     0.006     0.174     0.174"
" 40          HYDROGRAPH Copy to Outflow"
"           8   Copy to Outflow"
"                   0.006     0.006     0.006     0.174"
" 40          HYDROGRAPH   Combine    1"
"           6   Combine "
"           1   Node #"
"               Wetland"
"            Maximum flow                 0.179    c.m/sec"
"            Hydrograph volume         2767.879    c.m"
"                   0.006     0.006     0.006     0.179"
" 40          HYDROGRAPH Start - New Tributary"
"           2   Start - New Tributary"
"                   0.006     0.000     0.006     0.179"
" 33          CATCHMENT 103"
"           1   Triangular SCS"
"           1   Equal length"
"           1   SCS method"
"         103   Catchment 103 - Wetland"
"       0.000   % Impervious"
"       0.862   Total Area"
"      90.000   Flow length"
"       1.000   Overland Slope"
"       0.862   Pervious Area"
"      90.000   Pervious length"
"       1.000   Pervious slope"
"       0.000   Impervious Area"
"      90.000   Impervious length"
"       1.000   Impervious slope"
"       0.250   Pervious Manning 'n'"
"      70.000   Pervious SCS Curve No."
"       0.688   Pervious Runoff coefficient"
"       0.100   Pervious Ia/S coefficient"
"      10.886   Pervious Initial abstraction"
"       0.015   Impervious Manning 'n'"
"      98.000   Impervious SCS Curve No."
"       0.000   Impervious Runoff coefficient"
"       0.100   Impervious Ia/S coefficient"
"       0.518   Impervious Initial abstraction"
"                   0.119     0.000     0.006     0.179 c.m/sec"
"            Catchment 103          Pervious   Impervious Total Area "
"            Surface Area           0.862      0.000      0.862      hectare"
"            Time of concentration  38.550     6.807      38.550     minutes"
"            Time to Centroid       2562.498   2273.436   2562.497   minutes"
"            Rainfall depth         285.000    285.000    285.000    mm"
"            Rainfall volume        2456.70    0.00       2456.70    c.m"
"            Rainfall losses        88.888     8.121      88.888     mm"
"            Runoff depth           196.112    276.879    196.112    mm"
"            Runoff volume          1690.49    0.00       1690.49    c.m"
"            Runoff coefficient     0.688      0.000      0.688      "
"            Maximum flow           0.119      0.000      0.119      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                   0.119     0.119     0.006     0.179"
" 40          HYDROGRAPH Copy to Outflow"
"           8   Copy to Outflow"
"                   0.119     0.119     0.119     0.179"
" 40          HYDROGRAPH   Combine    1"
"           6   Combine "
"           1   Node #"
"               Wetland"
"            Maximum flow                 0.297    c.m/sec"
"            Hydrograph volume         4458.370    c.m"
"                   0.119     0.119     0.119     0.297"
" 40          HYDROGRAPH   Confluence    1"
"           7   Confluence "
"           1   Node #"
"               Wetland"
"            Maximum flow                 0.297    c.m/sec"
"            Hydrograph volume         4458.371    c.m"
"                   0.119     0.297     0.119     0.000"
" 38          START/RE-START TOTALS 1"
"           3   Runoff Totals on EXIT"
"            Total Catchment area                    2.695    hectare"
"            Total Impervious area                   0.283    hectare"
"            Total % impervious                     10.514"
" 19          EXIT"
```

Appendix C

Proposed Conditions Catchment Parameters and MIDUSS Modelling

190-216 ARKELL ROAD
STORMWATER MANAGEMENT
Guelph, Ontario

Project Number:	42063-104
Date:	March 19, 2020
Design By:	AJC
File:	Q:\42063\104\SWM\March 2020\42063-104 Master SWM Facility Design Sheet.xlsx

HYDROLOGIC PARAMETERS
Post-Development Conditions

Sub-Catchment Number	Area	Overland Slope	Overland Length	SCS Curve Number			Percent Impervious	Land Use	Comment
				Pervious (AMC II)*	Pervious (AMC III)	Impervious			
	(ha)	*(%)*	*(m)*				*(%)*		
201	0.658	0.7	45	68	83	98	79.0	ROW + Street Fronting Towns	
202	0.263	2.0	30	68	83	98	85.0	Block 1	
203	0.071	2.0	15	68	83	98	90.0	Block 2	
204	0.207	5.0	10	68	83	98	80.0	SWMF + Embankments	
Total to SWMF	**1.20**						**81.1**		
205-1	0.090	2.0	20	49	69	98	11.0	Uncontrolled to Arkell Gallery	
205-2	0.134	4.0	35	49	69	98	35.0	Uncontrolled to Arkell/Wetland	
206	0.185	0.8	100	39	60	98	0.0	Park, Uncont. Swales to Wetland	
207	0.222	5.0	10	49	69	98	0.0	Uncont. Rear Yards to Wetland	
208	0.862	1.0	90	70	84	98	0.0	Wetland	
Grand Total	**2.69**						**38.25**		

IDF PARAMETERS
City of Guelph

Frequency (Years)	a	b	c	Comment
2	743	6.0	0.7989	
5	1,593	11.0	0.8789	
10	2,221	12.0	0.9080	
25	3,158	15.0	0.9355	
50	3,886	16.0	0.9495	
100	4,688	17.0	0.9624	

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"               MIDUSS Output ------------------------------------------------>"
"               MIDUSS version                          Version 2.25  rev. 473"
"               MIDUSS created                        Sunday, February 7, 2010"
"          10   Units used:                                          ie METRIC"
"               Job folder:           Q:\42063\104\SWM\March 2020\MIDUSS\POST"
"               Output filename:                                  25mm-POST.in"
"               Licensee name:                                               A"
"               Company                                              Microsoft"
"               Date & Time last used:                3/25/2020 at 4:29:46 PM"
" 31          TIME PARAMETERS"
"        5.000   Time Step"
"      240.000   Max. Storm length"
"     1500.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"           1   Chicago storm"
"      509.000   Coefficient A"
"        6.000   Constant B"
"        0.799   Exponent C"
"        0.400   Fraction R"
"      240.000   Duration"
"        1.000   Time step multiplier"
"             Maximum intensity            71.966    mm/hr"
"             Total depth                  25.028    mm"
"           6   025hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 201"
"           1   Triangular SCS"
"           1   Equal length"
"           1   SCS method"
"         201   Catchment 201"
"       79.000   % Impervious"
"        0.658   Total Area"
"       45.000   Flow length"
"        0.700   Overland Slope"
"        0.138   Pervious Area"
"       45.000   Pervious length"
"        0.700   Pervious slope"
"        0.520   Impervious Area"
"       45.000   Impervious length"
"        0.700   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       68.000   Pervious SCS Curve No."
"        0.052   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"       11.953   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.800   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.069     0.000     0.000     0.000 c.m/sec"
"             Catchment 201          Pervious   Impervious Total Area "
"             Surface Area           0.138      0.520      0.658      hectare"
"             Time of concentration  110.604    4.626      6.409      minutes"
"             Time to Centroid       270.767    124.526    126.986    minutes"
"             Rainfall depth         25.028     25.028     25.028     mm"
"             Rainfall volume        34.58      130.10     164.68     c.m"
"             Rainfall losses        23.739     5.000      8.935      mm"
"             Runoff depth           1.289      20.028     16.093     mm"
"             Runoff volume          1.78       104.11     105.89     c.m"
"             Runoff coefficient     0.052      0.800      0.643      "
"             Maximum flow           0.000      0.069      0.069      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                    0.069     0.069     0.000     0.000"
" 40          HYDROGRAPH Copy to Outflow"
"           8   Copy to Outflow"
"                    0.069     0.069     0.069     0.000"
" 40          HYDROGRAPH   Combine    1"
"           6   Combine "
"           1   Node #"
"               SWMF"
"            Maximum flow                 0.069    c.m/sec"
"            Hydrograph volume          105.889    c.m"
"                    0.069     0.069     0.069     0.069"
" 40          HYDROGRAPH Start - New Tributary"
"           2   Start - New Tributary"
"                    0.069     0.000     0.069     0.069"
" 33          CATCHMENT 202"
"           1   Triangular SCS"
"           1   Equal length"
"           1   SCS method"
"         202   Catchment 202"
"       85.000   % Impervious"
"        0.263   Total Area"
"       30.000   Flow length"
"        2.000   Overland Slope"
"        0.039   Pervious Area"
"       30.000   Pervious length"
"        2.000   Pervious slope"
"        0.224   Impervious Area"
"       30.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       68.000   Pervious SCS Curve No."
"        0.052   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"       11.953   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.793   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.032     0.000     0.069     0.069 c.m/sec"
"             Catchment 202          Pervious   Impervious Total Area "
"             Surface Area           0.039      0.224      0.263      hectare"
"             Time of concentration  63.290     2.647      3.334      minutes"
"             Time to Centroid       219.184    121.411    122.518    minutes"
"             Rainfall depth         25.028     25.028     25.028     mm"
"             Rainfall volume        9.87       55.95      65.82      c.m"
"             Rainfall losses        23.739     5.170      7.955      mm"
"             Runoff depth           1.289      19.858     17.072     mm"
"             Runoff volume          0.51       44.39      44.90      c.m"
"             Runoff coefficient     0.052      0.793      0.682      "
"             Maximum flow           0.000      0.032      0.032      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                    0.032     0.032     0.069     0.069"
" 40          HYDROGRAPH Copy to Outflow"
"           8   Copy to Outflow"
"                    0.032     0.032     0.032     0.069"
" 40          HYDROGRAPH   Combine    1"
"           6   Combine "
"           1   Node #"
"               SWMF"
"            Maximum flow                 0.094    c.m/sec"
"            Hydrograph volume          150.789    c.m"
"                    0.032     0.032     0.032     0.094"
" 40          HYDROGRAPH Start - New Tributary"
"           2   Start - New Tributary"
"                    0.032     0.000     0.032     0.094"
```

```
" 33          CATCHMENT 203"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          203   Catchment 203"
"       90.000   % Impervious"
"        0.071   Total Area"
"       15.000   Flow length"
"        2.000   Overland Slope"
"        0.007   Pervious Area"
"       15.000   Pervious length"
"        2.000   Pervious slope"
"        0.064   Impervious Area"
"       15.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       68.000   Pervious SCS Curve No."
"        0.051   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"       11.953   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.797   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                  0.010     0.000     0.032     0.094 c.m/sec"
"             Catchment 203          Pervious   Impervious Total Area "
"             Surface Area           0.007      0.064      0.071      hectare"
"             Time of concentration  41.756     1.747      2.032      minutes"
"             Time to Centroid       195.704    119.783    120.324    minutes"
"             Rainfall depth         25.028     25.028     25.028     mm"
"             Rainfall volume        1.78       15.99      17.77      c.m"
"             Rainfall losses        23.739     5.082      6.948      mm"
"             Runoff depth           1.289      19.946     18.080     mm"
"             Runoff volume          0.09       12.75      12.84      c.m"
"             Runoff coefficient     0.051      0.797      0.722      "
"             Maximum flow           0.000      0.010      0.010      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                  0.010     0.010     0.032     0.094"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                  0.010     0.010     0.010     0.094"
" 40          HYDROGRAPH   Combine    1"
"            6   Combine "
"            1   Node #"
"                SWMF"
"             Maximum flow                  0.101    c.m/sec"
"             Hydrograph volume           163.626    c.m"
"                  0.010     0.010     0.010     0.101"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                  0.010     0.000     0.010     0.101"
" 33          CATCHMENT 204"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          204   Catchment 204"
"       80.000   % Impervious"
"        0.207   Total Area"
"       10.000   Flow length"
"        5.000   Overland Slope"
"        0.041   Pervious Area"
"       10.000   Pervious length"
"        5.000   Pervious slope"
"        0.166   Impervious Area"
"       10.000   Impervious length"
"        5.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       68.000   Pervious SCS Curve No."
"        0.051   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"       11.953   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.784   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                  0.026     0.000     0.010     0.101 c.m/sec"
"             Catchment 204          Pervious   Impervious Total Area "
"             Surface Area           0.041      0.166      0.207      hectare"
"             Time of concentration  24.870     1.040      1.425      minutes"
"             Time to Centroid       177.296    118.686    119.632    minutes"
"             Rainfall depth         25.028     25.028     25.028     mm"
"             Rainfall volume        10.36      41.45      51.81      c.m"
"             Rainfall losses        23.740     5.416      9.080      mm"
"             Runoff depth           1.288      19.612     15.947     mm"
"             Runoff volume          0.53       32.48      33.01      c.m"
"             Runoff coefficient     0.051      0.784      0.637      "
"             Maximum flow           0.000      0.026      0.026      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                  0.026     0.026     0.010     0.101"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                  0.026     0.026     0.026     0.101"
" 40          HYDROGRAPH   Combine    1"
"            6   Combine "
"            1   Node #"
"                SWMF"
"             Maximum flow                  0.127    c.m/sec"
"             Hydrograph volume           196.637    c.m"
"                  0.026     0.026     0.026     0.127"
" 40          HYDROGRAPH   Confluence    1"
"            7   Confluence "
"            1   Node #"
"                SWMF"
"             Maximum flow                  0.127    c.m/sec"
"             Hydrograph volume           196.637    c.m"
"                  0.026     0.127     0.026     0.000"
" 54          POND DESIGN"
"        0.127   Current peak flow    c.m/sec"
"        0.033   Target outflow    c.m/sec"
"        196.6   Hydrograph volume    c.m"
"          13.   Number of stages"
"      334.100   Minimum water level    metre"
"      335.300   Maximum water level    metre"
"      334.100   Starting water level    metre"
"            0   Keep Design Data: 1 = True; 0 = False"
"                  Level Discharge    Volume"
"                334.100     0.000     0.000"
"                334.200   0.00150    25.000"
"                334.300   0.00230    59.000"
"                334.400   0.01270   104.000"
"                334.500   0.03110   157.000"
"                334.600   0.04300   218.000"
"                334.700   0.05220   287.000"
"                334.800   0.05990   363.000"
"                334.900   0.06680   446.000"
"                335.000   0.07300   534.000"
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"               335.100   0.08860   629.000"
"               335.200    0.1118   731.000"
"               335.300    0.2366   839.000"
"            Peak outflow                  0.018    c.m/sec"
"            Maximum level               334.427    metre"
"            Maximum storage             118.543    c.m"
"            Centroidal lag                5.420   hours"
"                 0.026     0.127     0.018     0.000 c.m/sec"
" 40         HYDROGRAPH   Combine    2"
"           6   Combine "
"           2   Node #"
"               Wetland"
"            Maximum flow                  0.018    c.m/sec"
"            Hydrograph volume           195.513    c.m"
"                  0.026     0.127     0.018     0.018"
" 40         HYDROGRAPH Start - New Tributary"
"           2   Start - New Tributary"
"                  0.026     0.000     0.018     0.018"
" 33         CATCHMENT 206"
"           1   Triangular SCS"
"           1   Equal length"
"           1   SCS method"
"         206   Catchment 206"
"       0.000   % Impervious"
"       0.185   Total Area"
"     100.000   Flow length"
"       0.800   Overland Slope"
"       0.185   Pervious Area"
"     100.000   Pervious length"
"       0.800   Pervious slope"
"       0.000   Impervious Area"
"     100.000   Impervious length"
"       0.800   Impervious slope"
"       0.250   Pervious Manning 'n'"
"      39.000   Pervious SCS Curve No."
"       0.000   Pervious Runoff coefficient"
"       0.100   Pervious Ia/S coefficient"
"      39.728   Pervious Initial abstraction"
"       0.015   Impervious Manning 'n'"
"      98.000   Impervious SCS Curve No."
"       0.000   Impervious Runoff coefficient"
"       0.100   Impervious Ia/S coefficient"
"       0.518   Impervious Initial abstraction"
"                  0.000     0.000     0.018     0.018 c.m/sec"
"            Catchment 206          Pervious   Impervious Total Area "
"            Surface Area           0.185      0.000      0.185      hectare"
"            Time of concentration      ---    7.177      7.177      minutes"
"            Time to Centroid       0.000      128.605    128.605    minutes"
"            Rainfall depth         25.028     25.028     25.028     mm"
"            Rainfall volume        46.30      0.00       46.30      c.m"
"            Rainfall losses        25.028     4.977      25.028     mm"
"            Runoff depth           0.000      20.050     0.000      mm"
"            Runoff volume          0.00       0.00       0.00       c.m"
"            Runoff coefficient     0.000      0.000      0.000      "
"            Maximum flow           0.000      0.000      0.000      c.m/sec"
" 40         HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                  0.000     0.000     0.018     0.018"
" 40         HYDROGRAPH Copy to Outflow"
"           8   Copy to Outflow"
"                  0.000     0.000     0.000     0.018"
" 40         HYDROGRAPH   Combine    2"
"           6   Combine "
"           2   Node #"
"               Wetland"
"            Maximum flow                  0.018    c.m/sec"
"            Hydrograph volume           195.513    c.m"
"                  0.000     0.000     0.000     0.018"
" 40         HYDROGRAPH Start - New Tributary"
"           2   Start - New Tributary"
"                  0.000     0.000     0.000     0.018"
" 33         CATCHMENT 207"
"           1   Triangular SCS"
"           1   Equal length"
"           1   SCS method"
"         207   Catchment 207"
"       0.000   % Impervious"
"       0.222   Total Area"
"      10.000   Flow length"
"       5.000   Overland Slope"
"       0.222   Pervious Area"
"      10.000   Pervious length"
"       5.000   Pervious slope"
"       0.000   Impervious Area"
"      10.000   Impervious length"
"       5.000   Impervious slope"
"       0.250   Pervious Manning 'n'"
"      49.000   Pervious SCS Curve No."
"       0.000   Pervious Runoff coefficient"
"       0.100   Pervious Ia/S coefficient"
"      26.437   Pervious Initial abstraction"
"       0.015   Impervious Manning 'n'"
"      98.000   Impervious SCS Curve No."
"       0.000   Impervious Runoff coefficient"
"       0.100   Impervious Ia/S coefficient"
"       0.518   Impervious Initial abstraction"
"                  0.000     0.000     0.000     0.018 c.m/sec"
"            Catchment 207          Pervious   Impervious Total Area "
"            Surface Area           0.222      0.000      0.222      hectare"
"            Time of concentration      ---    1.040      1.040      minutes"
"            Time to Centroid       0.000      118.686    118.686    minutes"
"            Rainfall depth         25.028     25.028     25.028     mm"
"            Rainfall volume        55.56      0.00       55.56      c.m"
"            Rainfall losses        25.028     5.416      25.028     mm"
"            Runoff depth           0.000      19.612     0.000      mm"
"            Runoff volume          0.00       0.00       0.00       c.m"
"            Runoff coefficient     0.000      0.000      0.000      "
"            Maximum flow           0.000      0.000      0.000      c.m/sec"
" 40         HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                  0.000     0.000     0.000     0.018"
" 40         HYDROGRAPH Copy to Outflow"
"           8   Copy to Outflow"
"                  0.000     0.000     0.000     0.018"
" 40         HYDROGRAPH   Combine    2"
"           6   Combine "
"           2   Node #"
"               Wetland"
"            Maximum flow                  0.018    c.m/sec"
"            Hydrograph volume           195.513    c.m"
"                  0.000     0.000     0.000     0.018"
" 40         HYDROGRAPH Start - New Tributary"
"           2   Start - New Tributary"
"                  0.000     0.000     0.000     0.018"
" 33         CATCHMENT 208"
"           1   Triangular SCS"
"           1   Equal length"
"           1   SCS method"
"         208   Catchment 208"
"       0.000   % Impervious"
```

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"        0.862   Total Area"
"       90.000   Flow length"
"        1.000   Overland Slope"
"        0.862   Pervious Area"
"       90.000   Pervious length"
"        1.000   Pervious slope"
"        0.000   Impervious Area"
"       90.000   Impervious length"
"        1.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       70.000   Pervious SCS Curve No."
"        0.065   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"       10.886   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.000   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                  0.001     0.000     0.000     0.018 c.m/sec"
"             Catchment 208          Pervious   Impervious Total Area "
"             Surface Area           0.862      0.000      0.862      hectare"
"             Time of concentration  131.880    6.301      131.878    minutes"
"             Time to Centroid       295.300    127.158    295.298    minutes"
"             Rainfall depth         25.028     25.028     25.028     mm"
"             Rainfall volume        215.74     0.00       215.74     c.m"
"             Rainfall losses        23.402     4.941      23.402     mm"
"             Runoff depth           1.626      20.087     1.626      mm"
"             Runoff volume          14.02      0.00       14.02      c.m"
"             Runoff coefficient     0.065      0.000      0.065      "
"             Maximum flow           0.001      0.000      0.001      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                  0.001     0.001     0.000     0.018"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                  0.001     0.001     0.001     0.018"
" 40          HYDROGRAPH   Combine    2"
"            6   Combine "
"            2   Node #"
"                Wetland"
"             Maximum flow                  0.018    c.m/sec"
"             Hydrograph volume           209.529    c.m"
"                  0.001     0.001     0.001     0.018"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                  0.001     0.000     0.001     0.018"
" 33          CATCHMENT 2051"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"         2051   Catchment 205-1"
"       11.000   % Impervious"
"        0.090   Total Area"
"       20.000   Flow length"
"        2.000   Overland Slope"
"        0.080   Pervious Area"
"       20.000   Pervious length"
"        2.000   Pervious slope"
"        0.010   Impervious Area"
"       20.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       49.000   Pervious SCS Curve No."
"        0.000   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"       26.437   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.798   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                  0.001     0.000     0.001     0.018 c.m/sec"
"             Catchment 2051         Pervious   Impervious Total Area "
"             Surface Area           0.080      0.010      0.090      hectare"
"             Time of concentration      ---    2.076      2.076      minutes"
"             Time to Centroid       0.000      120.339    120.339    minutes"
"             Rainfall depth         25.028     25.028     25.028     mm"
"             Rainfall volume        20.05      2.48       22.52      c.m"
"             Rainfall losses        25.028     5.057      22.831     mm"
"             Runoff depth           0.000      19.971     2.197      mm"
"             Runoff volume          0.00       1.98       1.98       c.m"
"             Runoff coefficient     0.000      0.798      0.088      "
"             Maximum flow           0.000      0.001      0.001      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                  0.001     0.001     0.001     0.018"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                  0.001     0.001     0.001     0.018"
" 40          HYDROGRAPH   Combine    3"
"            6   Combine "
"            3   Node #"
"                Arkell"
"             Maximum flow                  0.001    c.m/sec"
"             Hydrograph volume             1.977    c.m"
"                  0.001     0.001     0.001     0.001"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                  0.001     0.000     0.001     0.001"
" 33          CATCHMENT 2052"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"         2052   Catchment 205-2"
"       35.000   % Impervious"
"        0.134   Total Area"
"       35.000   Flow length"
"        4.000   Overland Slope"
"        0.087   Pervious Area"
"       35.000   Pervious length"
"        4.000   Pervious slope"
"        0.047   Impervious Area"
"       35.000   Impervious length"
"        4.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       49.000   Pervious SCS Curve No."
"        0.000   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"       26.437   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.796   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                  0.007     0.000     0.001     0.001 c.m/sec"
"             Catchment 2052         Pervious   Impervious Total Area "
"             Surface Area           0.087      0.047      0.134      hectare"
"             Time of concentration      ---    2.359      2.359      minutes"
"             Time to Centroid       0.000      120.838    120.838    minutes"
```

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"            Rainfall depth         25.028     25.028     25.028     mm"
"            Rainfall volume        21.80      11.74      33.54      c.m"
"            Rainfall losses        25.028     5.112      18.057     mm"
"            Runoff depth           0.000      19.915     6.970      mm"
"            Runoff volume          0.00       9.34       9.34       c.m"
"            Runoff coefficient     0.000      0.796      0.279      "
"            Maximum flow           0.000      0.007      0.007      c.m/sec"
" 40         HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                   0.007     0.007     0.001     0.001"
" 40         HYDROGRAPH Copy to Outflow"
"           8   Copy to Outflow"
"                   0.007     0.007     0.007     0.001"
" 40         HYDROGRAPH   Combine    2"
"           6   Combine "
"           2   Node #"
"               Wetland"
"            Maximum flow                 0.019    c.m/sec"
"            Hydrograph volume          218.869    c.m"
"                   0.007     0.007     0.007     0.019"
" 38         START/RE-START TOTALS 2052"
"           3   Runoff Totals on EXIT"
"            Total Catchment area                    2.692    hectare"
"            Total Impervious area                   1.030    hectare"
"            Total % impervious                     38.249"
" 19         EXIT”
```

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"               MIDUSS Output ----------------------------------------------->"
"               MIDUSS version                          Version 2.25  rev. 473"
"               MIDUSS created                       Sunday, February 7, 2010"
"          10   Units used:                                        ie METRIC"
"               Job folder:           Q:\42063\104\SWM\March 2020\MIDUSS\POST"
"               Output filename:                                  2yr-POST.in"
"               Licensee name:                                              A"
"               Company                                             Microsoft"
"               Date & Time last used:              3/25/2020 at 4:30:39 PM"
" 31         TIME PARAMETERS"
"       5.000   Time Step"
"     180.000   Max. Storm length"
"    1500.000   Max. Hydrograph"
" 32         STORM Chicago storm"
"           1   Chicago storm"
"     743.000   Coefficient A"
"       6.000   Constant B"
"       0.799   Exponent C"
"       0.400   Fraction R"
"     180.000   Duration"
"       1.000   Time step multiplier"
"            Maximum intensity          109.374    mm/hr"
"            Total depth                 34.259    mm"
"           6   002hyd   Hydrograph extension used in this file"
" 33         CATCHMENT 201"
"           1   Triangular SCS"
"           1   Equal length"
"           1   SCS method"
"         201   Catchment 201"
"      79.000   % Impervious"
"       0.658   Total Area"
"      45.000   Flow length"
"       0.700   Overland Slope"
"       0.138   Pervious Area"
"      45.000   Pervious length"
"       0.700   Pervious slope"
"       0.520   Impervious Area"
"      45.000   Impervious length"
"       0.700   Impervious slope"
"       0.250   Pervious Manning 'n'"
"      68.000   Pervious SCS Curve No."
"       0.102   Pervious Runoff coefficient"
"       0.100   Pervious Ia/S coefficient"
"      11.953   Pervious Initial abstraction"
"       0.015   Impervious Manning 'n'"
"      98.000   Impervious SCS Curve No."
"       0.839   Impervious Runoff coefficient"
"       0.100   Impervious Ia/S coefficient"
"       0.518   Impervious Initial abstraction"
"                   0.107     0.000     0.000     0.000 c.m/sec"
"            Catchment 201          Pervious   Impervious Total Area "
"            Surface Area           0.138      0.520      0.658      hectare"
"            Time of concentration  63.466     3.861      5.735      minutes"
"            Time to Centroid       178.617    93.873     96.537     minutes"
"            Rainfall depth         34.259     34.259     34.259     mm"
"            Rainfall volume        47.34      178.08     225.42     c.m"
"            Rainfall losses        30.751     5.528      10.825     mm"
"            Runoff depth           3.507      28.731     23.434     mm"
"            Runoff volume          4.85       149.35     154.19     c.m"
"            Runoff coefficient     0.102      0.839      0.684      "
"            Maximum flow           0.001      0.107      0.107      c.m/sec"
" 40         HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                   0.107     0.107     0.000     0.000"
" 40         HYDROGRAPH Copy to Outflow"
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```
"            8   Copy to Outflow"
"                    0.107     0.107     0.107     0.000"
" 40          HYDROGRAPH   Combine    1"
"            6   Combine "
"            1   Node #"
"                SWMF"
"             Maximum flow                  0.107    c.m/sec"
"             Hydrograph volume           154.193    c.m"
"                    0.107     0.107     0.107     0.107"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                    0.107     0.000     0.107     0.107"
" 33          CATCHMENT 202"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          202   Catchment 202"
"       85.000   % Impervious"
"        0.263   Total Area"
"       30.000   Flow length"
"        2.000   Overland Slope"
"        0.039   Pervious Area"
"       30.000   Pervious length"
"        2.000   Pervious slope"
"        0.224   Impervious Area"
"       30.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       68.000   Pervious SCS Curve No."
"        0.102   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"       11.953   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.841   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.048     0.000     0.107     0.107 c.m/sec"
"             Catchment 202          Pervious   Impervious Total Area "
"             Surface Area           0.039      0.224      0.263      hectare"
"             Time of concentration  36.317     2.210      2.927      minutes"
"             Time to Centroid       148.326    91.264     92.464     minutes"
"             Rainfall depth         34.259     34.259     34.259     mm"
"             Rainfall volume        13.52      76.59      90.10      c.m"
"             Rainfall losses        30.751     5.447      9.243      mm"
"             Runoff depth           3.507      28.811     25.016     mm"
"             Runoff volume          1.38       64.41      65.79      c.m"
"             Runoff coefficient     0.102      0.841      0.730      "
"             Maximum flow           0.000      0.048      0.048      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.048     0.048     0.107     0.107"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                    0.048     0.048     0.048     0.107"
" 40          HYDROGRAPH   Combine    1"
"            6   Combine "
"            1   Node #"
"                SWMF"
"             Maximum flow                  0.146    c.m/sec"
"             Hydrograph volume           219.985    c.m"
"                    0.048     0.048     0.048     0.146"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                    0.048     0.000     0.048     0.146"
" 33          CATCHMENT 203"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          203   Catchment 203"
"       90.000   % Impervious"
"        0.071   Total Area"
"       15.000   Flow length"
"        2.000   Overland Slope"
"        0.007   Pervious Area"
"       15.000   Pervious length"
"        2.000   Pervious slope"
"        0.064   Impervious Area"
"       15.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       68.000   Pervious SCS Curve No."
"        0.102   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"       11.953   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.840   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.015     0.000     0.048     0.146 c.m/sec"
"             Catchment 203          Pervious   Impervious Total Area "
"             Surface Area           0.007      0.064      0.071      hectare"
"             Time of concentration  23.960     1.458      1.758      minutes"
"             Time to Centroid       134.541    90.077     90.671     minutes"
"             Rainfall depth         34.259     34.259     34.259     mm"
"             Rainfall volume        2.43       21.89      24.32      c.m"
"             Rainfall losses        30.753     5.483      8.010      mm"
"             Runoff depth           3.506      28.775     26.249     mm"
"             Runoff volume          0.25       18.39      18.64      c.m"
"             Runoff coefficient     0.102      0.840      0.766      "
"             Maximum flow           0.000      0.015      0.015      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.015     0.015     0.048     0.146"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                    0.015     0.015     0.015     0.146"
" 40          HYDROGRAPH   Combine    1"
"            6   Combine "
"            1   Node #"
"                SWMF"
"             Maximum flow                  0.157    c.m/sec"
"             Hydrograph volume           238.622    c.m"
"                    0.015     0.015     0.015     0.157"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                    0.015     0.000     0.015     0.157"
" 33          CATCHMENT 204"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          204   Catchment 204"
"       80.000   % Impervious"
"        0.207   Total Area"
"       10.000   Flow length"
"        5.000   Overland Slope"
"        0.041   Pervious Area"
"       10.000   Pervious length"
"        5.000   Pervious slope"
```

```
"        0.166   Impervious Area"
"       10.000   Impervious length"
"        5.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       68.000   Pervious SCS Curve No."
"        0.102   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"       11.953   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.817   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                0.040     0.000     0.015     0.157 c.m/sec"
"            Catchment 204          Pervious   Impervious Total Area "
"            Surface Area           0.041      0.166      0.207      hectare"
"            Time of concentration  14.271     0.868      1.275      minutes"
"            Time to Centroid       123.758    89.179     90.228     minutes"
"            Rainfall depth         34.259     34.259     34.259     mm"
"            Rainfall volume        14.18      56.73      70.92      c.m"
"            Rainfall losses        30.758     6.273      11.170     mm"
"            Runoff depth           3.501      27.985     23.088     mm"
"            Runoff volume          1.45       46.34      47.79      c.m"
"            Runoff coefficient     0.102      0.817      0.674      "
"            Maximum flow           0.000      0.040      0.040      c.m/sec"
" 40         HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                0.040     0.040     0.015     0.157"
" 40         HYDROGRAPH Copy to Outflow"
"           8   Copy to Outflow"
"                0.040     0.040     0.040     0.157"
" 40         HYDROGRAPH   Combine    1"
"           6   Combine "
"           1   Node #"
"               SWMF"
"            Maximum flow                0.197    c.m/sec"
"            Hydrograph volume           286.415    c.m"
"                0.040     0.040     0.040     0.197"
" 40         HYDROGRAPH   Confluence    1"
"           7   Confluence "
"           1   Node #"
"               SWMF"
"            Maximum flow                0.197    c.m/sec"
"            Hydrograph volume           286.415    c.m"
"                0.040     0.197     0.040     0.000"
" 54         POND DESIGN"
"       0.197   Current peak flow    c.m/sec"
"       0.033   Target outflow    c.m/sec"
"       286.4   Hydrograph volume    c.m"
"         13.   Number of stages"
"     334.100   Minimum water level    metre"
"     335.300   Maximum water level    metre"
"     334.100   Starting water level    metre"
"           0   Keep Design Data: 1 = True; 0 = False"
"                 Level Discharge    Volume"
"               334.100     0.000     0.000"
"               334.200   0.00150    25.000"
"               334.300   0.00230    59.000"
"               334.400   0.01270   104.000"
"               334.500   0.03110   157.000"
"               334.600   0.04300   218.000"
"               334.700   0.05220   287.000"
"               334.800   0.05990   363.000"
"               334.900   0.06680   446.000"
"               335.000   0.07300   534.000"
"               335.100   0.08860   629.000"
"               335.200    0.1118   731.000"
"               335.300    0.2366   839.000"
"            Peak outflow                 0.033    c.m/sec"
"            Maximum level              334.519    metre"
"            Maximum storage            168.337    c.m"
"            Centroidal lag               4.180   hours"
"                 0.040     0.197     0.033     0.000 c.m/sec"
" 40         HYDROGRAPH   Combine    2"
"           6   Combine "
"           2   Node #"
"               Wetland"
"            Maximum flow                 0.033    c.m/sec"
"            Hydrograph volume          285.262    c.m"
"                0.040     0.197     0.033     0.033"
" 40         HYDROGRAPH Start - New Tributary"
"           2   Start - New Tributary"
"                0.040     0.000     0.033     0.033"
" 33         CATCHMENT 206"
"           1   Triangular SCS"
"           1   Equal length"
"           1   SCS method"
"         206   Catchment 206"
"       0.000   % Impervious"
"       0.185   Total Area"
"     100.000   Flow length"
"       0.800   Overland Slope"
"       0.185   Pervious Area"
"     100.000   Pervious length"
"       0.800   Pervious slope"
"       0.000   Impervious Area"
"     100.000   Impervious length"
"       0.800   Impervious slope"
"       0.250   Pervious Manning 'n'"
"      39.000   Pervious SCS Curve No."
"       0.000   Pervious Runoff coefficient"
"       0.100   Pervious Ia/S coefficient"
"      39.728   Pervious Initial abstraction"
"       0.015   Impervious Manning 'n'"
"      98.000   Impervious SCS Curve No."
"       0.000   Impervious Runoff coefficient"
"       0.100   Impervious Ia/S coefficient"
"       0.518   Impervious Initial abstraction"
"                0.000     0.000     0.033     0.033 c.m/sec"
"            Catchment 206          Pervious   Impervious Total Area "
"            Surface Area           0.185      0.000      0.185      hectare"
"            Time of concentration      ---    5.990      5.990      minutes"
"            Time to Centroid       0.000      97.001     97.001     minutes"
"            Rainfall depth         34.259     34.259     34.259     mm"
"            Rainfall volume        63.38      0.00       63.38      c.m"
"            Rainfall losses        34.259     5.171      34.259     mm"
"            Runoff depth           0.000      29.088     0.000      mm"
"            Runoff volume          0.00       0.00       0.00       c.m"
"            Runoff coefficient     0.000      0.000      0.000      "
"            Maximum flow           0.000      0.000      0.000      c.m/sec"
" 40         HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                0.000     0.000     0.033     0.033"
" 40         HYDROGRAPH Copy to Outflow"
"           8   Copy to Outflow"
"                0.000     0.000     0.000     0.033"
" 40         HYDROGRAPH   Combine    2"
"           6   Combine "
"           2   Node #"
"               Wetland"
```

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"            Maximum flow                  0.033    c.m/sec"
"            Hydrograph volume           285.262    c.m"
"                    0.000     0.000     0.000     0.033"
" 40         HYDROGRAPH Start - New Tributary"
"           2   Start - New Tributary"
"                    0.000     0.000     0.000     0.033"
" 33         CATCHMENT 207"
"           1   Triangular SCS"
"           1   Equal length"
"           1   SCS method"
"         207   Catchment 207"
"       0.000   % Impervious"
"       0.222   Total Area"
"      10.000   Flow length"
"       5.000   Overland Slope"
"       0.222   Pervious Area"
"      10.000   Pervious length"
"       5.000   Pervious slope"
"       0.000   Impervious Area"
"      10.000   Impervious length"
"       5.000   Impervious slope"
"       0.250   Pervious Manning 'n'"
"      49.000   Pervious SCS Curve No."
"       0.007   Pervious Runoff coefficient"
"       0.100   Pervious Ia/S coefficient"
"      26.437   Pervious Initial abstraction"
"       0.015   Impervious Manning 'n'"
"      98.000   Impervious SCS Curve No."
"       0.000   Impervious Runoff coefficient"
"       0.100   Impervious Ia/S coefficient"
"       0.518   Impervious Initial abstraction"
"                    0.000     0.000     0.000     0.033 c.m/sec"
"            Catchment 207          Pervious   Impervious Total Area "
"            Surface Area           0.222      0.000      0.222      hectare"
"            Time of concentration  60.675     0.868      60.668     minutes"
"            Time to Centroid       186.490    89.179     186.478    minutes"
"            Rainfall depth         34.259     34.259     34.259     mm"
"            Rainfall volume        76.05      0.00       76.05      c.m"
"            Rainfall losses        34.034     6.273      34.034     mm"
"            Runoff depth           0.225      27.985     0.225      mm"
"            Runoff volume          0.50       0.00       0.50       c.m"
"            Runoff coefficient     0.007      0.000      0.007      "
"            Maximum flow           0.000      0.000      0.000      c.m/sec"
" 40         HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                    0.000     0.000     0.000     0.033"
" 40         HYDROGRAPH Copy to Outflow"
"           8   Copy to Outflow"
"                    0.000     0.000     0.000     0.033"
" 40         HYDROGRAPH   Combine    2"
"           6   Combine "
"           2   Node #"
"               Wetland"
"            Maximum flow                  0.033    c.m/sec"
"            Hydrograph volume           285.760    c.m"
"                    0.000     0.000     0.000     0.033"
" 40         HYDROGRAPH Start - New Tributary"
"           2   Start - New Tributary"
"                    0.000     0.000     0.000     0.033"
" 33         CATCHMENT 208"
"           1   Triangular SCS"
"           1   Equal length"
"           1   SCS method"
"         208   Catchment 208"
"       0.000   % Impervious"
"       0.862   Total Area"
"      90.000   Flow length"
"       1.000   Overland Slope"
"       0.862   Pervious Area"
"      90.000   Pervious length"
"       1.000   Pervious slope"
"       0.000   Impervious Area"
"      90.000   Impervious length"
"       1.000   Impervious slope"
"       0.250   Pervious Manning 'n'"
"      70.000   Pervious SCS Curve No."
"       0.121   Pervious Runoff coefficient"
"       0.100   Pervious Ia/S coefficient"
"      10.886   Pervious Initial abstraction"
"       0.015   Impervious Manning 'n'"
"      98.000   Impervious SCS Curve No."
"       0.000   Impervious Runoff coefficient"
"       0.100   Impervious Ia/S coefficient"
"       0.518   Impervious Initial abstraction"
"                    0.004     0.000     0.000     0.033 c.m/sec"
"            Catchment 208          Pervious   Impervious Total Area "
"            Surface Area           0.862      0.000      0.862      hectare"
"            Time of concentration  80.413     5.259      80.412     minutes"
"            Time to Centroid       195.942    95.913     195.941    minutes"
"            Rainfall depth         34.259     34.259     34.259     mm"
"            Rainfall volume        295.31     0.00       295.31     c.m"
"            Rainfall losses        30.128     5.108      30.128     mm"
"            Runoff depth           4.131      29.150     4.131      mm"
"            Runoff volume          35.61      0.00       35.61      c.m"
"            Runoff coefficient     0.121      0.000      0.121      "
"            Maximum flow           0.004      0.000      0.004      c.m/sec"
" 40         HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                    0.004     0.004     0.000     0.033"
" 40         HYDROGRAPH Copy to Outflow"
"           8   Copy to Outflow"
"                    0.004     0.004     0.004     0.033"
" 40         HYDROGRAPH   Combine    2"
"           6   Combine "
"           2   Node #"
"               Wetland"
"            Maximum flow                  0.035    c.m/sec"
"            Hydrograph volume           321.370    c.m"
"                    0.004     0.004     0.004     0.035"
" 40         HYDROGRAPH Start - New Tributary"
"           2   Start - New Tributary"
"                    0.004     0.000     0.004     0.035"
" 33         CATCHMENT 2051"
"           1   Triangular SCS"
"           1   Equal length"
"           1   SCS method"
"        2051   Catchment 205-1"
"      11.000   % Impervious"
"       0.090   Total Area"
"      20.000   Flow length"
"       2.000   Overland Slope"
"       0.080   Pervious Area"
"      20.000   Pervious length"
"       2.000   Pervious slope"
"       0.010   Impervious Area"
"      20.000   Impervious length"
"       2.000   Impervious slope"
"       0.250   Pervious Manning 'n'"
"      49.000   Pervious SCS Curve No."
"       0.007   Pervious Runoff coefficient"
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"        0.100   Pervious Ia/S coefficient"
"       26.437   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.841   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                  0.002     0.000     0.004     0.035 c.m/sec"
"             Catchment 2051         Pervious   Impervious Total Area "
"             Surface Area           0.080      0.010      0.090      hectare"
"             Time of concentration  121.063    1.732      8.814      minutes"
"             Time to Centroid       232.613    90.428     98.866     minutes"
"             Rainfall depth         34.259     34.259     34.259     mm"
"             Rainfall volume        27.44      3.39       30.83      c.m"
"             Rainfall losses        34.034     5.434      30.888     mm"
"             Runoff depth           0.225      28.825     3.371      mm"
"             Runoff volume          0.18       2.85       3.03       c.m"
"             Runoff coefficient     0.007      0.841      0.098      "
"             Maximum flow           0.000      0.002      0.002      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                  0.002     0.002     0.004     0.035"
" 40          HYDROGRAPH Copy to Outflow"
"           8   Copy to Outflow"
"                  0.002     0.002     0.002     0.035"
" 40          HYDROGRAPH   Combine    3"
"           6   Combine "
"           3   Node #"
"               Arkell"
"            Maximum flow                  0.002    c.m/sec"
"            Hydrograph volume             3.034    c.m"
"                  0.002     0.002     0.002     0.002"
" 40          HYDROGRAPH Start - New Tributary"
"           2   Start - New Tributary"
"                  0.002     0.000     0.002     0.002"
" 33          CATCHMENT 2052"
"           1   Triangular SCS"
"           1   Equal length"
"           1   SCS method"
"        2052   Catchment 205-2"
"       35.000   % Impervious"
"        0.134   Total Area"
"       35.000   Flow length"
"        4.000   Overland Slope"
"        0.087   Pervious Area"
"       35.000   Pervious length"
"        4.000   Pervious slope"
"        0.047   Impervious Area"
"       35.000   Impervious length"
"        4.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       49.000   Pervious SCS Curve No."
"        0.007   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"       26.437   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.842   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                  0.010     0.000     0.002     0.002 c.m/sec"
"             Catchment 2052         Pervious   Impervious Total Area "
"             Surface Area           0.087      0.047      0.134      hectare"
"             Time of concentration  137.570    1.969      3.902      minutes"
"             Time to Centroid       245.217    90.857     93.058     minutes"
"             Rainfall depth         34.259     34.259     34.259     mm"
"             Rainfall volume        29.84      16.07      45.91      c.m"
"             Rainfall losses        34.034     5.404      24.013     mm"
"             Runoff depth           0.225      28.855     10.245     mm"
"             Runoff volume          0.20       13.53      13.73      c.m"
"             Runoff coefficient     0.007      0.842      0.299      "
"             Maximum flow           0.000      0.010      0.010      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                  0.010     0.010     0.002     0.002"
" 40          HYDROGRAPH Copy to Outflow"
"           8   Copy to Outflow"
"                  0.010     0.010     0.010     0.002"
" 40          HYDROGRAPH   Combine    2"
"           6   Combine "
"           2   Node #"
"               Wetland"
"            Maximum flow                  0.036    c.m/sec"
"            Hydrograph volume             335.099    c.m"
"                  0.010     0.010     0.010     0.036"
" 38          START/RE-START TOTALS 2052"
"           3   Runoff Totals on EXIT"
"            Total Catchment area                       2.692    hectare"
"            Total Impervious area                      1.030    hectare"
"            Total % impervious                         38.249"
" 19          EXIT"
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"               MIDUSS Output ------------------------------------------------>"
"               MIDUSS version                          Version 2.25  rev. 473"
"               MIDUSS created                        Sunday, February 7, 2010"
"          10   Units used:                                          ie METRIC"
"               Job folder:           Q:\42063\104\SWM\March 2020\MIDUSS\POST"
"               Output filename:                                    5yr-POST.in"
"               Licensee name:                                               A"
"               Company                                             Microsoft"
"               Date & Time last used:                3/25/2020 at 4:31:55 PM"
" 31          TIME PARAMETERS"
"        5.000   Time Step"
"      180.000   Max. Storm length"
"     1500.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"           1   Chicago storm"
"     1593.000   Coefficient A"
"       11.000   Constant B"
"        0.879   Exponent C"
"        0.400   Fraction R"
"      180.000   Duration"
"        1.000   Time step multiplier"
"             Maximum intensity           139.250    mm/hr"
"             Total depth                  47.240    mm"
"           6   005hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 201"
"           1   Triangular SCS"
"           1   Equal length"
"           1   SCS method"
"         201   Catchment 201"
"       79.000   % Impervious"
"        0.658   Total Area"
"       45.000   Flow length"
"        0.700   Overland Slope"
"        0.138   Pervious Area"
"       45.000   Pervious length"
"        0.700   Pervious slope"
"        0.520   Impervious Area"
"       45.000   Impervious length"
"        0.700   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       68.000   Pervious SCS Curve No."
