

190 – 216 ARKELL ROAD GUELPH, ONTARIO

Stormwater Management Report

Project Location: 190 - 216 Arkell Road

Guelph, Ontario

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

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October 10, 2018

MTE File No.: 42063-104



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1.0 INTRODUCTION

1.1 Overview

MTE Consultants Inc. has been retained by Crescent Homes to complete a preliminary Stormwater Management (SWM) Report in support of a Draft Plan of Subdivision Application for lands known as 190, 202, 210 and 216 Arkell Road, located in the City of Guelph, as provided on Figure 1.

The subject site is generally bound by an existing wetland to the north, existing residential to the east, Arkell Road right-of-way to the south and an existing single family residential house to the west. The proposed subdivision lands are approximately 2.58ha in area; however, the northern third of the site cannot be developed due to the existing wetland and its setbacks. The site is legally described as Part of Lot 6, Puslinch Concession 8 in the City of Guelph, Regional Municipality of Waterloo. The site is currently comprised of four residential properties. Municipal addresses for the individual lots are 190, 202, 210, & 216 Arkell Road. The existing homes will be vacated and demolished prior to development.

The Draft Plan of Subdivision for the proposed development includes 34 townhome units fronting onto a municipal right-of-way and two 3-storey apartment buildings with a combined total of 32 apartment units located on a private condominium block in the southeast corner of the site. The proposed right-of-way will connect the existing Dawes Avenue to Arkell Road at the existing Summerfield Drive and Arkell Road intersection.

This report presents the proposed plan detailing the stormwater quality, quantity and infiltration measures that will be provided for the development.

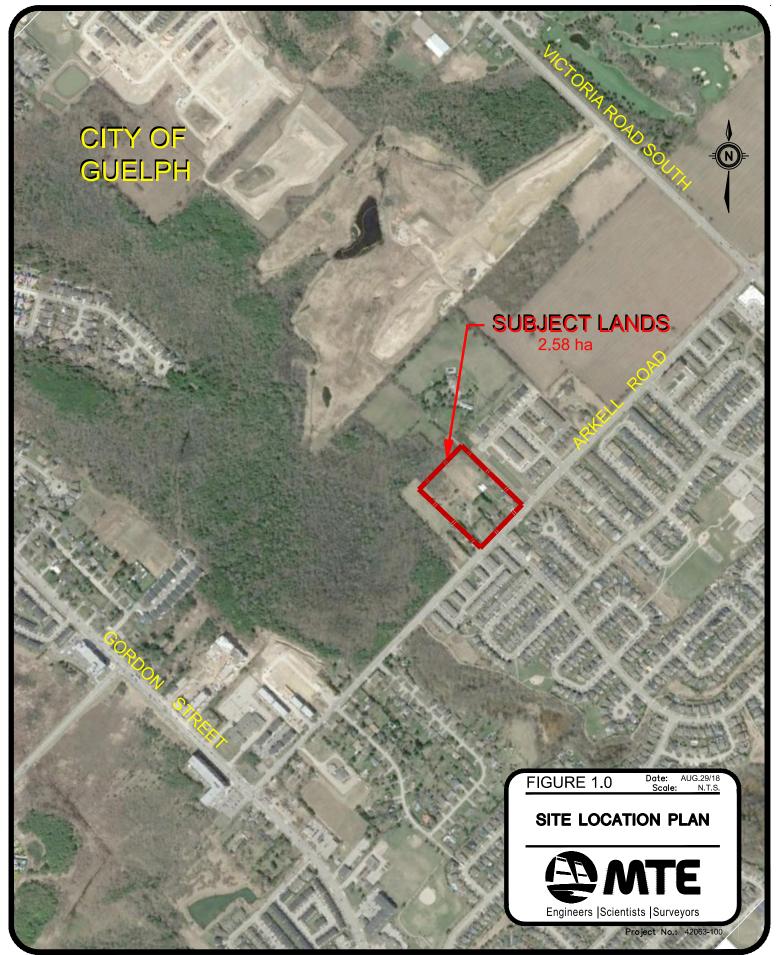
1.2 Purpose of Study

The purpose of this study is to develop a comprehensive stormwater management strategy for the current development proposal that is acceptable to the City of Guelph, the Grand River Conservation Authority and the Ministry of the Environment, Conservation and Parks.

1.3 Objectives

The primary objectives of this study are as follows:

- Establish criteria for the management of stormwater runoff from this site;
- Recommend a plan for controlling the quantity and quality of stormwater runoff from the study area;
- Recommend a strategy for controlling the volume of infiltration to groundwater; and
- Address environmental concerns related to development adjacent to the wetlands, high groundwater levels and nearby municipal wells.



October 5, 2018 — 9:41 a.m. — Plotted By: ktaylor

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2.0 EXISTING CONDITIONS AND BACKGROUND INFORMATION

2.1 Topographical Information

MTE completed a detailed topographical survey of the site in the fall of 2016. There is approximately 2m of topographical relief across the site from the south to the north. Elevations across the site range from approximately 335.30masl along the Arkell Road property limit to 333.30masl near the wetland. The adjacent residential subdivision east of the subject property is approximately 4m higher in elevation than the subject property. The existing conditions of the subject property are provided on the enclosed Existing Conditions Plan.

2.2 **Pre-Development Conditions**

The site is located within the Torrance Creek Subwatershed. The rear 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 30m wetland buffer.

Under pre-development conditions, surface runoff from the site flows northerly towards the wetland complex.

Based on existing conditions, the site was modeled as one (1) catchment using the MIDUSS hydrologic modeling program. Table 2.1 provides a brief description of the catchment as well as the design parameters used in the hydrologic modeling.

Figure 2 provides an illustration of the pre-development catchment area.

Hydrologic modelling details and results are further discussed in Section 5.

Catchment	Description	Area (ha.)	% Impervious	Flow Length (m)	Slope
			6	—	
100	Existing Residential	2.58	11	150	1

TABLE 2.1 - PRE-DEVELOPMENT CATCHMENT PARAMETERS

2.3 Geotechnical Information

In 2017, Peto MacCallum Ltd. carried out a geotechnical investigation for the proposed Arkell Hills Subdivision. The fieldwork for this investigation included six boreholes on the subject property (BH1-BH6).

Based on the results of Peto MacCallum's geotechnical investigation, the subsurface stratigraphy at the site generally consists of topsoil and some localized fill overlying native deposits of 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 MacCallum's Geotechnical Investigation.