"        0.170   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"       11.953   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.872   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.144     0.000     0.000     0.000 c.m/sec"
"             Catchment 201          Pervious   Impervious Total Area "
"             Surface Area           0.138      0.520      0.658      hectare"
"             Time of concentration  42.732     3.461      5.397      minutes"
"             Time to Centroid       150.203    91.057     93.974     minutes"
"             Rainfall depth         47.240     47.240     47.240     mm"
"             Rainfall volume        65.28      245.56     310.84     c.m"
"             Rainfall losses        39.199     6.027      12.993     mm"
"             Runoff depth           8.041      41.213     34.247     mm"
"             Runoff volume          11.11      214.23     225.34     c.m"
"             Runoff coefficient     0.170      0.872      0.725      "
"             Maximum flow           0.002      0.144      0.144      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                    0.144     0.144     0.000     0.000"
" 40          HYDROGRAPH Copy to Outflow"
"           8   Copy to Outflow"
"                    0.144     0.144     0.144     0.000"
" 40          HYDROGRAPH   Combine    1"
"           6   Combine "
"           1   Node #"
"               SWMF"
"            Maximum flow                  0.144    c.m/sec"
"            Hydrograph volume           225.343    c.m"
"                    0.144     0.144     0.144     0.144"
" 40          HYDROGRAPH Start - New Tributary"
"           2   Start - New Tributary"
"                    0.144     0.000     0.144     0.144"
" 33          CATCHMENT 202"
"           1   Triangular SCS"
"           1   Equal length"
"           1   SCS method"
"         202   Catchment 202"
"       85.000   % Impervious"
"        0.263   Total Area"
"       30.000   Flow length"
"        2.000   Overland Slope"
"        0.039   Pervious Area"
"       30.000   Pervious length"
"        2.000   Pervious slope"
"        0.224   Impervious Area"
"       30.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       68.000   Pervious SCS Curve No."
"        0.170   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"       11.953   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.878   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.067     0.000     0.144     0.144 c.m/sec"
"             Catchment 202          Pervious   Impervious Total Area "
"             Surface Area           0.039      0.224      0.263      hectare"
"             Time of concentration  24.452     1.981      2.723      minutes"
"             Time to Centroid       129.220    88.783     90.120     minutes"
"             Rainfall depth         47.240     47.240     47.240     mm"
"             Rainfall volume        18.64      105.60     124.24     c.m"
"             Rainfall losses        39.202     5.741      10.760     mm"
"             Runoff depth           8.038      41.499     36.480     mm"
"             Runoff volume          3.17       92.77      95.94      c.m"
"             Runoff coefficient     0.170      0.878      0.772      "
"             Maximum flow           0.001      0.067      0.067      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                    0.067     0.067     0.144     0.144"
" 40          HYDROGRAPH Copy to Outflow"
"           8   Copy to Outflow"
"                    0.067     0.067     0.067     0.144"
" 40          HYDROGRAPH   Combine    1"
"           6   Combine "
"           1   Node #"
"               SWMF"
"            Maximum flow                  0.206    c.m/sec"
"            Hydrograph volume           321.285    c.m"
"                    0.067     0.067     0.067     0.206"
" 40          HYDROGRAPH Start - New Tributary"
"           2   Start - New Tributary"
"                    0.067     0.000     0.067     0.206"
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" 33          CATCHMENT 203"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          203   Catchment 203"
"       90.000   % Impervious"
"        0.071   Total Area"
"       15.000   Flow length"
"        2.000   Overland Slope"
"        0.007   Pervious Area"
"       15.000   Pervious length"
"        2.000   Pervious slope"
"        0.064   Impervious Area"
"       15.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       68.000   Pervious SCS Curve No."
"        0.170   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"       11.953   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.874   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                  0.020     0.000     0.067     0.206 c.m/sec"
"             Catchment 203          Pervious   Impervious Total Area "
"             Surface Area           0.007      0.064      0.071      hectare"
"             Time of concentration  16.132     1.307      1.620      minutes"
"             Time to Centroid       119.698    87.817     88.490     minutes"
"             Rainfall depth         47.240     47.240     47.240     mm"
"             Rainfall volume        3.35       30.19      33.54      c.m"
"             Rainfall losses        39.230     5.949      9.277      mm"
"             Runoff depth           8.010      41.291     37.963     mm"
"             Runoff volume          0.57       26.39      26.95      c.m"
"             Runoff coefficient     0.170      0.874      0.804      "
"             Maximum flow           0.000      0.020      0.020      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                  0.020     0.020     0.067     0.206"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                  0.020     0.020     0.020     0.206"
" 40          HYDROGRAPH   Combine    1"
"            6   Combine "
"            1   Node #"
"                SWMF"
"             Maximum flow                  0.227    c.m/sec"
"             Hydrograph volume           348.239    c.m"
"                  0.020     0.020     0.020     0.227"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                  0.020     0.000     0.020     0.227"
" 33          CATCHMENT 204"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          204   Catchment 204"
"       80.000   % Impervious"
"        0.207   Total Area"
"       10.000   Flow length"
"        5.000   Overland Slope"
"        0.041   Pervious Area"
"       10.000   Pervious length"
"        5.000   Pervious slope"
"        0.166   Impervious Area"
"       10.000   Impervious length"
"        5.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       68.000   Pervious SCS Curve No."
"        0.169   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"       11.953   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.843   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                  0.053     0.000     0.020     0.227 c.m/sec"
"             Catchment 204          Pervious   Impervious Total Area "
"             Surface Area           0.041      0.166      0.207      hectare"
"             Time of concentration  9.609      0.778      1.200      minutes"
"             Time to Centroid       112.185    87.184     88.378     minutes"
"             Rainfall depth         47.240     47.240     47.240     mm"
"             Rainfall volume        19.56      78.23      97.79      c.m"
"             Rainfall losses        39.254     7.433      13.798     mm"
"             Runoff depth           7.986      39.806     33.442     mm"
"             Runoff volume          3.31       65.92      69.23      c.m"
"             Runoff coefficient     0.169      0.843      0.708      "
"             Maximum flow           0.001      0.053      0.053      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                  0.053     0.053     0.020     0.227"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                  0.053     0.053     0.053     0.227"
" 40          HYDROGRAPH   Combine    1"
"            6   Combine "
"            1   Node #"
"                SWMF"
"             Maximum flow                  0.280    c.m/sec"
"             Hydrograph volume           417.465    c.m"
"                  0.053     0.053     0.053     0.280"
" 40          HYDROGRAPH   Confluence    1"
"            7   Confluence "
"            1   Node #"
"                SWMF"
"             Maximum flow                  0.280    c.m/sec"
"             Hydrograph volume           417.465    c.m"
"                  0.053     0.280     0.053     0.000"
" 54          POND DESIGN"
"        0.280   Current peak flow    c.m/sec"
"        0.033   Target outflow    c.m/sec"
"        417.5   Hydrograph volume    c.m"
"          13.   Number of stages"
"      334.100   Minimum water level    metre"
"      335.300   Maximum water level    metre"
"      334.100   Starting water level    metre"
"            0   Keep Design Data: 1 = True; 0 = False"
"                  Level Discharge    Volume"
"                334.100     0.000     0.000"
"                334.200   0.00150    25.000"
"                334.300   0.00230    59.000"
"                334.400   0.01270   104.000"
"                334.500   0.03110   157.000"
"                334.600   0.04300   218.000"
"                334.700   0.05220   287.000"
"                334.800   0.05990   363.000"
"                334.900   0.06680   446.000"
"                335.000   0.07300   534.000"
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"               335.100   0.08860   629.000"
"               335.200    0.1118   731.000"
"               335.300    0.2366   839.000"
"            Peak outflow                 0.047    c.m/sec"
"            Maximum level              334.648    metre"
"            Maximum storage            251.225    c.m"
"            Centroidal lag               3.741   hours"
"                 0.053     0.280     0.047     0.000 c.m/sec"
" 40         HYDROGRAPH   Combine    2"
"           6   Combine "
"           2   Node #"
"               Wetland"
"            Maximum flow                 0.047    c.m/sec"
"            Hydrograph volume          416.111    c.m"
"                  0.053     0.280     0.047     0.047"
" 40         HYDROGRAPH Start - New Tributary"
"           2   Start - New Tributary"
"                  0.053     0.000     0.047     0.047"
" 33         CATCHMENT 206"
"           1   Triangular SCS"
"           1   Equal length"
"           1   SCS method"
"         206   Catchment 206"
"       0.000   % Impervious"
"       0.185   Total Area"
"     100.000   Flow length"
"       0.800   Overland Slope"
"       0.185   Pervious Area"
"     100.000   Pervious length"
"       0.800   Pervious slope"
"       0.000   Impervious Area"
"     100.000   Impervious length"
"       0.800   Impervious slope"
"       0.250   Pervious Manning 'n'"
"      39.000   Pervious SCS Curve No."
"       0.003   Pervious Runoff coefficient"
"       0.100   Pervious Ia/S coefficient"
"      39.728   Pervious Initial abstraction"
"       0.015   Impervious Manning 'n'"
"      98.000   Impervious SCS Curve No."
"       0.000   Impervious Runoff coefficient"
"       0.100   Impervious Ia/S coefficient"
"       0.518   Impervious Initial abstraction"
"                  0.000     0.000     0.047     0.047 c.m/sec"
"            Catchment 206          Pervious   Impervious Total Area "
"            Surface Area           0.185      0.000      0.185      hectare"
"            Time of concentration  481.533    5.369      481.390    minutes"
"            Time to Centroid       514.494    93.773     514.367    minutes"
"            Rainfall depth         47.240     47.240     47.240     mm"
"            Rainfall volume        87.39      0.00       87.39      c.m"
"            Rainfall losses        47.101     5.434      47.101     mm"
"            Runoff depth           0.139      41.806     0.139      mm"
"            Runoff volume          0.26       0.00       0.26       c.m"
"            Runoff coefficient     0.003      0.000      0.003      "
"            Maximum flow           0.000      0.000      0.000      c.m/sec"
" 40         HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                  0.000     0.000     0.047     0.047"
" 40         HYDROGRAPH Copy to Outflow"
"           8   Copy to Outflow"
"                  0.000     0.000     0.000     0.047"
" 40         HYDROGRAPH   Combine    2"
"           6   Combine "
"           2   Node #"
"               Wetland"
"            Maximum flow                 0.047    c.m/sec"
"            Hydrograph volume          416.369    c.m"
"                  0.000     0.000     0.000     0.047"
" 40         HYDROGRAPH Start - New Tributary"
"           2   Start - New Tributary"
"                  0.000     0.000     0.000     0.047"
" 33         CATCHMENT 207"
"           1   Triangular SCS"
"           1   Equal length"
"           1   SCS method"
"         207   Catchment 207"
"       0.000   % Impervious"
"       0.222   Total Area"
"      10.000   Flow length"
"       5.000   Overland Slope"
"       0.222   Pervious Area"
"      10.000   Pervious length"
"       5.000   Pervious slope"
"       0.000   Impervious Area"
"      10.000   Impervious length"
"       5.000   Impervious slope"
"       0.250   Pervious Manning 'n'"
"      49.000   Pervious SCS Curve No."
"       0.032   Pervious Runoff coefficient"
"       0.100   Pervious Ia/S coefficient"
"      26.437   Pervious Initial abstraction"
"       0.015   Impervious Manning 'n'"
"      98.000   Impervious SCS Curve No."
"       0.000   Impervious Runoff coefficient"
"       0.100   Impervious Ia/S coefficient"
"       0.518   Impervious Initial abstraction"
"                  0.001     0.000     0.000     0.047 c.m/sec"
"            Catchment 207          Pervious   Impervious Total Area "
"            Surface Area           0.222      0.000      0.222      hectare"
"            Time of concentration  22.648     0.778      22.647     minutes"
"            Time to Centroid       138.245    87.184     138.244    minutes"
"            Rainfall depth         47.240     47.240     47.240     mm"
"            Rainfall volume        104.87     0.00       104.87     c.m"
"            Rainfall losses        45.724     7.433      45.724     mm"
"            Runoff depth           1.516      39.806     1.516      mm"
"            Runoff volume          3.37       0.00       3.37       c.m"
"            Runoff coefficient     0.032      0.000      0.032      "
"            Maximum flow           0.001      0.000      0.001      c.m/sec"
" 40         HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                  0.001     0.001     0.000     0.047"
" 40         HYDROGRAPH Copy to Outflow"
"           8   Copy to Outflow"
"                  0.001     0.001     0.001     0.047"
" 40         HYDROGRAPH   Combine    2"
"           6   Combine "
"           2   Node #"
"               Wetland"
"            Maximum flow                 0.048    c.m/sec"
"            Hydrograph volume          419.735    c.m"
"                  0.001     0.001     0.001     0.048"
" 40         HYDROGRAPH Start - New Tributary"
"           2   Start - New Tributary"
"                  0.001     0.000     0.001     0.048"
" 33         CATCHMENT 208"
"           1   Triangular SCS"
"           1   Equal length"
"           1   SCS method"
"         208   Catchment 208"
"       0.000   % Impervious"
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"        0.862   Total Area"
"       90.000   Flow length"
"        1.000   Overland Slope"
"        0.862   Pervious Area"
"       90.000   Pervious length"
"        1.000   Pervious slope"
"        0.000   Impervious Area"
"       90.000   Impervious length"
"        1.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       70.000   Pervious SCS Curve No."
"        0.193   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"       10.886   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.000   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
                     0.013     0.000     0.001     0.048 c.m/sec"
             Catchment 208          Pervious   Impervious Total Area "
             Surface Area           0.862      0.000      0.862      hectare"
             Time of concentration  53.818     4.714      53.818     minutes"
             Time to Centroid       163.731    92.856     163.731    minutes"
             Rainfall depth         47.240     47.240     47.240     mm"
             Rainfall volume        407.21     0.00       407.21     c.m"
             Rainfall losses        38.142     5.539      38.142     mm"
             Runoff depth           9.098      41.700     9.098      mm"
             Runoff volume          78.42      0.00       78.42      c.m"
             Runoff coefficient     0.193      0.000      0.193      "
             Maximum flow           0.013      0.000      0.013      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
            4   Add Runoff "
                     0.013     0.013     0.001     0.048"
" 40          HYDROGRAPH Copy to Outflow"
            8   Copy to Outflow"
                     0.013     0.013     0.013     0.048"
" 40          HYDROGRAPH   Combine    2"
            6   Combine "
            2   Node #"
                Wetland"
            Maximum flow                  0.060    c.m/sec"
            Hydrograph volume           498.158    c.m"
                     0.013     0.013     0.013     0.060"
" 40          HYDROGRAPH Start - New Tributary"
            2   Start - New Tributary"
                     0.013     0.000     0.013     0.060"
" 33          CATCHMENT 2051"
            1   Triangular SCS"
            1   Equal length"
            1   SCS method"
          2051   Catchment 205-1"
        11.000   % Impervious"
         0.090   Total Area"
        20.000   Flow length"
         2.000   Overland Slope"
         0.080   Pervious Area"
        20.000   Pervious length"
         2.000   Pervious slope"
         0.010   Impervious Area"
        20.000   Impervious length"
         2.000   Impervious slope"
         0.250   Pervious Manning 'n'"
        49.000   Pervious SCS Curve No."
         0.032   Pervious Runoff coefficient"
         0.100   Pervious Ia/S coefficient"
        26.437   Pervious Initial abstraction"
         0.015   Impervious Manning 'n'"
        98.000   Impervious SCS Curve No."
         0.878   Impervious Runoff coefficient"
         0.100   Impervious Ia/S coefficient"
         0.518   Impervious Initial abstraction"
                     0.003     0.000     0.013     0.060 c.m/sec"
             Catchment 2051         Pervious   Impervious Total Area "
             Surface Area           0.080      0.010      0.090      hectare"
             Time of concentration  45.189     1.553      11.521     minutes"
             Time to Centroid       160.519    88.105     104.647    minutes"
             Rainfall depth         47.240     47.240     47.240     mm"
             Rainfall volume        37.84      4.68       42.52      c.m"
             Rainfall losses        45.723     5.780      41.329     mm"
             Runoff depth           1.517      41.459     5.911      mm"
             Runoff volume          1.22       4.10       5.32       c.m"
             Runoff coefficient     0.032      0.878      0.125      "
             Maximum flow           0.000      0.003      0.003      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
            4   Add Runoff "
                     0.003     0.003     0.013     0.060"
" 40          HYDROGRAPH Copy to Outflow"
            8   Copy to Outflow"
                     0.003     0.003     0.003     0.060"
" 40          HYDROGRAPH   Combine    3"
            6   Combine "
            3   Node #"
                Arkell"
            Maximum flow                  0.003    c.m/sec"
            Hydrograph volume             5.320    c.m"
                     0.003     0.003     0.003     0.003"
" 40          HYDROGRAPH Start - New Tributary"
            2   Start - New Tributary"
                     0.003     0.000     0.003     0.003"
" 33          CATCHMENT 2052"
            1   Triangular SCS"
            1   Equal length"
            1   SCS method"
          2052   Catchment 205-2"
        35.000   % Impervious"
         0.134   Total Area"
        35.000   Flow length"
         4.000   Overland Slope"
         0.087   Pervious Area"
        35.000   Pervious length"
         4.000   Pervious slope"
         0.047   Impervious Area"
        35.000   Impervious length"
         4.000   Impervious slope"
         0.250   Pervious Manning 'n'"
        49.000   Pervious SCS Curve No."
         0.032   Pervious Runoff coefficient"
         0.100   Pervious Ia/S coefficient"
        26.437   Pervious Initial abstraction"
         0.015   Impervious Manning 'n'"
        98.000   Impervious SCS Curve No."
         0.878   Impervious Runoff coefficient"
         0.100   Impervious Ia/S coefficient"
         0.518   Impervious Initial abstraction"
                     0.014     0.000     0.003     0.003 c.m/sec"
             Catchment 2052         Pervious   Impervious Total Area "
             Surface Area           0.087      0.047      0.134      hectare"
             Time of concentration  51.350     1.765      4.917      minutes"
             Time to Centroid       166.603    88.453     93.422     minutes"
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"            Rainfall depth          47.240      47.240      47.240      mm"
"            Rainfall volume         41.15       22.16       63.30       c.m"
"            Rainfall losses         45.723      5.743       31.730      mm"
"            Runoff depth            1.517       41.496      15.510      mm"
"            Runoff volume           1.32        19.46       20.78       c.m"
"            Runoff coefficient      0.032       0.878       0.328       "
"            Maximum flow            0.000       0.014       0.014       c.m/sec"
" 40         HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                   0.014     0.014     0.003     0.003"
" 40         HYDROGRAPH Copy to Outflow"
"           8   Copy to Outflow"
"                   0.014     0.014     0.014     0.003"
" 40         HYDROGRAPH   Combine    2"
"           6   Combine "
"           2   Node #"
"               Wetland"
"            Maximum flow                  0.062    c.m/sec"
"            Hydrograph volume           518.942    c.m"
"                   0.014     0.014     0.014     0.062"
" 38         START/RE-START TOTALS 2052"
"           3   Runoff Totals on EXIT"
"            Total Catchment area                     2.692    hectare"
"            Total Impervious area                    1.030    hectare"
"            Total % impervious                      38.249"
" 19         EXIT"
```

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"               MIDUSS Output ------------------------------------------------>"
"               MIDUSS version                          Version 2.25  rev. 473"
"               MIDUSS created                       Sunday, February 7, 2010"
"          10   Units used:                                        ie METRIC"
"               Job folder:           Q:\42063\104\SWM\March 2020\MIDUSS\POST"
"               Output filename:                                10yr-POST.in"
"               Licensee name:                                             A"
"               Company                                            Microsoft"
"               Date & Time last used:              3/25/2020 at 4:32:43 PM"
" 31         TIME PARAMETERS"
"       5.000   Time Step"
"     180.000   Max. Storm length"
"    1500.000   Max. Hydrograph"
" 32         STORM Chicago storm"
"           1   Chicago storm"
"    2221.000   Coefficient A"
"      12.000   Constant B"
"       0.908   Exponent C"
"       0.400   Fraction R"
"     180.000   Duration"
"       1.000   Time step multiplier"
"            Maximum intensity          169.551    mm/hr"
"            Total depth                 56.290    mm"
"           6   010hyd   Hydrograph extension used in this file"
" 33         CATCHMENT 201"
"           1   Triangular SCS"
"           1   Equal length"
"           1   SCS method"
"         201   Catchment 201"
"      79.000   % Impervious"
"       0.658   Total Area"
"      45.000   Flow length"
"       0.700   Overland Slope"
"       0.138   Pervious Area"
"      45.000   Pervious length"
"       0.700   Pervious slope"
"       0.520   Impervious Area"
"      45.000   Impervious length"
"       0.700   Impervious slope"
"       0.250   Pervious Manning 'n'"
"      68.000   Pervious SCS Curve No."
"       0.213   Pervious Runoff coefficient"
"       0.100   Pervious Ia/S coefficient"
"      11.953   Pervious Initial abstraction"
"       0.015   Impervious Manning 'n'"
"      98.000   Impervious SCS Curve No."
"       0.890   Impervious Runoff coefficient"
"       0.100   Impervious Ia/S coefficient"
"       0.518   Impervious Initial abstraction"
"                   0.177     0.000     0.000     0.000 c.m/sec"
"            Catchment 201          Pervious   Impervious Total Area "
"            Surface Area           0.138      0.520      0.658      hectare"
"            Time of concentration  34.372     3.184      5.050      minutes"
"            Time to Centroid       139.340    89.643     92.617     minutes"
"            Rainfall depth         56.290     56.290     56.290     mm"
"            Rainfall volume        77.78      292.61     370.39     c.m"
"            Rainfall losses        44.298     6.195      14.196     mm"
"            Runoff depth           11.992     50.095     42.094     mm"
"            Runoff volume          16.57      260.41     276.98     c.m"
"            Runoff coefficient     0.213      0.890      0.748      "
"            Maximum flow           0.004      0.177      0.177      c.m/sec"
" 40         HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                   0.177     0.177     0.000     0.000"
" 40         HYDROGRAPH Copy to Outflow"
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```
"            8   Copy to Outflow"
"                    0.177     0.177     0.177     0.000"
" 40          HYDROGRAPH   Combine    1"
"            6   Combine "
"            1   Node #"
"                SWMF"
"             Maximum flow                 0.177    c.m/sec"
"             Hydrograph volume          276.977    c.m"
"                    0.177     0.177     0.177     0.177"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                    0.177     0.000     0.177     0.177"
" 33          CATCHMENT 202"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          202   Catchment 202"
"       85.000   % Impervious"
"        0.263   Total Area"
"       30.000   Flow length"
"        2.000   Overland Slope"
"        0.039   Pervious Area"
"       30.000   Pervious length"
"        2.000   Pervious slope"
"        0.224   Impervious Area"
"       30.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       68.000   Pervious SCS Curve No."
"        0.213   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"       11.953   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.894   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.084     0.000     0.177     0.177 c.m/sec"
"             Catchment 202          Pervious   Impervious Total Area "
"             Surface Area           0.039      0.224      0.263      hectare"
"             Time of concentration  19.668     1.822      2.541      minutes"
"             Time to Centroid       121.736    87.573     88.949     minutes"
"             Rainfall depth         56.290     56.290     56.290     mm"
"             Rainfall volume        22.21      125.84     148.04     c.m"
"             Rainfall losses        44.311     5.945      11.700     mm"
"             Runoff depth           11.979     50.345     44.590     mm"
"             Runoff volume          4.73       112.55     117.27     c.m"
"             Runoff coefficient     0.213      0.894      0.792      "
"             Maximum flow           0.002      0.084      0.084      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.084     0.084     0.177     0.177"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                    0.084     0.084     0.084     0.177"
" 40          HYDROGRAPH   Combine    1"
"            6   Combine "
"            1   Node #"
"                SWMF"
"             Maximum flow                 0.261    c.m/sec"
"             Hydrograph volume          394.249    c.m"
"                    0.084     0.084     0.084     0.261"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                    0.084     0.000     0.084     0.261"
" 33          CATCHMENT 203"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          203   Catchment 203"
"       90.000   % Impervious"
"        0.071   Total Area"
"       15.000   Flow length"
"        2.000   Overland Slope"
"        0.007   Pervious Area"
"       15.000   Pervious length"
"        2.000   Pervious slope"
"        0.064   Impervious Area"
"       15.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       68.000   Pervious SCS Curve No."
"        0.212   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"       11.953   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.887   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.025     0.000     0.084     0.261 c.m/sec"
"             Catchment 203          Pervious   Impervious Total Area "
"             Surface Area           0.007      0.064      0.071      hectare"
"             Time of concentration  12.976     1.202      1.507      minutes"
"             Time to Centroid       113.768    86.719     87.419     minutes"
"             Rainfall depth         56.290     56.290     56.290     mm"
"             Rainfall volume        4.00       35.97      39.97      c.m"
"             Rainfall losses        44.353     6.369      10.167     mm"
"             Runoff depth           11.937     49.921     46.123     mm"
"             Runoff volume          0.85       31.90      32.75      c.m"
"             Runoff coefficient     0.212      0.887      0.819      "
"             Maximum flow           0.000      0.025      0.025      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.025     0.025     0.084     0.261"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                    0.025     0.025     0.025     0.261"
" 40          HYDROGRAPH   Combine    1"
"            6   Combine "
"            1   Node #"
"                SWMF"
"             Maximum flow                 0.287    c.m/sec"
"             Hydrograph volume          426.996    c.m"
"                    0.025     0.025     0.025     0.287"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                    0.025     0.000     0.025     0.287"
" 33          CATCHMENT 204"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          204   Catchment 204"
"       80.000   % Impervious"
"        0.207   Total Area"
"       10.000   Flow length"
"        5.000   Overland Slope"
"        0.041   Pervious Area"
"       10.000   Pervious length"
"        5.000   Pervious slope"
```

```
"        0.166   Impervious Area"
"       10.000   Impervious length"
"        5.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       68.000   Pervious SCS Curve No."
"        0.212   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"       11.953   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.849   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                0.066     0.000     0.025     0.287 c.m/sec"
"             Catchment 204          Pervious   Impervious Total Area "
"             Surface Area           0.041      0.166      0.207      hectare"
"             Time of concentration  7.729      0.716      1.128      minutes"
"             Time to Centroid       107.544    86.182     87.439     minutes"
"             Rainfall depth         56.290     56.290     56.290     mm"
"             Rainfall volume        23.30      93.22      116.52     c.m"
"             Rainfall losses        44.340     8.472      15.645     mm"
"             Runoff depth           11.950     47.818     40.645     mm"
"             Runoff volume          4.95       79.19      84.13      c.m"
"             Runoff coefficient     0.212      0.849      0.722      "
"             Maximum flow           0.003      0.065      0.066      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                0.066     0.066     0.025     0.287"
" 40          HYDROGRAPH Copy to Outflow"
"           8   Copy to Outflow"
"                0.066     0.066     0.066     0.287"
" 40          HYDROGRAPH   Combine    1"
"           6   Combine "
"           1   Node #"
"               SWMF"
"             Maximum flow                0.353    c.m/sec"
"             Hydrograph volume           511.131    c.m"
"                0.066     0.066     0.066     0.353"
" 40          HYDROGRAPH   Confluence    1"
"           7   Confluence "
"           1   Node #"
"               SWMF"
"             Maximum flow                0.353    c.m/sec"
"             Hydrograph volume           511.131    c.m"
"                0.066     0.353     0.066     0.000"
" 54          POND DESIGN"
"       0.353   Current peak flow    c.m/sec"
"       0.033   Target outflow    c.m/sec"
"       511.1   Hydrograph volume    c.m"
"         13.   Number of stages"
"     334.100   Minimum water level    metre"
"     335.300   Maximum water level    metre"
"     334.100   Starting water level    metre"
"           0   Keep Design Data: 1 = True; 0 = False"
"                 Level Discharge    Volume"
"               334.100     0.000     0.000"
"               334.200   0.00150    25.000"
"               334.300   0.00230    59.000"
"               334.400   0.01270   104.000"
"               334.500   0.03110   157.000"
"               334.600   0.04300   218.000"
"               334.700   0.05220   287.000"
"               334.800   0.05990   363.000"
"               334.900   0.06680   446.000"
"               335.000   0.07300   534.000"
"               335.100   0.08860   629.000"
"               335.200    0.1118   731.000"
"               335.300    0.2366   839.000"
"             Peak outflow                 0.055    c.m/sec"
"             Maximum level              334.738    metre"
"             Maximum storage            315.950    c.m"
"             Centroidal lag               3.613   hours"
"                  0.066     0.353     0.055     0.000 c.m/sec"
" 40          HYDROGRAPH   Combine    2"
"           6   Combine "
"           2   Node #"
"               Wetland"
"             Maximum flow                 0.055    c.m/sec"
"             Hydrograph volume          509.938    c.m"
"                0.066     0.353     0.055     0.055"
" 40          HYDROGRAPH Start - New Tributary"
"           2   Start - New Tributary"
"                0.066     0.000     0.055     0.055"
" 33          CATCHMENT 206"
"           1   Triangular SCS"
"           1   Equal length"
"           1   SCS method"
"         206   Catchment 206"
"       0.000   % Impervious"
"       0.185   Total Area"
"     100.000   Flow length"
"       0.800   Overland Slope"
"       0.185   Pervious Area"
"     100.000   Pervious length"
"       0.800   Pervious slope"
"       0.000   Impervious Area"
"     100.000   Impervious length"
"       0.800   Impervious slope"
"       0.250   Pervious Manning 'n'"
"      39.000   Pervious SCS Curve No."
"       0.012   Pervious Runoff coefficient"
"       0.100   Pervious Ia/S coefficient"
"      39.728   Pervious Initial abstraction"
"       0.015   Impervious Manning 'n'"
"      98.000   Impervious SCS Curve No."
"       0.000   Impervious Runoff coefficient"
"       0.100   Impervious Ia/S coefficient"
"       0.518   Impervious Initial abstraction"
"                0.000     0.000     0.055     0.055 c.m/sec"
"             Catchment 206          Pervious   Impervious Total Area "
"             Surface Area           0.185      0.000      0.185      hectare"
"             Time of concentration  239.708    4.939      239.690    minutes"
"             Time to Centroid       338.813    92.183     338.794    minutes"
"             Rainfall depth         56.290     56.290     56.290     mm"
"             Rainfall volume        104.14     0.00       104.14     c.m"
"             Rainfall losses        55.627     5.689      55.627     mm"
"             Runoff depth           0.663      50.601     0.663      mm"
"             Runoff volume          1.23       0.00       1.23       c.m"
"             Runoff coefficient     0.012      0.000      0.012      "
"             Maximum flow           0.000      0.000      0.000      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                0.000     0.000     0.055     0.055"
" 40          HYDROGRAPH Copy to Outflow"
"           8   Copy to Outflow"
"                0.000     0.000     0.000     0.055"
" 40          HYDROGRAPH   Combine    2"
"           6   Combine "
"           2   Node #"
"               Wetland"
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"            Maximum flow                  0.055    c.m/sec"
"            Hydrograph volume           511.164    c.m"
"                    0.000     0.000     0.000     0.055"
" 40         HYDROGRAPH Start - New Tributary"
"           2   Start - New Tributary"
"                    0.000     0.000     0.000     0.055"
" 33         CATCHMENT 207"
"           1   Triangular SCS"
"           1   Equal length"
"           1   SCS method"
"         207   Catchment 207"
"       0.000   % Impervious"
"       0.222   Total Area"
"      10.000   Flow length"
"       5.000   Overland Slope"
"       0.222   Pervious Area"
"      10.000   Pervious length"
"       5.000   Pervious slope"
"       0.000   Impervious Area"
"      10.000   Impervious length"
"       5.000   Impervious slope"
"       0.250   Pervious Manning 'n'"
"      49.000   Pervious SCS Curve No."
"       0.054   Pervious Runoff coefficient"
"       0.100   Pervious Ia/S coefficient"
"      26.437   Pervious Initial abstraction"
"       0.015   Impervious Manning 'n'"
"      98.000   Impervious SCS Curve No."
"       0.000   Impervious Runoff coefficient"
"       0.100   Impervious Ia/S coefficient"
"       0.518   Impervious Initial abstraction"
"                    0.002     0.000     0.000     0.055 c.m/sec"
"            Catchment 207          Pervious   Impervious Total Area "
"            Surface Area           0.222      0.000      0.222      hectare"
"            Time of concentration  15.456     0.716      15.455     minutes"
"            Time to Centroid       125.557    86.182     125.556    minutes"
"            Rainfall depth         56.290     56.290     56.290     mm"
"            Rainfall volume        124.96     0.00       124.96     c.m"
"            Rainfall losses        53.270     8.472      53.269     mm"
"            Runoff depth           3.021      47.818     3.021      mm"
"            Runoff volume          6.71       0.00       6.71       c.m"
"            Runoff coefficient     0.054      0.000      0.054      "
"            Maximum flow           0.002      0.000      0.002      c.m/sec"
" 40         HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                    0.002     0.002     0.000     0.055"
" 40         HYDROGRAPH Copy to Outflow"
"           8   Copy to Outflow"
"                    0.002     0.002     0.002     0.055"
" 40         HYDROGRAPH   Combine    2"
"           6   Combine "
"           2   Node #"
"               Wetland"
"            Maximum flow                  0.057    c.m/sec"
"            Hydrograph volume           517.870    c.m"
"                    0.002     0.002     0.002     0.057"
" 40         HYDROGRAPH Start - New Tributary"
"           2   Start - New Tributary"
"                    0.002     0.000     0.002     0.057"
" 33         CATCHMENT 208"
"           1   Triangular SCS"
"           1   Equal length"
"           1   SCS method"
"         208   Catchment 208"
"       0.000   % Impervious"
"       0.862   Total Area"
"      90.000   Flow length"
"       1.000   Overland Slope"
"       0.862   Pervious Area"
"      90.000   Pervious length"
"       1.000   Pervious slope"
"       0.000   Impervious Area"
"      90.000   Impervious length"
"       1.000   Impervious slope"
"       0.250   Pervious Manning 'n'"
"      70.000   Pervious SCS Curve No."
"       0.237   Pervious Runoff coefficient"
"       0.100   Pervious Ia/S coefficient"
"      10.886   Pervious Initial abstraction"
"       0.015   Impervious Manning 'n'"
"      98.000   Impervious SCS Curve No."
"       0.000   Impervious Runoff coefficient"
"       0.100   Impervious Ia/S coefficient"
"       0.518   Impervious Initial abstraction"
"                    0.023     0.000     0.002     0.057 c.m/sec"
"            Catchment 208          Pervious   Impervious Total Area "
"            Surface Area           0.862      0.000      0.862      hectare"
"            Time of concentration  44.026     4.336      44.026     minutes"
"            Time to Centroid       150.997    91.294     150.996    minutes"
"            Rainfall depth         56.290     56.290     56.290     mm"
"            Rainfall volume        485.22     0.00       485.22     c.m"
"            Rainfall losses        42.934     5.730      42.934     mm"
"            Runoff depth           13.356     50.560     13.356     mm"
"            Runoff volume          115.13     0.00       115.13     c.m"
"            Runoff coefficient     0.237      0.000      0.237      "
"            Maximum flow           0.023      0.000      0.023      c.m/sec"
" 40         HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                    0.023     0.023     0.002     0.057"
" 40         HYDROGRAPH Copy to Outflow"
"           8   Copy to Outflow"
"                    0.023     0.023     0.023     0.057"
" 40         HYDROGRAPH   Combine    2"
"           6   Combine "
"           2   Node #"
"               Wetland"
"            Maximum flow                  0.079    c.m/sec"
"            Hydrograph volume           633.001    c.m"
"                    0.023     0.023     0.023     0.079"
" 40         HYDROGRAPH Start - New Tributary"
"           2   Start - New Tributary"
"                    0.023     0.000     0.023     0.079"
" 33         CATCHMENT 2051"
"           1   Triangular SCS"
"           1   Equal length"
"           1   SCS method"
"        2051   Catchment 205-1"
"      11.000   % Impervious"
"       0.090   Total Area"
"      20.000   Flow length"
"       2.000   Overland Slope"
"       0.080   Pervious Area"
"      20.000   Pervious length"
"       2.000   Pervious slope"
"       0.010   Impervious Area"
"      20.000   Impervious length"
"       2.000   Impervious slope"
"       0.250   Pervious Manning 'n'"
"      49.000   Pervious SCS Curve No."
"       0.054   Pervious Runoff coefficient"
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"        0.100   Pervious Ia/S coefficient"
"       26.437   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.892   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                  0.004     0.000     0.023     0.079 c.m/sec"
"             Catchment 2051         Pervious   Impervious Total Area "
"             Surface Area           0.080      0.010      0.090      hectare"
"             Time of concentration  30.838     1.428      11.067     minutes"
"             Time to Centroid       142.222    86.974     105.081    minutes"
"             Rainfall depth         56.290     56.290     56.290     mm"
"             Rainfall volume        45.09      5.57       50.66      c.m"
"             Rainfall losses        53.264     6.067      48.072     mm"
"             Runoff depth           3.026      50.224     8.218      mm"
"             Runoff volume          2.42       4.97       7.40       c.m"
"             Runoff coefficient     0.054      0.892      0.146      "
"             Maximum flow           0.001      0.004      0.004      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                  0.004     0.004     0.023     0.079"
" 40          HYDROGRAPH Copy to Outflow"
"           8   Copy to Outflow"
"                  0.004     0.004     0.004     0.079"
" 40          HYDROGRAPH   Combine    3"
"           6   Combine "
"           3   Node #"
"               Arkell"
"            Maximum flow                 0.004    c.m/sec"
"            Hydrograph volume            7.396    c.m"
"                  0.004     0.004     0.004     0.004"
" 40          HYDROGRAPH Start - New Tributary"
"           2   Start - New Tributary"
"                  0.004     0.000     0.004     0.004"
" 33          CATCHMENT 2052"
"           1   Triangular SCS"
"           1   Equal length"
"           1   SCS method"
"        2052   Catchment 205-2"
"       35.000   % Impervious"
"        0.134   Total Area"
"       35.000   Flow length"
"        4.000   Overland Slope"
"        0.087   Pervious Area"
"       35.000   Pervious length"
"        4.000   Pervious slope"
"        0.047   Impervious Area"
"       35.000   Impervious length"
"        4.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       49.000   Pervious SCS Curve No."
"        0.054   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"       26.437   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.894   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                  0.018     0.000     0.004     0.004 c.m/sec"
"             Catchment 2052         Pervious   Impervious Total Area "
"             Surface Area           0.087      0.047      0.134      hectare"
"             Time of concentration  35.043     1.623      4.980      minutes"
"             Time to Centroid       146.780    87.261     93.239     minutes"
"             Rainfall depth         56.290     56.290     56.290     mm"
"             Rainfall volume        49.03      26.40      75.43      c.m"
"             Rainfall losses        53.263     5.940      36.700     mm"
"             Runoff depth           3.027      50.351     19.590     mm"
"             Runoff volume          2.64       23.61      26.25      c.m"
"             Runoff coefficient     0.054      0.894      0.348      "
"             Maximum flow           0.001      0.018      0.018      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                  0.018     0.018     0.004     0.004"
" 40          HYDROGRAPH Copy to Outflow"
"           8   Copy to Outflow"
"                  0.018     0.018     0.018     0.004"
" 40          HYDROGRAPH   Combine    2"
"           6   Combine "
"           2   Node #"
"               Wetland"
"            Maximum flow                 0.082    c.m/sec"
"            Hydrograph volume            659.253    c.m"
"                  0.018     0.018     0.018     0.082"
" 38          START/RE-START TOTALS 2052"
"           3   Runoff Totals on EXIT"
"            Total Catchment area                      2.692    hectare"
"            Total Impervious area                     1.030    hectare"
"            Total % impervious                       38.249"
" 19          EXIT"
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"               MIDUSS Output ------------------------------------------------>"
"               MIDUSS version                          Version 2.25  rev. 473"
"               MIDUSS created                        Sunday, February 7, 2010"
"          10   Units used:                                          ie METRIC"
"               Job folder:           Q:\42063\104\SWM\March 2020\MIDUSS\POST"
"               Output filename:                                  25yr-POST.in"
"               Licensee name:                                               A"
"               Company                                              Microsoft"
"               Date & Time last used:                3/25/2020 at 4:33:23 PM"
" 31          TIME PARAMETERS"
"       5.000   Time Step"
"     180.000   Max. Storm length"
"    1500.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"           1   Chicago storm"
"    3158.000   Coefficient A"
"      15.000   Constant B"
"       0.936   Exponent C"
"       0.400   Fraction R"
"     180.000   Duration"
"       1.000   Time step multiplier"
"            Maximum intensity          191.271    mm/hr"
"            Total depth                 68.087    mm"
"           6   025hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 201"
"           1   Triangular SCS"
"           1   Equal length"
"           1   SCS method"
"         201   Catchment 201"
"      79.000   % Impervious"
"       0.658   Total Area"
"      45.000   Flow length"
"       0.700   Overland Slope"
"       0.138   Pervious Area"
"      45.000   Pervious length"
"       0.700   Pervious slope"
"       0.520   Impervious Area"
"      45.000   Impervious length"
"       0.700   Impervious slope"
"       0.250   Pervious Manning 'n'"
"      68.000   Pervious SCS Curve No."
"       0.263   Pervious Runoff coefficient"
"       0.100   Pervious Ia/S coefficient"
"      11.953   Pervious Initial abstraction"
"       0.015   Impervious Manning 'n'"
"      98.000   Impervious SCS Curve No."
"       0.903   Impervious Runoff coefficient"
"       0.100   Impervious Ia/S coefficient"
"       0.518   Impervious Initial abstraction"
"                   0.211     0.000     0.000     0.000 c.m/sec"
"            Catchment 201          Pervious   Impervious Total Area "
"            Surface Area           0.138      0.520      0.658      hectare"
"            Time of concentration  29.148     3.022      4.902      minutes"
"            Time to Centroid       131.687    88.867     91.949     minutes"
"            Rainfall depth         68.087     68.087     68.087     mm"
"            Rainfall volume        94.08      353.93     448.01     c.m"
"            Rainfall losses        50.161     6.636      15.776     mm"
"            Runoff depth           17.926     61.450     52.310     mm"
"            Runoff volume          24.77      319.43     344.20     c.m"
"            Runoff coefficient     0.263      0.903      0.768      "
"            Maximum flow           0.007      0.210      0.211      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                   0.211     0.211     0.000     0.000"
" 40          HYDROGRAPH Copy to Outflow"
"           8   Copy to Outflow"
"                   0.211     0.211     0.211     0.000"
" 40          HYDROGRAPH   Combine    1"
"           6   Combine "
"           1   Node #"
"               SWMF"
"            Maximum flow                 0.211    c.m/sec"
"            Hydrograph volume          344.202    c.m"
"                   0.211     0.211     0.211     0.211"
" 40          HYDROGRAPH Start - New Tributary"
"           2   Start - New Tributary"
"                   0.211     0.000     0.211     0.211"
" 33          CATCHMENT 202"
"           1   Triangular SCS"
"           1   Equal length"
"           1   SCS method"
"         202   Catchment 202"
"      85.000   % Impervious"
"       0.263   Total Area"
"      30.000   Flow length"
"       2.000   Overland Slope"
"       0.039   Pervious Area"
"      30.000   Pervious length"
"       2.000   Pervious slope"
"       0.224   Impervious Area"
"      30.000   Impervious length"
"       2.000   Impervious slope"
"       0.250   Pervious Manning 'n'"
"      68.000   Pervious SCS Curve No."
"       0.263   Pervious Runoff coefficient"
"       0.100   Pervious Ia/S coefficient"
"      11.953   Pervious Initial abstraction"
"       0.015   Impervious Manning 'n'"
"      98.000   Impervious SCS Curve No."
"       0.910   Impervious Runoff coefficient"
"       0.100   Impervious Ia/S coefficient"
"       0.518   Impervious Initial abstraction"
"                   0.099     0.000     0.211     0.211 c.m/sec"
"            Catchment 202          Pervious   Impervious Total Area "
"            Surface Area           0.039      0.224      0.263      hectare"
"            Time of concentration  16.679     1.729      2.455      minutes"
"            Time to Centroid       116.724    86.924     88.371     minutes"
"            Rainfall depth         68.087     68.087     68.087     mm"
"            Rainfall volume        26.86      152.21     179.07     c.m"
"            Rainfall losses        50.168     6.138      12.742     mm"
"            Runoff depth           17.918     61.949     55.344     mm"
"            Runoff volume          7.07       138.49     145.56     c.m"
"            Runoff coefficient     0.263      0.910      0.813      "
"            Maximum flow           0.003      0.098      0.099      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                   0.099     0.099     0.211     0.211"
" 40          HYDROGRAPH Copy to Outflow"
"           8   Copy to Outflow"
"                   0.099     0.099     0.099     0.211"
" 40          HYDROGRAPH   Combine    1"
"           6   Combine "
"           1   Node #"
"               SWMF"
"            Maximum flow                 0.310    c.m/sec"
"            Hydrograph volume          489.757    c.m"
"                   0.099     0.099     0.099     0.310"
" 40          HYDROGRAPH Start - New Tributary"
"           2   Start - New Tributary"
"                   0.099     0.000     0.099     0.310"
```

```
" 33          CATCHMENT 203"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          203   Catchment 203"
"       90.000   % Impervious"
"        0.071   Total Area"
"       15.000   Flow length"
"        2.000   Overland Slope"
"        0.007   Pervious Area"
"       15.000   Pervious length"
"        2.000   Pervious slope"
"        0.064   Impervious Area"
"       15.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       68.000   Pervious SCS Curve No."
"        0.263   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"       11.953   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.899   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.029     0.000     0.099     0.310 c.m/sec"
"             Catchment 203          Pervious   Impervious Total Area "
"             Surface Area           0.007      0.064      0.071      hectare"
"             Time of concentration  11.004     1.141      1.451      minutes"
"             Time to Centroid       109.896    86.165     86.912     minutes"
"             Rainfall depth         68.087     68.087     68.087     mm"
"             Rainfall volume        4.83       43.51      48.34      c.m"
"             Rainfall losses        50.183     6.843      11.177     mm"
"             Runoff depth           17.903     61.244     56.910     mm"
"             Runoff volume          1.27       39.13      40.41      c.m"
"             Runoff coefficient     0.263      0.899      0.836      "
"             Maximum flow           0.001      0.029      0.029      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.029     0.029     0.099     0.310"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                    0.029     0.029     0.029     0.310"
" 40          HYDROGRAPH   Combine    1"
"            6   Combine "
"            1   Node #"
"                SWMF"
"             Maximum flow                  0.339    c.m/sec"
"             Hydrograph volume           530.163    c.m"
"                    0.029     0.029     0.029     0.339"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                    0.029     0.000     0.029     0.339"
" 33          CATCHMENT 204"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          204   Catchment 204"
"       80.000   % Impervious"
"        0.207   Total Area"
"       10.000   Flow length"
"        5.000   Overland Slope"
"        0.041   Pervious Area"
"       10.000   Pervious length"
"        5.000   Pervious slope"
"        0.166   Impervious Area"
"       10.000   Impervious length"
"        5.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       68.000   Pervious SCS Curve No."
"        0.260   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"       11.953   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.858   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.076     0.000     0.029     0.339 c.m/sec"
"             Catchment 204          Pervious   Impervious Total Area "
"             Surface Area           0.041      0.166      0.207      hectare"
"             Time of concentration  6.554      0.679      1.094      minutes"
"             Time to Centroid       104.754    85.725     87.067     minutes"
"             Rainfall depth         68.087     68.087     68.087     mm"
"             Rainfall volume        28.19      112.75     140.94     c.m"
"             Rainfall losses        50.359     9.668      17.806     mm"
"             Runoff depth           17.728     58.419     50.281     mm"
"             Runoff volume          7.34       96.74      104.08     c.m"
"             Runoff coefficient     0.260      0.858      0.738      "
"             Maximum flow           0.004      0.075      0.076      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.076     0.076     0.029     0.339"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                    0.076     0.076     0.076     0.339"
" 40          HYDROGRAPH   Combine    1"
"            6   Combine "
"            1   Node #"
"                SWMF"
"             Maximum flow                  0.415    c.m/sec"
"             Hydrograph volume           634.244    c.m"
"                    0.076     0.076     0.076     0.415"
" 40          HYDROGRAPH   Confluence    1"
"            7   Confluence "
"            1   Node #"
"                SWMF"
"             Maximum flow                  0.415    c.m/sec"
"             Hydrograph volume           634.244    c.m"
"                    0.076     0.415     0.076     0.000"
" 54          POND DESIGN"
"        0.415   Current peak flow    c.m/sec"
"        0.033   Target outflow    c.m/sec"
"        634.2   Hydrograph volume    c.m"
"          13.   Number of stages"
"      334.100   Minimum water level    metre"
"      335.300   Maximum water level    metre"
"      334.100   Starting water level    metre"
"            0   Keep Design Data: 1 = True; 0 = False"
"                  Level Discharge    Volume"
"                334.100     0.000     0.000"
"                334.200   0.00150    25.000"
"                334.300   0.00230    59.000"
"                334.400   0.01270   104.000"
"                334.500   0.03110   157.000"
"                334.600   0.04300   218.000"
"                334.700   0.05220   287.000"
"                334.800   0.05990   363.000"
"                334.900   0.06680   446.000"
"                335.000   0.07300   534.000"
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"               335.100   0.08860   629.000"
"               335.200    0.1118   731.000"
"               335.300    0.2366   839.000"
"            Peak outflow                 0.063    c.m/sec"
"            Maximum level              334.843    metre"
"            Maximum storage            398.876    c.m"
"            Centroidal lag               3.556   hours"
"                 0.076     0.415     0.063     0.000 c.m/sec"
" 40         HYDROGRAPH   Combine    2"
"           6   Combine "
"           2   Node #"
"               Wetland"
"            Maximum flow                 0.063    c.m/sec"
"            Hydrograph volume          633.091    c.m"
"                  0.076     0.415     0.063     0.063"
" 40         HYDROGRAPH Start - New Tributary"
"           2   Start - New Tributary"
"                  0.076     0.000     0.063     0.063"
" 33         CATCHMENT 206"
"           1   Triangular SCS"
"           1   Equal length"
"           1   SCS method"
"         206   Catchment 206"
"       0.000   % Impervious"
"       0.185   Total Area"
"     100.000   Flow length"
"       0.800   Overland Slope"
"       0.185   Pervious Area"
"     100.000   Pervious length"
"       0.800   Pervious slope"
"       0.000   Impervious Area"
"     100.000   Impervious length"
"       0.800   Impervious slope"
"       0.250   Pervious Manning 'n'"
"      39.000   Pervious SCS Curve No."
"       0.028   Pervious Runoff coefficient"
"       0.100   Pervious Ia/S coefficient"
"      39.728   Pervious Initial abstraction"
"       0.015   Impervious Manning 'n'"
"      98.000   Impervious SCS Curve No."
"       0.000   Impervious Runoff coefficient"
"       0.100   Impervious Ia/S coefficient"
"       0.518   Impervious Initial abstraction"
"                  0.000     0.000     0.063     0.063 c.m/sec"
"            Catchment 206          Pervious   Impervious Total Area "
"            Surface Area           0.185      0.000      0.185      hectare"
"            Time of concentration  141.834    4.688      141.830    minutes"
"            Time to Centroid       255.033    91.203     255.028    minutes"
"            Rainfall depth         68.087     68.087     68.087     mm"
"            Rainfall volume        125.96     0.00       125.96     c.m"
"            Rainfall losses        66.197     5.789      66.197     mm"
"            Runoff depth           1.889      62.297     1.889      mm"
"            Runoff volume          3.50       0.00       3.50       c.m"
"            Runoff coefficient     0.028      0.000      0.028      "
"            Maximum flow           0.000      0.000      0.000      c.m/sec"
" 40         HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                  0.000     0.000     0.063     0.063"
" 40         HYDROGRAPH Copy to Outflow"
"           8   Copy to Outflow"
"                  0.000     0.000     0.000     0.063"
" 40         HYDROGRAPH   Combine    2"
"           6   Combine "
"           2   Node #"
"               Wetland"
"            Maximum flow                 0.063    c.m/sec"
"            Hydrograph volume          636.586    c.m"
"                  0.000     0.000     0.000     0.063"
" 40         HYDROGRAPH Start - New Tributary"
"           2   Start - New Tributary"
"                  0.000     0.000     0.000     0.063"
" 33         CATCHMENT 207"
"           1   Triangular SCS"
"           1   Equal length"
"           1   SCS method"
"         207   Catchment 207"
"       0.000   % Impervious"
"       0.222   Total Area"
"      10.000   Flow length"
"       5.000   Overland Slope"
"       0.222   Pervious Area"
"      10.000   Pervious length"
"       5.000   Pervious slope"
"       0.000   Impervious Area"
"      10.000   Impervious length"
"       5.000   Impervious slope"
"       0.250   Pervious Manning 'n'"
"      49.000   Pervious SCS Curve No."
"       0.083   Pervious Runoff coefficient"
"       0.100   Pervious Ia/S coefficient"
"      26.437   Pervious Initial abstraction"
"       0.015   Impervious Manning 'n'"
"      98.000   Impervious SCS Curve No."
"       0.000   Impervious Runoff coefficient"
"       0.100   Impervious Ia/S coefficient"
"       0.518   Impervious Initial abstraction"
"                  0.005     0.000     0.000     0.063 c.m/sec"
"            Catchment 207          Pervious   Impervious Total Area "
"            Surface Area           0.222      0.000      0.222      hectare"
"            Time of concentration  11.434     0.679      11.434     minutes"
"            Time to Centroid       117.661    85.725     117.660    minutes"
"            Rainfall depth         68.087     68.087     68.087     mm"
"            Rainfall volume        151.15     0.00       151.15     c.m"
"            Rainfall losses        62.433     9.668      62.433     mm"
"            Runoff depth           5.653      58.419     5.653      mm"
"            Runoff volume          12.55      0.00       12.55      c.m"
"            Runoff coefficient     0.083      0.000      0.083      "
"            Maximum flow           0.005      0.000      0.005      c.m/sec"
" 40         HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                  0.005     0.005     0.000     0.063"
" 40         HYDROGRAPH Copy to Outflow"
"           8   Copy to Outflow"
"                  0.005     0.005     0.005     0.063"
" 40         HYDROGRAPH   Combine    2"
"           6   Combine "
"           2   Node #"
"               Wetland"
"            Maximum flow                 0.067    c.m/sec"
"            Hydrograph volume          649.136    c.m"
"                  0.005     0.005     0.005     0.067"
" 40         HYDROGRAPH Start - New Tributary"
"           2   Start - New Tributary"
"                  0.005     0.000     0.005     0.067"
" 33         CATCHMENT 208"
"           1   Triangular SCS"
"           1   Equal length"
"           1   SCS method"
"         208   Catchment 208"
"       0.000   % Impervious"
```

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"        0.862   Total Area"
"       90.000   Flow length"
"        1.000   Overland Slope"
"        0.862   Pervious Area"
"       90.000   Pervious length"
"        1.000   Pervious slope"
"        0.000   Impervious Area"
"       90.000   Impervious length"
"        1.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       70.000   Pervious SCS Curve No."
"        0.289   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"       10.886   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.000   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.039     0.000     0.005     0.067 c.m/sec"
"             Catchment 208          Pervious   Impervious Total Area "
"             Surface Area           0.862      0.000      0.862      hectare"
"             Time of concentration  37.760     4.116      37.760     minutes"
"             Time to Centroid       141.982    90.424     141.982    minutes"
"             Rainfall depth         68.087     68.087     68.087     mm"
"             Rainfall volume        586.91     0.00       586.91     c.m"
"             Rainfall losses        48.395     6.029      48.395     mm"
"             Runoff depth           19.692     62.058     19.692     mm"
"             Runoff volume          169.74     0.00       169.74     c.m"
"             Runoff coefficient     0.289      0.000      0.289      "
"             Maximum flow           0.039      0.000      0.039      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                    0.039     0.039     0.005     0.067"
" 40          HYDROGRAPH Copy to Outflow"
"           8   Copy to Outflow"
"                    0.039     0.039     0.039     0.067"
" 40          HYDROGRAPH   Combine    2"
"           6   Combine "
"           2   Node #"
"               Wetland"
"            Maximum flow                  0.105    c.m/sec"
"            Hydrograph volume           818.878    c.m"
"                    0.039     0.039     0.039     0.105"
" 40          HYDROGRAPH Start - New Tributary"
"           2   Start - New Tributary"
"                    0.039     0.000     0.039     0.105"
" 33          CATCHMENT 2051"
"           1   Triangular SCS"
"           1   Equal length"
"           1   SCS method"
"        2051   Catchment 205-1"
"       11.000   % Impervious"
"        0.090   Total Area"
"       20.000   Flow length"
"        2.000   Overland Slope"
"        0.080   Pervious Area"
"       20.000   Pervious length"
"        2.000   Pervious slope"
"        0.010   Impervious Area"
"       20.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       49.000   Pervious SCS Curve No."
"        0.083   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"       26.437   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.906   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.004     0.000     0.039     0.105 c.m/sec"
"             Catchment 2051         Pervious   Impervious Total Area "
"             Surface Area           0.080      0.010      0.090      hectare"
"             Time of concentration  22.814     1.356      10.499     minutes"
"             Time to Centroid       130.453    86.402     105.172    minutes"
"             Rainfall depth         68.087     68.087     68.087     mm"
"             Rainfall volume        54.54      6.74       61.28      c.m"
"             Rainfall losses        62.424     6.379      56.259     mm"
"             Runoff depth           5.663      61.708     11.828     mm"
"             Runoff volume          4.54       6.11       10.64      c.m"
"             Runoff coefficient     0.083      0.906      0.174      "
"             Maximum flow           0.001      0.004      0.004      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                    0.004     0.004     0.039     0.105"
" 40          HYDROGRAPH Copy to Outflow"
"           8   Copy to Outflow"
"                    0.004     0.004     0.004     0.105"
" 40          HYDROGRAPH   Combine    3"
"           6   Combine "
"           3   Node #"
"               Arkell"
"            Maximum flow                  0.004    c.m/sec"
"            Hydrograph volume            10.645    c.m"
"                    0.004     0.004     0.004     0.004"
" 40          HYDROGRAPH Start - New Tributary"
"           2   Start - New Tributary"
"                    0.004     0.000     0.004     0.004"
" 33          CATCHMENT 2052"
"           1   Triangular SCS"
"           1   Equal length"
"           1   SCS method"
"         2052   Catchment 205-2"
"       35.000   % Impervious"
"        0.134   Total Area"
"       35.000   Flow length"
"        4.000   Overland Slope"
"        0.087   Pervious Area"
"       35.000   Pervious length"
"        4.000   Pervious slope"
"        0.047   Impervious Area"
"       35.000   Impervious length"
"        4.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       49.000   Pervious SCS Curve No."
"        0.083   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"       26.437   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.909   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.021     0.000     0.004     0.004 c.m/sec"
"             Catchment 2052         Pervious   Impervious Total Area "
"             Surface Area           0.087      0.047      0.134      hectare"
"             Time of concentration  25.925     1.541      5.084      minutes"
"             Time to Centroid       133.934    86.651     93.521     minutes"
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```
"            Rainfall depth         68.087     68.087     68.087     mm"
"            Rainfall volume        59.30      31.93      91.24      c.m"
"            Rainfall losses        62.423     6.216      42.751     mm"
"            Runoff depth           5.663      61.871     25.336     mm"
"            Runoff volume          4.93       29.02      33.95      c.m"
"            Runoff coefficient     0.083      0.909      0.372      "
"            Maximum flow           0.001      0.021      0.021      c.m/sec"
" 40         HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                   0.021     0.021     0.004     0.004"
" 40         HYDROGRAPH Copy to Outflow"
"           8   Copy to Outflow"
"                   0.021     0.021     0.021     0.004"
" 40         HYDROGRAPH   Combine    2"
"           6   Combine "
"           2   Node #"
"               Wetland"
"            Maximum flow                 0.109    c.m/sec"
"            Hydrograph volume          852.828    c.m"
"                   0.021     0.021     0.021     0.109"
" 38         START/RE-START TOTALS 2052"
"           3   Runoff Totals on EXIT"
"            Total Catchment area                    2.692    hectare"
"            Total Impervious area                   1.030    hectare"
"            Total % impervious                     38.249"
" 19         EXIT"
```

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"               MIDUSS Output ----------------------------------------------->"
"               MIDUSS version                          Version 2.25  rev. 473"
"               MIDUSS created                       Sunday, February 7, 2010"
"           10  Units used:                                        ie METRIC"
"               Job folder:           Q:\42063\104\SWM\March 2020\MIDUSS\POST"
"               Output filename:                                 50yr-POST.in"
"               Licensee name:                                              A"
"               Company                                             Microsoft"
"               Date & Time last used:              3/25/2020 at 4:34:08 PM"
" 31         TIME PARAMETERS"
"       5.000   Time Step"
"     180.000   Max. Storm length"
"    1500.000   Max. Hydrograph"
" 32         STORM Chicago storm"
"           1   Chicago storm"
"    3886.000   Coefficient A"
"      16.000   Constant B"
"       0.950   Exponent C"
"       0.400   Fraction R"
"     180.000   Duration"
"       1.000   Time step multiplier"
"            Maximum intensity          215.474    mm/hr"
"            Total depth                 77.443    mm"
"           6   050hyd   Hydrograph extension used in this file"
" 33         CATCHMENT 201"
"           1   Triangular SCS"
"           1   Equal length"
"           1   SCS method"
"         201   Catchment 201"
"      79.000   % Impervious"
"       0.658   Total Area"
"      45.000   Flow length"
"       0.700   Overland Slope"
"       0.138   Pervious Area"
"      45.000   Pervious length"
"       0.700   Pervious slope"
"       0.520   Impervious Area"
"      45.000   Impervious length"
"       0.700   Impervious slope"
"       0.250   Pervious Manning 'n'"
"      68.000   Pervious SCS Curve No."
"       0.299   Pervious Runoff coefficient"
"       0.100   Pervious Ia/S coefficient"
"      11.953   Pervious Initial abstraction"
"       0.015   Impervious Manning 'n'"
"      98.000   Impervious SCS Curve No."
"       0.909   Impervious Runoff coefficient"
"       0.100   Impervious Ia/S coefficient"
"       0.518   Impervious Initial abstraction"
"                   0.243     0.000     0.000     0.000 c.m/sec"
"            Catchment 201          Pervious   Impervious Total Area "
"            Surface Area           0.138      0.520      0.658      hectare"
"            Time of concentration  25.977     2.875      4.733      minutes"
"            Time to Centroid       127.039    88.252     91.370     minutes"
"            Rainfall depth         77.443     77.443     77.443     mm"
"            Rainfall volume        107.01     402.56     509.57     c.m"
"            Rainfall losses        54.283     7.037      16.959     mm"
"            Runoff depth           23.160     70.406     60.484     mm"
"            Runoff volume          32.00      365.98     397.99     c.m"
"            Runoff coefficient     0.299      0.909      0.781      "
"            Maximum flow           0.010      0.243      0.243      c.m/sec"
" 40         HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                   0.243     0.243     0.000     0.000"
" 40         HYDROGRAPH Copy to Outflow"
```

```
"            8   Copy to Outflow"
"                    0.243     0.243     0.243     0.000"
" 40          HYDROGRAPH   Combine    1"
"            6   Combine "
"            1   Node #"
"                SWMF"
"             Maximum flow                  0.243    c.m/sec"
"             Hydrograph volume           397.986    c.m"
"                    0.243     0.243     0.243     0.243"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                    0.243     0.000     0.243     0.243"
" 33          CATCHMENT 202"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          202   Catchment 202"
"       85.000   % Impervious"
"        0.263   Total Area"
"       30.000   Flow length"
"        2.000   Overland Slope"
"        0.039   Pervious Area"
"       30.000   Pervious length"
"        2.000   Pervious slope"
"        0.224   Impervious Area"
"       30.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       68.000   Pervious SCS Curve No."
"        0.299   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"       11.953   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.919   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.113     0.000     0.243     0.243 c.m/sec"
"             Catchment 202          Pervious   Impervious Total Area "
"             Surface Area           0.039      0.224      0.263      hectare"
"             Time of concentration  14.864     1.645      2.362      minutes"
"             Time to Centroid       113.589    86.425     87.899     minutes"
"             Rainfall depth         77.443     77.443     77.443     mm"
"             Rainfall volume        30.55      173.12     203.67     c.m"
"             Rainfall losses        54.316     6.300      13.503     mm"
"             Runoff depth           23.126     71.142     63.940     mm"
"             Runoff volume          9.12       159.04     168.16     c.m"
"             Runoff coefficient     0.299      0.919      0.826      "
"             Maximum flow           0.004      0.113      0.113      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.113     0.113     0.243     0.243"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                    0.113     0.113     0.113     0.243"
" 40          HYDROGRAPH   Combine    1"
"            6   Combine "
"            1   Node #"
"                SWMF"
"             Maximum flow                  0.356    c.m/sec"
"             Hydrograph volume           566.148    c.m"
"                    0.113     0.113     0.113     0.356"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                    0.113     0.000     0.113     0.356"
" 33          CATCHMENT 203"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          203   Catchment 203"
"       90.000   % Impervious"
"        0.071   Total Area"
"       15.000   Flow length"
"        2.000   Overland Slope"
"        0.007   Pervious Area"
"       15.000   Pervious length"
"        2.000   Pervious slope"
"        0.064   Impervious Area"
"       15.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       68.000   Pervious SCS Curve No."
"        0.297   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"       11.953   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.906   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.033     0.000     0.113     0.356 c.m/sec"
"             Catchment 203          Pervious   Impervious Total Area "
"             Surface Area           0.007      0.064      0.071      hectare"
"             Time of concentration  9.807      1.085      1.392      minutes"
"             Time to Centroid       107.462    85.713     86.479     minutes"
"             Rainfall depth         77.443     77.443     77.443     mm"
"             Rainfall volume        5.50       49.49      54.98      c.m"
"             Rainfall losses        54.415     7.314      12.024     mm"
"             Runoff depth           23.027     70.128     65.418     mm"
"             Runoff volume          1.63       44.81      46.45      c.m"
"             Runoff coefficient     0.297      0.906      0.845      "
"             Maximum flow           0.001      0.033      0.033      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.033     0.033     0.113     0.356"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                    0.033     0.033     0.033     0.356"
" 40          HYDROGRAPH   Combine    1"
"            6   Combine "
"            1   Node #"
"                SWMF"
"             Maximum flow                  0.390    c.m/sec"
"             Hydrograph volume           612.595    c.m"
"                    0.033     0.033     0.033     0.390"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                    0.033     0.000     0.033     0.390"
" 33          CATCHMENT 204"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          204   Catchment 204"
"       80.000   % Impervious"
"        0.207   Total Area"
"       10.000   Flow length"
"        5.000   Overland Slope"
"        0.041   Pervious Area"
"       10.000   Pervious length"
"        5.000   Pervious slope"
```

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"        0.166   Impervious Area"
"       10.000   Impervious length"
"        5.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       68.000   Pervious SCS Curve No."
"        0.297   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"       11.953   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.860   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                  0.086     0.000     0.033     0.390 c.m/sec"
"             Catchment 204          Pervious   Impervious Total Area "
"             Surface Area           0.041      0.166      0.207      hectare"
"             Time of concentration  5.841      0.647      1.059      minutes"
"             Time to Centroid       102.704    85.323     86.704     minutes"
"             Rainfall depth         77.443     77.443     77.443     mm"
"             Rainfall volume        32.06      128.25     160.31     c.m"
"             Rainfall losses        54.435     10.804     19.530     mm"
"             Runoff depth           23.008     66.639     57.912     mm"
"             Runoff volume          9.53       110.35     119.88     c.m"
"             Runoff coefficient     0.297      0.860      0.748      "
"             Maximum flow           0.005      0.084      0.086      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                  0.086     0.086     0.033     0.390"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                  0.086     0.086     0.086     0.390"
" 40          HYDROGRAPH   Combine    1"
"            6   Combine "
"            1   Node #"
"                SWMF"
"             Maximum flow                 0.476    c.m/sec"
"             Hydrograph volume          732.474    c.m"
"                  0.086     0.086     0.086     0.476"
" 40          HYDROGRAPH   Confluence    1"
"            7   Confluence "
"            1   Node #"
"                SWMF"
"             Maximum flow                 0.476    c.m/sec"
"             Hydrograph volume          732.474    c.m"
"                  0.086     0.476     0.086     0.000"
" 54          POND DESIGN"
"        0.476   Current peak flow    c.m/sec"
"        0.033   Target outflow    c.m/sec"
"        732.5   Hydrograph volume    c.m"
"          13.   Number of stages"
"      334.100   Minimum water level    metre"
"      335.300   Maximum water level    metre"
"      334.100   Starting water level    metre"
"            0   Keep Design Data: 1 = True; 0 = False"
"                  Level Discharge    Volume"
"                334.100     0.000     0.000"
"                334.200   0.00150    25.000"
"                334.300   0.00230    59.000"
"                334.400   0.01270   104.000"
"                334.500   0.03110   157.000"
"                334.600   0.04300   218.000"
"                334.700   0.05220   287.000"
"                334.800   0.05990   363.000"
"                334.900   0.06680   446.000"
"                335.000   0.07300   534.000"
"                335.100   0.08860   629.000"
"                335.200    0.1118   731.000"
"                335.300    0.2366   839.000"
"             Peak outflow                 0.068    c.m/sec"
"             Maximum level              334.927    metre"
"             Maximum storage            469.466    c.m"
"             Centroidal lag               3.553   hours"
"                  0.086     0.476     0.068     0.000 c.m/sec"
" 40          HYDROGRAPH   Combine    2"
"            6   Combine "
"            2   Node #"
"                Wetland"
"             Maximum flow                 0.068    c.m/sec"
"             Hydrograph volume          730.698    c.m"
"                  0.086     0.476     0.068     0.068"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                  0.086     0.000     0.068     0.068"
" 33          CATCHMENT 206"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          206   Catchment 206"
"        0.000   % Impervious"
"        0.185   Total Area"
"      100.000   Flow length"
"        0.800   Overland Slope"
"        0.185   Pervious Area"
"      100.000   Pervious length"
"        0.800   Pervious slope"
"        0.000   Impervious Area"
"      100.000   Impervious length"
"        0.800   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       39.000   Pervious SCS Curve No."
"        0.042   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"       39.728   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.000   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                  0.001     0.000     0.068     0.068 c.m/sec"
"             Catchment 206          Pervious   Impervious Total Area "
"             Surface Area           0.185      0.000      0.185      hectare"
"             Time of concentration  107.162    4.460      107.160    minutes"
"             Time to Centroid       221.509    90.500     221.506    minutes"
"             Rainfall depth         77.443     77.443     77.443     mm"
"             Rainfall volume        143.27     0.00       143.27     c.m"
"             Rainfall losses        74.173     5.952      74.173     mm"
"             Runoff depth           3.270      71.490     3.270      mm"
"             Runoff volume          6.05       0.00       6.05       c.m"
"             Runoff coefficient     0.042      0.000      0.042      "
"             Maximum flow           0.001      0.000      0.001      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                  0.001     0.001     0.068     0.068"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                  0.001     0.001     0.001     0.068"
" 40          HYDROGRAPH   Combine    2"
"            6   Combine "
"            2   Node #"
"                Wetland"
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"            Maximum flow                  0.069    c.m/sec"
"            Hydrograph volume           736.747    c.m"
"                    0.001     0.001     0.001     0.069"
" 40         HYDROGRAPH Start - New Tributary"
"           2   Start - New Tributary"
"                    0.001     0.000     0.001     0.069"
" 33         CATCHMENT 207"
"           1   Triangular SCS"
"           1   Equal length"
"           1   SCS method"
"         207   Catchment 207"
"       0.000   % Impervious"
"       0.222   Total Area"
"      10.000   Flow length"
"       5.000   Overland Slope"
"       0.222   Pervious Area"
"      10.000   Pervious length"
"       5.000   Pervious slope"
"       0.000   Impervious Area"
"      10.000   Impervious length"
"       5.000   Impervious slope"
"       0.250   Pervious Manning 'n'"
"      49.000   Pervious SCS Curve No."
"       0.106   Pervious Runoff coefficient"
"       0.100   Pervious Ia/S coefficient"
"      26.437   Pervious Initial abstraction"
"       0.015   Impervious Manning 'n'"
"      98.000   Impervious SCS Curve No."
"       0.000   Impervious Runoff coefficient"
"       0.100   Impervious Ia/S coefficient"
"       0.518   Impervious Initial abstraction"
"                    0.008     0.000     0.001     0.069 c.m/sec"
"            Catchment 207          Pervious   Impervious Total Area "
"            Surface Area           0.222      0.000      0.222      hectare"
"            Time of concentration  9.632      0.647      9.632      minutes"
"            Time to Centroid       113.406    85.323     113.405    minutes"
"            Rainfall depth         77.443     77.443     77.443     mm"
"            Rainfall volume        171.92     0.00       171.92     c.m"
"            Rainfall losses        69.233     10.804     69.233     mm"
"            Runoff depth           8.209      66.639     8.209      mm"
"            Runoff volume          18.22      0.00       18.22      c.m"
"            Runoff coefficient     0.106      0.000      0.106      "
"            Maximum flow           0.008      0.000      0.008      c.m/sec"
" 40         HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                    0.008     0.008     0.001     0.069"
" 40         HYDROGRAPH Copy to Outflow"
"           8   Copy to Outflow"
"                    0.008     0.008     0.008     0.069"
" 40         HYDROGRAPH   Combine    2"
"           6   Combine "
"           2   Node #"
"               Wetland"
"            Maximum flow                  0.074    c.m/sec"
"            Hydrograph volume           754.972    c.m"
"                    0.008     0.008     0.008     0.074"
" 40         HYDROGRAPH Start - New Tributary"
"           2   Start - New Tributary"
"                    0.008     0.000     0.008     0.074"
" 33         CATCHMENT 208"
"           1   Triangular SCS"
"           1   Equal length"
"           1   SCS method"
"         208   Catchment 208"
"       0.000   % Impervious"
"       0.862   Total Area"
"      90.000   Flow length"
"       1.000   Overland Slope"
"       0.862   Pervious Area"
"      90.000   Pervious length"
"       1.000   Pervious slope"
"       0.000   Impervious Area"
"      90.000   Impervious length"
"       1.000   Impervious slope"
"       0.250   Pervious Manning 'n'"
"      70.000   Pervious SCS Curve No."
"       0.326   Pervious Runoff coefficient"
"       0.100   Pervious Ia/S coefficient"
"      10.886   Pervious Initial abstraction"
"       0.015   Impervious Manning 'n'"
"      98.000   Impervious SCS Curve No."
"       0.000   Impervious Runoff coefficient"
"       0.100   Impervious Ia/S coefficient"
"       0.518   Impervious Initial abstraction"
"                    0.055     0.000     0.008     0.074 c.m/sec"
"            Catchment 208          Pervious   Impervious Total Area "
"            Surface Area           0.862      0.000      0.862      hectare"
"            Time of concentration  33.846     3.916      33.846     minutes"
"            Time to Centroid       136.399    89.753     136.399    minutes"
"            Rainfall depth         77.443     77.443     77.443     mm"
"            Rainfall volume        667.56     0.00       667.56     c.m"
"            Rainfall losses        52.197     6.410      52.197     mm"
"            Runoff depth           25.246     71.032     25.246     mm"
"            Runoff volume          217.62     0.00       217.62     c.m"
"            Runoff coefficient     0.326      0.000      0.326      "
"            Maximum flow           0.055      0.000      0.055      c.m/sec"
" 40         HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                    0.055     0.055     0.008     0.074"
" 40         HYDROGRAPH Copy to Outflow"
"           8   Copy to Outflow"
"                    0.055     0.055     0.055     0.074"
" 40         HYDROGRAPH   Combine    2"
"           6   Combine "
"           2   Node #"
"               Wetland"
"            Maximum flow                  0.127    c.m/sec"
"            Hydrograph volume           972.592    c.m"
"                    0.055     0.055     0.055     0.127"
" 40         HYDROGRAPH Start - New Tributary"
"           2   Start - New Tributary"
"                    0.055     0.000     0.055     0.127"
" 33         CATCHMENT 2051"
"           1   Triangular SCS"
"           1   Equal length"
"           1   SCS method"
"        2051   Catchment 205-1"
"      11.000   % Impervious"
"       0.090   Total Area"
"      20.000   Flow length"
"       2.000   Overland Slope"
"       0.080   Pervious Area"
"      20.000   Pervious length"
"       2.000   Pervious slope"
"       0.010   Impervious Area"
"      20.000   Impervious length"
"       2.000   Impervious slope"
"       0.250   Pervious Manning 'n'"
"      49.000   Pervious SCS Curve No."
"       0.106   Pervious Runoff coefficient"
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"        0.100   Pervious Ia/S coefficient"
"       26.437   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.914   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                  0.005     0.000     0.055     0.127 c.m/sec"
"             Catchment 2051         Pervious   Impervious Total Area "
"             Surface Area           0.080      0.010      0.090      hectare"
"             Time of concentration  19.218     1.290      9.985      minutes"
"             Time to Centroid       124.252    85.940     104.522    minutes"
"             Rainfall depth         77.443     77.443     77.443     mm"
"             Rainfall volume        62.03      7.67       69.70      c.m"
"             Rainfall losses        69.208     6.693      62.331     mm"
"             Runoff depth           8.235      70.750     15.112     mm"
"             Runoff volume          6.60       7.00       13.60      c.m"
"             Runoff coefficient     0.106      0.914      0.195      "
"             Maximum flow           0.002      0.005      0.005      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                  0.005     0.005     0.055     0.127"
" 40          HYDROGRAPH Copy to Outflow"
"           8   Copy to Outflow"
"                  0.005     0.005     0.005     0.127"
" 40          HYDROGRAPH   Combine    3"
"           6   Combine "
"           3   Node #"
"               Arkell"
"            Maximum flow                  0.005    c.m/sec"
"            Hydrograph volume            13.601    c.m"
"                  0.005     0.005     0.005     0.005"
" 40          HYDROGRAPH Start - New Tributary"
"           2   Start - New Tributary"
"                  0.005     0.000     0.005     0.005"
" 33          CATCHMENT 2052"
"           1   Triangular SCS"
"           1   Equal length"
"           1   SCS method"
"        2052   Catchment 205-2"
"       35.000   % Impervious"
"        0.134   Total Area"
"       35.000   Flow length"
"        4.000   Overland Slope"
"        0.087   Pervious Area"
"       35.000   Pervious length"
"        4.000   Pervious slope"
"        0.047   Impervious Area"
"       35.000   Impervious length"
"        4.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       49.000   Pervious SCS Curve No."
"        0.106   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"       26.437   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.917   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                  0.024     0.000     0.005     0.005 c.m/sec"
"             Catchment 2052         Pervious   Impervious Total Area "
"             Surface Area           0.087      0.047      0.134      hectare"
"             Time of concentration  21.839     1.466      5.078      minutes"
"             Time to Centroid       127.216    86.162     93.441     minutes"
"             Rainfall depth         77.443     77.443     77.443     mm"
"             Rainfall volume        67.45      36.32      103.77     c.m"
"             Rainfall losses        69.199     6.412      47.224     mm"
"             Runoff depth           8.243      71.030     30.219     mm"
"             Runoff volume          7.18       33.31      40.49      c.m"
"             Runoff coefficient     0.106      0.917      0.390      "
"             Maximum flow           0.002      0.024      0.024      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                  0.024     0.024     0.005     0.005"
" 40          HYDROGRAPH Copy to Outflow"
"           8   Copy to Outflow"
"                  0.024     0.024     0.024     0.005"
" 40          HYDROGRAPH   Combine    2"
"           6   Combine "
"           2   Node #"
"               Wetland"
"            Maximum flow                  0.132    c.m/sec"
"            Hydrograph volume          1013.085    c.m"
"                  0.024     0.024     0.024     0.132"
" 38          START/RE-START TOTALS 2052"
"           3   Runoff Totals on EXIT"
"            Total Catchment area                      2.692    hectare"
"            Total Impervious area                     1.030    hectare"
"            Total % impervious                       38.249"
" 19          EXIT"
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"               MIDUSS Output ------------------------------------------------>"
"               MIDUSS version                          Version 2.25  rev. 473"
"               MIDUSS created                        Sunday, February 7, 2010"
"          10   Units used:                                          ie METRIC"
"               Job folder:           Q:\42063\104\SWM\March 2020\MIDUSS\POST"
"               Output filename:                                  100yr-POST.in"
"               Licensee name:                                               A"
"               Company                                              Microsoft"
"               Date & Time last used:                3/25/2020 at 4:34:52 PM"
" 31          TIME PARAMETERS"
"       5.000   Time Step"
"     180.000   Max. Storm length"
"    1500.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"           1   Chicago storm"
"    4688.000   Coefficient A"
"      17.000   Constant B"
"       0.962   Exponent C"
"       0.400   Fraction R"
"     180.000   Duration"
"       1.000   Time step multiplier"
"            Maximum intensity          239.650    mm/hr"
"            Total depth                 87.263    mm"
"           6   100hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 201"
"           1   Triangular SCS"
"           1   Equal length"
"           1   SCS method"
"         201   Catchment 201"
"      79.000   % Impervious"
"       0.658   Total Area"
"      45.000   Flow length"
"       0.700   Overland Slope"
"       0.138   Pervious Area"
"      45.000   Pervious length"
"       0.700   Pervious slope"
"       0.520   Impervious Area"
"      45.000   Impervious length"
"       0.700   Impervious slope"
"       0.250   Pervious Manning 'n'"
"      68.000   Pervious SCS Curve No."
"       0.333   Pervious Runoff coefficient"
"       0.100   Pervious Ia/S coefficient"
"      11.953   Pervious Initial abstraction"
"       0.015   Impervious Manning 'n'"
"      98.000   Impervious SCS Curve No."
"       0.917   Impervious Runoff coefficient"
"       0.100   Impervious Ia/S coefficient"
"       0.518   Impervious Initial abstraction"
"                   0.277     0.000     0.000     0.000 c.m/sec"
"            Catchment 201          Pervious   Impervious Total Area "
"            Surface Area           0.138      0.520      0.658      hectare"
"            Time of concentration  23.547     2.751      4.584      minutes"
"            Time to Centroid       123.335    87.766     90.900     minutes"
"            Rainfall depth         87.263     87.263     87.263     mm"
"            Rainfall volume        120.58     453.61     574.19     c.m"
"            Rainfall losses        58.186     7.273      17.965     mm"
"            Runoff depth           29.077     79.990     69.298     mm"
"            Runoff volume          40.18      415.80     455.98     c.m"
"            Runoff coefficient     0.333      0.917      0.794      "
"            Maximum flow           0.013      0.275      0.277      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                   0.277     0.277     0.000     0.000"
" 40          HYDROGRAPH Copy to Outflow"
"           8   Copy to Outflow"
"                   0.277     0.277     0.277     0.000"
" 40          HYDROGRAPH   Combine    1"
"           6   Combine "
"           1   Node #"
"               SWMF"
"            Maximum flow                 0.277    c.m/sec"
"            Hydrograph volume          455.983    c.m"
"                   0.277     0.277     0.277     0.277"
" 40          HYDROGRAPH Start - New Tributary"
"           2   Start - New Tributary"
"                   0.277     0.000     0.277     0.277"
" 33          CATCHMENT 202"
"           1   Triangular SCS"
"           1   Equal length"
"           1   SCS method"
"         202   Catchment 202"
"      85.000   % Impervious"
"       0.263   Total Area"
"      30.000   Flow length"
"       2.000   Overland Slope"
"       0.039   Pervious Area"
"      30.000   Pervious length"
"       2.000   Pervious slope"
"       0.224   Impervious Area"
"      30.000   Impervious length"
"       2.000   Impervious slope"
"       0.250   Pervious Manning 'n'"
"      68.000   Pervious SCS Curve No."
"       0.333   Pervious Runoff coefficient"
"       0.100   Pervious Ia/S coefficient"
"      11.953   Pervious Initial abstraction"
"       0.015   Impervious Manning 'n'"
"      98.000   Impervious SCS Curve No."
"       0.925   Impervious Runoff coefficient"
"       0.100   Impervious Ia/S coefficient"
"       0.518   Impervious Initial abstraction"
"                   0.128     0.000     0.277     0.277 c.m/sec"
"            Catchment 202          Pervious   Impervious Total Area "
"            Surface Area           0.039      0.224      0.263      hectare"
"            Time of concentration  13.474     1.574      2.285      minutes"
"            Time to Centroid       111.080    86.019     87.514     minutes"
"            Rainfall depth         87.263     87.263     87.263     mm"
"            Rainfall volume        34.43      195.08     229.50     c.m"
"            Rainfall losses        58.218     6.508      14.265     mm"
"            Runoff depth           29.045     80.755     72.998     mm"
"            Runoff volume          11.46      180.53     191.99     c.m"
"            Runoff coefficient     0.333      0.925      0.837      "
"            Maximum flow           0.005      0.127      0.128      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                   0.128     0.128     0.277     0.277"
" 40          HYDROGRAPH Copy to Outflow"
"           8   Copy to Outflow"
"                   0.128     0.128     0.128     0.277"
" 40          HYDROGRAPH   Combine    1"
"           6   Combine "
"           1   Node #"
"               SWMF"
"            Maximum flow                 0.404    c.m/sec"
"            Hydrograph volume          647.969    c.m"
"                   0.128     0.128     0.128     0.404"
" 40          HYDROGRAPH Start - New Tributary"
"           2   Start - New Tributary"
"                   0.128     0.000     0.128     0.404"
```

```
" 33          CATCHMENT 203"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          203   Catchment 203"
"       90.000   % Impervious"
"        0.071   Total Area"
"       15.000   Flow length"
"        2.000   Overland Slope"
"        0.007   Pervious Area"
"       15.000   Pervious length"
"        2.000   Pervious slope"
"        0.064   Impervious Area"
"       15.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       68.000   Pervious SCS Curve No."
"        0.332   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"       11.953   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.910   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                  0.037     0.000     0.128     0.404 c.m/sec"
"              Catchment 203          Pervious   Impervious Total Area "
"              Surface Area           0.007      0.064      0.071      hectare"
"              Time of concentration  8.890      1.039      1.344      minutes"
"              Time to Centroid       105.473    85.361     86.144     minutes"
"              Rainfall depth         87.263     87.263     87.263     mm"
"              Rainfall volume        6.20       55.76      61.96      c.m"
"              Rainfall losses        58.307     7.853      12.898     mm"
"              Runoff depth           28.957     79.410     74.365     mm"
"              Runoff volume          2.06       50.74      52.80      c.m"
"              Runoff coefficient     0.332      0.910      0.852      "
"              Maximum flow           0.001      0.037      0.037      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                  0.037     0.037     0.128     0.404"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                  0.037     0.037     0.037     0.404"
" 40          HYDROGRAPH   Combine    1"
"            6   Combine "
"            1   Node #"
"                SWMF"
"              Maximum flow                  0.441    c.m/sec"
"              Hydrograph volume           700.768    c.m"
"                  0.037     0.037     0.037     0.441"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                  0.037     0.000     0.037     0.441"
" 33          CATCHMENT 204"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          204   Catchment 204"
"       80.000   % Impervious"
"        0.207   Total Area"
"       10.000   Flow length"
"        5.000   Overland Slope"
"        0.041   Pervious Area"
"       10.000   Pervious length"
"        5.000   Pervious slope"
"        0.166   Impervious Area"
"       10.000   Impervious length"
"        5.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       68.000   Pervious SCS Curve No."
"        0.331   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"       11.953   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.862   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                  0.097     0.000     0.037     0.441 c.m/sec"
"              Catchment 204          Pervious   Impervious Total Area "
"              Surface Area           0.041      0.166      0.207      hectare"
"              Time of concentration  5.295      0.619      1.028      minutes"
"              Time to Centroid       101.143    85.004     86.418     minutes"
"              Rainfall depth         87.263     87.263     87.263     mm"
"              Rainfall volume        36.13      144.51     180.64     c.m"
"              Rainfall losses        58.362     12.046     21.309     mm"
"              Runoff depth           28.901     75.217     65.954     mm"
"              Runoff volume          11.97      124.56     136.53     c.m"
"              Runoff coefficient     0.331      0.862      0.756      "
"              Maximum flow           0.007      0.094      0.097      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                  0.097     0.097     0.037     0.441"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                  0.097     0.097     0.097     0.441"
" 40          HYDROGRAPH   Combine    1"
"            6   Combine "
"            1   Node #"
"                SWMF"
"              Maximum flow                  0.539    c.m/sec"
"              Hydrograph volume           837.294    c.m"
"                  0.097     0.097     0.097     0.539"
" 40          HYDROGRAPH   Confluence    1"
"            7   Confluence "
"            1   Node #"
"                SWMF"
"              Maximum flow                  0.539    c.m/sec"
"              Hydrograph volume           837.294    c.m"
"                  0.097     0.539     0.097     0.000"
" 54          POND DESIGN"
"        0.539   Current peak flow    c.m/sec"
"        0.033   Target outflow    c.m/sec"
"        837.3   Hydrograph volume    c.m"
"          13.   Number of stages"
"      334.100   Minimum water level    metre"
"      335.300   Maximum water level    metre"
"      334.100   Starting water level    metre"
"            0   Keep Design Data: 1 = True; 0 = False"
"                  Level Discharge    Volume"
"                334.100     0.000     0.000"
"                334.200   0.00150    25.000"
"                334.300   0.00230    59.000"
"                334.400   0.01270   104.000"
"                334.500   0.03110   157.000"
"                334.600   0.04300   218.000"
"                334.700   0.05220   287.000"
"                334.800   0.05990   363.000"
"                334.900   0.06680   446.000"
"                335.000   0.07300   534.000"
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"               335.100   0.07880   629.000"
"               335.200   0.08410   731.000"
"               335.300    0.1974   839.000"
"            Peak outflow                  0.074    c.m/sec"
"            Maximum level               335.013    metre"
"            Maximum storage             546.165    c.m"
"            Centroidal lag                3.570   hours"
"                 0.097     0.539     0.074     0.000 c.m/sec"
" 40         HYDROGRAPH   Combine    2"
"           6   Combine "
"           2   Node #"
"               Wetland"
"            Maximum flow                  0.074    c.m/sec"
"            Hydrograph volume           835.702    c.m"
"                   0.097     0.539     0.074     0.074"
" 40         HYDROGRAPH Start - New Tributary"
"           2   Start - New Tributary"
"                   0.097     0.000     0.074     0.074"
" 33         CATCHMENT 206"
"           1   Triangular SCS"
"           1   Equal length"
"           1   SCS method"
"         206   Catchment 206"
"       0.000   % Impervious"
"       0.185   Total Area"
"     100.000   Flow length"
"       0.800   Overland Slope"
"       0.185   Pervious Area"
"     100.000   Pervious length"
"       0.800   Pervious slope"
"       0.000   Impervious Area"
"     100.000   Impervious length"
"       0.800   Impervious slope"
"       0.250   Pervious Manning 'n'"
"      39.000   Pervious SCS Curve No."
"       0.058   Pervious Runoff coefficient"
"       0.100   Pervious Ia/S coefficient"
"      39.728   Pervious Initial abstraction"
"       0.015   Impervious Manning 'n'"
"      98.000   Impervious SCS Curve No."
"       0.000   Impervious Runoff coefficient"
"       0.100   Impervious Ia/S coefficient"
"       0.518   Impervious Initial abstraction"
"                   0.001     0.000     0.074     0.074 c.m/sec"
"            Catchment 206          Pervious   Impervious Total Area "
"            Surface Area           0.185      0.000      0.185      hectare"
"            Time of concentration  87.193     4.268      87.192     minutes"
"            Time to Centroid       199.915    89.893     199.913    minutes"
"            Rainfall depth         87.263     87.263     87.263     mm"
"            Rainfall volume        161.44     0.00       161.44     c.m"
"            Rainfall losses        82.184     6.187      82.184     mm"
"            Runoff depth           5.079      81.076     5.079      mm"
"            Runoff volume          9.40       0.00       9.40       c.m"
"            Runoff coefficient     0.058      0.000      0.058      "
"            Maximum flow           0.001      0.000      0.001      c.m/sec"
" 40         HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                   0.001     0.001     0.074     0.074"
" 40         HYDROGRAPH Copy to Outflow"
"           8   Copy to Outflow"
"                   0.001     0.001     0.001     0.074"
" 40         HYDROGRAPH   Combine    2"
"           6   Combine "
"           2   Node #"
"               Wetland"
"            Maximum flow                  0.074    c.m/sec"
"            Hydrograph volume           845.099    c.m"
"                   0.001     0.001     0.001     0.074"
" 40         HYDROGRAPH Start - New Tributary"
"           2   Start - New Tributary"
"                   0.001     0.000     0.001     0.074"
" 33         CATCHMENT 207"
"           1   Triangular SCS"
"           1   Equal length"
"           1   SCS method"
"         207   Catchment 207"
"       0.000   % Impervious"
"       0.222   Total Area"
"      10.000   Flow length"
"       5.000   Overland Slope"
"       0.222   Pervious Area"
"      10.000   Pervious length"
"       5.000   Pervious slope"
"       0.000   Impervious Area"
"      10.000   Impervious length"
"       5.000   Impervious slope"
"       0.250   Pervious Manning 'n'"
"      49.000   Pervious SCS Curve No."
"       0.130   Pervious Runoff coefficient"
"       0.100   Pervious Ia/S coefficient"
"      26.437   Pervious Initial abstraction"
"       0.015   Impervious Manning 'n'"
"      98.000   Impervious SCS Curve No."
"       0.000   Impervious Runoff coefficient"
"       0.100   Impervious Ia/S coefficient"
"       0.518   Impervious Initial abstraction"
"                   0.011     0.000     0.001     0.074 c.m/sec"
"            Catchment 207          Pervious   Impervious Total Area "
"            Surface Area           0.222      0.000      0.222      hectare"
"            Time of concentration  8.392      0.619      8.392      minutes"
"            Time to Centroid       110.282    85.004     110.282    minutes"
"            Rainfall depth         87.263     87.263     87.263     mm"
"            Rainfall volume        193.72     0.00       193.72     c.m"
"            Rainfall losses        75.940     12.046     75.940     mm"
"            Runoff depth           11.324     75.217     11.324     mm"
"            Runoff volume          25.14      0.00       25.14      c.m"
"            Runoff coefficient     0.130      0.000      0.130      "
"            Maximum flow           0.011      0.000      0.011      c.m/sec"
" 40         HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                   0.011     0.011     0.001     0.074"
" 40         HYDROGRAPH Copy to Outflow"
"           8   Copy to Outflow"
"                   0.011     0.011     0.011     0.074"
" 40         HYDROGRAPH   Combine    2"
"           6   Combine "
"           2   Node #"
"               Wetland"
"            Maximum flow                  0.082    c.m/sec"
"            Hydrograph volume           870.238    c.m"
"                   0.011     0.011     0.011     0.082"
" 40         HYDROGRAPH Start - New Tributary"
"           2   Start - New Tributary"
"                   0.011     0.000     0.011     0.082"
" 33         CATCHMENT 208"
"           1   Triangular SCS"
"           1   Equal length"
"           1   SCS method"
"         208   Catchment 208"
"       0.000   % Impervious"
```

```
"        0.862   Total Area"
"       90.000   Flow length"
"        1.000   Overland Slope"
"        0.862   Pervious Area"
"       90.000   Pervious length"
"        1.000   Pervious slope"
"        0.000   Impervious Area"
"       90.000   Impervious length"
"        1.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       70.000   Pervious SCS Curve No."
"        0.361   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"       10.886   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.000   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
                     0.074     0.000     0.011     0.082 c.m/sec"
             Catchment 208          Pervious   Impervious Total Area "
             Surface Area           0.862      0.000      0.862      hectare"
             Time of concentration  30.815     3.747      30.815     minutes"
             Time to Centroid       132.018    89.195     132.018    minutes"
             Rainfall depth         87.263     87.263     87.263     mm"
             Rainfall volume        752.21     0.00       752.21     c.m"
             Rainfall losses        55.779     6.989      55.779     mm"
             Runoff depth           31.484     80.275     31.484     mm"
             Runoff volume          271.40     0.00       271.40     c.m"
             Runoff coefficient     0.361      0.000      0.361      "
             Maximum flow           0.074      0.000      0.074      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
            4   Add Runoff "
                     0.074     0.074     0.011     0.082"
" 40          HYDROGRAPH Copy to Outflow"
            8   Copy to Outflow"
                     0.074     0.074     0.074     0.082"
" 40          HYDROGRAPH   Combine    2"
            6   Combine "
            2   Node #"
                Wetland"
             Maximum flow                  0.154    c.m/sec"
             Hydrograph volume          1141.634    c.m"
                     0.074     0.074     0.074     0.154"
" 40          HYDROGRAPH Start - New Tributary"
            2   Start - New Tributary"
                     0.074     0.000     0.074     0.154"
" 33          CATCHMENT 2051"
            1   Triangular SCS"
            1   Equal length"
            1   SCS method"
         2051   Catchment 205-1"
       11.000   % Impervious"
        0.090   Total Area"
       20.000   Flow length"
        2.000   Overland Slope"
        0.080   Pervious Area"
       20.000   Pervious length"
        2.000   Pervious slope"
        0.010   Impervious Area"
       20.000   Impervious length"
        2.000   Impervious slope"
        0.250   Pervious Manning 'n'"
       49.000   Pervious SCS Curve No."
        0.130   Pervious Runoff coefficient"
        0.100   Pervious Ia/S coefficient"
       26.437   Pervious Initial abstraction"
        0.015   Impervious Manning 'n'"
       98.000   Impervious SCS Curve No."
        0.919   Impervious Runoff coefficient"
        0.100   Impervious Ia/S coefficient"
        0.518   Impervious Initial abstraction"
                     0.006     0.000     0.074     0.154 c.m/sec"
             Catchment 2051         Pervious   Impervious Total Area "
             Surface Area           0.080      0.010      0.090      hectare"
             Time of concentration  16.744     1.234      9.514      minutes"
             Time to Centroid       119.723    85.583     103.808    minutes"
             Rainfall depth         87.263     87.263     87.263     mm"
             Rainfall volume        69.90      8.64       78.54      c.m"
             Rainfall losses        75.909     7.039      68.333     mm"
             Runoff depth           11.354     80.225     18.930     mm"
             Runoff volume          9.09       7.94       17.04      c.m"
             Runoff coefficient     0.130      0.919      0.217      "
             Maximum flow           0.003      0.006      0.006      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
            4   Add Runoff "
                     0.006     0.006     0.074     0.154"
" 40          HYDROGRAPH Copy to Outflow"
            8   Copy to Outflow"
                     0.006     0.006     0.006     0.154"
" 40          HYDROGRAPH   Combine    3"
            6   Combine "
            3   Node #"
                Arkell"
             Maximum flow                  0.006    c.m/sec"
             Hydrograph volume            17.037    c.m"
                     0.006     0.006     0.006     0.006"
" 40          HYDROGRAPH Start - New Tributary"
            2   Start - New Tributary"
                     0.006     0.000     0.006     0.006"
" 33          CATCHMENT 2052"
            1   Triangular SCS"
            1   Equal length"
            1   SCS method"
         2052   Catchment 205-2"
       35.000   % Impervious"
        0.134   Total Area"
       35.000   Flow length"
        4.000   Overland Slope"
        0.087   Pervious Area"
       35.000   Pervious length"
        4.000   Pervious slope"
        0.047   Impervious Area"
       35.000   Impervious length"
        4.000   Impervious slope"
        0.250   Pervious Manning 'n'"
       49.000   Pervious SCS Curve No."
        0.130   Pervious Runoff coefficient"
        0.100   Pervious Ia/S coefficient"
       26.437   Pervious Initial abstraction"
        0.015   Impervious Manning 'n'"
       98.000   Impervious SCS Curve No."
        0.923   Impervious Runoff coefficient"
        0.100   Impervious Ia/S coefficient"
        0.518   Impervious Initial abstraction"
                     0.027     0.000     0.006     0.006 c.m/sec"
             Catchment 2052         Pervious   Impervious Total Area "
             Surface Area           0.087      0.047      0.134      hectare"
             Time of concentration  19.027     1.403      5.060      minutes"
             Time to Centroid       122.302    85.779     93.357     minutes"
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"            Rainfall depth         87.263     87.263     87.263     mm"
"            Rainfall volume        76.01      40.93      116.93     c.m"
"            Rainfall losses        75.903     6.680      51.675     mm"
"            Runoff depth           11.361     80.584     35.589     mm"
"            Runoff volume          9.90       37.79      47.69      c.m"
"            Runoff coefficient     0.130      0.923      0.408      "
"            Maximum flow           0.003      0.027      0.027      c.m/sec"
" 40         HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                   0.027     0.027     0.006     0.006"
" 40         HYDROGRAPH Copy to Outflow"
"           8   Copy to Outflow"
"                   0.027     0.027     0.027     0.006"
" 40         HYDROGRAPH   Combine    2"
"           6   Combine "
"           2   Node #"
"               Wetland"
"            Maximum flow                 0.161    c.m/sec"
"            Hydrograph volume         1189.323    c.m"
"                   0.027     0.027     0.027     0.161"
" 38         START/RE-START TOTALS 2052"
"           3   Runoff Totals on EXIT"
"            Total Catchment area                    2.692    hectare"
"            Total Impervious area                   1.030    hectare"
"            Total % impervious                     38.249"
" 19         EXIT"
```

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"               MIDUSS Output ------------------------------------------------>"
"               MIDUSS version                          Version 2.25  rev. 473"
"               MIDUSS created                       Sunday, February 7, 2010"
"          10   Units used:                                          ie METRIC"
"               Job folder:           Q:\42063\104\SWM\March 2020\MIDUSS\POST"
"               Output filename:                                  Reg-POST.in"
"               Licensee name:                                              A"
"               Company                                             Microsoft"
"               Date & Time last used:               3/25/2020 at 4:35:42 PM"
" 31         TIME PARAMETERS"
"       5.000   Time Step"
"    2880.000   Max. Storm length"
"    9000.000   Max. Hydrograph"
" 32         STORM Mass Curve"
"           3   Mass Curve"
"     285.000   Rainfall depth"
"    2880.000   Duration"
"          38   Q:\TOOLS\SWM\Hazel entire 48 hours.mrd   Hurricane Hazel (entire 48 h)"
"            Maximum intensity           53.012    mm/hr"
"            Total depth                285.000    mm"
"           8   99999hyd   Hydrograph extension used in this file"
" 33         CATCHMENT 201"
"           1   Triangular SCS"
"           1   Equal length"
"           1   SCS method"
"         201   Catchment 201"
"      79.000   % Impervious"
"       0.658   Total Area"
"      45.000   Flow length"
"       0.700   Overland Slope"
"       0.138   Pervious Area"
"      45.000   Pervious length"
"       0.700   Pervious slope"
"       0.520   Impervious Area"
"      45.000   Impervious length"
"       0.700   Impervious slope"
"       0.250   Pervious Manning 'n'"
"      68.000   Pervious SCS Curve No."
"       0.666   Pervious Runoff coefficient"
"       0.100   Pervious Ia/S coefficient"
"      11.953   Pervious Initial abstraction"
"       0.015   Impervious Manning 'n'"
"      98.000   Impervious SCS Curve No."
"       0.976   Impervious Runoff coefficient"
"       0.100   Impervious Ia/S coefficient"
"       0.518   Impervious Initial abstraction"
"                   0.095     0.000     0.000     0.000 c.m/sec"
"            Catchment 201          Pervious   Impervious Total Area "
"            Surface Area           0.138      0.520      0.658      hectare"
"            Time of concentration  28.500     4.998      8.604      minutes"
"            Time to Centroid       2558.973   2273.168   2317.013   minutes"
"            Rainfall depth         285.000    285.000    285.000    mm"
"            Rainfall volume        393.81     1481.49    1875.30    c.m"
"            Rainfall losses        95.289     6.703      25.306     mm"
"            Runoff depth           189.711    278.297    259.694    mm"
"            Runoff volume          262.14     1446.64    1708.79    c.m"
"            Runoff coefficient     0.666      0.976      0.911      "
"            Maximum flow           0.019      0.079      0.095      c.m/sec"
" 40         HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                   0.095     0.095     0.000     0.000"
" 40         HYDROGRAPH Copy to Outflow"
"           8   Copy to Outflow"
"                   0.095     0.095     0.095     0.000"
" 40         HYDROGRAPH   Combine    1"
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"           6   Combine "
"           1   Node #"
"               SWMF"
"            Maximum flow                0.095    c.m/sec"
"            Hydrograph volume         1708.786    c.m"
"                    0.095     0.095     0.095     0.095"
" 40         HYDROGRAPH Start - New Tributary"
"           2   Start - New Tributary"
"                    0.095     0.000     0.095     0.095"
" 33         CATCHMENT 202"
"           1   Triangular SCS"
"           1   Equal length"
"           1   SCS method"
"         202   Catchment 202"
"       85.000   % Impervious"
"        0.263   Total Area"
"       30.000   Flow length"
"        2.000   Overland Slope"
"        0.039   Pervious Area"
"       30.000   Pervious length"
"        2.000   Pervious slope"
"        0.224   Impervious Area"
"       30.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       68.000   Pervious SCS Curve No."
"        0.665   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"       11.953   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.965   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.037     0.000     0.095     0.095 c.m/sec"
"             Catchment 202          Pervious   Impervious Total Area "
"             Surface Area           0.039      0.224      0.263      hectare"
"             Time of concentration  16.308     2.860      4.318      minutes"
"             Time to Centroid       2541.867   2265.585   2295.527   minutes"
"             Rainfall depth         285.000    285.000    285.000    mm"
"             Rainfall volume        112.43     637.12     749.55     c.m"
"             Rainfall losses        95.511     9.886      22.730     mm"
"             Runoff depth           189.489    275.114    262.270    mm"
"             Runoff volume          74.75      615.02     689.77     c.m"
"             Runoff coefficient     0.665      0.965      0.920      "
"             Maximum flow           0.005      0.034      0.037      c.m/sec"
" 40         HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                    0.037     0.037     0.095     0.095"
" 40         HYDROGRAPH Copy to Outflow"
"           8   Copy to Outflow"
"                    0.037     0.037     0.037     0.095"
" 40         HYDROGRAPH   Combine    1"
"           6   Combine "
"           1   Node #"
"               SWMF"
"            Maximum flow                0.132    c.m/sec"
"            Hydrograph volume         2398.557    c.m"
"                    0.037     0.037     0.037     0.132"
" 40         HYDROGRAPH Start - New Tributary"
"           2   Start - New Tributary"
"                    0.037     0.000     0.037     0.132"
" 33         CATCHMENT 203"
"           1   Triangular SCS"
"           1   Equal length"
"           1   SCS method"
"         203   Catchment 203"
"       90.000   % Impervious"
"        0.071   Total Area"
"       15.000   Flow length"
"        2.000   Overland Slope"
"        0.007   Pervious Area"
"       15.000   Pervious length"
"        2.000   Pervious slope"
"        0.064   Impervious Area"
"       15.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       68.000   Pervious SCS Curve No."
"        0.664   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"       11.953   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.963   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.010     0.000     0.037     0.132 c.m/sec"
"             Catchment 203          Pervious   Impervious Total Area "
"             Surface Area           0.007      0.064      0.071      hectare"
"             Time of concentration  10.759     1.887      2.519      minutes"
"             Time to Centroid       2534.157   2269.666   2288.508   minutes"
"             Rainfall depth         285.000    285.000    285.000    mm"
"             Rainfall volume        20.24      182.12     202.35     c.m"
"             Rainfall losses        95.626     10.684     19.178     mm"
"             Runoff depth           189.374    274.316    265.822    mm"
"             Runoff volume          13.45      175.29     188.73     c.m"
"             Runoff coefficient     0.664      0.963      0.933      "
"             Maximum flow           0.001      0.009      0.010      c.m/sec"
" 40         HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                    0.010     0.010     0.037     0.132"
" 40         HYDROGRAPH Copy to Outflow"
"           8   Copy to Outflow"
"                    0.010     0.010     0.010     0.132"
" 40         HYDROGRAPH   Combine    1"
"           6   Combine "
"           1   Node #"
"               SWMF"
"            Maximum flow                0.143    c.m/sec"
"            Hydrograph volume         2587.292    c.m"
"                    0.010     0.010     0.010     0.143"
" 40         HYDROGRAPH Start - New Tributary"
"           2   Start - New Tributary"
"                    0.010     0.000     0.010     0.143"
" 33         CATCHMENT 204"
"           1   Triangular SCS"
"           1   Equal length"
"           1   SCS method"
"         204   Catchment 204"
"       80.000   % Impervious"
"        0.207   Total Area"
"       10.000   Flow length"
"        5.000   Overland Slope"
"        0.041   Pervious Area"
"       10.000   Pervious length"
"        5.000   Pervious slope"
"        0.166   Impervious Area"
"       10.000   Impervious length"
"        5.000   Impervious slope"
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"        0.250   Pervious Manning 'n'"
"       68.000   Pervious SCS Curve No."
"        0.660   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"       11.953   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.958   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                  0.028     0.000     0.010     0.143 c.m/sec"
"             Catchment 204          Pervious   Impervious Total Area "
"             Surface Area           0.041      0.166      0.207      hectare"
"             Time of concentration  6.408      1.124      1.900      minutes"
"             Time to Centroid       2526.854   2265.642   2304.017   minutes"
"             Rainfall depth         285.000    285.000    285.000    mm"
"             Rainfall volume        117.99     471.96     589.95     c.m"
"             Rainfall losses        96.893     11.927     28.920     mm"
"             Runoff depth           188.107    273.073    256.080    mm"
"             Runoff volume          77.88      452.21     530.09     c.m"
"             Runoff coefficient     0.660      0.958      0.899      "
"             Maximum flow           0.005      0.023      0.028      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                  0.028     0.028     0.010     0.143"
" 40          HYDROGRAPH Copy to Outflow"
"           8   Copy to Outflow"
"                  0.028     0.028     0.028     0.143"
" 40          HYDROGRAPH   Combine    1"
"           6   Combine "
"           1   Node #"
"               SWMF"
"             Maximum flow                 0.171    c.m/sec"
"             Hydrograph volume          3117.378    c.m"
"                  0.028     0.028     0.028     0.171"
" 40          HYDROGRAPH   Confluence    1"
"           7   Confluence "
"           1   Node #"
"               SWMF"
"             Maximum flow                 0.171    c.m/sec"
"             Hydrograph volume          3117.378    c.m"
"                  0.028     0.171     0.028     0.000"
" 54          POND DESIGN"
"        0.171   Current peak flow    c.m/sec"
"        0.033   Target outflow    c.m/sec"
"       3117.4   Hydrograph volume    c.m"
"          13.   Number of stages"
"      334.100   Minimum water level    metre"
"      335.300   Maximum water level    metre"
"      334.100   Starting water level    metre"
"            0   Keep Design Data: 1 = True; 0 = False"
"                  Level Discharge    Volume"
"                334.100     0.000     0.000"
"                334.200   0.00150    25.000"
"                334.300   0.00230    59.000"
"                334.400   0.01270   104.000"
"                334.500   0.03110   157.000"
"                334.600   0.04300   218.000"
"                334.700   0.05220   287.000"
"                334.800   0.05990   363.000"
"                334.900   0.06680   446.000"
"                335.000   0.07300   534.000"
"                335.100   0.07880   629.000"
"                335.200   0.08410   731.000"
"                335.300    0.1974   839.000"
"             Peak outflow                 0.098    c.m/sec"
"             Maximum level              335.213    metre"
"             Maximum storage            744.568    c.m"
"             Centroidal lag              40.763    hours"
"                  0.028     0.171     0.098     0.000 c.m/sec"
" 40          HYDROGRAPH   Combine    2"
"           6   Combine "
"           2   Node #"
"               Wetland"
"             Maximum flow                 0.098    c.m/sec"
"             Hydrograph volume          3117.362    c.m"
"                  0.028     0.171     0.098     0.098"
" 40          HYDROGRAPH Start - New Tributary"
"           2   Start - New Tributary"
"                  0.028     0.000     0.098     0.098"
" 33          CATCHMENT 206"
"           1   Triangular SCS"
"           1   Equal length"
"           1   SCS method"
"         206   Catchment 206"
"       0.000   % Impervious"
"       0.185   Total Area"
"     100.000   Flow length"
"       0.800   Overland Slope"
"       0.185   Pervious Area"
"     100.000   Pervious length"
"       0.800   Pervious slope"
"       0.000   Impervious Area"
"     100.000   Impervious length"
"       0.800   Impervious slope"
"       0.250   Pervious Manning 'n'"
"      39.000   Pervious SCS Curve No."
"       0.328   Pervious Runoff coefficient"
"       0.100   Pervious Ia/S coefficient"
"      39.728   Pervious Initial abstraction"
"       0.015   Impervious Manning 'n'"
"      98.000   Impervious SCS Curve No."
"       0.000   Impervious Runoff coefficient"
"       0.100   Impervious Ia/S coefficient"
"       0.518   Impervious Initial abstraction"
"                  0.014     0.000     0.098     0.098 c.m/sec"
"             Catchment 206          Pervious   Impervious Total Area "
"             Surface Area           0.185      0.000      0.185      hectare"
"             Time of concentration  53.427     7.753      53.427     minutes"
"             Time to Centroid       2719.989   2277.097   2719.988   minutes"
"             Rainfall depth         285.000    285.000    285.000    mm"
"             Rainfall volume        527.25     0.00       527.25     c.m"
"             Rainfall losses        191.403    6.553      191.403    mm"
"             Runoff depth           93.597     278.447    93.597     mm"
"             Runoff volume          173.15     0.00       173.16     c.m"
"             Runoff coefficient     0.328      0.000      0.328      "
"             Maximum flow           0.014      0.000      0.014      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                  0.014     0.014     0.098     0.098"
" 40          HYDROGRAPH Copy to Outflow"
"           8   Copy to Outflow"
"                  0.014     0.014     0.014     0.098"
" 40          HYDROGRAPH   Combine    2"
"           6   Combine "
"           2   Node #"
"               Wetland"
"             Maximum flow                 0.110    c.m/sec"
"             Hydrograph volume          3290.518    c.m"
"                  0.014     0.014     0.014     0.110"
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" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                    0.014     0.000     0.014     0.110"
" 33          CATCHMENT 207"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          207   Catchment 207"
"        0.000   % Impervious"
"        0.222   Total Area"
"       10.000   Flow length"
"        5.000   Overland Slope"
"        0.222   Pervious Area"
"       10.000   Pervious length"
"        5.000   Pervious slope"
"        0.000   Impervious Area"
"       10.000   Impervious length"
"        5.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       49.000   Pervious SCS Curve No."
"        0.446   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"       26.437   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.000   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.022     0.000     0.014     0.110 c.m/sec"
"             Catchment 207          Pervious   Impervious Total Area "
"             Surface Area           0.222      0.000      0.222      hectare"
"             Time of concentration  7.078      1.124      7.078      minutes"
"             Time to Centroid       2618.927   2265.643   2618.926   minutes"
"             Rainfall depth         285.000    285.000    285.000    mm"
"             Rainfall volume        632.70     0.00       632.70     c.m"
"             Rainfall losses        157.968    11.927     157.968    mm"
"             Runoff depth           127.032    273.073    127.032    mm"
"             Runoff volume          282.01     0.00       282.01     c.m"
"             Runoff coefficient     0.446      0.000      0.446      "
"             Maximum flow           0.022      0.000      0.022      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.022     0.022     0.014     0.110"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                    0.022     0.022     0.022     0.110"
" 40          HYDROGRAPH   Combine    2"
"            6   Combine "
"            2   Node #"
"                Wetland"
"             Maximum flow                  0.125    c.m/sec"
"             Hydrograph volume          3572.528    c.m"
"                    0.022     0.022     0.022     0.125"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                    0.022     0.000     0.022     0.125"
" 33          CATCHMENT 208"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          208   Catchment 208"
"        0.000   % Impervious"
"        0.862   Total Area"
"       90.000   Flow length"
"        1.000   Overland Slope"
"        0.862   Pervious Area"
"       90.000   Pervious length"
"        1.000   Pervious slope"
"        0.000   Impervious Area"
"       90.000   Impervious length"
"        1.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       70.000   Pervious SCS Curve No."
"        0.688   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"       10.886   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.000   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.119     0.000     0.022     0.125 c.m/sec"
"             Catchment 208          Pervious   Impervious Total Area "
"             Surface Area           0.862      0.000      0.862      hectare"
"             Time of concentration  38.550     6.807      38.550     minutes"
"             Time to Centroid       2562.498   2273.436   2562.497   minutes"
"             Rainfall depth         285.000    285.000    285.000    mm"
"             Rainfall volume        2456.70    0.00       2456.70    c.m"
"             Rainfall losses        88.888     8.121      88.888     mm"
"             Runoff depth           196.112    276.879    196.112    mm"
"             Runoff volume          1690.49    0.00       1690.49    c.m"
"             Runoff coefficient     0.688      0.000      0.688      "
"             Maximum flow           0.119      0.000      0.119      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.119     0.119     0.022     0.125"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                    0.119     0.119     0.119     0.125"
" 40          HYDROGRAPH   Combine    2"
"            6   Combine "
"            2   Node #"
"                Wetland"
"             Maximum flow                  0.230    c.m/sec"
"             Hydrograph volume          5263.013    c.m"
"                    0.119     0.119     0.119     0.230"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                    0.119     0.000     0.119     0.230"
" 33          CATCHMENT 2051"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"         2051   Catchment 205-1"
"       11.000   % Impervious"
"        0.090   Total Area"
"       20.000   Flow length"
"        2.000   Overland Slope"
"        0.080   Pervious Area"
"       20.000   Pervious length"
"        2.000   Pervious slope"
"        0.010   Impervious Area"
"       20.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       49.000   Pervious SCS Curve No."
"        0.448   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"       26.437   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
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"       98.000   Impervious SCS Curve No."
"        0.964   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.009     0.000     0.119     0.230 c.m/sec"
"             Catchment 2051         Pervious   Impervious Total Area "
"             Surface Area           0.080      0.010      0.090      hectare"
"             Time of concentration  14.123     2.242      11.626     minutes"
"             Time to Centroid       2628.313   2264.408   2551.838   minutes"
"             Rainfall depth         285.000    285.000    285.000    mm"
"             Rainfall volume        228.29     28.22      256.50     c.m"
"             Rainfall losses        157.429    10.377     141.253    mm"
"             Runoff depth           127.571    274.623    143.747    mm"
"             Runoff volume          102.18     27.19      129.37     c.m"
"             Runoff coefficient     0.448      0.964      0.504      "
"             Maximum flow           0.008      0.001      0.009      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                    0.009     0.009     0.119     0.230"
" 40          HYDROGRAPH Copy to Outflow"
"           8   Copy to Outflow"
"                    0.009     0.009     0.009     0.230"
" 40          HYDROGRAPH   Combine    3"
"           6   Combine "
"           3   Node #"
"               Arkell"
"            Maximum flow                  0.009    c.m/sec"
"            Hydrograph volume           129.372    c.m"
"                    0.009     0.009     0.009     0.009"
" 40          HYDROGRAPH Start - New Tributary"
"           2   Start - New Tributary"
"                    0.009     0.000     0.009     0.009"
" 33          CATCHMENT 2052"
"           1   Triangular SCS"
"           1   Equal length"
"           1   SCS method"
"         2052   Catchment 205-2"
"       35.000   % Impervious"
"        0.134   Total Area"
"       35.000   Flow length"
"        4.000   Overland Slope"
"        0.087   Pervious Area"
"       35.000   Pervious length"
"        4.000   Pervious slope"
"        0.047   Impervious Area"
"       35.000   Impervious length"
"        4.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       49.000   Pervious SCS Curve No."
"        0.448   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"       26.437   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.963   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.015     0.000     0.009     0.009 c.m/sec"
"             Catchment 2052         Pervious   Impervious Total Area "
"             Surface Area           0.087      0.047      0.134      hectare"
"             Time of concentration  16.048     2.548      8.802      minutes"
"             Time to Centroid       2630.834   2267.970   2436.066   minutes"
"             Rainfall depth         285.000    285.000    285.000    mm"
"             Rainfall volume        248.24     133.67     381.90     c.m"
"             Rainfall losses        157.429    10.489     106.000    mm"
"             Runoff depth           127.571    274.511    179.000    mm"
"             Runoff volume          111.11     128.75     239.86     c.m"
"             Runoff coefficient     0.448      0.963      0.628      "
"             Maximum flow           0.009      0.007      0.015      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                    0.015     0.015     0.009     0.009"
" 40          HYDROGRAPH Copy to Outflow"
"           8   Copy to Outflow"
"                    0.015     0.015     0.015     0.009"
" 40          HYDROGRAPH   Combine    2"
"           6   Combine "
"           2   Node #"
"               Wetland"
"            Maximum flow                  0.244    c.m/sec"
"            Hydrograph volume          5502.872    c.m"
"                    0.015     0.015     0.015     0.244"
" 38          START/RE-START TOTALS 2052"
"           3   Runoff Totals on EXIT"
"            Total Catchment area                      2.692    hectare"
"            Total Impervious area                     1.030    hectare"
"            Total % impervious                       38.249"
" 19          EXIT"
```

Appendix D

Proposed SWM Facility Design Calculations

190-216 ARKELL ROAD
STORMWATER MANAGEMENT
Guelph, Ontario

Project Number:	42063-104
Date:	March 19, 2020
Design By:	AJC
File:	Q:\42063\104\SWM\March 2020\42063-104 Master SWM Facility Design Sheet.xlsx

Step 1: Choose Level of Water Quality Control

Basic 60% long-term S.S. Removal

Step 2: Choose Type of Facility

Dry Pond (Continuous Flow)

Step 3: Define Catchment area and Imperviousness

Catchment Area (ha)	Imperviousness (%)
1.199	81.14

Unit Storage Volume Required (m^3/ha)

229.71

Storage Volume Required (m^3)

275.42

Table 3.2 Water Quality Storage Requirements based on Receiving Waters (from MOE Stormwater Management Planning and Design Manual, March 2003)

Protection Level	SWMP Type	Storage Volume (m^3/ha) for Impervious Level			
		35	55	70	85
Enhanced 80% long-term S.S. removal	*Wetlands*	80	105	120	140
	Hybrid Wet Pond/Wetland	110	150	175	195
	Wet Pond	140	190	225	250
Normal 70% long-term S.S. Removal	*Wetlands*	60	70	80	90
	Hybrid Wet Pond/Wetland	75	90	105	120
	Wet Pond	90	110	130	150
Basic 60% long-term S.S. Removal	*Wetlands*	60	60	60	60
	Hybrid Wet Pond/Wetland	60	70	75	80
	Wet Pond	60	75	85	95
	Dry Pond (Continuous Flow)	90	150	200	240

190-216 ARKELL ROAD
STORMWATER MANAGEMENT
Guelph, Ontario

Project Number: 42063-104
Date: March 20, 2020
Design By: AJC
File: Q:\42063\104\SWM\March 2020\42063-104 Master SWM Facility Design Sheet.xlsx

STAGE-STORAGE RELATIONSHIP

Stage	Active Depth	Forebay			Total Pond Volume	Active Storage Volume	Volume Summary	Ponding Elevation	Comments	Stage
		Area	Volume	Cumulative Volume						
m	*m*	m^2	m^3	m^3	m^3	m^3	m^3	*m*		*m*
334.10		201	0	0	0				Bottom of Cell	334.10
334.20		293	25	25	25					334.20
334.30		396	34	59	59					334.30
334.40		496	45	104	104		118	334.43	25mm-4hr	334.40
334.50		574	54	157	157		168	334.52	2-yr	334.50
334.60		643	61	218	218		251	334.65	5-yr	334.60
334.70		734	69	287	287		316	334.76	10-yr	334.70
334.80		793	76	363	363		399	334.86	25-yr	334.80
334.90		856	82	446	446		469	334.94	50-yr	334.90
335.00		918	89	534	534		546	335.02	100-yr	335.00
335.10		982	95	629	629					335.10
335.20		1047	101	731	731				Emergency Overflow Weir	335.20
335.30		1113	108	839	839		745	335.21	Regional	335.30
335.40		1183	115	954	954					335.40
335.50		1252	122	1075	1075				Top of Berm	335.50

190-216 ARKELL ROAD
STORMWATER MANAGEMENT
Guelph, Ontario

Project Number: 42063-104
Date: March 20, 2020
Design By: AJC
File: Q:\42063\104\SWM\March 2020\42063-104 Master SWM Facility Design Sheet.xlsx

Orifice Calculations

$Q_o = C_d * A_o * (2 * g * H_o)^{0.5}$

	Orifice 1	Orifice 2	Orifice 3
C_d	0.63	0.63	0.63
Invert (m)	334.10	334.30	500.00
Width (m)			
Diameter/Height (m)	0.050	0.200	0.000
Type (H/V)	V	V	v

C_d	Description
0.63	Orifice Plate
0.80	Orifice Tube

Weir Calculations

$Q_w = 2/3 * C_d * (2g)^{1/2} * L * H_w^{3/2} + 8/15 * C_d * (2g)^{1/2} * \tan\theta * H_w^{5/2}$

C_d	0.50
Invert (m)	335.20
Length (m)	2.000
Side Slope (H:V)	4
Side Slope (rad)	1.326

STAGE-DISCHARGE RELATIONSHIP

																Extended Detention	Erosion Control
Stage	Active Volume	Orifice 1			Orifice 2			Orifice 3			Weir Flow	Total Flow		Average Discharge	Increment Volume	Increment Dewatering Time	Cumulative Dewatering Time	Cumulative Dewatering Time
		Area	H_o	Flow	Area	H_o	Flow	Area	H_o	Flow								
m	m^3	m^2	*m*	m^3/s	m^2	*m*	m^3/s	m^2	*m*	m^3/s	m^3/s	m^3/s		m^3/s	m^3	*hours*	*hours*	*hours*
334.10	0	0.00	0.00	0.0000	0.00	0.00	0.0000	0.00	0.00	0.0000	0.0000	0.0000		0.0008	25	9.14	19.54	19.54
334.20	25	0.00	0.08	0.0015	0.00	0.00	0.0000	0.00	0.00	0.0000	0.0000	0.0015		0.0019	34	5.05	10.39	10.39
334.30	59	0.00	0.18	0.0023	0.00	0.00	0.0000	0.00	0.00	0.0000	0.0000	0.0023		0.0075	45	1.66	5.35	5.35
334.40	104	0.00	0.28	0.0029	0.02	0.05	0.0098	0.00	0.00	0.0000	0.0000	0.0127		0.0219	54	0.68	3.69	3.69
334.50	157	0.00	0.38	0.0034	0.03	0.10	0.0277	0.00	0.00	0.0000	0.0000	0.0311		0.0370	61	0.46	3.01	3.01
334.60	218	0.00	0.48	0.0038	0.03	0.20	0.0392	0.00	0.00	0.0000	0.0000	0.0430		0.0476	69	0.40	2.55	2.55
334.70	287	0.00	0.58	0.0042	0.03	0.30	0.0480	0.00	0.00	0.0000	0.0000	0.0522		0.0561	76	0.38	2.15	2.15
334.80	363	0.00	0.68	0.0045	0.03	0.40	0.0554	0.00	0.00	0.0000	0.0000	0.0599		0.0634	82	0.36	1.77	1.77
334.90	446	0.00	0.78	0.0048	0.03	0.50	0.0620	0.00	0.00	0.0000	0.0000	0.0668		0.0699	89	0.35	1.41	1.41
335.00	534	0.00	0.88	0.0051	0.03	0.60	0.0679	0.00	0.00	0.0000	0.0000	0.0730		0.0759	95	0.35	1.06	1.06
335.10	629	0.00	0.98	0.0054	0.03	0.70	0.0733	0.00	0.00	0.0000	0.0000	0.0788		0.0814	101	0.35	0.71	0.71
335.20	731	0.00	1.08	0.0057	0.03	0.80	0.0784	0.00	0.00	0.0000	0.0000	0.0841		0.1408	108	0.21	0.37	0.37
335.30	839	0.00	1.18	0.0059	0.03	0.90	0.0832	0.00	0.00	0.0000	0.1083	0.1974		0.3200	115	0.10	0.15	0.15
335.40	954	0.00	1.28	0.0062	0.03	1.00	0.0877	0.00	0.00	0.0000	0.3486	0.4425		0.6295	122	0.05	0.05	0.05
335.50	1075	0.00	1.38	0.0064	0.03	1.10	0.0919	0.00	0.00	0.0000	0.7181	0.8165						

190-216 ARKELL ROAD
STORMWATER MANAGEMENT

Guelph, Ontario

Project Number: 42063-104
Date: March 20, 2020
Design By: AJC
File: Q:\42063\104\SWM\March 2020\42063-104 Master SWM Facility Design Sheet.xlsx

STAGE DISCHARGE DRAWDOWN CALCULATION

Stage	Elevation *m*	Discharge m^3/s	Volume m^3	Comments
1	334.100	0.0000	0.0	Bottom of Pond - 50mm orifice
2	334.200	0.0015	24.7	
3	334.300	0.0023	59.2	200mm orifice
4	334.400	0.0127	103.8	
5	334.500	0.0311	157.3	
6	334.600	0.0430	218.1	
7	334.700	0.0522	287.0	
	334.800	0.0599	363.3	
1	334.900	0.0668	445.8	
2	335.000	0.0730	534.5	
3	335.100	0.0788	629.5	
4	335.200	0.0841	730.9	

h_1 =	334.427	*m*	starting elevation
h_2 =	334.100	*m*	bottom elevation
V =	118	m^3	starting volume
t =	5.0	*min*	time step

Drawdown Time = 30.75 *hrs*

0 *mm* remaining
0.1 m^3 remaining

Remaining after:	m^3	*mm*
12 *hrs*	9	35
24 *hrs*	1	2
36 *hrs*	0	0
48 *hrs*	0	0
72 *hrs*	0	0

Stormceptor®

FORTERRA

Stormceptor® EF Sizing Report

ESTIMATED NET ANNUAL SEDIMENT (TSS) LOAD REDUCTION STORMCEPTOR®

03/18/2020

Province:	Ontario
City:	Guelph
Nearest Rainfall Station:	WATERLOO WELLINGTON AP
NCDC Rainfall Station Id:	9387
Years of Rainfall Data:	34

Project Name:	190-216 Arkell
Project Number:	42063-104
Designer Name:	Alex Cressman
Designer Company:	MTE Consultants Inc.
Designer Email/Phone:	acressman@mte85.com
EOR Name:	
EOR Company:	
EOR Email/Phone:	

Site Name:	190-216 Arkell
Drainage Area (ha):	0.99
% Imperviousness:	81.00

Runoff Coefficient 'c': 0.78

Particle Size Distribution:	CA ETV
Target TSS Removal (%):	60.0
Require Hydrocarbon Spill Capture?	No
Upstream Flow Control?	No
Required Water Quality Runoff Volume Capture (%):	
Estimated Water Quality Flow Rate (L/s):	
Peak Conveyance (maximum) Flow Rate (L/s):	
Site Sediment Transport Rate (kg/ha/yr):	

Net Annual Sediment (TSS) Load Reduction Sizing Summary

Stormceptor Model	TSS Removal Provided (%)
EF4	53
EF6	60
EF8	63
EF10	65
EF12	67

Recommended Stormceptor EF Model: EF6

Estimated Net Annual Sediment (TSS) Load Reduction (%): 60

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THIRD-PARTY TESTING AND VERIFICATION

►**Stormceptor® EF and Stormceptor® EFO** are the latest evolutions in the Stormceptor® oil-grit separator (OGS) technology series, and are designed to remove a wide variety of pollutants from stormwater and snowmelt runoff. These technologies have been third-party tested in accordance with the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators** and performance has been third-party verified in accordance with the **ISO 14034 Environmental Technology Verification (ETV)** protocol.

PERFORMANCE

►**Stormceptor® EF and EFO** remove stormwater pollutants through gravity separation and floatation, and feature a patent-pending design that generates positive removal of total suspended solids (TSS) throughout each storm event, including high-intensity storms. Captured pollutants include sediment, free oils, and sediment-bound pollutants such as nutrients, heavy metals, and petroleum hydrocarbons. Stormceptor is sized to remove a high level of TSS from the frequent rainfall events that contribute the vast majority of annual runoff volume and pollutant load. The technology incorporates an internal bypass to convey excessive stormwater flows from high-intensity storms through the device without resuspension and washout (scour) of previously captured pollutants. Proper routine maintenance ensures high pollutant removal performance and protection of downstream waterwavs.

PARTICLE SIZE DISTRIBUTION (PSD)

►The **Canadian ETV PSD** shown in the table below was used, or in part, for this sizing. This is the identical PSD that is referenced in the Canadian ETV ***Procedure for Laboratory Testing of Oil-Grit Separators*** for both sediment removal testing and scour testing. The Canadian ETV PSD contains a wide range of particle sizes in the sand and silt fractions, and is considered reasonably representative of the particle size fractions found in typical urban stormwater runoff.

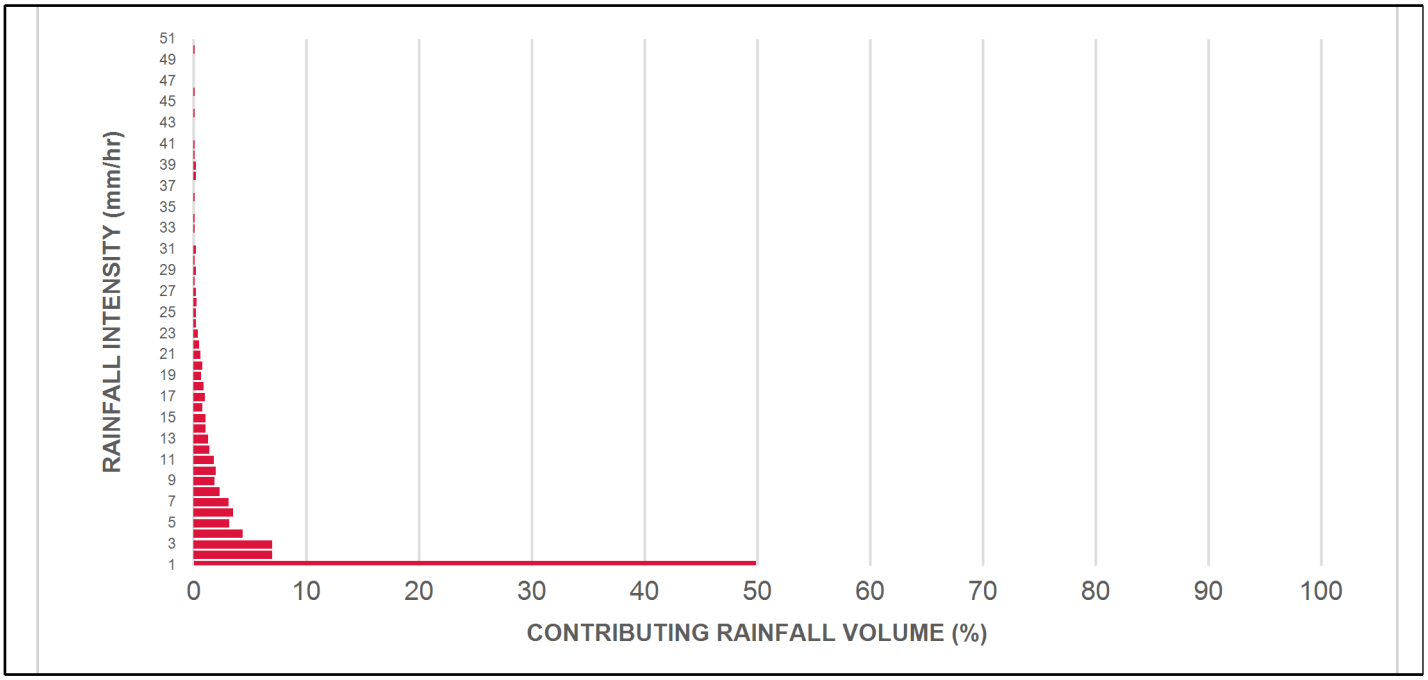
Particle Size (µm)	Percent Less Than	Particle Size Fraction (µm)	Percent
1000	100	500-1000	5
500	95	250-500	5
250	90	150-250	15
150	75	100-150	15
100	60	75-100	10
75	50	50-75	5
50	45	20-50	10
20	35	8-20	15
8	20	5-8	10
5	10	2-5	5
2	5	<2	5

Rainfall Intensity (mm / hr)	Percent Rainfall Volume (%)	Cumulative Rainfall Volume (%)	Flow Rate (L/s)	Flow Rate (L/min)	Surface Loading Rate (L/min/m²)	Removal Efficiency (%)	Incremental Removal (%)	Cumulative Removal (%)
1	49.9	49.9	2.16	130.0	49.0	69	34.3	34.3
2	7.0	56.9	4.33	260.0	99.0	63	4.4	38.8
3	7.0	63.9	6.49	389.0	148.0	59	4.1	42.9
4	4.4	68.3	8.65	519.0	197.0	55	2.4	45.3
5	3.2	71.5	10.82	649.0	247.0	53	1.7	47.0
6	3.5	75.0	12.98	779.0	296.0	51	1.8	48.8
7	3.1	78.1	15.14	909.0	345.0	50	1.5	50.3
8	2.3	80.4	17.31	1038.0	395.0	48	1.1	51.4
9	1.9	82.3	19.47	1168.0	444.0	48	0.9	52.3
10	2.0	84.3	21.63	1298.0	494.0	47	0.9	53.3
11	1.8	86.1	23.80	1428.0	543.0	47	0.8	54.1
12	1.4	87.5	25.96	1558.0	592.0	46	0.6	54.8
13	1.3	88.8	28.12	1687.0	642.0	46	0.6	55.4
14	1.1	89.9	30.29	1817.0	691.0	46	0.5	55.9
15	1.1	91.0	32.45	1947.0	740.0	45	0.5	56.4
16	0.8	91.8	34.61	2077.0	790.0	45	0.4	56.7
17	1.0	92.8	36.77	2206.0	839.0	45	0.4	57.2
18	0.9	93.7	38.94	2336.0	888.0	45	0.4	57.6
19	0.7	94.4	41.10	2466.0	938.0	44	0.3	57.9
20	0.8	95.2	43.26	2596.0	987.0	44	0.4	58.2
21	0.6	95.8	45.43	2726.0	1036.0	44	0.3	58.5
22	0.5	96.3	47.59	2855.0	1086.0	45	0.2	58.7
23	0.4	96.7	49.75	2985.0	1135.0	46	0.2	58.9
24	0.2	96.9	51.92	3115.0	1184.0	46	0.1	59.0
25	0.2	97.1	54.08	3245.0	1234.0	47	0.1	59.1

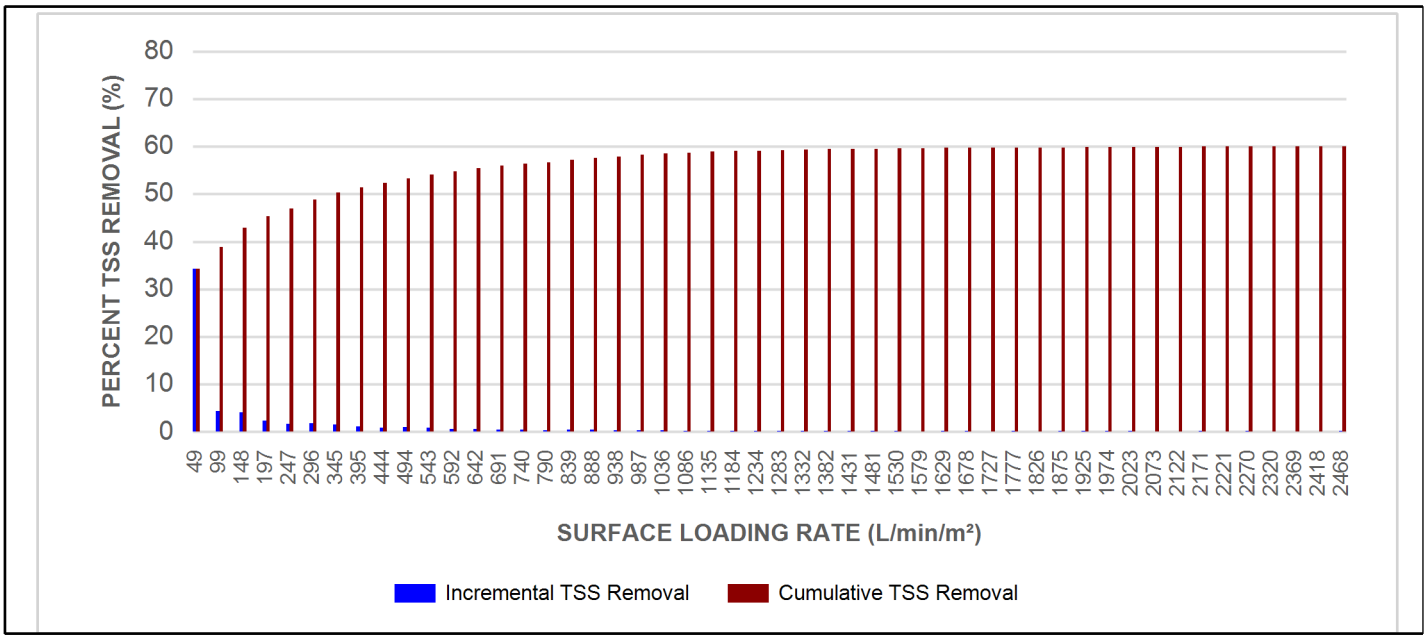
Rainfall Intensity (mm / hr)	Percent Rainfall Volume (%)	Cumulative Rainfall Volume (%)	Flow Rate (L/s)	Flow Rate (L/min)	Surface Loading Rate (L/min/m²)	Removal Efficiency (%)	Incremental Removal (%)	Cumulative Removal (%)
26	0.3	97.4	56.24	3375.0	1283.0	48	0.1	59.2
27	0.2	97.6	58.41	3504.0	1332.0	48	0.1	59.3
28	0.1	97.7	60.57	3634.0	1382.0	49	0.0	59.4
29	0.2	97.9	62.73	3764.0	1431.0	48	0.1	59.5
30	0.1	98.0	64.90	3894.0	1481.0	46	0.0	59.5
31	0.2	98.2	67.06	4024.0	1530.0	45	0.1	59.6
32	0.0	98.2	69.22	4153.0	1579.0	43	0.0	59.6
33	0.1	98.3	71.39	4283.0	1629.0	42	0.0	59.7
34	0.1	98.4	73.55	4413.0	1678.0	41	0.0	59.7
35	0.0	98.4	75.71	4543.0	1727.0	40	0.0	59.7
36	0.1	98.5	77.88	4673.0	1777.0	39	0.0	59.7
37	0.0	98.5	80.04	4802.0	1826.0	38	0.0	59.7
38	0.2	98.7	82.20	4932.0	1875.0	37	0.1	59.8
39	0.2	98.9	84.37	5062.0	1925.0	36	0.1	59.9
40	0.1	99.0	86.53	5192.0	1974.0	35	0.0	59.9
41	0.1	99.1	88.69	5322.0	2023.0	34	0.0	59.9
42	0.0	99.1	90.86	5451.0	2073.0	33	0.0	59.9
43	0.0	99.1	93.02	5581.0	2122.0	32	0.0	59.9
44	0.1	99.2	95.18	5711.0	2171.0	32	0.0	60.0
45	0.0	99.2	97.35	5841.0	2221.0	31	0.0	60.0
46	0.1	99.3	99.51	5971.0	2270.0	30	0.0	60.0
47	0.0	99.3	101.67	6100.0	2320.0	30	0.0	60.0
48	0.0	99.3	103.84	6230.0	2369.0	29	0.0	60.0
49	0.0	99.3	106.00	6360.0	2418.0	28	0.0	60.0
50	0.1	99.4	108.16	6490.0	2468.0	28	0.0	60.0
Estimated Net Annual Sediment (TSS) Load Reduction =								**60 %**

imbrium

RAINFALL DATA FROM WATERLOO WELLINGTON AP RAINFALL STATION



INCREMENTAL AND CUMULATIVE TSS REMOVAL FOR THE RECOMMENDED STORMCEPTOR® MODEL



Maximum Pipe Diameter / Peak Conveyance

Stormceptor EF / EFO	Model Diameter		Min Angle Inlet / Outlet Pipes	Max Inlet Pipe Diameter		Max Outlet Pipe Diameter		Peak Conveyance Flow Rate	
	(m)	(ft)		(mm)	(in)	(mm)	(in)	(L/s)	(cfs)
EF4 / EFO4	1.2	4	90	609	24	609	24	425	15
EF6 / EFO6	1.8	6	90	914	36	914	36	990	35
EF8 / EFO8	2.4	8	90	1219	48	1219	48	1700	60
EF10 / EFO10	3.0	10	90	1828	72	1828	72	2830	100
EF12 / EFO12	3.6	12	90	1828	72	1828	72	2830	100

SCOUR PREVENTION AND ONLINE CONFIGURATION

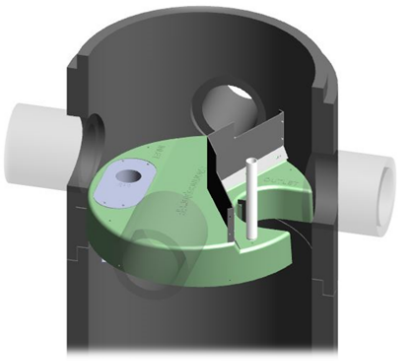
►**Stormceptor® EF and EFO** feature an internal bypass and superior scour prevention technology that have been demonstrated in third-party testing according to the scour testing provisions of the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators**, and the exceptional scour test performance has been third-party verified in accordance with the ISO 14034 ETV protocol. As a result, Stormceptor EF and EFO are approved for online installation, eliminating the need for costly additional bypass structures, piping, and installation expense.

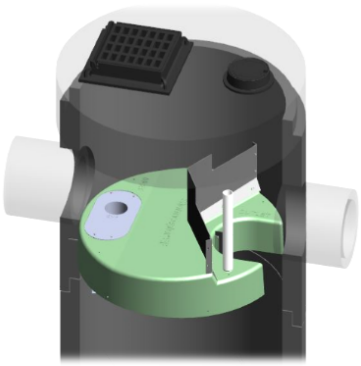
DESIGN FLEXIBILITY

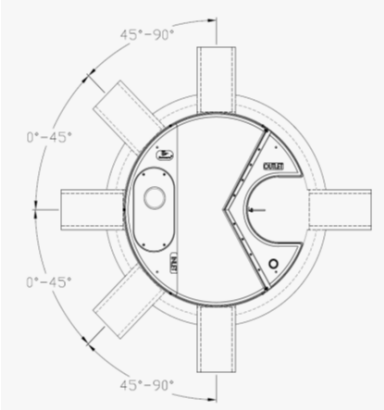
►**Stormceptor® EF** and **EFO** offers design flexibility in one simplified platform, accepting stormwater flow from a single inlet pipe or multiple inlet pipes, and/or surface runoff through an inlet grate. The device can also serve as a junction structure, accommodate a 90-degree inlet-to-outlet bend angle, and can be modified to ensure performance in submerged conditions.

OIL CAPTURE AND RETENTION

►While Stormceptor® EF will capture and retain oil from dry weather spills and low intensity runoff, **Stormceptor® EFO** has demonstrated superior oil capture and greater than 99% oil retention in third-party testing according to the light liquid re-entrainment testing provisions of the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators**. Stormceptor EFO is recommended for sites where oil capture and retention is a requirement.







INLET-TO-OUTLET DROP

Elevation differential between inlet and outlet pipe inverts is dictated by the angle at which the inlet pipe(s) enters the unit.

0° - 45° : The inlet pipe is 1-inch (25mm) higher than the outlet pipe.

45° - 90° : The inlet pipe is 2-inches (50mm) higher than the outlet pipe.

HEAD LOSS

The head loss through Stormceptor EF is similar to that of a 60-degree bend structure. The applicable K value for calculating minor losses through the unit is 1.1. For submerged conditions the applicable K value is 3.0.

Pollutant Capacity

Stormceptor EF / EFO	Model Diameter		Depth (Outlet Pipe Invert to Sump Floor)		Oil Volume		Recommended Sediment Maintenance Depth *		Maximum Sediment Volume *		Maximum Sediment Mass **	
	(m)	(ft)	(m)	(ft)	(L)	(Gal)	(mm)	(in)	(L)	(ft^3)	(kg)	(lb)
EF4 / EFO4	1.2	4	1.52	5.0	197	52	203	8	1190	42	1904	5250
EF6 / EFO6	1.8	6	1.93	6.3	348	92	305	12	3470	123	5552	15375
EF8 / EFO8	2.4	8	2.59	8.5	545	144	610	24	8780	310	14048	38750
EF10 / EFO10	3.0	10	3.25	10.7	874	231	610	24	17790	628	28464	78500
EF12 / EFO12	3.6	12	3.89	12.8	1219	322	610	24	31220	1103	49952	137875

*Increased sump depth may be added to increase sediment storage capacity

** Average density of wet packed sediment in sump = 1.6 kg/L (100 lb/ft^3)

Feature	Benefit	Feature Appeals To
Patent-pending enhanced flow treatment and scour prevention technology	Superior, verified third-party performance	Regulator, Specifying & Design Engineer
Third-party verified light liquid capture and retention for EFO version	Proven performance for fuel/oil hotspot locations	Regulator, Specifying & Design Engineer, Site Owner
Functions as bend, junction or inlet structure	Design flexibility	Specifying & Design Engineer
Minimal drop between inlet and outlet	Site installation ease	Contractor
Large diameter outlet riser for inspection and maintenance	Easy maintenance access from grade	Maintenance Contractor & Site Owner

STANDARD STORMCEPTOR EF/EFO DRAWINGS

For standard details, please visit http://www.imbriumsystems.com/stormwater-treatment-solutions/stormceptor-ef

STANDARD STORMCEPTOR EF/EFO SPECIFICATION

For specifications, please visit http://www.imbriumsystems.com/stormwater-treatment-solutions/stormceptor-ef

Table of TSS Removal vs Surface Loading Rate Based on Third-Party Test Results
Stormceptor® EF

SLR (L/min/m^2)	TSS % REMOVAL	SLR (L/min/m^2)	TSS % REMOVAL	SLR (L/min/m^2)	TSS % REMOVAL	SLR (L/min/m^2)	TSS % REMOVAL
1	70	660	46	1320	48	1980	35
30	70	690	46	1350	48	2010	34

imbrium

60	67	720	45	1380	49	2040	34
90	63	750	45	1410	49	2070	33
120	61	780	45	1440	48	2100	33
150	58	810	45	1470	47	2130	32
180	56	840	45	1500	46	2160	32
210	54	870	45	1530	45	2190	31
240	53	900	45	1560	44	2220	31
270	52	930	44	1590	43	2250	30
300	51	960	44	1620	42	2280	30
330	50	990	44	1650	42	2310	30
360	49	1020	44	1680	41	2340	29
390	48	1050	45	1710	40	2370	29
420	48	1080	45	1740	39	2400	29
450	48	1110	45	1770	39	2430	28
480	47	1140	46	1800	38	2460	28
510	47	1170	46	1830	37	2490	28
540	47	1200	47	1860	37	2520	27
570	46	1230	47	1890	36	2550	27
600	46	1260	47	1920	36	2580	27
630	46	1290	48	1950	35		

STANDARD PERFORMANCE SPECIFICATION FOR "OIL GRIT SEPARATOR" (OGS) STORMWATER QUALITY TREATMENT DEVICE

PART 1 – GENERAL

1.1 WORK INCLUDED

This section specifies requirements for selecting, sizing, and designing an underground Oil Grit Separator (OGS) device for stormwater quality treatment, with third-party testing results and a Statement of Verification in accordance with ISO 14034 Environmental Management – Environmental Technology Verification (ETV).

1.2 REFERENCE STANDARDS & PROCEDURES

ISO 14034:2016 Environmental management – Environmental technology verification (ETV)

Canadian Environmental Technology Verification (ETV) Program's **Procedure for Laboratory Testing of Oil-Grit Separators.**

1.3 SUBMITTALS

1.3.1 All submittals, including sizing reports & shop drawings, shall be submitted upon request with each order to the contractor then forwarded to the Engineer of Record for review and acceptance. Shop drawings shall detail all OGS components, elevations, and sequence of construction.

1.3.2 Alternative devices shall have features identical to or greater than the specified device, including: treatment chamber diameter, treatment chamber wet volume, sediment storage volume, and oil storage volume.

1.3.3 Unless directed otherwise by the Engineer of Record, OGS stormwater quality treatment product substitutions or alternatives submitted within ten days prior to project bid shall not be accepted. All alternatives or substitutions submitted shall be signed and sealed by a local registered Professional Engineer, based on the exact same criteria detailed in Section 3, in entirety, subject to review and approval by the Engineer of Record.

PART 2 – PRODUCTS

2.1 OGS POLLUTANT STORAGE

The OGS device shall include a sump for sediment storage, and a protected volume for the capture and storage of petroleum hydrocarbons and buoyant gross pollutants. The **minimum** sediment & petroleum hydrocarbon storage capacity shall be as follows:

2.1.1

4 ft (1219 mm) Diameter OGS Units:	1.19 m^3 sediment / 265 L oil
6 ft (1829 mm) Diameter OGS Units:	3.48 m^3 sediment / 609 L oil
8 ft (2438 mm) Diameter OGS Units:	8.78 m^3 sediment / 1,071 L oil
10 ft (3048 mm) Diameter OGS Units:	17.78 m^3 sediment / 1,673 L oil
12 ft (3657 mm) Diameter OGS Units:	31.23 m^3 sediment / 2,476 L oil

PART 3 – PERFORMANCE & DESIGN

3.1 GENERAL

The OGS stormwater quality treatment device shall be verified in accordance with ISO 14034:2016 Environmental management – Environmental technology verification (ETV). The OGS stormwater quality treatment device shall remove oil, sediment and gross pollutants from stormwater runoff during frequent wet weather events, and retain these pollutants during less frequent high flow wet weather events below the insert within the OGS for later removal during maintenance. The Manufacturer shall have at least ten (10) years of local experience, history and success in engineering design, manufacturing and production and supply of OGS stormwater quality treatment device systems, acceptable to the Engineer of Record.

3.2 SIZING METHODOLOGY

The OGS device shall be engineered, designed and sized to provide stormwater quality treatment based on treating a minimum of 90 percent of the average annual runoff volume and a minimum removal of an annual average 60% of the sediment (TSS) load based on the Particle Size Distribution (PSD) specified in the sizing report for the specified device. Sizing shall be determined using historical rainfall data and a sediment removal performance curve derived from the actual third-party verified laboratory testing data. The OGS device shall also have sufficient annual sediment storage capacity as specified and calculated in Section 2.1.

3.3 CANADIAN ETV or ISO 14034 ETV VERIFICATION OF SCOUR TESTING

The OGS device shall have Canadian ETV or ISO 14034 ETV Verification of third-party scour testing conducted in accordance with the Canadian ETV Program's **Procedure for Laboratory Testing of Oil-Grit Separators.**

3.3.1 To be acceptable for on-line installation, the OGS device must demonstrate an average scour test effluent concentration less than 10 mg/L at each surface loading rate tested, up to and including 2600 L/min/m^2.

Worksheet for Enhanced Grass Swale Inlet - 25mm Event

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.030	
Channel Slope	0.00500	m/m
Left Side Slope	4.00	m/m (H:V)
Right Side Slope	4.00	m/m (H:V)
Bottom Width	1.50	m
Discharge	0.13	m³/s

Results

Normal Depth	0.13	m
Flow Area	0.25	m²
Wetted Perimeter	2.54	m
Hydraulic Radius	0.10	m
Top Width	2.50	m
Critical Depth	0.08	m
Critical Slope	0.02163	m/m
Velocity	0.50	m/s
Velocity Head	0.01	m
Specific Energy	0.14	m
Froude Number	0.51	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	m
Length	0.00	m
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	m
Profile Description		
Profile Headloss	0.00	m
Downstream Velocity	Infinity	m/s
Upstream Velocity	Infinity	m/s
Normal Depth	0.13	m
Critical Depth	0.08	m
Channel Slope	0.00500	m/m

Worksheet for Enhanced Grass Swale Inlet - 25mm Event

GVF Output Data

Critical Slope	0.02163	m/m

Worksheet for Enhanced Grass Swale Inlet - 100yr Event

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.030	
Channel Slope	0.00500	m/m
Left Side Slope	4.00	m/m (H:V)
Right Side Slope	4.00	m/m (H:V)
Bottom Width	1.50	m
Discharge	0.54	m³/s

Results

Normal Depth	0.27	m
Flow Area	0.70	m²
Wetted Perimeter	3.73	m
Hydraulic Radius	0.19	m
Top Width	3.67	m
Critical Depth	0.20	m
Critical Slope	0.01710	m/m
Velocity	0.77	m/s
Velocity Head	0.03	m
Specific Energy	0.30	m
Froude Number	0.56	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	m
Length	0.00	m
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	m
Profile Description		
Profile Headloss	0.00	m
Downstream Velocity	Infinity	m/s
Upstream Velocity	Infinity	m/s
Normal Depth	0.27	m
Critical Depth	0.20	m
Channel Slope	0.00500	m/m

Worksheet for Enhanced Grass Swale Inlet - 100yr Event

GVF Output Data

Critical Slope	0.01710	m/m

Worksheet for Wetland Outlet Swale - 100yr Event

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.030	
Channel Slope	0.00500	m/m
Left Side Slope	5.00	m/m (H:V)
Right Side Slope	5.00	m/m (H:V)
Bottom Width	0.00	m
Discharge	0.07	m³/s

Results

Normal Depth	0.18	m
Flow Area	0.16	m²
Wetted Perimeter	1.82	m
Hydraulic Radius	0.09	m
Top Width	1.78	m
Critical Depth	0.13	m
Critical Slope	0.02226	m/m
Velocity	0.46	m/s
Velocity Head	0.01	m
Specific Energy	0.19	m
Froude Number	0.50	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	m
Length	0.00	m
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	m
Profile Description		
Profile Headloss	0.00	m
Downstream Velocity	Infinity	m/s
Upstream Velocity	Infinity	m/s
Normal Depth	0.18	m
Critical Depth	0.13	m
Channel Slope	0.00500	m/m

Worksheet for Wetland Outlet Swale - 100yr Event

GVF Output Data

Critical Slope	0.02226	m/m

Culvert Calculator Report
SWM Outlet Pipe 450mm

Solve For: Discharge

Culvert Summary					
Allowable HW Elevation	335.01	m	Headwater Depth/Height	1.99	
Computed Headwater Elev	335.01	m	Discharge	0.3317	m³/s
Inlet Control HW Elev.	334.80	m	Tailwater Elevation	333.80	m
Outlet Control HW Elev.	335.01	m	Control Type	Outlet Control	

Grades					
Upstream Invert	334.10	m	Downstream Invert	333.80	m
Length	50.40	m	Constructed Slope	0.005952	m/m

Hydraulic Profile					
Profile	CompositeM2PressureProfile		Depth, Downstream	0.40	m
Slope Type	Mild		Normal Depth	N/A	m
Flow Regime	Subcritical		Critical Depth	0.40	m
Velocity Downstream	2.19	m/s	Critical Slope	0.009688	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.012	
Section Material	Corrugated HDPE (Smooth Interior)		Span	0.46	m
Section Size	450 mm		Rise	0.46	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	335.01	m	Upstream Velocity Head	0.21	m
Ke	0.20		Entrance Loss	0.04	m

Inlet Control Properties					
Inlet Control HW Elev.	334.80	m	Flow Control	Submerged	
Inlet Type	Beveled ring, 33.7° bevels		Area Full	0.2	m²
K	0.00180		HDS 5 Chart	3	
M	2.50000		HDS 5 Scale	B	
C	0.02430		Equation Form	1	
Y	0.83000				

Culvert Calculator Report
SWM Emergency Culvert 375mm

Solve For: Discharge

Culvert Summary					
Allowable HW Elevation	335.21	m	Headwater Depth/Height	3.26	
Computed Headwater Elev	335.21	m	Discharge	0.4966	m³/s
Inlet Control HW Elev.	334.83	m	Tailwater Elevation	333.24	m
Outlet Control HW Elev.	335.21	m	Control Type	Outlet Control	

Grades					
Upstream Invert	333.72	m	Downstream Invert	333.24	m
Length	40.40	m	Constructed Slope	0.011881	m/m

Hydraulic Profile					
Profile	CompositeM2PressureProfile		Depth, Downstream	0.44	m
Slope Type	Mild		Normal Depth	N/A	m
Flow Regime	Subcritical		Critical Depth	0.44	m
Velocity Downstream	3.06	m/s	Critical Slope	0.020768	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.012	
Section Material	Corrugated HDPE (Smooth Interior)		Span	0.46	m
Section Size	450 mm		Rise	0.46	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	335.21	m	Upstream Velocity Head	0.47	m
Ke	0.20		Entrance Loss	0.09	m

Inlet Control Properties					
Inlet Control HW Elev.	334.83	m	Flow Control	Submerged	
Inlet Type	Beveled ring, 33.7° bevels		Area Full	0.2	m²
K	0.00180		HDS 5 Chart	3	
M	2.50000		HDS 5 Scale	B	
C	0.02430		Equation Form	1	
Y	0.83000				

Appendix E

Monthly Water Balance Calculations

190-216 Arkell Road
SITE WATER BUDGET (INFILTRATION) ANALYSIS
Guelph, Ontario

Project Number: 42063-104
Date: March 26, 2020
Design By: XSP
File: Q:\42063\104\Water Balance\March 2020\42063-104 Water Balance (Thornthwaite-Mather) Mar26 2020.xlsx

PRE-DEVELOPMENT CONDITION

Contributing Catchments: 101,102
Contributing Areas: 1.83 ha
Percent Impervious 15.5 %
Weather Station: Guelph Arboretum
Soil Type: Silt,Sand
Vegetation: Majorly Grass
Topography: Flat Land
Soil Moisture Retention Capacity: 75 mm
Runoff Factor: 0.45
Evapotranspiration Factor for Impervious Surfaces: 0.33

Month	Daily Average Temperature (C°)	Monthly Heat Index	Unadjusted Daily PE (mm)	Correction Factor	Adjusted PE (mm)	Average Precipitation (mm)	P-PE (mm)	Accum. Pot. Water Loss (mm)	Storage (mm)	ΔS (mm)	Pervious ET (mm)	Actual ET (mm)	Moisture Surplus (mm)	Water Runoff (mm)	Snow Melt Runoff (mm)	Total Recharge & Runoff (mm)	Total Recharge & Runoff (m^3)	Total Infiltration Depth (mm)	Total Infiltration Volume (m^3)	Actual Runoff (mm)	Runoff Volume (m^3)
Jan	-7.6	0.00	0.0	24.3	0.0	56.4	56.4	0.0	209.1	0.0	0.0	0.0	0.0	10.5	0.0	10.5	192	5.7	105	4.7	86
Feb	-6.9	0.00	0.0	24.5	0.0	50.8	50.8	0.0	259.9	0.0	0.0	0.0	0.0	5.2	0.0	5.2	96	2.9	53	2.4	43
Mar	-1.3	0.00	0.0	30.6	0.0	72.1	72.1	0.0	332.0	0.0	0.0	0.0	0.0	2.6	0.0	2.6	48	1.4	26	1.2	22
Apr	5.9	1.28	0.9	33.6	31.8	78.3	46.5	0.0	75.0	0.0	31.8	28.5	49.8	26.2	25.7	51.9	951	28.5	523	23.4	428
May	12.3	3.91	2.0	38.0	77.2	79.9	2.7	0.0	75.0	0.0	77.2	69.2	10.7	18.5	115.7	134.1	2,458	73.7	1,351	60.4	1,107
Jun	16.9	6.32	2.8	38.6	109.0	76	-33.0	-33.0	47.0	-28.0	104.0	93.2	10.8	14.6	57.8	72.4	1,328	39.8	730	32.6	598
Jul	19.7	7.97	3.3	38.9	128.8	88.5	-40.3	-73.3	27.0	-20.0	108.5	97.3	11.2	12.9	28.9	41.8	767	23.0	421	18.8	345
Aug	18.6	7.31	3.1	36.0	112.3	95.9	-16.4	-89.7	22.0	-5.0	100.9	90.4	10.5	11.7	14.5	26.1	479	14.4	263	11.8	216
Sep	14.1	4.80	2.3	31.2	73.0	92.1	19.1	0.0	41.1	19.1	73.0	65.4	7.6	9.6	7.2	16.9	309	9.3	170	7.6	139
Oct	7.9	2.00	1.3	28.5	36.5	69.2	32.7	0.0	73.8	32.7	36.5	32.8	3.8	6.7	3.6	10.3	189	5.7	104	4.6	85
Nov	2.4	0.33	0.4	24.2	9.0	86.3	77.3	0.0	75.0	1.2	9.0	8.1	77.0	41.8	1.8	43.6	800	24.0	440	19.7	360
Dec	-4	0.00	0.0	23.0	0.0	77.7	77.7	0.0	152.7	0.0	0.0	0.0	0.0	20.9	1.8	22.7	417	12.5	229	10.2	188
Total		33.9	16.2		577.6	**923.2**	**345.6**					**484.9**	**181.3**	**181.3**	**257.0**	**438.3**	**8,034**	**240.8**	**4,415**	**197.4**	**3,619**

Note: P - Precipitation, PE - Potential Evapotranspiration, ΔS- Change in Soil Moisture Storage, ET - Evapotranspiration

Note: P - Precipitation, PE - Potential Evapotranspiration, ΔS- Change in Soil Moisture Storage, ET - Evapotranspiration

190-216 Arkell Road
SITE WATER BUDGET ANALYSIS
Guelph, Ontario

Project Number: 42063-104
Date: March 26, 2020
Design By: XSP
File: Q:\42063\104\Water Balance\March 2020\42063-104 Water Balance (Thornthwaite-Mather) Mar26 2020.xlsx

POST-DEVELOPMENT CONDITION

Contributing Catchments: 201,202,203,204,205-1, 205-2,206,207
Contributing Areas: 1.83 ha
Percent Impervious 56.3 %
Weather Station: Guelph Arboretum

Soil Type: Silt,Sand
Vegetation: Urban Lawn
Topography: Flat Land
Soil Moisture Retention Capacity 75 mm

Runoff Factor 0.72
Evapotranspiration Factor for Impervious Surfaces 0.33

Month	Daily Average Temperature (C°)	Monthly Heat Index	Unadjusted Daily PE (mm)	Correction Factor	Adjusted PE (mm)	Average Precipitation (mm)	P-PE (mm)	Accum. Pot. Water Loss (mm)	Storage (mm)	ΔS (mm)	Pervious ET (mm)	Actual ET (mm)	Moisture Surplus (mm)	Water Runoff (mm)	Snow Melt Runoff (mm)	Total Recharge & Runoff (mm)	Total Recharge & Runoff (m^3)	Runoff before Enhanced Infiltration (mm)	Runoff before Enhanced Infiltration (m^3)	Total Enhanced Recharge* (m^3)	Total Enhanced Recharge (mm)	Recharge Pervious (m^3)	Recharge Pervious (mm)	Total Recharge (m^3)	Total Recharge (mm)	Acutal Runoff Volume (m^3)	Acutal Runoff (mm)
Jan	-7.6	0.00	0.0	24.3	0.0	56.4	56.4	0.0	209.1	0.0	0.0	0.0	0.0	12.8	0.0	12.8	235	9.2	168	0	0	67	3.7	67	3.7	168	9.2
Feb	-6.9	0.00	0.0	24.5	0.0	50.8	50.8	0.0	259.9	0.0	0.0	0.0	0.0	6.4	0.0	6.4	117	4.6	84	0	0	33	1.8	33	1.8	84	4.6
Mar	-1.3	0.00	0.0	30.6	0.0	72.1	72.1	0.0	332.0	0.0	0.0	0.0	0.0	3.2	0.0	3.2	59	2.3	42	0	0	17	0.9	17	0.9	42	2.3
Apr	5.9	1.28	0.9	33.6	31.8	78.3	46.5	0.0	75.0	0.0	31.8	19.8	58.5	30.8	25.7	56.5	1,035	40.5	741	0	0	294	16.1	294	16.1	741	40.5
May	12.3	3.91	2.0	38.0	77.2	79.9	2.7	0.0	75.0	0.0	77.2	48.1	31.8	31.3	115.6	147.0	2,690	105.2	1,925	0	0	765	41.8	765	41.8	1,925	105.2
Jun	16.9	6.32	2.8	38.6	109.0	76	-33.0	-33.0	47.0	-28.0	104.0	64.8	39.2	35.3	57.8	93.1	1,704	66.6	1,219	0	0	484	26.5	484	26.5	1,219	66.6
Jul	19.7	7.97	3.3	38.9	128.8	88.5	-40.3	-73.3	27.0	-20.0	108.5	67.6	40.9	38.1	28.9	67.0	1,226	48.0	878	0	0	349	19.0	349	19.0	878	48.0
Aug	18.6	7.31	3.1	36.0	112.3	95.9	-16.4	-89.7	22.0	-5.0	100.9	62.9	38.0	38.1	14.5	52.5	961	37.6	688	0	0	273	14.9	273	14.9	688	37.6
Sep	14.1	4.80	2.3	31.2	73.0	92.1	19.1	0.0	41.1	19.1	73.0	45.5	27.5	32.8	7.2	40.0	732	28.6	524	0	0	208	11.4	208	11.4	524	28.6
Oct	7.9	2.00	1.3	28.5	36.5	69.2	32.7	0.0	73.8	32.7	36.5	22.8	13.8	23.3	3.6	26.9	492	19.3	352	0	0	140	7.6	140	7.6	352	19.3
Nov	2.4	0.33	0.4	24.2	9.0	86.3	77.3	0.0	75.0	1.2	9.0	5.6	79.4	51.4	1.8	53.2	973	38.1	696	0	0	277	15.1	277	15.1	696	38.1
Dec	-4	0.00	0.0	23.0	0.0	77.7	77.7	0.0	152.7	0.0	0.0	0.0	0.0	25.7	1.8	27.5	503	19.7	360	0	0	143	7.8	143	7.8	360	19.7
Total		33.9	16.2		577.6	**923.2**	**345.6**					**337.0**	**329.2**	**329.2**	**257.0**	**586.2**	**10,727**	**419.5**	**7,678**	**0**	**0**	**3,049**	**166.6**	**3,049**	**166.6**	**7,678**	**419.5**

Note: P - Precipitation, PE - Potential Evapotranspiration, ΔS- Change in Soil Moisture Storage, ET - Evapotranspiration
* Enhanced recharge volume was estimated by a continuous hydrologic model, based on the design of infiltration facility and condition of its contributing area:

190-216 Arkell Road
SITE WATER BUDGET ANALYSIS
Guelph, Ontario

Project Number: 42063-104
Date: March 26, 2020
Design By: XSP
File: Q:\42063\104\Water Balance\March 2020\42063-104 Water Balance (Thornthwaite-Mather) Mar26 2020.xlsx

POST-DEVELOPMENT CONDITION (Area Draining to Wetland)

Contributing Catchments: 201,202,203,204,205-2,206,207
Contributing Areas: 1.74 ha
Percent Impervious 58.6 %
Weather Station: Guelph Arboretum
Soil Type: Silt,Sand
Vegetation: Urban Lawn
Topography: Flat Land
Soil Moisture Retention Capacity 75 mm
Runoff Factor 0.73
Evapotranspiration Factor for Impervious Surfaces 0.33

Month	Daily Average Temperature (C°)	Monthly Heat Index	Unadjusted Daily PE (mm)	Correction Factor	Adjusted PE (mm)	Average Precipitation (mm)	P-PE (mm)	Accum. Pot. Water Loss (mm)	Storage (mm)	ΔS (mm)	Pervious ET (mm)	Actual ET (mm)	Moisture Surplus (mm)	Water Runoff (mm)	Snow Melt Runoff (mm)	Total Recharge & Runoff (mm)	Total Recharge & Runoff (m^3)	Runoff before Enhanced Infiltration (mm)	Runoff before Enhanced Infiltration (m^3)	Total Enhanced Recharge* (m^3)	Total Enhanced Recharge (mm)	Recharge Pervious (m^3)	Recharge Pervious (mm)	Total Recharge (m^3)	Total Recharge (mm)	Acutal Runoff Volume (m^3)	Acutal Runoff (mm)
Jan	-7.6	0.00	0.0	24.3	0.0	56.4	56.4	0.0	209.1	0.0	0.0	0.0	0.0	13.0	0.0	13.0	226	9.5	165	0	0	61	3.5	61	3.5	165	9.5
Feb	-6.9	0.00	0.0	24.5	0.0	50.8	50.8	0.0	259.9	0.0	0.0	0.0	0.0	6.5	0.0	6.5	113	4.7	83	0	0	30	1.7	30	1.7	83	4.7
Mar	-1.3	0.00	0.0	30.6	0.0	72.1	72.1	0.0	332.0	0.0	0.0	0.0	0.0	3.2	0.0	3.2	56	2.4	41	0	0	15	0.9	15	0.9	41	2.4
Apr	5.9	1.28	0.9	33.6	31.8	78.3	46.5	0.0	75.0	0.0	31.8	19.3	59.0	31.1	25.7	56.8	988	41.5	723	0	0	266	15.3	266	15.3	723	41.5
May	12.3	3.91	2.0	38.0	77.2	79.9	2.7	0.0	75.0	0.0	77.2	46.9	33.0	32.1	115.6	147.7	2,570	108.0	1,879	0	0	692	39.7	692	39.7	1,879	108.0
Jun	16.9	6.32	2.8	38.6	109.0	76	-33.0	-33.0	47.0	-28.0	104.0	63.2	40.8	36.5	57.8	94.3	1,640	68.9	1,199	0	0	441	25.4	441	25.4	1,199	68.9
Jul	19.7	7.97	3.3	38.9	128.8	88.5	-40.3	-73.3	27.0	-20.0	108.5	65.9	42.6	39.5	28.9	68.4	1,191	50.0	870	0	0	320	18.4	320	18.4	870	50.0
Aug	18.6	7.31	3.1	36.0	112.3	95.9	-16.4	-89.7	22.0	-5.0	100.9	61.3	39.6	39.6	14.5	54.0	940	39.5	687	0	0	253	14.5	253	14.5	687	39.5
Sep	14.1	4.80	2.3	31.2	73.0	92.1	19.1	0.0	41.1	19.1	73.0	44.3	28.7	34.1	7.2	41.3	719	30.2	526	0	0	194	11.1	194	11.1	526	30.2
Oct	7.9	2.00	1.3	28.5	36.5	69.2	32.7	0.0	73.8	32.7	36.5	22.2	14.4	24.2	3.6	27.8	485	20.4	354	0	0	130	7.5	130	7.5	354	20.4
Nov	2.4	0.33	0.4	24.2	9.0	86.3	77.3	0.0	75.0	1.2	9.0	5.5	79.6	51.9	1.8	53.7	935	39.3	683	0	0	251	14.5	251	14.5	683	39.3
Dec	-4	0.00	0.0	23.0	0.0	77.7	77.7	0.0	152.7	0.0	0.0	0.0	0.0	26.0	1.8	27.8	483	20.3	353	0	0	130	7.5	130	7.5	353	20.3
Total		33.9	16.2		577.6	**923.2**	**345.6**					**328.5**	**337.7**	**337.7**	**257.0**	**594.7**	**10,347**	**434.7**	**7,563**	**0**	**0**	**2,784**	**160.0**	**2,784**	**160.0**	**7,563**	**434.7**

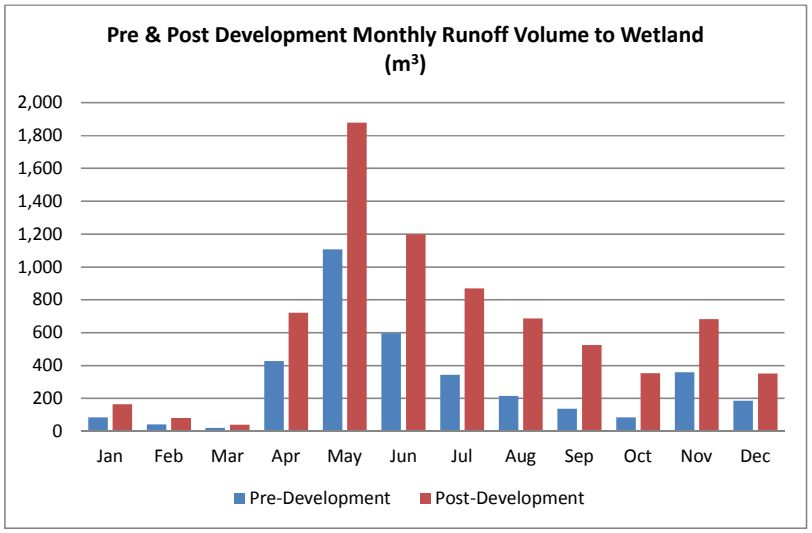
Note: P - Precipitation, PE - Potential Evapotranspiration, ΔS- Change in Soil Moisture Storage, ET - Evapotranspiration
* Enhanced recharge volume was estimated by a continuous hydrologic model, based on the design of infiltration facility and condition of its contributing area:

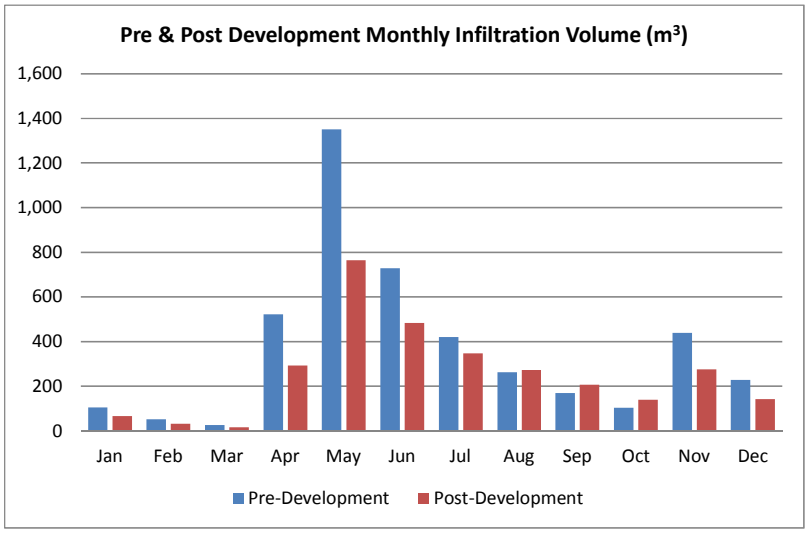
190-216 Arkell Road
SITE WATER BUDGET ANALYSIS
Guelph, Ontario

Project Number: 42063-104
Date: March 26, 2020
Design By: XSP
File: Q:\42063\104\Water Balance\March 2020\42063-104 Water Balance (Thornthwaite-Mather) Mar26 2020.xlsx

Month	Total Runoff Volume to Weland (m^3)				Total Infiltration Volume (m^3)			
	Pre-development	Post-development	Difference	Change %	Pre-development	Post-development	Difference	Change %
Jan	86	165	79	91.1	105	67	-39	-36.6
Feb	43	83	39	91.1	53	33	-19	-36.6
Mar	22	41	20	91.1	26	17	-10	-36.6
Apr	428	723	294	68.6	523	294	-229	-43.7
May	1,107	1,879	771	69.7	1,351	765	-586	-43.4
Jun	598	1,199	601	100.5	730	484	-245	-33.6
Jul	345	870	525	152.0	421	349	-73	-17.3
Aug	216	687	471	218.3	263	273	10	3.7
Sep	139	526	387	277.9	170	208	38	22.6
Oct	85	354	269	315.7	104	140	36	34.6
Nov	360	683	323	89.6	440	277	-163	-37.1
Dec	188	353	165	88.1	229	143	-86	-37.5
Total	3,619	7,563	3,944	109.0	4,415	3,049	-1,365	-30.9

Note: Negative sign indicate a decrease under post-development conditions.





Appendix F

Geotechnical Report

Peto MacCallum Ltd.
CONSULTING ENGINEERS

GEOTECHNICAL INVESTIGATION
PROPOSED ARKELL ROAD SUBDIVISION
GUELPH, ONTARIO

for

CRESCENT HOMES INC.
c/o MTE CONSULTANTS INC.

PETO MacCALLUM LTD.
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1 cc: PML Kitchener

PML Ref.: 17KF002
Report: 1
October 1, 2018

Peto MacCallum Ltd.
CONSULTING ENGINEERS

October 1, 2018

PML Ref.: 17KF002
Report: 1

Mr. Nitin Jain
Crescent Homes
c/o Mr. Jason Cabral, C.E.T.
MTE Consultants Inc.
520 Bingemans Centre Drive,
Kitchener, Ontario
N2B 3X9

Dear Mr. Jain

Geotechnical Investigation
Proposed Arkell Road Subdivision
Guelph, Ontario

Peto MacCallum Ltd. (PML) is pleased to report the results of the geotechnical investigation recently completed at the above noted project site. Authorization to proceed with this assignment was provided verbally from Mr. Nitin Jain of Crescent Homes Inc., with a signed Engineering Services Agreement to be returned.

The project involves the proposed development of a residential subdivision on the north side of Arkell Road (at Summerfield Drive), in Guelph, Ontario. It is understood that the proposed development site is currently comprised of several residential dwellings, which will be demolished as part of the project. The site is approximately 2.58 ha in size, however, the northern third of the site will not be developed. The development will include 66 town-house / apartment units, with associated parked areas as well as one roadway.

The purpose of the geotechnical investigation was to explore the subsurface soil and ground water conditions at the site. Based on the findings, we have prepared an engineering report with geotechnical recommendations pertaining to design and construction of the proposed residential subdivision. Specific considerations to be addressed in this report include:

- A description of the site and the field investigation procedure;
- A summary of the subsurface soil and ground water conditions encountered, including the presence of any topsoil, organic, fill or other anomalous features below grade;
- Log of borehole sheets, a borehole location plan drawing, and geotechnical laboratory test results;

- Foundation design options, including shallow foundation recommendations, bearing resistances, settlement projections and site class for seismic design;
- Slab-on-grade floor recommendations, including compaction requirements, perimeter and underfloor drainage requirements, and geotechnical suitability of onsite soils for re-use;
- Excavation recommendations, including safe side slopes and dewatering requirements,
- Pipe bedding, cover and backfill requirements, including material and compaction requirements, suitability of excavated soils for reuse as backfill;
- Ground water infiltration; and,
- Pavement design recommendations, including component thicknesses, compaction requirements, and drainage requirements.

The comments and recommendations provided in this report are based on the site conditions at the time of the investigation, and are for preliminary design purposes only. Any changes in plans will require review by PML to assess the applicability of the report, and may require modified recommendations, additional analysis and / or investigation. When the project design is complete, the general recommendations given in this report should be reviewed to ensure their applicability.

A limited chemical testing program of select soil samples was also completed. It should be noted that the scope of work did not include a Phase One or Phase Two Environmental Site Assessment (ESA), and the chemical testing program might not have identified all potential or actual occurrences of soil or ground water impairment at the site.

Investigation Procedure

The field work for the geotechnical investigation was completed on February 13 and March 21, 2017. Boreholes were drilled at six locations (BH1 to BH6) as shown on the appended Borehole Location Plan, Drawing 1. The field work included the installation of a total of four monitoring wells in BH2, BH3, BH4 and BH5.

The boreholes were advanced using a Diedrich D50 track mounted drillrig equipped with an automatic hammer and continuous flight hollow stem augers. The drilling equipment was supplied and operated by specialist contractors working under subcontract to PML.

Representative samples of the overburden were recovered at regular intervals throughout the depths explored. Standard penetration tests (SPT) were carried out during sampling operations of the boreholes using conventional split spoon equipment. Ground water observations were made in the boreholes during and upon completion of drilling. The boreholes were backfilled and compacted in accordance with O.Reg.903 upon completion of drilling.

The field work was supervised throughout by a member of PML's engineering staff who directed the drilling and sampling operation, prepared the stratigraphic logs, monitored ground water conditions, and processed the recovered samples.

The borehole and monitoring well locations were established in the field by Peto MacCallum Ltd. The ground surface elevations were surveyed by MTE Consultants Inc., and provided to PML on a borehole location plan.

All soil samples collected during the investigation were returned to PML's laboratory for detailed visual examination and testing. The geotechnical testing program included natural moisture content determinations on all recovered samples and two particle size distribution analyses carried out on samples of the major soil types encountered.

Summarized Site and Subsurface Conditions

The site is currently comprised of several residential dwellings, which will be demolished as part of the project. However, the northern third of the site will not be developed. The total area of the site is approximately 2.54 ha in size and relatively flat, with a gentle slope to the north, to the wetland area adjacent to the site. It is noted that the adjacent development to the east is approximately 5 m higher that the subject site.

Subsurface Conditions

Reference is made to the appended Log of Borehole sheets for details of the field work including soil descriptions, inferred stratigraphy, standard penetration test (SPT) N values, ground water observations and laboratory moisture content determinations.

Due to the soil sampling procedures and the limited size of samples, the depth/elevation demarcations on the borehole logs must be viewed as "transitional" zones, and cannot be construed as exact geologic boundaries between layers.

In general, the subsurface stratigraphy encountered at the borehole locations consists of surficial topsoil and localized fill overlying cohesionless native deposits.

Topsoil / Topsoil Fill

Between 100 and 300 mm (average thickness of 220 mm) of dark brown silt topsoil or topsoil fill was contacted from the surface in all of the boreholes. The topsoil was typically described as damp to moist, dark brown silt, trace sand with rootlets.

Fill

Below the topsoil / topsoil fill in BH1 and BH6, fill was penetrated, extending to depths of 0.46 m to 0.69 m below existing grades. The fill was variable in composition, comprising either sand and gravel or silt. Occasional rootlets were observed within the fill deposits in BH6.

Within the fill, SPT N values typically between 7 and 18 blows per 0.30 m penetration of the split spoon sampler indicate that a variable degree of compaction was used to place the fill soils. The fill soils were described as damp and moist, as demonstrated by laboratory moisture contents in the range of 5 to 20%.

Native Deposits

Native cohesionless deposits encountered below the surficial topsoil and fill were variable and generally comprised silt / sand / sand and gravel extending to the borehole termination depths. A deposit of silt till was also contacted in BH6, extending from 5.8 to 6.6 m. Generally, the encountered native cohesionless soil deposits were compact to very dense, with typical SPT N values ranging from 10 to greater than 50 blows per 0.3 m penetration of the split spoon sampler. Localized loose / very loose zones were contacted in BH1 (between 0.46 to 0.69 m), BH2

(between 0.25 to 0.69 m) and BH3 (between 0.2 to 1.4 m). Moisture contents typically ranging between 3 and 20% were indicative of variable damp to saturated conditions, with depth.

Two soil samples of the sand / sand and gravel were collected and analyzed for particle size distribution analysis, with results presented on Figure 1 and Figure 2 attached. Based on the results, the soil classification was generally consistent with those observed during the field work as included on the appended Log of Borehole sheets.

Ground Water Conditions

Ground water observations carried out during and upon completion of drilling are fully summarized on the appended Log of Borehole Sheets.

Ground water was first contacted at depths of 0.7 to 2.9 m below grade in the boreholes, corresponding to elevations of 333.4 to 331.7 (metric, geodetic), respectively.

An initial water level was also taken within the monitoring wells once installed. Ground water was measured at depths of 0.75 to 3.4 m below grade in the monitoring wells, corresponding to elevations of between 333.38 and 331.8 (metric, geodetic), respectively. Follow up ground water levels by MTE Consultants Inc., completed between March, 2017 and June, 2018 measured ground water at depths of surface level (MW4) to 3.65 m below grade (MW2), corresponding to an elevation range of between 330.38 (MW2 and MW5) to 333.99 (MW4) (metric, geodetic).

Based on the ground water observations, the ground water level appears to generally slope down from north to south, away from the wetland area.

The ground water levels at the site are subject to seasonal fluctuations and precipitation patterns.

Discussion and Recommendations

The site is an approximately 2.58 ha, rectangular shaped piece of land which is relatively flat located on the north side of Arkell Road at Summerfield Drive, Guelph, Ontario.

It is understood that the proposed development site is currently comprised of several residential dwellings, which will be demolished as part of the project. The development will include 66 town-house / apartment units, with associated parked areas as well as one roadway. However, northern third of the site will not be developed.

Once the design details for the proposed development are finalized, the recommendations in this report should be revisited to confirm that they remain applicable.

In general, the subsurface stratigraphy encountered at the borehole locations consist of surficial topsoil and localized fill overlying cohesionless native deposits.

Site Grading

As noted, the site is relatively flat with a total relief of approximately 1 m. The adjacent development to the east is approximately 5 m higher than the subject site. Consideration is being given to infilling the site.

Due to the inherent variability of the existing fill materials and the lack of consistent compactive effort utilized during fill placement, these materials are not considered suitable for support of building foundations, floor slabs, pavements, or other settlement sensitive structures. Also, the loose to very loose native materials (BH1, BH2 and BH3) are not considered suitable for the support of building foundations. In this regard, all existing fill and localized very loose / loose materials should be completely subexcavated from beneath any settlement sensitive structures (i.e., building envelopes, pavements, etc.) and replaced with well compacted, suitable engineered fill materials.

Following the stripping / removal of all surficial topsoil and any other deleterious material, and approval of the subgrade, the grades may then be raised where required. Surficial topsoil / organic thicknesses across the site were typically between 100 and 300 mm. In calculating the approximate quantity of topsoil to be stripped, we recommend that the topsoil thickness shown on the individual borehole logs be increased by 50 mm to account for variations and some stripping of the mineral soil below.

Prior to any fill placement, the subgrade surface should be proofrolled with a heavy vibratory compactor under the full time supervision of qualified geotechnical personnel. Any soft spots encountered during the proofrolling process should be subexcavated to the level of competent soils.

Fill used to raise grades should comprise either on site native inorganic cut soils or approved imported material. All engineered fill materials should be pre-approved by the geotechnical consultant prior to placement. Engineered fill material should be placed in maximum 300 mm thick lifts and compacted to at least 98% standard Proctor maximum dry density (SPMDD) below footings and 95% SPMDD below floors and pavements. Further, generic recommendations for fill subgrade preparation and engineered fill construction are provided in Appendix A.

It is noted that materials generated from grade cuts will generally consist of native cohesionless soil deposits. In general, the native on site cohesionless soils will be suitable for reuse as engineered fill, subject to geotechnical verification during construction, providing all organic, wet or saturated soils, and otherwise deleterious soils are discarded. Silty soils described as wet or saturated on the borehole logs should be dried prior to reuse.

The silty soils (i.e. silt) are frost susceptible and highly susceptible to moisture content variations, and are not well suited for engineering fill construction. Compaction to 98% SPMDD may be difficult to achieve; however, these insitu soils should be acceptable for use as engineered fill where compaction to 95% SPMDD is specified.

Foundations

For preliminary design purposes, conventional strip / spread footings founded at least 0.30 m into the competent compact to dense native deposits, or on engineered structural fill compacted to 98% SPMDD, may be designed for a net bearing resistance of 150 kPa at the serviceability limit state (SLS) and a factored bearing resistance of 225 kPa at the ultimate limit state (ULS). If very loose / loose soils are contacted at the proposed footing level, the loose soils should be subexcavated to the level of competent founding soils.

Accordingly, footings designed in accordance with the Ontario Building Code for residential housing will be satisfactory. The following table summarizes the minimum foundation depths based on the borehole findings:

LOCATION	MINIMUM FOUNDATION DEPTH (m)	CORRESPONDING ELEVATION (METRIC, GEODETIC)
BH1	1.0	333.50
BH2	1.0	334.10
BH3	1.7	332.70
BH4	0.6	333.50
BH5	0.6	334.30
BH6	0.7	333.30

Although in general, footings are anticipated to be placed on native insitu soils, where required the footings may be supported on engineered structural fill, placed in accordance with the generic recommendations for engineered fill construction provided in Appendix A. Prior to placement of engineered fill, all existing fill must be removed and the soils should be subexcavated to the level of competent native overburden soils noted in the table above. For engineered fill supporting footing loads, compaction to a minimum 98% of the materials SPMDD, should be specified as per recommendations outlined in the preceding 'Site Grading' section of this report and in Appendix B.

Footings supported on the structural fill may also be designed using the values for a net factored resistance at ULS and SLS of 225 and 150 kPa, respectively. Full time inspection of any structural fill placement by PML personnel is recommended to approve subgrade conditions, fill materials and to verify that the specified compaction levels are being achieved. Prior to concrete placement, all founding surfaces should be examined by PML personnel to check the competency of the founding surfaces.

Total settlements of footings founded on the approved engineered fill or compact to dense native overburden deposits, designed as outlined above are not expected to exceed 25 mm, with differential settlements between footings being no more than 50% of this value.

All exterior footings should be provided with a minimum 1.2 m of earth cover or the thermal insulation equivalent to provide adequate insulation against potential frost damage. A 25 mm thick layer of polystyrene insulation is thermally equivalent to 600 mm of soil cover.

Prior to concrete placement, all founding surfaces should be examined by PML personnel to check the competency of the founding surfaces.

For earthquake design, a site Class D seismic response classification may be assumed, in accordance with the 2012 Ontario Building Code.

Basement / Slab-on-Grade Floor Slabs

In general, the ground water level at the site was first contacted below depths of 0.7 to 2.9 m (Elevation 333.4 to 331.7) with follow up ground water monitoring showing ground water depths of surface level to 3.65 m below grade (Elevation 330.38 to 333.99). Basements, if any, must be located at least 1.0 m above the high ground water level. Conventional slab-on-grade construction of basement floor slabs is feasible on compact to dense native soil deposits, or on engineered structural fill compacted to 95% SPMDD.

Preparation of the floor slab subgrade should include stripping of the topsoil, and other deleterious material followed by proofrolling of the exposed subgrade with a heavy roller to ensure uniform adequate support. Excessively loose, soft or compressible materials revealed during the proofrolling operations should be subexcavated and replaced with well compacted approved material.

Fill placed under the floor slab to achieve finished subgrade levels or as foundation excavation backfill should comprise approved inorganic material having a moisture content within 3% of the optimum value, placed in maximum 200 mm thick lifts, and compacted to at least 95% of SPMDD.

A minimum 150 mm thick layer of well compacted clear stone (or equivalent) is recommended directly beneath the slab-on-grade. A polyethylene vapour barrier should be placed at the surface of the stone if a moisture sensitive finish is to be placed on the floor.

For slab-on-grade (basement less) structures, exterior grades should be maintained at least 150 mm below the finished floor slab-on-grade level and sloped to promote drainage away from the building.

Foundation Drainage and Earth Pressure Parameters

Foundation drainage measures should be taken for units with basements. Perforated drainage pipe should be laid around the outside edge of the footings, and connected to a frost free sump system. It is recommended that the drainage pipes be surrounded with a granular filter protected with filter fabric, or alternatively wrapped with filter cloth and surrounded by concrete sand.

A “free draining” granular material, or an equivalent, approved drainage board product must be provided for the basement walls, in accordance with the Ontario Building Code. The onsite native cohesionless deposits may be suitable for use as basement wall backfill. However, it should be noted that soils with high silt content (i.e. silt) are not suitable for use as basement wall backfill unless a drainage board product is provided. Backfilling should not take place until the ground floor has been constructed, in order to provide lateral support for the wall.

In conjunction with the granular material, a weeping tile system should be installed to minimize the build-up of hydrostatic pressure behind the wall. The weeping tile should be surrounded by a properly designed graded granular filter or wrapped with approved geotextile to prevent migration of fines into the system. The drainage pipe should be placed on a positive grade and lead to a frost-free sump or outlet.

The following earth pressure design parameters may be assumed for calculation of backfill materials compacted to 95% SPMDD:

PARAMETER	OPS GRANULAR B	Onsite SAND / SAND AND GRAVEL
Angle of Internal Friction (degrees)	32	30
Unit Weight (kN/m^3)	21	20
Coefficient of Active Earth Pressure (K_a)	0.30	0.33
Coefficient of Earth Pressure At Rest (K_o)	0.47	0.50
Coefficient of Passive Earth Pressure (K_p)	3.23	2.77

Note: Earth pressure coefficients assume Rankin analysis (wall friction ignored, non-sloping backfill)

It is assumed that basement floors will be more than 1.0 m above the ground water table and as such, underfloor drainage systems will not be required.

Excavation and Dewatering

It is assumed that excavations for site grading, footings and service trenches will extend through the surficial topsoil and into the native cohesionless soils, which are classified as Type 3 materials as defined in the Occupational Health and Safety Act (OHSA). Subject to inspection and providing adequate ground water control is achieved, excavations within Type 3 soils that are to be entered by workers should be inclined from the base of the excavation at one horizontal to one vertical (1H:1V) or flatter.

Ground water was first contacted at depths of 0.7 to 2.9 m below grade in the boreholes, corresponding to elevations of 333.4 to 331.7 (metric, geodetic), respectively.

An initial water level was also taken within the monitoring wells once installed. Ground water was measured at depths of 0.75 to 3.4 m below grade in the monitoring wells, corresponding to elevations of between 333.38 and 331.8 (metric, geodetic), respectively. Follow up ground water levels by MTE Consultants Inc., completed between March 2017 and June 2018 showed ground water depths of surface level to 3.65 m below grade (Elevation 330.38 to 333.99). The extent of ground water control will depend on the depth of excavation below the ground water level.

Shallow excavations extending less than 0.5 m below the ground water level can be dewatered using conventional sump pumping techniques. Deeper excavations, extending more than 0.5 m below the ground water level may require extensive ground water control measures such as keg wells or well point dewatering. The actual dewatering methods should be established at the contractor's discretion within the context of a performance specification for the project. Regardless of the dewatering method chosen, the hydraulic head and ground water inflow must be properly controlled to ensure a stable and safe excavation and to facilitate construction. The design of the dewatering system should be specified to maintain and control ground water at least 0.30 m below the excavation base level, in order to provide a stable excavation base throughout construction.

It should be noted that under the Ontario Water Resources Act, the Water Taking and Transfer Regulation 387/04, and in compliance with the Ministry of Environment and Climate Change's (MOECC) policy and Permit to Take Water (PTTW) Manual (April 2005), an application should be filed to the MOECC for the subject project construction dewatering PTTW, if the dewatering discharge is greater than 400,000 L/day, or about 4.6 L/s. If the dewatering discharge is between 50,000 L/day (or about 0.6 L/s) and 400,000 L/day (or about 4.6 L/s), dewatering activities need to be registered on the Environmental Activity and Sector Registry (EASR). Reference is made to the hydrological report by MTE Consultants Inc. for further details.

At the time of tendering, test pits should be excavated on site to allow prospective Contractors to judge the ground water conditions and to determine the appropriate control methods required closer to the time of construction. Ground water conditions are subject to seasonal variations. In this regard, a later summer construction schedule would be preferable.

Pipe Bedding and Backfilling

No bearing problems are anticipated for pipes founded in the native cohesionless soils or structural fill. On stable subgrade, a minimum 150 mm thick bedding course of Granular A material compacted to 95% SPMDD is recommended beneath the pipes. The Granular A material should extend around the pipe to at least 300 mm above the pipe obvert or as set out by Ontario Provincial Standards (OPS), or the local authority.

Backfill below pavements, floor slabs and other settlement sensitive features should be similarly compacted to 95% SPMDD. Backfill should be placed in 300 mm maximum lifts. Material that is too wet for compaction to a minimum of 95% SPMDD should be allocated for use in landscaped / non settlement sensitive locations, and compacted to at least 90% SPMDD.

The trenching and backfilling operations should be carried out in a manner which minimizes the length of trench left open yet accommodates efficient pipe laying and compaction activities.

Pavement Construction

Prior to the construction of the new pavements, surficial topsoil, fill and loose to very loose deposits should be removed. If some settlement is acceptable, the loose to very loose soils can remain in place. Based on the anticipated traffic patterns, frost susceptibility, and strength of the expected subgrade soils, the following pavement component thicknesses are considered suitable for local residential and parking lot traffic categories (no truck / heavy vehicle use).

PAVEMENT COMPONENT	**THICKNESS (mm)**
Asphalt	80
Granular A Base	150
Granular B Subbase	350

The flexible pavement designs provided above consider that construction will be carried out during the drier time of the year and the subgrade is stable, as determined by proofrolling inspected by PML personnel. If the subgrade is wet and unstable, additional granular subbase will be required.

The pavement materials should conform to current OPS specifications. The Granular A base and Granular B subbase courses should be placed in thin lifts and compacted to a minimum of 100% SPMDD, and asphalt should be placed to a minimum of 92% of the material's maximum relative density (MRD). Reference is made to OPS Specification 310, as revised.

During construction, testing should be conducted to confirm the gradation and compactibility characteristics of the granular base and subbase materials and the mix design properties of the asphalt.

Proofrolling procedures and the placement and compaction of all the fill and granular materials and asphalt for the pavement construction and backfilling at the site should be inspected on a continuous basis by PML technicians.

If relatively impermeable silty soils are present at a shallow depth beneath the pavement structure, pavement subdrains should be provided to prevent water accumulation on the pavement subgrade surface. The subgrade should be graded so that water is directed to the catch basin structures or to the pavement edge. Subdrains should be discharged in to the catch basins. The subdrains may consist of filter wrapped, 100 mm diameter perforated plastic pipe, set within the subbase layer at the subgrade surface.

Soil Infiltration

Soil infiltration rates for storm water management (SWM) and roof water infiltration systems were determined for the major near surface soil units and are as follows:

SOIL TYPE	ESTIMATED COEFFICIENT OF PERMEABILITY (cm/sec)	INFILTRATION RATE (mm/hr)
Sand / Sand and Gravel	1×10^{-3}	30

Any SWM ponds should be inspected by PML personnel during construction to verify the presence of a suitable subgrade. In general, the slopes of the storm water management pond should be constructed at 5H:1V or shallower and be provided with vegetation cover to minimize the potential for erosion and sloughing of the side slopes.

Limited Chemical Testing Program

As noted, a limited chemical testing program was completed on samples recovered during geotechnical investigation. PML understands that excess soil may be generated during construction, the volume of which is unknown at this time. The chemical testing program was completed to check the geoenvironmental quality of the site soils at selected sampling locations in order to provide commentary regarding on site or off site re-use and / or disposal options of potentially excess soils.

The soil sampling and testing was conducted as a limited testing program. A Phase One Environmental Site Assessment (ESA) was not within the scope of work for this assignment. Accordingly, soil and ground water impairment that has not been identified by the limited chemical testing program may exist elsewhere at the site. The limited chemical testing program does not constitute an ESA as defined under the Environmental Protection Act and O. Reg. 153/04, as amended.

Chemical Testing Protocol

Representative samples collected during the geotechnical investigation were returned to our laboratory for detailed visual examination. Soil samples were submitted for chemical analysis to AGAT Laboratories Limited (AGAT), a Canadian Association for Laboratory Accreditation Inc. (CALA) accredited laboratory in Mississauga, Ontario. The chemical analyses conducted by AGAT were in accordance with the O. Reg. 153/04, as amended Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act dated March 9, 2004, amended as of July 1, 2011.

As part of the geoenvironmental procedural protocol, all recovered soil samples were examined for visual and olfactory evidence of potential contamination. In addition, soil vapour concentrations (SVCs) were measured in the headspace of the recovered samples. The measured SVCs were typically 0 to 5 parts per million, which are not considered significant.

Five soil samples were submitted for chemical analysis for metals and inorganic parameters, and two samples were submitted for analysis for organochlorine (OC) pesticides. Selection of samples was based on visual and olfactory indications of contamination, SVCs and for general coverage. Details of the samples submitted for chemical testing are as follows:

SAMPLE ID	BOREHOLE	SAMPLE NUMBER	DEPTH (m)	SOIL TYPE	PARAMETERS TESTED
BH4 SS1	1	1	0 to 0.6	Topsoil	M&I and OC pesticides
BH5 SS1	5	1	0 to 0.6	Topsoil	M&I
BH5 SS4	5	4	2.3 to 2.7	Native	M&I
BH6 SS1	6	1	0 to 0.6	Topsoil / Fill	M&I and OC pesticides
BH6 SS3	6	3	1.5 to 2.1	Native	M&I

Site Condition Standards

The Ministry of the Environment, Conservation and Parks (MECP) has developed a set of Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act (April 15, 2011) and O.Reg. 153/04, as amended. The standards consist of nine tables (Table 1 through Table 9) that provide criteria for maximum concentrations of various contaminants. In general, the applicable Table and corresponding Site Condition Standards (SCSs) depend on the site location, land use, soil texture, bedrock depth, soil pH and source of potable water at the site.

The site is currently comprised of several residential dwellings and it is to be developed into a residential subdivision. The site is bordered by the Torrance Creek Wetland Complex to the north, which is a provincially significant wetland as identified by the Ministry of Natural Resources. Based on review of the above factors, PML selected the Generic Criteria of the O.Reg. 153/04, Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act dated April 15, 2011. In particular, the Table 1 (T1) Full Depth Background Site Condition Standards for Residential / Parkland / Institutional / Industrial / Commercial / Community (RPI/ICC) property use would likely apply to the site; however a full evaluation of applicable SCSs in accordance with Sections 41 and 43.1 of O.Reg. 153/04, as amended, was not within the scope of this assignment and further environmental work would be required to confirm this.

For off site re-use with minimal environmental restrictions, the O.Reg. 153/04, as amended, Full Depth Background Table 1 (T1) SCSs for RPI/ICC property uses were utilized. In addition, the Full Depth Generic SCSs (T2) in a Portable Ground Water Condition for ICC property use are also examined.

It is noted that a comparison to the Table 3 SCSs for full depth generic condition, Tables 4 and 5 SCSs for stratified site condition, Tables 6 and 7 SCSs for shallow bedrock condition and Table 8 and Table 9 for use within 30 m of a water body for a non-potable ground water condition were not conducted as part of this assignment. If the potential receiving site for excess soil falls within one of these categories, additional evaluation by PML will be required to confirm conformance.

Analytical Findings and Conclusions

Laboratory certificates of analysis compared to the Table 1 and 2 SCSs are included in Appendix C. The measured values and corresponding Standards (labelled as G/S for Guideline / Standard) are shown on the certificates of analysis. In the event of an exceedance of the SCSs, the level is shown in **bold** text, where applicable.

On Site Re-use

Based on the results of chemical testing, the measured concentrations of the tested parameters met the T1 RPI/ICC SCSs, with the exception of zinc in two samples (BH5 SS1 and BH6 SS3).

It is noted that there is no legal imperative to remove or treat the soil that exceeds the applicable SCSs, provided it is demonstrated that there is no off site impact or adverse effect. However, if contaminated soil is left on site, the landowner assumes liability associated with the contamination. The liability concerns could include potential scrutiny from the MECP, neighbouring property owners and the public; potential for decreased value of the land and issues during potential divesting of the property due to environmental liability concerns on the part of future owners or their financiers/insurers.

Off Site Re-use

As noted, the measured concentrations of the tested parameters met the T1 RPI/ICC SCSs, with the exception of zinc in two samples (BH5 SS1 and BH6 SS3). When compared to the T2 ICC Standards, one sample (BH6 SS3) exceeded the SCS for zinc.

If the soil is to be removed from the site for off site re-use, the following conditions must be met:

- The extent of the material that exceeds the applicable SCSs is delineated;
- All analytical results and environmental assessment reports must be fully disclosed to the receiving site owners / authorities and they have agreed to receive the material;
- The work must be completed in accordance with local by-laws governing soil movement and/or placement at other sites;
- The applicable SCSs for the receiving site have been determined, as confirmed by the environmental consultant and the SCSs are consistent with the chemical quality of the soil originating at the source site;
- Transportation and placement of the excess soil is monitored by the environmental consultant to check the material is appropriately placed at the pre-approved site;
- The excess soil cannot be taken to a property for which a RSC is being filed as outlined in O.Reg. 153/04, as amended, unless the chemical testing program is completed in accordance with the regulation;
- The excess soil cannot be taken to a property for which a RSC has been previously filed unless the soil quality meets the SCSs contained in the RSC;
- The receiving site must be arranged and/or approved well in advance of excavation in order to avoid delays during construction. As well, it is noted the chemical testing requirements for various receiving sites is site-specific and additional testing may be required, beyond that provided in this report; and

- The excavation work should be conducted in accordance with a Soil Management Plan prepared by a qualified professional to ensure that all surplus excavated material is tested and managed appropriately, and that imported fill material is of suitable quality and meets the SCSs applicable to the site. Re-use of excess excavated soil on site is also subject to acceptance for re-use by the geotechnical consultant at the time of construction based on geotechnical considerations.

If landfill disposal of excess soils is considered, PML recommends toxicity characteristic leaching procedure (TCLP) testing be completed in accordance with O. Reg. 347/558, Schedule 4, as amended.

It is recommended that transportation of fill material from the Source Site(s) to the Receiving Site(s) be carried out in accordance with the MECP document Management of Excess Soil – A guideline for Best Management Practices dated January, 2014.

Additional sampling and chemical testing should be carried out during construction to verify the chemical quality of the excess soil to assess the appropriate management/disposal options for the soil leaving the site.

It should be noted that the soil conditions may differ from those encountered during this assignment. PML should be contacted if impacted soil conditions become apparent to further assess and appropriately handle the materials, if any, and to evaluate whether modifications to the conclusions documented in this report are necessary.

Geotechnical Review and Construction Inspection and Testing

It is recommended that the design drawings be submitted to PML for general geotechnical review for compatibility with the site conditions and recommendations of this report.

Earthworks operations should be carried out under the supervision of PML to approve subgrade preparation, backfill materials, placement and compaction procedures, and verify the specified degree of compaction is achieved uniformly throughout fill materials.

The comments and preliminary recommendations provided in this report are based on the information revealed in the boreholes. Conditions away from and between boreholes may vary. Geotechnical review during construction should be on going to confirm the subsurface conditions are substantially similar to those encountered in the boreholes, which may otherwise require modification to the original recommendations.

Closure

This assignment is subject to the Statement of Limitations that is included in Appendix B and must be read in conjunction with this report.

We trust this report has been completed within our terms of reference, and is sufficient for your immediate requirements. If you have any questions or require further information, please do not hesitate to contact our office.

Sincerely

Peto MacCallum Ltd.

Hassen Shinwary, BASc
Project Supervisor
Geotechnical and Geoenvironmental Services

LICENSED PROFESSIONAL ENGINEER
K. D. HANES
100187331
Oct 1, 2018
PROVINCE OF ONTARIO

Ken Hanes, P.Eng.
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Gerry Mitchell, MEng, P.Eng.
Vice President

HS/KH:sh

Enclosures:
Figures 1 to 2 – Particle Size Distribution Charts
List of Abbreviations
Log of Boreholes 1 to 6
Drawing 1 – Borehole Location Plan
Appendix A – Engineered Fill
Appendix B – Statement of Limitations
Appendix C – AGAT Certificates of Analysis

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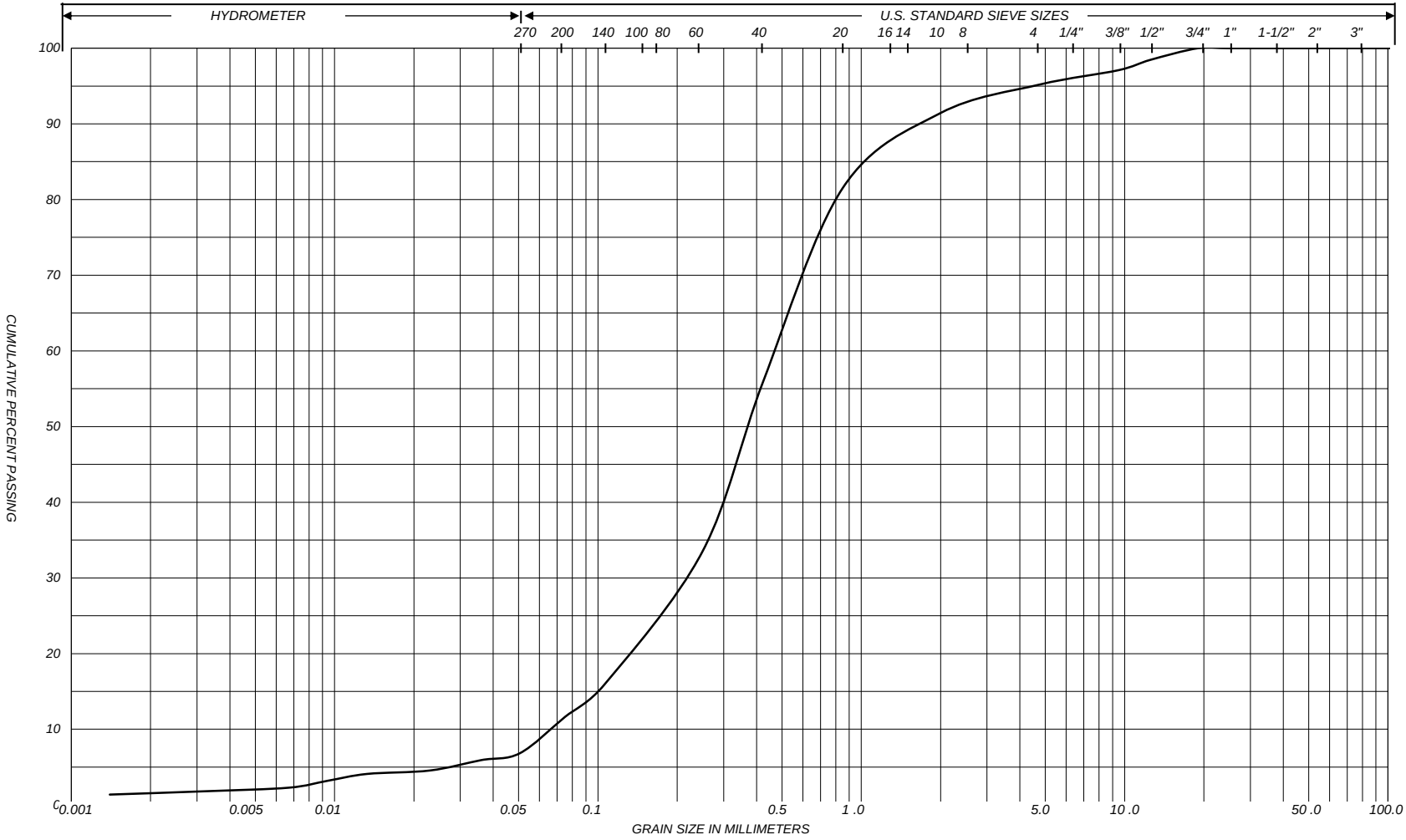
PML REF. 17KF002
REPORT NO. 1
FIGURE. 1

PARTICLE SIZE DISTRIBUTION CHART



SILT & CLAY				FINE	MEDIUM	COARSE	GRAVEL				COBBLES	UNIFIED
				SAND								
CLAY	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	GRAVEL				COBBLES	M.I.T.
	SILT			SAND								
CLAY	SILT			VERY FINE	FINE	MEDIUM	COARSE	GRAVEL				U.S. BUREAU
				SAND								

REMARKS Borehole 1, Sample SS6, Depth 4.5 to 5.0 m

SAND, SOME SILT, TRACE GRAVEL

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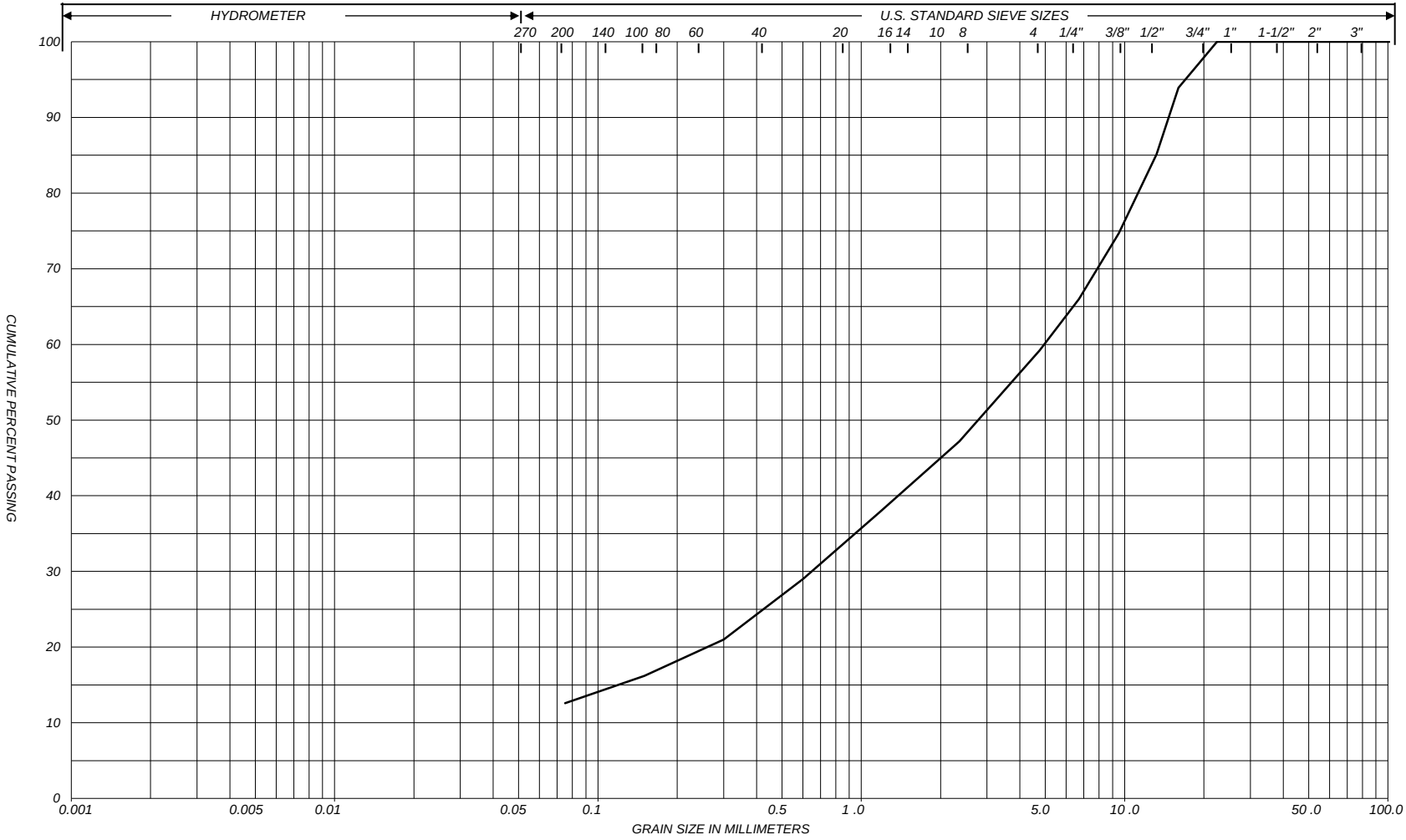
PML REF. 17KF002
REPORT NO. 1
FIGURE. 2

PARTICLE SIZE DISTRIBUTION CHART



SILT & CLAY				FINE	MEDIUM	COARSE	GRAVEL				COBBLES		UNIFIED
				SAND									
CLAY	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	GRAVEL				COBBLES		M.I.T.
	SILT			SAND									
CLAY	SILT			VERY FINE	FINE	MEDIUM	COARSE	GRAVEL					U.S. BUREAU
				SAND									

REMARKS Borehole 2, Sample SS2, Depth 0.7 to 1.2 m

SAND AND GRAVEL, SOME SILT

LIST OF ABBREVIATIONS

PENETRATION RESISTANCE

Standard Penetration Resistance N: - The number of blows required to advance a standard split spoon sampler 0.3 m into the subsoil. - Driven by means of a 63.5 kg hammer falling freely a distance of 0.76 m.

Dynamic Penetration Resistance: The number of blows required to advance a 51 mm, 60 degree cone, fitted to the end of drill rods, 0.3 m into the subsoil. The driving energy being 475 J per blow.

DESCRIPTION OF SOIL

The consistency of cohesive soils and the relative density or denseness of cohesionless soils are described in the following terms:

CONSISTENCY	N (blows/0.3 m)	c (kPa)	DENSENESS	N (blows/0.3 m)
Very Soft	0 - 2	0 - 12	Very Loose	0 - 4
Soft	2 - 4	12 - 25	Loose	4 - 10
Firm	4 - 8	25 - 50	Compact	10 - 30
Stiff	8 - 15	50 - 100	Dense	30 - 50
Very Stiff	15 - 30	100 - 200	Very Dense	> 50
Hard	> 30	> 200		

WTPL	Wetter Than Plastic Limit
APL	About Plastic Limit
DTPL	Drier Than Plastic Limit

TYPE OF SAMPLE

SS	Split Spoon	TW	Thinwall Open
WS	Washed Sample	TP	Thinwall Piston
SB	Scraper Bucket Sample	OS	Oesterberg Sample
AS	Auger Sample	FS	Foil Sample
CS	Chunk Sample	RC	Rock Core
ST	Slotted Tube Sample	USS	Undisturbed Shear Strength
PH	Sample Advanced Hydraulically	RSS	Remoulded Shear Strength
PM	Sample Advanced Manually		

SOIL TESTS

Qu	Unconfined Compression	LV	Laboratory Vane
Q	Undrained Triaxial	FV	Field Vane
Qcu	Consolidated Undrained Triaxial	C	Consolidation
Qd	Drained Triaxial		

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LOG OF BOREHOLE NO. 1

PROJECT Proposed Arkell Road Subdivision
LOCATION Arkell Road, Guelph, Ontario
BORING METHOD Continuous Flight Hollow Stem Augers
BORING DATE: 2017 02 13
PML REF.: 17KF002
ENGINEER K. Hanes
TECHNICIAN H. Shinwary

DEPTH in METRES	DESCRIPTION	LEGEND	NUMBER	TYPE	BLOWS/0.3m N - VALUES	ELEVATION SCALE
	GROUND ELEVATION 334.56					
0.10	TOPSOIL: Dark brown silt, trace sand, numerous rootlets, damp		1	SS	7	
0.46						
0.69	FILL: Brown sand and gravel, trace silt, moist					
333.87			2	SS	42	
	SILT: Loose brown silt, trace sand, occasional rootlets, damp					
	SAND AND GRAVEL: Dense to very dense brown sand and gravel, trace to some silt, numerous cobbles, damp		3	SS	50/150mm	
2.1						
332.5	becoming moist		4	SS	39	
2.9						
331.7	becoming compact, no cobbles, saturated, contains saturated silt layers		5	SS	23	
4.0						
330.6	SAND: Compact brown sand, trace to some silt, trace gravel, saturated		6	SS	12	
6.6			7	SS	16	
328.0	BOREHOLE TERMINATED AT 6.6 m					

SHEAR STRENGTH C_u (kPa) 50 100 150 200
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST ●
BLOWS/0.3M 20 40 60 80

LIQUID LIMIT _____ W_L
PLASTIC LIMIT ____ W_P
WATER CONTENT ___ W
W_P W W_L
WATER CONTENT % 10 20 30

UNIT WEIGHT γ kN/m³

GROUND WATER OBSERVATIONS AND REMARKS

GR SA SI&CL

Sampler wet from SS5

Upon completion of augering
Wet cave to 3.1 m

NOTES: Headspace: SS1 0ppm, SS2 0ppm, SS3 0ppm, SS4 0ppm, SS5 0ppm, SS6 0ppm, SS7 0ppm

WATER LEVEL OBSERVED DURING / UPON COMPLETION OF DRILLING
WATER LEVEL MEASURED IN MONITORING WELL

UNDISTURBED FIELD VANE
REMOLDED FIELD VANE
LAB SHEAR TEST
POCKET PENETROMETER
POCKET TORVANE

CHECKED BY KH

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. 2

PROJECT Proposed Arkell Road Subdivision
LOCATION Arkell Road, Guelph, Ontario
BORING METHOD Continuous Flight Hollow Stem Augers
BORING DATE: 2017 02 13
PML REF.: 17KF002
ENGINEER K. Hanes
TECHNICIAN H. Shinwary

GROUND ELEVATION 335.16

DEPTH in METRES	DESCRIPTION	NUMBER	TYPE	BLOWS/0.3m N - VALUES
0.25 / 334.91	TOPSOIL: Dark brown silt, trace sand, numerous rootlets, damp	1	SS	3
0.69 / 334.47	SILT: Loose dark brown silt, some sand, trace gravel, occasional rootlets, damp	2	SS	57
	SAND AND GRAVEL: Very dense sand and gravel, trace to some silt, numerous cobbles, damp	3	SS	64
2.1 / 333.1	SAND: Compact to dense brown sand, trace to some silt, trace gravel, occasional cobbles, saturated	4	SS	34
		5	SS	31
		6	SS	30
		7	SS	26
7.7 / 8.1 / 327.1	SILT: Dense brown silt, trace sand, trace gravel, wet BOREHOLE TERMINATED AT 8.1 m	8	SS	39

SHEAR STRENGTH C_u (kPa) 50 100 150 200
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST ●
BLOWS/0.3M 20 40 60 80

LIQUID LIMIT ____ W_L
PLASTIC LIMIT ____ W_P
WATER CONTENT ___ W
W_P W W_L
WATER CONTENT % 10 20 30

UNIT WEIGHT γ kN/m³

GROUND WATER OBSERVATIONS AND REMARKS

Stick up
GR SA SI&CL
Concrete
Sampler wet from SS4
Bentonite Seal
50 mm Plastic Riser
FIlter Sand
Screen

Water Level Readings:
Initial: 3.40 m
Elevation: 331.76

2017-04: 2.51 m
Elevation: 332.45

NOTES: Headspace: SS1 0ppm, SS2 0ppm, SS3 0ppm, SS4 0ppm, SS5 5ppm, SS6 0ppm, SS7 0ppm, SS8 0ppm

WATER LEVEL OBSERVED DURING / UPON COMPLETION OF DRILLING
WATER LEVEL MEASURED IN MONITORING WELL

UNDISTURBED FIELD VANE
REMOLDED FIELD VANE
LAB SHEAR TEST
POCKET PENETROMETER
POCKET TORVANE

CHECKED BY KH

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. 3

PROJECT Proposed Arkell Road Subdivision
LOCATION Arkell Road, Guelph, Ontario
BORING METHOD Continuous Flight Hollow Stem Augers
BORING DATE: 2017 02 13
PML REF.: 17KF002
ENGINEER K. Hanes
TECHNICIAN H. Shinwary

DEPTH in METRES	DESCRIPTION	LEGEND	NUMBER	TYPE	BLOWS/0.3m N - VALUES	ELEVATION SCALE
	GROUND ELEVATION 334.42					
0.20	TOPSOIL: Dark brown silt, trace sand, numerous rootlets, moist		1	SS	5	334
0.51 / 333.91	SILT: Loose dark brown silt, some sand, occasional rootlets		2	SS	3	
1.4 / 333.1	SAND AND GRAVEL: Very loose brown sand and gravel, trace to some silt, occasional cobbles, damp becoming compact, saturated		3	SS	35	333
			4	SS	31	332
2.9 / 331.5	SAND: Compact to dense brown sand, trace to some silt, trace gravel, occasional cobbles, saturated		5	SS	24	331
			6	SS	42	330
			7	SS	27	329
7.8			8	SS	21	328
8.0 / 326.4	SILT: Compact brown silt, trace sand, trace gravel, wet BOREHOLE TERMINATED AT 8.0 m					327

SHEAR STRENGTH C_u (kPa) 50 100 150 200
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST ●
BLOWS/0.3M 20 40 60 80

LIQUID LIMIT _____ W_L
PLASTIC LIMIT ____ W_P
WATER CONTENT ___ W
W_P W W_L
WATER CONTENT % 10 20 30

UNIT WEIGHT γ kN/m^3

GROUND WATER OBSERVATIONS AND REMARKS

Stick up
Concrete
Sampler wet from SS3
Bentonite Seal
50 mm Plastic Riser
FIlter Sand
Screen

Water Level Readings:
Initial: 1.95 m
Elevation: 332.47

2017-04: 1.86 m
Elevation: 332.56

NOTES: Headspace: SS1 0ppm, SS2 0ppm, SS3 0ppm, SS4 0ppm, SS5 5ppm, SS6 0ppm, SS7 5ppm, SS8 0ppm

WATER LEVEL OBSERVED DURING / UPON COMPLETION OF DRILLING
WATER LEVEL MEASURED IN MONITORING WELL

+ UNDISTURBED FIELD VANE
⊕ REMOLDED FIELD VANE
⊛ LAB SHEAR TEST
▲ POCKET PENETROMETER
◆ POCKET TORVANE

CHECKED BY KH

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. 4

PROJECT Proposed Arkell Road Subdivision
LOCATION Arkell Road, Guelph, Ontario
BORING METHOD Continuous Flight Hollow Stem Augers
BORING DATE: 2017 03 21
PML REF.: 17KF002
ENGINEER K. Hanes
TECHNICIAN H. Shinwary

DEPTH in METRES	DESCRIPTION	NUMBER	TYPE	BLOWS/0.3m N - VALUES	ELEVATION SCALE
	GROUND ELEVATION 334.13				
0.30	TOPSOIL: Dark brown silt, trace sand, numerous rootlets, moist	1	SS	6	334
0.69 / 333.44	SAND AND GRAVEL: Compact brown sand and gravel, trace to some silt, occasional cobbles, moist	2	SS	13	333
1.5	becoming saturated				
332.7	SAND: Compact brown sand, trace to some silt, trace gravel, saturated	3	SS	14	332
		4	SS	11	
		5	SS	12	331
		6	SS	18	330
		7	SS	10	329
		8	SS	25	328
8.1 / 326.0	BOREHOLE TERMINATED AT 8.1 m				327

SHEAR STRENGTH C_u (kPa) 50 100 150 200
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST ●
BLOWS/0.3M 20 40 60 80

LIQUID LIMIT _____ W_L
PLASTIC LIMIT ____ W_P
WATER CONTENT ___ W
W_P W W_L
WATER CONTENT % 10 20 30

UNIT WEIGHT γ kN/m³

GROUND WATER OBSERVATIONS AND REMARKS

Stick up
GR SA SI&CL
Concrete
Sampler wet from SS2
Bentonite Seal
FIlter Sand
Screen

Water Level Readings:
Initial: 0.75 m
Elevation: 333.38

2017-04: 0.44 m
Elevation: 333.55

NOTES: Headspace: SS1 0ppm, SS2 5ppm, SS3 0ppm, SS4 5ppm, SS5 0ppm, SS6 0ppm, SS7 0ppm, SS8 0ppm

WATER LEVEL OBSERVED DURING / UPON COMPLETION OF DRILLING
WATER LEVEL MEASURED IN MONITORING WELL

UNDISTURBED FIELD VANE
REMOLDED FIELD VANE
LAB SHEAR TEST
POCKET PENETROMETER
POCKET TORVANE

CHECKED BY KH

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. 5

PROJECT Proposed Arkell Road Subdivision
LOCATION Arkell Road, Guelph, Ontario
BORING METHOD Continuous Flight Hollow Stem Augers
BORING DATE: 2017 03 21
PML REF.: 17KF002
ENGINEER K. Hanes
TECHNICIAN H. Shinwary

DEPTH in METRES	DESCRIPTION	NUMBER	TYPE	BLOWS/0.3m N - VALUES	ELEVATION SCALE
	GROUND ELEVATION 334.97				
0.25 / 334.72	TOPSOIL: Dark brown silt, trace sand, trace gravel, numerous rootlets, damp	1	SS	13	
	SAND AND GRAVEL: Dense brown sand and gravel, trace to some silt, numerous cobbles, damp	2	SS	49	334
		3	SS	31	
2.2 / 332.8	SAND: Compact brown sand, some gravel, trace to some silt, occasional cobbles, saturated	4	SS	24	333
		5	SS	27	332
		6	SS	14	331
5.6 / 329.4	becoming very dense	7	SS	51	330
7.1 / 327.9	SAND AND GRAVEL: Very dense brown sand and gravel, trace silt, numerous cobbles, saturated	8	SS	52	329
8.1 / 326.9	BOREHOLE TERMINATED AT 8.1 m				328
					327

SHEAR STRENGTH C_u (kPa) 50 100 150 200
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST ●
BLOWS/0.3M 20 40 60 80

LIQUID LIMIT ____ W_L
PLASTIC LIMIT ____ W_P
WATER CONTENT ___ W
W_P W W_L
WATER CONTENT % 10 20 30

UNIT WEIGHT γ kN/m³

GROUND WATER OBSERVATIONS AND REMARKS

Stick up
GR SA SI&CL
Concrete
Sampler wet from SS4
Bentonite Seal
FIlter Sand
Screen

Water Level Readings:
Initial: 2.3 m
Elevation: 332.67

2017-04: 2.18 m
Elevation: 332.65

NOTES: Headspace: SS1 0ppm, SS2 0ppm, SS3 5ppm, SS4 5ppm, SS5 0ppm, SS6 0ppm, SS7 0ppm, SS8 0ppm

WATER LEVEL OBSERVED DURING / UPON COMPLETION OF DRILLING
WATER LEVEL MEASURED IN MONITORING WELL

UNDISTURBED FIELD VANE
REMOLDED FIELD VANE
LAB SHEAR TEST
POCKET PENETROMETER
POCKET TORVANE

CHECKED BY KH

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. 6

PROJECT Proposed Arkell Road Subdivision
LOCATION Arkell Road, Guelph, Ontario
BORING METHOD Continuous Flight Hollow Stem Augers
BORING DATE: 2017 03 21
PML REF.: 17KF002
ENGINEER K. Hanes
TECHNICIAN H. Shinwary

DEPTH in METRES	DESCRIPTION	LEGEND	NUMBER	TYPE	BLOWS/0.3m N - VALUES	ELEVATION SCALE
	GROUND ELEVATION 334.0					
0.20	TOPSOIL: Dark brown silt, trace sand, numerous rootlets, damp		1	SS	18	
0.41						
0.69	FILL: Dark brown silt, some sand, trace gravel, occasional rootlets, damp					
333.31			2	SS	45	333
1.5	SAND AND GRAVEL: Dense brown sand and gravel, trace to some silt, numerous cobbles, damp					
332.6	becoming moist		3	SS	36	
2.2	becoming saturated					332
331.8	SILT: Compact brown silt, trace sand, trace gravel, trace clay, wet to saturated		4	SS	12	
			5	SS	10	331
						330
			6	SS	16	
5.8						329
328.2	SILT TILL: Very dense brown silt, some sand, some gravel, occasional cobbles, damp		7	SS	50/75mm	328
6.6						
327.4	BOREHOLE TERMINATED AT 6.6 m					

SHEAR STRENGTH C_u (kPa) 50 100 150 200
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST ●
BLOWS/0.3M 20 40 60 80

LIQUID LIMIT ____ W_L
PLASTIC LIMIT ____ W_P
WATER CONTENT ___ W
W_P W W_L
WATER CONTENT % 10 20 30

UNIT WEIGHT γ kN/m³

GROUND WATER OBSERVATIONS AND REMARKS

GR SA SI&CL

Sampler wet from SS3

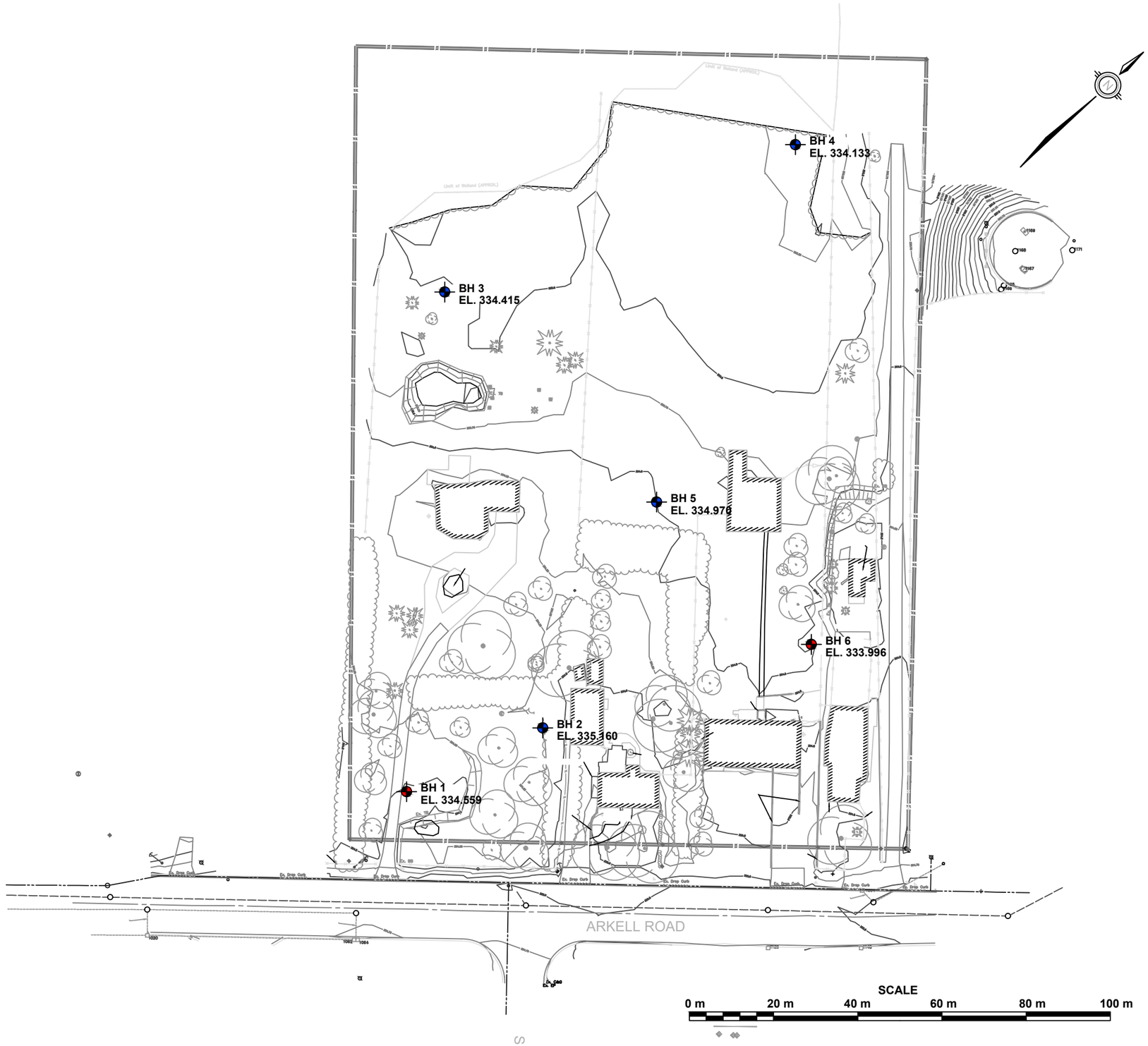
Upon completion of augering
Cave to 2.0 m
Free water at 1.83 m

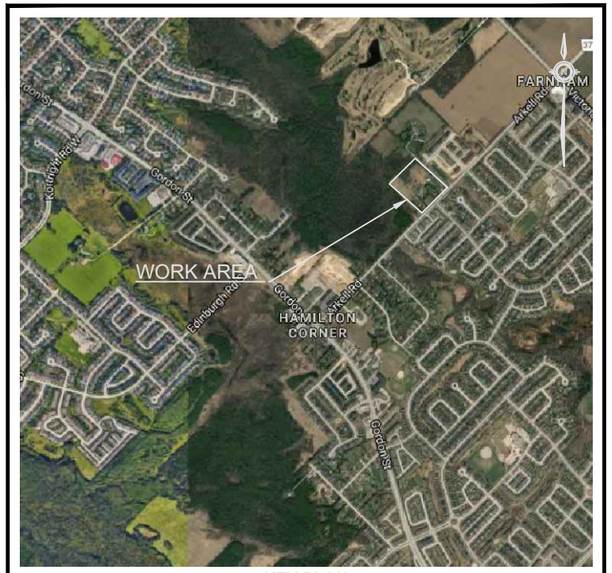
NOTES: Headspace: SS1 0ppm, SS2 0ppm, SS3 0ppm, SS4 5ppm, SS5 0ppm, SS6 0ppm, SS7 0ppm

WATER LEVEL OBSERVED DURING / UPON COMPLETION OF DRILLING
WATER LEVEL MEASURED IN MONITORING WELL

UNDISTURBED FIELD VANE
REMOLDED FIELD VANE
LAB SHEAR TEST
POCKET PENETROMETER
POCKET TORVANE

CHECKED BY KH





KEY PLAN

LEGEND:

- BOREHOLE
- BOREHOLE WITH MONITORING WELL

REFERENCE:

BOREHOLE LOCATION PLAN REPRODUCED FROM DRAWING SUPPLIED BY CLIENT.

NOTE:

THE INFERRED STRATIGRAPHY REFERRED TO IN THE REPORT IS BASED ON THE DATA FROM THESE BOREHOLES SUPPLEMENTED BY GEOLOGICAL EVIDENCE. THE ACTUAL STRATIGRAPHY BETWEEN THE BOREHOLES MAY VARY.

CRESCENT HOMES

PROPOSED ARKELL ROAD SUBDIVISION

ARKELL ROAD

GUELPH, ONTARIO

BOREHOLE LOCATION PLAN

Peto MacCallum Ltd.
CONSULTING ENGINEERS

DRAWN	D. BRICE	DATE	SCALE	PML REF.	DWG. NO.
CHECKED	H. SHINWARY	OCTOBER 201□	AS SHOWN	17KF002	1
APPROVED	W. LOGHRIN				

APPENDIX A

ENGINEERED FILL

ENGINEERED FILL

The information presented in this appendix is intended for general guidance only. Site specific conditions and prevailing weather may require modification of compaction standards, backfill type or procedures. Each site must be discussed, and procedures agreed with Peto MacCallum Ltd. prior to the start of the earthworks and must be subject to ongoing review during construction. This appendix is not intended to apply to embankments. Steeply sloping ravine residential lots require special consideration.

For fill to be classified as engineered fill suitable for supporting structural loads, a number of conditions must be satisfied, including but not necessarily limited to the following:

1. Purpose

The site specific purpose of the engineered fill must be recognized. In advance of construction, all parties should discuss the project and its requirements and agree on an appropriate set of standards and procedures.

2. Minimum Extent

The engineered fill envelope must extend beyond the footprint of the structure to be supported. The minimum extent of the envelope should be defined from a geotechnical perspective by:

- at founding level, extend a minimum 1.0 m beyond the outer edge of the foundations, greater if adequate layout has not yet been completed as noted below; and
- extend downward and outward at a slope no greater than 45° to meet the subgrade

All fill within the envelope established above must meet the requirements of engineered fill in order to support the structure safely. Other considerations such as survey control, or construction methods may require an envelope that is larger, as noted in the following sections.

Once the minimum envelope has been established, structures must not be moved or extended without consultation with Peto MacCallum Ltd. Similarly, Peto MacCallum Ltd. should be consulted prior to any excavation within the minimum envelope.

3. Survey Control

Accurate survey control is essential to the success of an engineered fill project. The boundaries of the engineered fill must be laid out by a surveyor in consultation with engineering staff from Peto MacCallum Ltd. Careful consideration of the maximum building envelope is required.

During construction it is necessary to have a qualified surveyor provide total station control on the three dimensional extent of filling.

4. Subsurface Preparation

Prior to placement of fill, the subgrade must be prepared to the satisfaction of Peto MacCallum Ltd. All deleterious material must be removed and in some cases, excavation of native mineral soils may be required.

Particular attention must be paid to wet subgrades and possible additional measures required to achieve sufficient compaction. Where fill is placed against a slope, benching may be necessary and natural drainage paths must not be blocked.

5. Suitable Fill Materials

All material to be used as fill must be approved by Peto MacCallum Ltd. Such approval will be influenced by many factors and must be site and project specific. External fill sources must be sampled, tested and approved prior to material being hauled to site.

6. Test Section

In advance of the start of construction of the engineered fill pad, the Contractor should conduct a test section. The compaction criterion will be assessed in consultation with Peto MacCallum Ltd. for the various fill material types using different lift thicknesses and number of passes for the compaction equipment proposed by the Contractor.

Additional test sections may be required throughout the course of the project to reflect changes in fill sources, natural moisture content of the material and weather conditions.

The Contractor should be particularly aware of changes in the moisture content of fill material. Site review by Peto MacCallum Ltd. is required to ensure the desired lift thickness is maintained and that each lift is systematically compacted, tested and approved before a subsequent lift is commenced.

7. Inspection and Testing

Uniform, thorough compaction is crucial to the performance of the engineered fill and the supported structure. Hence, all subgrade preparation, filling and compacting must be carried out under the full time inspection by Peto MacCallum Ltd.

All founding surfaces for all buildings and residential dwellings or any part thereof (including but not limited to footings and floor slabs) on structural fill or native soils must be inspected and approved by PML engineering personnel prior to placement of the base/subbase granular material and/or concrete. The purpose of the inspection is to ensure the subgrade soils are capable of supporting the building/house foundation and floor slab loads and to confirm the building/house envelope does not extend beyond the limits of any structural fill pads.

8. Protection of Fill

Fill is generally more susceptible to the effects of weather than natural soil. Fill placed and approved to the level at which structural support is required must be protected from excessive wetting, drying, erosion or freezing. Where adequate protection has not been provided, it may be necessary to provide deeper footings or to strip and recompact some of the fill.

9. Construction Delay Time Considerations

The integrity of the fill pad can deteriorate due to the harsh effects of our Canadian weather. Hence, particular care must be taken if the fill pad is constructed over a long time period.

It is necessary therefore, that all fill sources are tested to ensure the material compactability prior to the soil arriving at site. When there has been a lengthy delay between construction periods of the fill pad, it is necessary to conduct subgrade proof rolling, test pits or boreholes to verify the adequacy of the exposed subgrade to accept new fill material.

When the fill pad will be constructed over a lengthy period of time, a field survey should be completed at the end of each construction season to verify the areal extent and the level at which the compacted fill has been brought up to, tested and approved.

In the following spring, subexcavation may be necessary if the fill pad has been softened attributable to ponded surface water or freeze/thaw cycles.

A new survey is required at the beginning of the next construction season to verify that random dumping and/or spreading of fill has not been carried out at the site.

10. Approved Fill Pad Surveillance

It should be appreciated that once the fill pad has been brought to final grade and documented by field survey, there must be ongoing surveillance to ensure that the integrity of the fill pad is not threatened.

Grading operations adjacent to fill pads can often take place several months or years after completion of the fill pad.

It is imperative that all site management and supervision staff, the staff of Contractors and earthwork operators be fully aware of the boundaries of all approved engineered fill pads.

Excavation into an approved engineered fill pad should never be contemplated without the full knowledge, approval and documentation by the geotechnical consultant.

If the fill pad is knowingly built several years in advance of ultimate construction, the areal limits of the fill pad should be substantially overbuilt laterally to allow for changes in possible structure location and elevation and other earthwork operations and competing interests on the site. The overbuilt distance required is project and/or site specified.

Iron bars should be placed at the corner/intermediate points of the fill pad as a permanent record of the approved limits of the work for record keeping purposes.

11. Unusual Working Conditions

Construction of fill pads may at times take place at night and/or during periods of freezing weather conditions because of the requirements of the project schedule. It should be appreciated therefore, that both situations present more difficult working conditions. The Owner, Contractor, Design Consultant and Geotechnical Engineer must be willing to work together to revise site construction procedures, enhance field testing and surveillance, and incorporate design modifications as necessary to suit site conditions.

When working at night there must be sufficient artificial light to properly illuminate the fill pad and borrow areas.

Placement of material to form an engineered fill pad during winter and freezing temperatures has its own special conditions that must be addressed. It is imperative that each day prior to placement of new fill, the exposed subgrade must be inspected and any overnight snow or frozen material removed. Particular attention should be given to the borrow source inspection to ensure only nonfrozen fill is brought to the site.

The Contractor must continually assess the work program and have the necessary spreading and compacting equipment to ensure that densification of the fill material takes place in a minimum amount of time. Changes may be required to the spreading methods, lift thickness, and compaction techniques to ensure the desired compaction is achieved uniformly throughout each fill lift.

The Contractor should adequately protect the subgrade at the end of each shift to minimize frost penetration overnight. Since water cannot be added to the fill material to facilitate compaction, it is imperative that densification of the fill be achieved by additional compaction effort and an appropriate reduced lift thickness. Once the fill pad has been completed, it must be properly protected from freezing temperatures and ponding of water during the spring thaw period.

If the pad is unusually thick or if the fill thickness varies dramatically across the width or length of the fill pad, Peto MacCallum Ltd. should be consulted for additional recommendations. In this case, alternative special provisions may be recommended, such as providing a surcharge preload for a limited time or increase the degree of compaction of the fill.

APPENDIX B

STATEMENT OF LIMITATIONS

STATEMENT OF LIMITATIONS

This report is prepared for and made available for the sole use of the client named. Peto MacCallum Ltd. (PML) hereby disclaims any liability or responsibility to any person or entity, other than those for whom this report is specifically issued, for any loss, damage, expenses, or penalties that may arise or result from the use of any information or recommendations contained in this report. The contents of this report may not be used or relied upon by any other person without the express written consent and authorization of PML.

This report shall not be relied upon for any purpose other than as agreed with the client named without the written consent of PML. It shall not be used to express or imply warranty as to the fitness of the property for a particular purpose. A portion of this report may not be used as a separate entity: that is to say the report is to be read in its entirety at all times.

The report is based solely on the scope of services which are specifically referred to in this report. No physical or intrusive testing has been performed, except as specifically referenced in this report. This report is not a certification of compliance with past or present regulations, codes, guidelines and policies.

The scope of services carried out by PML is based on details of the proposed development and land use to address certain issues, purposes and objectives with respect to the specific site as identified by the client. Services not expressly set forth in writing are expressly excluded from the services provided by PML. In other words, PML has not performed any observations, investigations, study analysis, engineering evaluation or testing that is not specifically listed in the scope of services in this report. PML assumes no responsibility or duty to the client for any such services and shall not be liable for failing to discover any condition, whose discovery would require the performance of services not specifically referred to in this report.

The findings an comments made by PML in this report are based on the conditions observed at the time of PML's site reconnaissance. No assurances can be made and no assurances are given with respect to any potential changes in site conditions following the time of completion of PML's field work. Furthermore, regulations, codes and guidelines may change at any time subsequent to the date of this report and these changes may effect the validity of the findings and recommendations given in this report.

STATEMENT OF LIMITATIONS

The results and conclusions with respect to site conditions are therefore in no way intended to be taken as a guarantee or representation, expressed or implied, that the site is free from any contaminants from past or current land use activities or that the conditions in all areas of the site and beneath or within structures are the same as those areas specifically sampled.

Any investigation, examination, measurements or sampling explorations at a particular location may not be representative of conditions between sampled locations. Soil, ground water, surface water, or building material conditions between and beyond the sampled locations may differ from those encountered at the sampling locations and conditions may become apparent during construction which could not be detected or anticipated at the time of the intrusive sampling investigation.

Budget estimates contained in this report are to be viewed as an engineering estimate of probable costs and provided solely for the purposes of assisting the client in its budgeting process. It is understood and agreed that PML will not in any way be held liable as a result of any budget figures provided by it.

The Client expressly waives its right to withhold PML's fees, either in whole or in part, or to make any claim or commence any action or bring any other proceedings, whether in contract, tort, or otherwise against PML in anyway connected with advice or information given by PML relating to the cost estimate or Environmental Remediation/Cleanup and Restoration or Soil and Ground Water Management Plan Cost Estimate.

APPENDIX C

AGAT CERTIFICATES OF ANALYSIS

O.Reg. 153/04, As Amended, Table 1 Standards (Soil)

(Residential / Parkland / Institutional / Industrial / Commercial / Community Property Use)

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

CLIENT NAME: PETO MACCALLUM LIMITED
16 FRANKLIN STREET SOUTH
KITCHENER, ON N2C1R4
(519) 893-7500

ATTENTION TO: Ken Hanes

PROJECT: 17KF002

AGAT WORK ORDER: 17T199091

SOIL ANALYSIS REVIEWED BY: Amanjot Bhela, Inorganic Coordinator

TRACE ORGANICS REVIEWED BY: Neli Popnikolova, Senior Chemist

DATE REPORTED: Apr 18, 2017

PAGES (INCLUDING COVER): 7

VERSION*: 1

Should you require any information regarding this analysis please contact your client services representative at (905) 712-5100

*NOTES

All samples will be disposed of within 30 days following analysis. Please contact the lab if you require additional sample storage time.

AGAT Laboratories

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http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 17T199091

PROJECT: 17KF002

CLIENT NAME: PETO MACCALLUM LIMITED

ATTENTION TO: Ken Hanes

SAMPLING SITE:

SAMPLED BY:

O. Reg. 153(511) - Metals & Inorganics (Soil)

DATE RECEIVED: 2017-03-23

DATE REPORTED: 2017-04-18

		SAMPLE DESCRIPTION:		BH4-SS1	BH5-SS1	BH6-SS1
		SAMPLE TYPE:		Soil	Soil	Soil
		DATE SAMPLED:		2017-03-21	2017-03-21	2017-03-21
Parameter	Unit	G / S	RDL	8276142	8276150	8276151
Antimony	µg/g	1.3	0.8	<0.8	<0.8	<0.8
Arsenic	µg/g	18	1	3	5	6
Barium	µg/g	220	2	15	45	48
Beryllium	µg/g	2.5	0.5	<0.5	<0.5	<0.5
Boron	µg/g	36	5	6	6	<5
Boron (Hot Water Soluble)	µg/g	NA	0.10	0.17	0.23	0.27
Cadmium	µg/g	1.2	0.5	<0.5	0.7	0.6
Chromium	µg/g	70	2	8	13	13
Cobalt	µg/g	21	0.5	1.9	4.4	4.9
Copper	µg/g	92	1	8	11	11
Lead	µg/g	120	1	40	62	53
Molybdenum	µg/g	2	0.5	0.6	0.9	0.5
Nickel	µg/g	82	1	5	10	10
Selenium	µg/g	1.5	0.4	<0.4	0.4	0.5
Silver	µg/g	0.5	0.2	<0.2	<0.2	<0.2
Thallium	µg/g	1	0.4	<0.4	<0.4	<0.4
Uranium	µg/g	2.5	0.5	0.5	0.5	0.5
Vanadium	µg/g	86	1	11	22	24
Zinc	µg/g	290	5	182	313	254
Chromium VI	µg/g	0.66	0.2	<0.2	<0.2	<0.2
Cyanide	µg/g	0.051	0.040	<0.040	<0.040	<0.040
Mercury	µg/g	0.27	0.10	<0.10	<0.10	<0.10
Electrical Conductivity	mS/cm	0.57	0.005	0.177	0.233	0.173
Sodium Adsorption Ratio	NA	2.4	NA	0.125	0.142	0.053
pH, 2:1 CaCl2 Extraction	pH Units		NA	6.74	6.90	7.07

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to Table 1: Full Depth Background Site Condition Standards - Soil - Residential/Parkland/Institutional/Industrial/Commercial/Community Property Use

8276142-8276151 EC & SAR were determined on the DI water extract obtained from the 2:1 leaching procedure (2 parts DI water:1 part soil). pH was determined on the 0.01M CaCl2 extract prepared at 2:1 ratio.

Certified By: Amanjot Bhela

AGAT Laboratories

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http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 17T199091

PROJECT: 17KF002

CLIENT NAME: PETO MACCALLUM LIMITED

ATTENTION TO: Ken Hanes

SAMPLING SITE:

SAMPLED BY:

O. Reg. 153(511) - OC Pesticides (Soil)

DATE RECEIVED: 2017-03-23

DATE REPORTED: 2017-04-18

		SAMPLE DESCRIPTION:		BH4-SS1	BH6-SS1
		SAMPLE TYPE:		Soil	Soil
		DATE SAMPLED:		2017-03-21	2017-03-21
Parameter	Unit	G / S	RDL	8276142	8276151
Hexachloroethane	µg/g	0.01	0.01	<0.01	<0.01
Gamma-Hexachlorocyclohexane	µg/g	0.01	0.005	<0.005	<0.005
Heptachlor	µg/g	0.05	0.005	<0.005	<0.005
Aldrin	µg/g	0.05	0.005	<0.005	<0.005
Heptachlor Epoxide	µg/g	0.05	0.005	<0.005	<0.005
Endosulfan	µg/g	0.04	0.005	<0.005	<0.005
Chlordane	µg/g	0.05	0.007	<0.007	<0.007
DDE	µg/g	0.05	0.007	<0.007	<0.007
DDD	µg/g	0.05	0.007	<0.007	<0.007
DDT	µg/g	1.4	0.007	<0.007	<0.007
Dieldrin	µg/g	0.05	0.005	<0.005	<0.005
Endrin	µg/g	0.04	0.005	<0.005	<0.005
Methoxychlor	µg/g	0.05	0.005	<0.005	<0.005
Hexachlorobenzene	µg/g	0.01	0.005	<0.005	<0.005
Hexachlorobutadiene	µg/g	0.01	0.01	<0.01	<0.01
Moisture Content	%		0.1	33.0	6.7
Surrogate	Unit	Acceptable Limits			
TCMX	%	50-140		70	66
Decachlorobiphenyl	%	60-130		72	88

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to Table 1: Full Depth Background Site Condition Standards - Soil - Residential/Parkland/Institutional/Industrial/Commercial/Community Property Use

8276142-8276151 Results are based on the dry weight of the soil.
Note: DDT applies to the total of op'DDT and pp'DDT, DDD applies to the total of op'DDD and pp'DDD and DDE applies to the total of op'DDE and pp'DDE. Endosulfan applies to the total of Endosulfan I and Endosulfan II.
Chlordane applies to the total of Alpha-Chlordane and Gamma-Chlordane.

Certified By: N Popnikolof

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
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TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Guideline Violation

AGAT WORK ORDER: 17T199091

PROJECT: 17KF002

CLIENT NAME: PETO MACCALLUM LIMITED

ATTENTION TO: Ken Hanes

SAMPLEID	SAMPLE TITLE	GUIDELINE	ANALYSIS PACKAGE	PARAMETER	UNIT	GUIDEVALUE	RESULT
8276150	BH5-SS1	ON T1 S RPI/ICC	O. Reg. 153(511) - Metals & Inorganics (Soil)	Zinc	µg/g	290	313

AGAT Laboratories

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http://www.agatlabs.com

Quality Assurance

CLIENT NAME: PETO MACCALLUM LIMITED

AGAT WORK ORDER: 17T199091

PROJECT: 17KF002

ATTENTION TO: Ken Hanes

SAMPLING SITE:

SAMPLED BY:

Soil Analysis

RPT Date: Apr 18, 2017			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
O. Reg. 153(511) - Metals & Inorganics (Soil)															
Antimony	8272855		3.6	3.6	NA	< 0.8	126%	70%	130%	105%	80%	120%	96%	70%	130%
Arsenic	8272855		9	7	25.0%	< 1	108%	70%	130%	105%	80%	120%	103%	70%	130%
Barium	8272855		76	75	1.3%	< 2	101%	70%	130%	98%	80%	120%	101%	70%	130%
Beryllium	8272855		<0.5	<0.5	NA	< 0.5	83%	70%	130%	105%	80%	120%	89%	70%	130%
Boron	8272855		6	6	NA	< 5	82%	70%	130%	107%	80%	120%	93%	70%	130%
Boron (Hot Water Soluble)	8272855		0.41	0.42	NA	< 0.10	112%	60%	140%	103%	70%	130%	99%	60%	140%
Cadmium	8272855		0.8	0.8	NA	< 0.5	110%	70%	130%	106%	80%	120%	105%	70%	130%
Chromium	8272855		18	18	0.0%	< 2	96%	70%	130%	114%	80%	120%	112%	70%	130%
Cobalt	8272855		5.5	5.5	0.0%	< 0.5	102%	70%	130%	110%	80%	120%	99%	70%	130%
Copper	8272855		63	62	1.6%	< 1	101%	70%	130%	117%	80%	120%	85%	70%	130%
Lead	8272855		190	197	3.6%	< 1	105%	70%	130%	101%	80%	120%	70%	70%	130%
Molybdenum	8272855		1.3	1.3	NA	< 0.5	107%	70%	130%	103%	80%	120%	105%	70%	130%
Nickel	8272855		24	25	4.1%	< 1	103%	70%	130%	112%	80%	120%	100%	70%	130%
Selenium	8272855		0.9	1.0	NA	< 0.4	128%	70%	130%	99%	80%	120%	106%	70%	130%
Silver	8272855		<0.2	<0.2	NA	< 0.2	98%	70%	130%	115%	80%	120%	110%	70%	130%
Thallium	8272855		<0.4	<0.4	NA	< 0.4	103%	70%	130%	104%	80%	120%	98%	70%	130%
Uranium	8272855		<0.5	<0.5	NA	< 0.5	98%	70%	130%	93%	80%	120%	95%	70%	130%
Vanadium	8272855		20	20	0.0%	< 1	99%	70%	130%	109%	80%	120%	109%	70%	130%
Zinc	8272855		205	199	3.0%	< 5	102%	70%	130%	117%	80%	120%	84%	70%	130%
Chromium VI	8277762		<0.2	<0.2	NA	< 0.2	93%	70%	130%	98%	80%	120%	100%	70%	130%
Cyanide	8278916		<0.040	<0.040	NA	< 0.040	102%	70%	130%	108%	80%	120%	94%	70%	130%
Mercury	8272855		0.15	0.17	NA	< 0.10	100%	70%	130%	88%	80%	120%	93%	70%	130%
Electrical Conductivity	8277893		0.376	0.369	1.9%	< 0.005	93%	90%	110%	NA			NA		
Sodium Adsorption Ratio	8276363		0.057	0.053	7.3%	NA	NA			NA			NA		
pH, 2:1 CaCl2 Extraction	8277854		7.37	7.42	0.7%	NA	101%	80%	120%	NA			NA		

Comments: NA signifies Not Applicable.
Duplicate Qualifier: As the measured result approaches the RL, the uncertainty associated with the value increases dramatically, thus duplicate acceptance limits apply only where the average of the two duplicates is greater than five times the RL.

Certified By: Amanjot Bhela

AGAT Laboratories

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Quality Assurance

CLIENT NAME: PETO MACCALLUM LIMITED

AGAT WORK ORDER: 17T199091

PROJECT: 17KF002

ATTENTION TO: Ken Hanes

SAMPLING SITE:

SAMPLED BY:

Trace Organics Analysis

RPT Date: Apr 18, 2017			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
O. Reg. 153(511) - OC Pesticides (Soil)															
Hexachloroethane	8267227		< 0.01	< 0.01	NA	< 0.01	82%	50%	140%	96%	50%	140%	64%	50%	140%
Gamma-Hexachlorocyclohexane	8267227		< 0.005	< 0.005	NA	< 0.005	92%	50%	140%	78%	50%	140%	66%	50%	140%
Heptachlor	8267227		< 0.005	< 0.005	NA	< 0.005	80%	50%	140%	90%	50%	140%	80%	50%	140%
Aldrin	8267227		< 0.005	< 0.005	NA	< 0.005	109%	50%	140%	94%	50%	140%	68%	50%	140%
Heptachlor Epoxide	8267227		< 0.005	< 0.005	NA	< 0.005	90%	50%	140%	96%	50%	140%	82%	50%	140%
Endosulfan	8267227		< 0.005	< 0.005	NA	< 0.005	89%	50%	140%	88%	50%	140%	69%	50%	140%
Chlordane	8267227		< 0.007	< 0.007	NA	< 0.007	87%	50%	140%	91%	50%	140%	78%	50%	140%
DDE	8267227		< 0.007	< 0.007	NA	< 0.007	88%	50%	140%	98%	50%	140%	78%	50%	140%
DDD	8267227		< 0.007	< 0.007	NA	< 0.007	94%	50%	140%	94%	50%	140%	84%	50%	140%
DDT	8267227		< 0.007	< 0.007	NA	< 0.007	88%	50%	140%	87%	50%	140%	78%	50%	140%
Dieldrin	8267227		< 0.005	< 0.005	NA	< 0.005	84%	50%	140%	90%	50%	140%	80%	50%	140%
Endrin	8267227		< 0.005	< 0.005	NA	< 0.005	84%	50%	140%	76%	50%	140%	82%	50%	140%
Methoxychlor	8267227		< 0.005	< 0.005	NA	< 0.005	76%	50%	140%	82%	50%	140%	96%	50%	140%
Hexachlorobenzene	8267227		< 0.005	< 0.005	NA	< 0.005	92%	50%	140%	100%	50%	140%	92%	50%	140%
Hexachlorobutadiene	8267227		< 0.01	< 0.01	NA	< 0.01	93%	50%	140%	100%	50%	140%	68%	50%	140%

Comments: When the average of the sample and duplicate results is less than 5x the RDL, the Relative Percent Difference (RPD) will be indicated as Not Applicable (NA).

Certified By: N Popnikolof

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Method Summary

CLIENT NAME: PETO MACCALLUM LIMITED

AGAT WORK ORDER: 17T199091

PROJECT: 17KF002

ATTENTION TO: Ken Hanes

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Soil Analysis			
Antimony	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Arsenic	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Barium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Beryllium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Boron	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Boron (Hot Water Soluble)	MET-93-6104	EPA SW 846 6010C; MSA, Part 3, Ch.21	ICP/OES
Cadmium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Chromium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Cobalt	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Copper	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Lead	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Molybdenum	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Nickel	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Selenium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Silver	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Thallium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Uranium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Vanadium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Zinc	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Chromium VI	INOR-93-6029	SM 3500 B; MSA Part 3, Ch. 25	SPECTROPHOTOMETER
Cyanide	INOR-93-6052	MOE CN-3015 & E 3009 A;SM 4500 CN	TECHNICON AUTO ANALYZER
Mercury	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Electrical Conductivity	INOR-93-6036	McKeague 4.12, SM 2510 B	EC METER
Sodium Adsorption Ratio	INOR-93-6007	McKeague 4.12 & 3.26 & EPA SW-846 6010B	ICP/OES
pH, 2:1 CaCl2 Extraction	INOR-93-6031	MSA part 3 & SM 4500-H+ B	PH METER
Trace Organics Analysis			
Hexachloroethane	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
Gamma-Hexachlorocyclohexane	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
Heptachlor	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
Aldrin	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
Heptachlor Epoxide	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
Endosulfan	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
Chlordane	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
DDE	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
DDD	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
DDT	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
Dieldrin	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
Endrin	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
Methoxychlor	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
Hexachlorobenzene	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
Hexachlorobutadiene	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
TCMX	ORG-91-5112	EPA SW-846 3541,3620 & 8081	GC/ECD
Decachlorobiphenyl	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
Moisture Content		MOE E3139	BALANCE

AGAT Laboratories

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CLIENT NAME: PETO MACCALLUM LIMITED
16 FRANKLIN STREET SOUTH
KITCHENER, ON N2C1R4
(519) 893-7500

ATTENTION TO: Ken Hanes

PROJECT: 17KF002

AGAT WORK ORDER: 17W201248

SOIL ANALYSIS REVIEWED BY: Sofka Pehlyova, Senior Analyst

DATE REPORTED: Apr 10, 2017

PAGES (INCLUDING COVER): 5

VERSION*: 1

Should you require any information regarding this analysis please contact your client services representative at (905) 712-5100

*NOTES

All samples will be disposed of within 30 days following analysis. Please contact the lab if you require additional sample storage time.

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Certificate of Analysis

AGAT WORK ORDER: 17W201248

PROJECT: 17KF002

CLIENT NAME: PETO MACCALLUM LIMITED

ATTENTION TO: Ken Hanes

SAMPLING SITE:

SAMPLED BY:H. Shinwary

O. Reg. 153(511) - Metals & Inorganics (Soil)

DATE RECEIVED: 2017-03-30

DATE REPORTED: 2017-04-10

		SAMPLE DESCRIPTION:		BH5-SS4	BH6-SS3
		SAMPLE TYPE:		Soil	Soil
		DATE SAMPLED:		2017-03-21	2017-03-21
Parameter	Unit	G / S	RDL	8288805	8288806
Antimony	µg/g	1.3	0.8	<0.8	<0.8
Arsenic	µg/g	18	1	3	4
Barium	µg/g	220	2	9	13
Beryllium	µg/g	2.5	0.5	<0.5	<0.5
Boron	µg/g	36	5	<5	<5
Boron (Hot Water Soluble)	µg/g	NA	0.10	<0.10	<0.10
Cadmium	µg/g	1.2	0.5	<0.5	0.6
Chromium	µg/g	70	2	5	8
Cobalt	µg/g	21	0.5	1.8	4.0
Copper	µg/g	92	1	8	15
Lead	µg/g	120	1	18	43
Molybdenum	µg/g	2	0.5	<0.5	0.8
Nickel	µg/g	82	1	4	8
Selenium	µg/g	1.5	0.4	<0.4	<0.4
Silver	µg/g	0.5	0.2	<0.2	<0.2
Thallium	µg/g	1	0.4	<0.4	<0.4
Uranium	µg/g	2.5	0.5	<0.5	<0.5
Vanadium	µg/g	86	1	11	19
Zinc	µg/g	290	5	180	370
Chromium VI	µg/g	0.66	0.2	<0.2	<0.2
Cyanide	µg/g	0.051	0.040	<0.040	<0.040
Mercury	µg/g	0.27	0.10	<0.10	<0.10
Electrical Conductivity	mS/cm	0.57	0.005	0.098	0.174
Sodium Adsorption Ratio	NA	2.4	NA	0.303	0.509
pH, 2:1 CaCl2 Extraction	pH Units		NA	7.94	8.16

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to Table 1: Full Depth Background Site Condition Standards - Soil - Residential/Parkland/Institutional/Industrial/Commercial/Community Property Use

8288805-8288806 EC & SAR were determined on the DI water extract obtained from the 2:1 leaching procedure (2 parts DI water:1 part soil). pH was determined on the 0.01M CaCl2 extract prepared at 2:1 ratio.

Certified By: Sofiya Pehlyova

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Guideline Violation

AGAT WORK ORDER: 17W201248

PROJECT: 17KF002

CLIENT NAME: PETO MACCALLUM LIMITED

ATTENTION TO: Ken Hanes

SAMPLEID	SAMPLE TITLE	GUIDELINE	ANALYSIS PACKAGE	PARAMETER	UNIT	GUIDEVALUE	RESULT
8288806	BH6-SS3	ON T1 S RPI/ICC	O. Reg. 153(511) - Metals & Inorganics (Soil)	Zinc	µg/g	290	370

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Quality Assurance

CLIENT NAME: PETO MACCALLUM LIMITED

AGAT WORK ORDER: 17W201248

PROJECT: 17KF002

ATTENTION TO: Ken Hanes

SAMPLING SITE:

SAMPLED BY:H. Shinwary

Soil Analysis

RPT Date: Apr 10, 2017			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
O. Reg. 153(511) - Metals & Inorganics (Soil)															
Antimony	8287941		<0.8	<0.8	NA	< 0.8	116%	70%	130%	100%	80%	120%	92%	70%	130%
Arsenic	8287941		4	4	NA	< 1	107%	70%	130%	98%	80%	120%	104%	70%	130%
Barium	8287941		48	47	2.6%	< 2	98%	70%	130%	96%	80%	120%	101%	70%	130%
Beryllium	8287941		<0.5	<0.5	NA	< 0.5	78%	70%	130%	108%	80%	120%	89%	70%	130%
Boron	8287941		<5	<5	NA	< 5	89%	70%	130%	108%	80%	120%	91%	70%	130%
Boron (Hot Water Soluble)	8287941		0.34	0.36	NA	< 0.10	112%	60%	140%	100%	70%	130%	101%	60%	140%
Cadmium	8287941		<0.5	<0.5	NA	< 0.5	89%	70%	130%	100%	80%	120%	103%	70%	130%
Chromium	8287941		13	13	0.0%	< 2	95%	70%	130%	106%	80%	120%	120%	70%	130%
Cobalt	8287941		6.0	6.2	3.3%	< 0.5	102%	70%	130%	108%	80%	120%	108%	70%	130%
Copper	8287941		32	33	3.1%	< 1	94%	70%	130%	110%	80%	120%	115%	70%	130%
Lead	8287941		10	10	0.0%	< 1	101%	70%	130%	101%	80%	120%	99%	70%	130%
Molybdenum	8287941		<0.5	<0.5	NA	< 0.5	101%	70%	130%	103%	80%	120%	103%	70%	130%
Nickel	8287941		13	13	0.0%	< 1	105%	70%	130%	107%	80%	120%	108%	70%	130%
Selenium	8287941		<0.4	<0.4	NA	< 0.4	107%	70%	130%	103%	80%	120%	102%	70%	130%
Silver	8287941		<0.2	<0.2	NA	< 0.2	93%	70%	130%	106%	80%	120%	105%	70%	130%
Thallium	8287941		<0.4	<0.4	NA	< 0.4	86%	70%	130%	102%	80%	120%	103%	70%	130%
Uranium	8287941		<0.5	<0.5	NA	< 0.5	90%	70%	130%	92%	80%	120%	95%	70%	130%
Vanadium	8287941		22	22	0.0%	< 1	100%	70%	130%	106%	80%	120%	124%	70%	130%
Zinc	8287941		53	49	7.8%	< 5	103%	70%	130%	118%	80%	120%	116%	70%	130%
Chromium VI	8284952		<0.2	<0.2	NA	< 0.2	92%	70%	130%	96%	80%	120%	98%	70%	130%
Cyanide	8288805	8288805	<0.040	<0.040	NA	< 0.040	102%	70%	130%	103%	80%	120%	104%	70%	130%
Mercury	8287941		<0.10	<0.10	NA	< 0.10	102%	70%	130%	95%	80%	120%	102%	70%	130%
Electrical Conductivity	8291645		0.428	0.431	0.7%	< 0.005	94%	90%	110%	NA			NA		
Sodium Adsorption Ratio	8287941		0.751	0.761	1.3%	NA	NA			NA			NA		
pH, 2:1 CaCl2 Extraction	8285504		7.26	7.23	0.4%	NA	100%	80%	120%	NA			NA		

Comments: NA signifies Not Applicable.
Duplicate Qualifier: As the measured result approaches the RL, the uncertainty associated with the value increases dramatically, thus duplicate acceptance limits apply only where the average of the two duplicates is greater than five times the RL.

Certified By: Sofiya Pehlyova

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Method Summary

CLIENT NAME: PETO MACCALLUM LIMITED

AGAT WORK ORDER: 17W201248

PROJECT: 17KF002

ATTENTION TO: Ken Hanes

SAMPLING SITE:

SAMPLED BY:H. Shinwary

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Soil Analysis			
Antimony	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Arsenic	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Barium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Beryllium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Boron	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Boron (Hot Water Soluble)	MET-93-6104	EPA SW 846 6010C; MSA, Part 3, Ch.21	ICP/OES
Cadmium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Chromium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Cobalt	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Copper	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Lead	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Molybdenum	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Nickel	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Selenium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Silver	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Thallium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Uranium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Vanadium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Zinc	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Chromium VI	INOR-93-6029	SM 3500 B; MSA Part 3, Ch. 25	SPECTROPHOTOMETER
Cyanide	INOR-93-6052	MOE CN-3015 & E 3009 A;SM 4500 CN	TECHNICON AUTO ANALYZER
Mercury	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Electrical Conductivity	INOR-93-6036	McKeague 4.12, SM 2510 B	EC METER
Sodium Adsorption Ratio	INOR-93-6007	McKeague 4.12 & 3.26 & EPA SW-846 6010B	ICP/OES
pH, 2:1 CaCl2 Extraction	INOR-93-6031	MSA part 3 & SM 4500-H+ B	PH METER

O.Reg. 153/04, As Amended, Table 2 Standards (Soil)

(Industrial / Commercial / Community Property Use)

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CLIENT NAME: PETO MACCALLUM LIMITED
16 FRANKLIN STREET SOUTH
KITCHENER, ON N2C1R4
(519) 893-7500

ATTENTION TO: Ken Hanes

PROJECT: 17KF002

AGAT WORK ORDER: 17T199091

SOIL ANALYSIS REVIEWED BY: Amanjot Bhela, Inorganic Coordinator

TRACE ORGANICS REVIEWED BY: Neli Popnikolova, Senior Chemist

DATE REPORTED: Apr 18, 2017

PAGES (INCLUDING COVER): 6

VERSION*: 1

Should you require any information regarding this analysis please contact your client services representative at (905) 712-5100

*NOTES

All samples will be disposed of within 30 days following analysis. Please contact the lab if you require additional sample storage time.

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Certificate of Analysis

AGAT WORK ORDER: 17T199091

PROJECT: 17KF002

CLIENT NAME: PETO MACCALLUM LIMITED

ATTENTION TO: Ken Hanes

SAMPLING SITE:

SAMPLED BY:

O. Reg. 153(511) - Metals & Inorganics (Soil)

DATE RECEIVED: 2017-03-23

DATE REPORTED: 2017-04-18

		SAMPLE DESCRIPTION:		BH4-SS1	BH5-SS1	BH6-SS1
		SAMPLE TYPE:		Soil	Soil	Soil
		DATE SAMPLED:		2017-03-21	2017-03-21	2017-03-21
Parameter	Unit	G / S	RDL	8276142	8276150	8276151
Antimony	µg/g	40	0.8	<0.8	<0.8	<0.8
Arsenic	µg/g	18	1	3	5	6
Barium	µg/g	670	2	15	45	48
Beryllium	µg/g	8	0.5	<0.5	<0.5	<0.5
Boron	µg/g	120	5	6	6	<5
Boron (Hot Water Soluble)	µg/g	2	0.10	0.17	0.23	0.27
Cadmium	µg/g	1.9	0.5	<0.5	0.7	0.6
Chromium	µg/g	160	2	8	13	13
Cobalt	µg/g	80	0.5	1.9	4.4	4.9
Copper	µg/g	230	1	8	11	11
Lead	µg/g	120	1	40	62	53
Molybdenum	µg/g	40	0.5	0.6	0.9	0.5
Nickel	µg/g	270	1	5	10	10
Selenium	µg/g	5.5	0.4	<0.4	0.4	0.5
Silver	µg/g	40	0.2	<0.2	<0.2	<0.2
Thallium	µg/g	3.3	0.4	<0.4	<0.4	<0.4
Uranium	µg/g	33	0.5	0.5	0.5	0.5
Vanadium	µg/g	86	1	11	22	24
Zinc	µg/g	340	5	182	313	254
Chromium VI	µg/g	8	0.2	<0.2	<0.2	<0.2
Cyanide	µg/g	0.051	0.040	<0.040	<0.040	<0.040
Mercury	µg/g	3.9	0.10	<0.10	<0.10	<0.10
Electrical Conductivity	mS/cm	1.4	0.005	0.177	0.233	0.173
Sodium Adsorption Ratio	NA	12	NA	0.125	0.142	0.053
pH, 2:1 CaCl2 Extraction	pH Units		NA	6.74	6.90	7.07

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to ON T2 S ICC CT

8276142-8276151 EC & SAR were determined on the DI water extract obtained from the 2:1 leaching procedure (2 parts DI water:1 part soil). pH was determined on the 0.01M CaCl2 extract prepared at 2:1 ratio.

Certified By: Amanjot Bhela

AGAT Laboratories

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Certificate of Analysis

AGAT WORK ORDER: 17T199091

PROJECT: 17KF002

CLIENT NAME: PETO MACCALLUM LIMITED

ATTENTION TO: Ken Hanes

SAMPLING SITE:

SAMPLED BY:

O. Reg. 153(511) - OC Pesticides (Soil)

DATE RECEIVED: 2017-03-23

DATE REPORTED: 2017-04-18

		SAMPLE DESCRIPTION:		BH4-SS1	BH6-SS1
		SAMPLE TYPE:		Soil	Soil
		DATE SAMPLED:		2017-03-21	2017-03-21
Parameter	Unit	G / S	RDL	8276142	8276151
Hexachloroethane	µg/g	0.21	0.01	<0.01	<0.01
Gamma-Hexachlorocyclohexane	µg/g	0.056	0.005	<0.005	<0.005
Heptachlor	µg/g	0.19	0.005	<0.005	<0.005
Aldrin	µg/g	0.088	0.005	<0.005	<0.005
Heptachlor Epoxide	µg/g	0.05	0.005	<0.005	<0.005
Endosulfan	µg/g	0.3	0.005	<0.005	<0.005
Chlordane	µg/g	0.05	0.007	<0.007	<0.007
DDE	µg/g	0.52	0.007	<0.007	<0.007
DDD	µg/g	4.6	0.007	<0.007	<0.007
DDT	µg/g	1.4	0.007	<0.007	<0.007
Dieldrin	µg/g	0.088	0.005	<0.005	<0.005
Endrin	µg/g	0.04	0.005	<0.005	<0.005
Methoxychlor	µg/g	1.6	0.005	<0.005	<0.005
Hexachlorobenzene	µg/g	0.66	0.005	<0.005	<0.005
Hexachlorobutadiene	µg/g	0.031	0.01	<0.01	<0.01
Moisture Content	%		0.1	33.0	6.7
Surrogate	Unit	Acceptable Limits			
TCMX	%	50-140		70	66
Decachlorobiphenyl	%	60-130		72	88

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to ON T2 S ICC CT

8276142-8276151 Results are based on the dry weight of the soil.
Note: DDT applies to the total of op'DDT and pp'DDT, DDD applies to the total of op'DDD and pp'DDD and DDE applies to the total of op'DDE and pp'DDE. Endosulfan applies to the total of Endosulfan I and Endosulfan II.
Chlordane applies to the total of Alpha-Chlordane and Gamma-Chlordane.

Certified By: N Popowkolof

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Quality Assurance

CLIENT NAME: PETO MACCALLUM LIMITED

AGAT WORK ORDER: 17T199091

PROJECT: 17KF002

ATTENTION TO: Ken Hanes

SAMPLING SITE:

SAMPLED BY:

Soil Analysis

RPT Date: Apr 18, 2017			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
O. Reg. 153(511) - Metals & Inorganics (Soil)															
Antimony	8272855		3.6	3.6	NA	< 0.8	126%	70%	130%	105%	80%	120%	96%	70%	130%
Arsenic	8272855		9	7	25.0%	< 1	108%	70%	130%	105%	80%	120%	103%	70%	130%
Barium	8272855		76	75	1.3%	< 2	101%	70%	130%	98%	80%	120%	101%	70%	130%
Beryllium	8272855		<0.5	<0.5	NA	< 0.5	83%	70%	130%	105%	80%	120%	89%	70%	130%
Boron	8272855		6	6	NA	< 5	82%	70%	130%	107%	80%	120%	93%	70%	130%
Boron (Hot Water Soluble)	8272855		0.41	0.42	NA	< 0.10	112%	60%	140%	103%	70%	130%	99%	60%	140%
Cadmium	8272855		0.8	0.8	NA	< 0.5	110%	70%	130%	106%	80%	120%	105%	70%	130%
Chromium	8272855		18	18	0.0%	< 2	96%	70%	130%	114%	80%	120%	112%	70%	130%
Cobalt	8272855		5.5	5.5	0.0%	< 0.5	102%	70%	130%	110%	80%	120%	99%	70%	130%
Copper	8272855		63	62	1.6%	< 1	101%	70%	130%	117%	80%	120%	85%	70%	130%
Lead	8272855		190	197	3.6%	< 1	105%	70%	130%	101%	80%	120%	70%	70%	130%
Molybdenum	8272855		1.3	1.3	NA	< 0.5	107%	70%	130%	103%	80%	120%	105%	70%	130%
Nickel	8272855		24	25	4.1%	< 1	103%	70%	130%	112%	80%	120%	100%	70%	130%
Selenium	8272855		0.9	1.0	NA	< 0.4	128%	70%	130%	99%	80%	120%	106%	70%	130%
Silver	8272855		<0.2	<0.2	NA	< 0.2	98%	70%	130%	115%	80%	120%	110%	70%	130%
Thallium	8272855		<0.4	<0.4	NA	< 0.4	103%	70%	130%	104%	80%	120%	98%	70%	130%
Uranium	8272855		<0.5	<0.5	NA	< 0.5	98%	70%	130%	93%	80%	120%	95%	70%	130%
Vanadium	8272855		20	20	0.0%	< 1	99%	70%	130%	109%	80%	120%	109%	70%	130%
Zinc	8272855		205	199	3.0%	< 5	102%	70%	130%	117%	80%	120%	84%	70%	130%
Chromium VI	8277762		<0.2	<0.2	NA	< 0.2	93%	70%	130%	98%	80%	120%	100%	70%	130%
Cyanide	8278916		<0.040	<0.040	NA	< 0.040	102%	70%	130%	108%	80%	120%	94%	70%	130%
Mercury	8272855		0.15	0.17	NA	< 0.10	100%	70%	130%	88%	80%	120%	93%	70%	130%
Electrical Conductivity	8277893		0.376	0.369	1.9%	< 0.005	93%	90%	110%	NA			NA		
Sodium Adsorption Ratio	8276363		0.057	0.053	7.3%	NA	NA			NA			NA		
pH, 2:1 CaCl2 Extraction	8277854		7.37	7.42	0.7%	NA	101%	80%	120%	NA			NA		

Comments: NA signifies Not Applicable.
Duplicate Qualifier: As the measured result approaches the RL, the uncertainty associated with the value increases dramatically, thus duplicate acceptance limits apply only where the average of the two duplicates is greater than five times the RL.

Certified By: Amanjot Bhela

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Quality Assurance

CLIENT NAME: PETO MACCALLUM LIMITED

AGAT WORK ORDER: 17T199091

PROJECT: 17KF002

ATTENTION TO: Ken Hanes

SAMPLING SITE:

SAMPLED BY:

Trace Organics Analysis

RPT Date: Apr 18, 2017

PARAMETER	Batch	Sample Id	DUPLICATE			Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
			Dup #1	Dup #2	RPD		Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
O. Reg. 153(511) - OC Pesticides (Soil)															
Hexachloroethane	8267227		< 0.01	< 0.01	NA	< 0.01	82%	50%	140%	96%	50%	140%	64%	50%	140%
Gamma-Hexachlorocyclohexane	8267227		< 0.005	< 0.005	NA	< 0.005	92%	50%	140%	78%	50%	140%	66%	50%	140%
Heptachlor	8267227		< 0.005	< 0.005	NA	< 0.005	80%	50%	140%	90%	50%	140%	80%	50%	140%
Aldrin	8267227		< 0.005	< 0.005	NA	< 0.005	109%	50%	140%	94%	50%	140%	68%	50%	140%
Heptachlor Epoxide	8267227		< 0.005	< 0.005	NA	< 0.005	90%	50%	140%	96%	50%	140%	82%	50%	140%
Endosulfan	8267227		< 0.005	< 0.005	NA	< 0.005	89%	50%	140%	88%	50%	140%	69%	50%	140%
Chlordane	8267227		< 0.007	< 0.007	NA	< 0.007	87%	50%	140%	91%	50%	140%	78%	50%	140%
DDE	8267227		< 0.007	< 0.007	NA	< 0.007	88%	50%	140%	98%	50%	140%	78%	50%	140%
DDD	8267227		< 0.007	< 0.007	NA	< 0.007	94%	50%	140%	94%	50%	140%	84%	50%	140%
DDT	8267227		< 0.007	< 0.007	NA	< 0.007	88%	50%	140%	87%	50%	140%	78%	50%	140%
Dieldrin	8267227		< 0.005	< 0.005	NA	< 0.005	84%	50%	140%	90%	50%	140%	80%	50%	140%
Endrin	8267227		< 0.005	< 0.005	NA	< 0.005	84%	50%	140%	76%	50%	140%	82%	50%	140%
Methoxychlor	8267227		< 0.005	< 0.005	NA	< 0.005	76%	50%	140%	82%	50%	140%	96%	50%	140%
Hexachlorobenzene	8267227		< 0.005	< 0.005	NA	< 0.005	92%	50%	140%	100%	50%	140%	92%	50%	140%
Hexachlorobutadiene	8267227		< 0.01	< 0.01	NA	< 0.01	93%	50%	140%	100%	50%	140%	68%	50%	140%

Comments: When the average of the sample and duplicate results is less than 5x the RDL, the Relative Percent Difference (RPD) will be indicated as Not Applicable (NA).

Certified By: N Popnikolof

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Method Summary

CLIENT NAME: PETO MACCALLUM LIMITED

AGAT WORK ORDER: 17T199091

PROJECT: 17KF002

ATTENTION TO: Ken Hanes

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Soil Analysis			
Antimony	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Arsenic	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Barium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Beryllium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Boron	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Boron (Hot Water Soluble)	MET-93-6104	EPA SW 846 6010C; MSA, Part 3, Ch.21	ICP/OES
Cadmium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Chromium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Cobalt	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Copper	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Lead	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Molybdenum	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Nickel	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Selenium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Silver	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Thallium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Uranium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Vanadium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Zinc	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Chromium VI	INOR-93-6029	SM 3500 B; MSA Part 3, Ch. 25	SPECTROPHOTOMETER
Cyanide	INOR-93-6052	MOE CN-3015 & E 3009 A;SM 4500 CN	TECHNICON AUTO ANALYZER
Mercury	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Electrical Conductivity	INOR-93-6036	McKeague 4.12, SM 2510 B	EC METER
Sodium Adsorption Ratio	INOR-93-6007	McKeague 4.12 & 3.26 & EPA SW-846 6010B	ICP/OES
pH, 2:1 CaCl2 Extraction	INOR-93-6031	MSA part 3 & SM 4500-H+ B	PH METER
Trace Organics Analysis			
Hexachloroethane	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
Gamma-Hexachlorocyclohexane	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
Heptachlor	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
Aldrin	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
Heptachlor Epoxide	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
Endosulfan	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
Chlordane	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
DDE	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
DDD	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
DDT	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
Dieldrin	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
Endrin	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
Methoxychlor	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
Hexachlorobenzene	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
Hexachlorobutadiene	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
TCMX	ORG-91-5112	EPA SW-846 3541,3620 & 8081	GC/ECD
Decachlorobiphenyl	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
Moisture Content		MOE E3139	BALANCE

AGAT Laboratories

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CLIENT NAME: PETO MACCALLUM LIMITED
16 FRANKLIN STREET SOUTH
KITCHENER, ON N2C1R4
(519) 893-7500

ATTENTION TO: Ken Hanes

PROJECT: 17KF002

AGAT WORK ORDER: 17W201248

SOIL ANALYSIS REVIEWED BY: Sofka Pehlyova, Senior Analyst

DATE REPORTED: Apr 10, 2017

PAGES (INCLUDING COVER): 5

VERSION*: 1

Should you require any information regarding this analysis please contact your client services representative at (905) 712-5100

*NOTES

All samples will be disposed of within 30 days following analysis. Please contact the lab if you require additional sample storage time.

AGAT Laboratories

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Certificate of Analysis

AGAT WORK ORDER: 17W201248

PROJECT: 17KF002

CLIENT NAME: PETO MACCALLUM LIMITED

ATTENTION TO: Ken Hanes

SAMPLING SITE:

SAMPLED BY:H. Shinwary

O. Reg. 153(511) - Metals & Inorganics (Soil)

DATE RECEIVED: 2017-03-30

DATE REPORTED: 2017-04-10

		SAMPLE DESCRIPTION:		BH5-SS4	BH6-SS3
		SAMPLE TYPE:		Soil	Soil
		DATE SAMPLED:		2017-03-21	2017-03-21
Parameter	Unit	G / S	RDL	8288805	8288806
Antimony	µg/g	40	0.8	<0.8	<0.8
Arsenic	µg/g	18	1	3	4
Barium	µg/g	670	2	9	13
Beryllium	µg/g	8	0.5	<0.5	<0.5
Boron	µg/g	120	5	<5	<5
Boron (Hot Water Soluble)	µg/g	2	0.10	<0.10	<0.10
Cadmium	µg/g	1.9	0.5	<0.5	0.6
Chromium	µg/g	160	2	5	8
Cobalt	µg/g	80	0.5	1.8	4.0
Copper	µg/g	230	1	8	15
Lead	µg/g	120	1	18	43
Molybdenum	µg/g	40	0.5	<0.5	0.8
Nickel	µg/g	270	1	4	8
Selenium	µg/g	5.5	0.4	<0.4	<0.4
Silver	µg/g	40	0.2	<0.2	<0.2
Thallium	µg/g	3.3	0.4	<0.4	<0.4
Uranium	µg/g	33	0.5	<0.5	<0.5
Vanadium	µg/g	86	1	11	19
Zinc	µg/g	340	5	180	370
Chromium VI	µg/g	8	0.2	<0.2	<0.2
Cyanide	µg/g	0.051	0.040	<0.040	<0.040
Mercury	µg/g	3.9	0.10	<0.10	<0.10
Electrical Conductivity	mS/cm	1.4	0.005	0.098	0.174
Sodium Adsorption Ratio	NA	12	NA	0.303	0.509
pH, 2:1 CaCl2 Extraction	pH Units		NA	7.94	8.16

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to ON T2 S ICC CT

8288805-8288806 EC & SAR were determined on the DI water extract obtained from the 2:1 leaching procedure (2 parts DI water:1 part soil). pH was determined on the 0.01M CaCl2 extract prepared at 2:1 ratio.

Certified By: Sofiya Pehlyova

AGAT Laboratories

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Guideline Violation

AGAT WORK ORDER: 17W201248

PROJECT: 17KF002

CLIENT NAME: PETO MACCALLUM LIMITED

ATTENTION TO: Ken Hanes

SAMPLEID	SAMPLE TITLE	GUIDELINE	ANALYSIS PACKAGE	PARAMETER	UNIT	GUIDEVALUE	RESULT
8288806	BH6-SS3	ON T2 S ICC CT	O. Reg. 153(511) - Metals & Inorganics (Soil)	Zinc	µg/g	340	370

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Quality Assurance

CLIENT NAME: PETO MACCALLUM LIMITED
AGAT WORK ORDER: 17W201248
PROJECT: 17KF002
ATTENTION TO: Ken Hanes
SAMPLING SITE:
SAMPLED BY:H. Shinwary

Soil Analysis

RPT Date: Apr 10, 2017			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
O. Reg. 153(511) - Metals & Inorganics (Soil)															
Antimony	8287941		<0.8	<0.8	NA	< 0.8	116%	70%	130%	100%	80%	120%	92%	70%	130%
Arsenic	8287941		4	4	NA	< 1	107%	70%	130%	98%	80%	120%	104%	70%	130%
Barium	8287941		48	47	2.6%	< 2	98%	70%	130%	96%	80%	120%	101%	70%	130%
Beryllium	8287941		<0.5	<0.5	NA	< 0.5	78%	70%	130%	108%	80%	120%	89%	70%	130%
Boron	8287941		<5	<5	NA	< 5	89%	70%	130%	108%	80%	120%	91%	70%	130%
Boron (Hot Water Soluble)	8287941		0.34	0.36	NA	< 0.10	112%	60%	140%	100%	70%	130%	101%	60%	140%
Cadmium	8287941		<0.5	<0.5	NA	< 0.5	89%	70%	130%	100%	80%	120%	103%	70%	130%
Chromium	8287941		13	13	0.0%	< 2	95%	70%	130%	106%	80%	120%	120%	70%	130%
Cobalt	8287941		6.0	6.2	3.3%	< 0.5	102%	70%	130%	108%	80%	120%	108%	70%	130%
Copper	8287941		32	33	3.1%	< 1	94%	70%	130%	110%	80%	120%	115%	70%	130%
Lead	8287941		10	10	0.0%	< 1	101%	70%	130%	101%	80%	120%	99%	70%	130%
Molybdenum	8287941		<0.5	<0.5	NA	< 0.5	101%	70%	130%	103%	80%	120%	103%	70%	130%
Nickel	8287941		13	13	0.0%	< 1	105%	70%	130%	107%	80%	120%	108%	70%	130%
Selenium	8287941		<0.4	<0.4	NA	< 0.4	107%	70%	130%	103%	80%	120%	102%	70%	130%
Silver	8287941		<0.2	<0.2	NA	< 0.2	93%	70%	130%	106%	80%	120%	105%	70%	130%
Thallium	8287941		<0.4	<0.4	NA	< 0.4	86%	70%	130%	102%	80%	120%	103%	70%	130%
Uranium	8287941		<0.5	<0.5	NA	< 0.5	90%	70%	130%	92%	80%	120%	95%	70%	130%
Vanadium	8287941		22	22	0.0%	< 1	100%	70%	130%	106%	80%	120%	124%	70%	130%
Zinc	8287941		53	49	7.8%	< 5	103%	70%	130%	118%	80%	120%	116%	70%	130%
Chromium VI	8284952		<0.2	<0.2	NA	< 0.2	92%	70%	130%	96%	80%	120%	98%	70%	130%
Cyanide	8288805	8288805	<0.040	<0.040	NA	< 0.040	102%	70%	130%	103%	80%	120%	104%	70%	130%
Mercury	8287941		<0.10	<0.10	NA	< 0.10	102%	70%	130%	95%	80%	120%	102%	70%	130%
Electrical Conductivity	8291645		0.428	0.431	0.7%	< 0.005	94%	90%	110%	NA			NA		
Sodium Adsorption Ratio	8287941		0.751	0.761	1.3%	NA	NA			NA			NA		
pH, 2:1 CaCl2 Extraction	8285504		7.26	7.23	0.4%	NA	100%	80%	120%	NA			NA		

Comments: NA signifies Not Applicable.
Duplicate Qualifier: As the measured result approaches the RL, the uncertainty associated with the value increases dramatically, thus duplicate acceptance limits apply only where the average of the two duplicates is greater than five times the RL.

Certified By: Sofiya Pehlyova

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Method Summary

CLIENT NAME: PETO MACCALLUM LIMITED

AGAT WORK ORDER: 17W201248

PROJECT: 17KF002

ATTENTION TO: Ken Hanes

SAMPLING SITE:

SAMPLED BY:H. Shinwary

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Soil Analysis			
Antimony	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Arsenic	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Barium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Beryllium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Boron	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Boron (Hot Water Soluble)	MET-93-6104	EPA SW 846 6010C; MSA, Part 3, Ch.21	ICP/OES
Cadmium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Chromium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Cobalt	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Copper	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Lead	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Molybdenum	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Nickel	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Selenium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Silver	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Thallium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Uranium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Vanadium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Zinc	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Chromium VI	INOR-93-6029	SM 3500 B; MSA Part 3, Ch. 25	SPECTROPHOTOMETER
Cyanide	INOR-93-6052	MOE CN-3015 & E 3009 A;SM 4500 CN	TECHNICON AUTO ANALYZER
Mercury	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Electrical Conductivity	INOR-93-6036	McKeague 4.12, SM 2510 B	EC METER
Sodium Adsorption Ratio	INOR-93-6007	McKeague 4.12 & 3.26 & EPA SW-846 6010B	ICP/OES
pH, 2:1 CaCl2 Extraction	INOR-93-6031	MSA part 3 & SM 4500-H+ B	PH METER

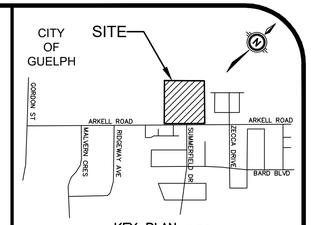
P:\P\42063\104\42063-104-EC1

MTE FILE PATH:

LEGEND

- SITE BOUNDARY
- WETLAND BOUNDARY
- 15m WETLAND SETBACK
- 30m WETLAND SETBACK
- 326 — EXISTING CONTOURS
- Ex. Drop Curb — EXISTING CURB
- EXISTING DRIPLINE
- EXISTING DIRECTION OF DRAINAGE/SWALE
- EXISTING BUILDING
- (TOP) / (BOTTOM) — EXISTING EMBANKMENT (SLOPE AS NOTED)
- Ex. 300mmø SAN. / Ex. MH — EXISTING SANITARY SEWER
- Ex. 200mmø WTM. / Ex. HYD. SET — EXISTING WATERMAIN
- Ex. 375mmø STM. / Ex. MH — EXISTING STORM SEWER
- EXISTING RETAINING WALL
- EXISTING FENCE
- EXISTING PIEZOMETER
- EXISTING BOREHOLE/ MONITORING WELL

CITY OF GUELPH — SITE



KEY PLAN N.T.S.

GEODETIC BM ELEV. = 335.455m
CITY OF GUELPH
#255 BURKE WELL PUMP HOUSE

SITE BENCHMARK ELEV. = 335.455m
SEE ABOVE

NOTE TO CONTRACTOR :

DO NOT SCALE DRAWINGS.

CONTRACTORS MUST CHECK AND VERIFY ALL DIMENSIONS AND REPORT ANY DISCREPANCIES TO THE ENGINEER BEFORE PROCEEDING WITH THE WORK.

THE OWNER/ARCHITECT/CONTRACTOR IS ADVISED THAT M.T.E. CONSULTANTS INC. CANNOT CERTIFY ANY COMPONENT OF THE SITE WORKS NOT INSPECTED DURING CONSTRUCTION. IT IS THE RESPONSIBILITY OF THE GENERAL CONTRACTOR TO NOTIFY M.T.E. CONSULTANTS INC. PRIOR TO COMMENCEMENT OF CONSTRUCTION TO ARRANGE FOR INSPECTION.

No.	REVISION	BY	DATE
8.			
7.			
6.			
5.			
4.			
3.			
2.			
1.	ISSUED FOR DRAFT PLAN APPROVAL	IXC	APR.3/20

MTE
Engineers, Scientists, Surveyors
519-743-6500

OWNER
CRESCENT HAVEN HOMES INC.
180 FROBISHER DRIVE UNIT 3 WATERLOO

PROJECT
ARKELL ROAD PROPERTIES
216 ARKELL ROAD GUELPH

DRAWING
EXISTING CONDITIONS PLAN

Project Manager: I.CEKIC	Project No.: 42063-104
Design By: CJC/AJC	Checked By: VAL
Drawn By: SXP/KAT	Checked By: AJC
Surveyed By: MTE	Drawing No.: EC1.1
Date: Dec.04/19	
Scale: 1:400	Sheet 1 of 1

March 31, 2020 - 8:53:39 AM - Plotted By: Alex Cressman

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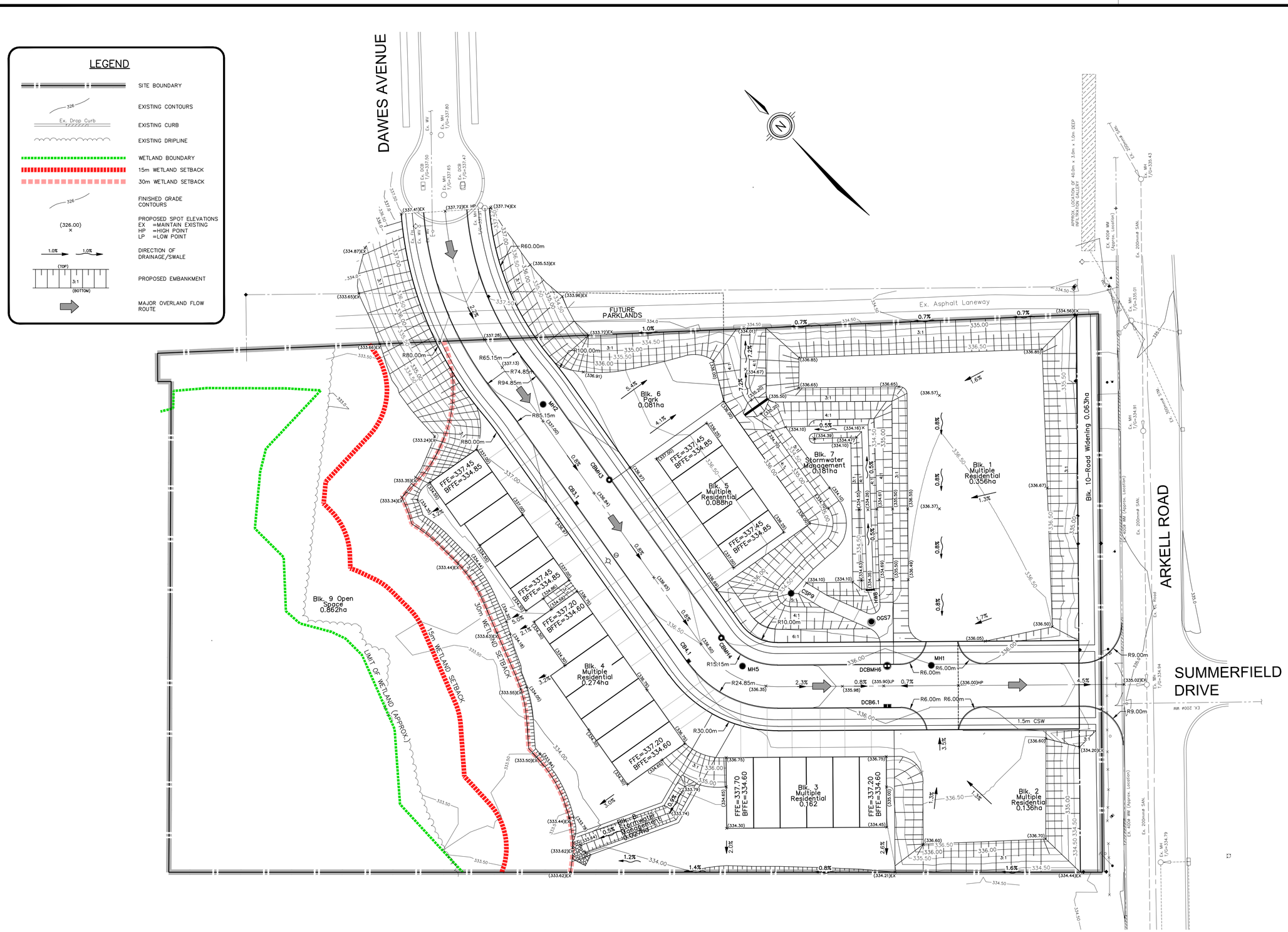
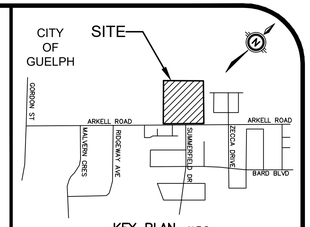
MTE PLOT PATH:

March 31, 2020 - 8:54:37 AM - Plotted By: Alex Cressman

LEGEND

- SITE BOUNDARY
- EXISTING CONTOURS (326)
- EXISTING CURB (Ex. Drop Curb)
- EXISTING DRIPLINE
- WETLAND BOUNDARY
- 15m WETLAND SETBACK
- 30m WETLAND SETBACK
- FINISHED GRADE CONTOURS (326)
- PROPOSED SPOT ELEVATIONS (326.00) EX =MAINTAIN EXISTING, HP =HIGH POINT, LP =LOW POINT
- DIRECTION OF DRAINAGE/SWALE (1.0% (TOP) 3:1 (BOTTOM) 1.0%)
- PROPOSED EMBANKMENT
- MAJOR OVERLAND FLOW ROUTE





GEODETIC BM ELEV. = 335.455m
CITY OF GUELPH
#255 BURKE WELL PUMP HOUSE

SITE BENCHMARK ELEV. = 335.455m
SEE ABOVE

NOTE TO CONTRACTOR :

DO NOT SCALE DRAWINGS.

CONTRACTORS MUST CHECK AND VERIFY ALL DIMENSIONS AND REPORT ANY DISCREPANCIES TO THE ENGINEER BEFORE PROCEEDING WITH THE WORK.

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No.	REVISION	BY	DATE
8.			
7.			
6.			
5.			
4.			
3.			
2.			
1.	ISSUED FOR DRAFT PLAN APPROVAL	IKC	APR.03/20

MTE
Engineers, Scientists, Surveyors
519-743-6500

OWNER
CRESCENT HAVEN HOMES INC.
180 FROBISHER DRIVE UNIT 3 WATERLOO

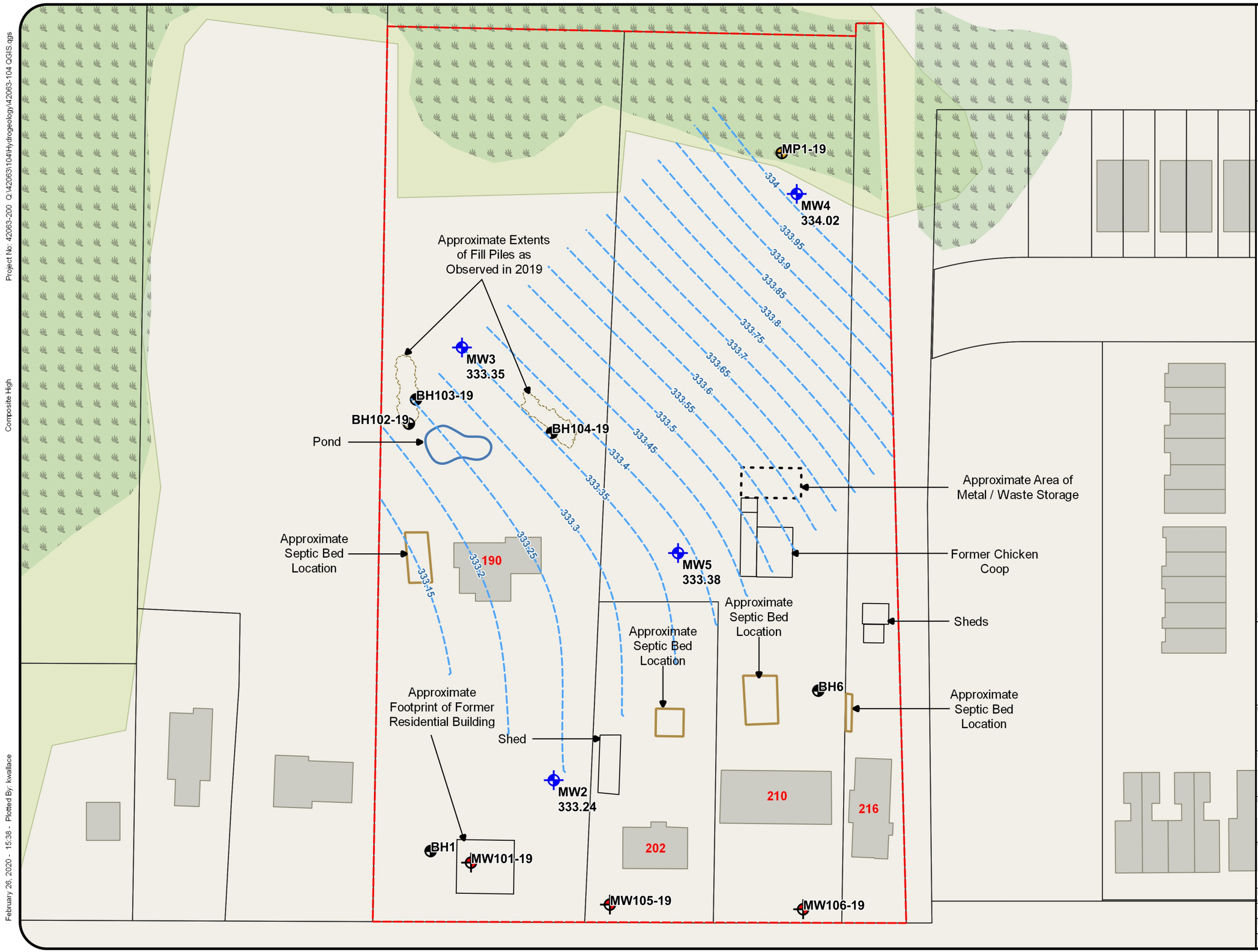
PROJECT
ARKELL ROAD PROPERTIES
216 ARKELL ROAD GUELPH

DRAWING
AREA GRADING PLAN

Project Manager	I.CEKIC	Project No.	42063-104
Design By	AJC	Checked By	VAL
Drawn By	SXP/KAT	Checked By	AJC
Surveyed By	MTE	Drawing No.	AG1.1
Date	Mar.30/20		
Scale	1:400	Sheet 1 of 1	

Appendix G

Composite High Groundwater



NORTH

PROJECT NORTH

Legend

- Property Boundary
- Study Area
- Wooded Area
- Provincial Significant Wetlands

Investigative Locations

- Borehole - ESA
- Minipiezometer
- ESA Wells (not used in composite high determination)
- Groundwater Monitoring Well & High Groundwater Elevation (mamsl)

Note:

Maximum groundwater elevations are those measured during the continuous groundwater level monitoring of select on-Site groundwater monitoring wells.

Monitoring period: March 27, 2017 to December 6, 2019.

Data Sources:

Contains information licensed under the Open Government License Ontario

0 8 16 24 32 40 m

Scale (11x17): 1:850

Project CRS: NAD83 / UTM zone 17N

MTE

Engineers,Scientists, Surveyors

Ph. (519) 743-6500

Client	Crescent Homes Ltd.
Project	Hydrogeological Investigation
Site	190-216 Arkell Road, Guelph
Title	**Composite High Groundwater**
Reviewed By	-
Prepared By	KLW
Drawn By	KLW
Date	Feb. 2020
Project No	42063-104
Figure No	-

Project No: 42063-200 Q:\42063\1041Hydrogeology\42063-104 QGIS.qgs

Composite High

February 26, 2020 - 15:38 - Plotted By: kwallace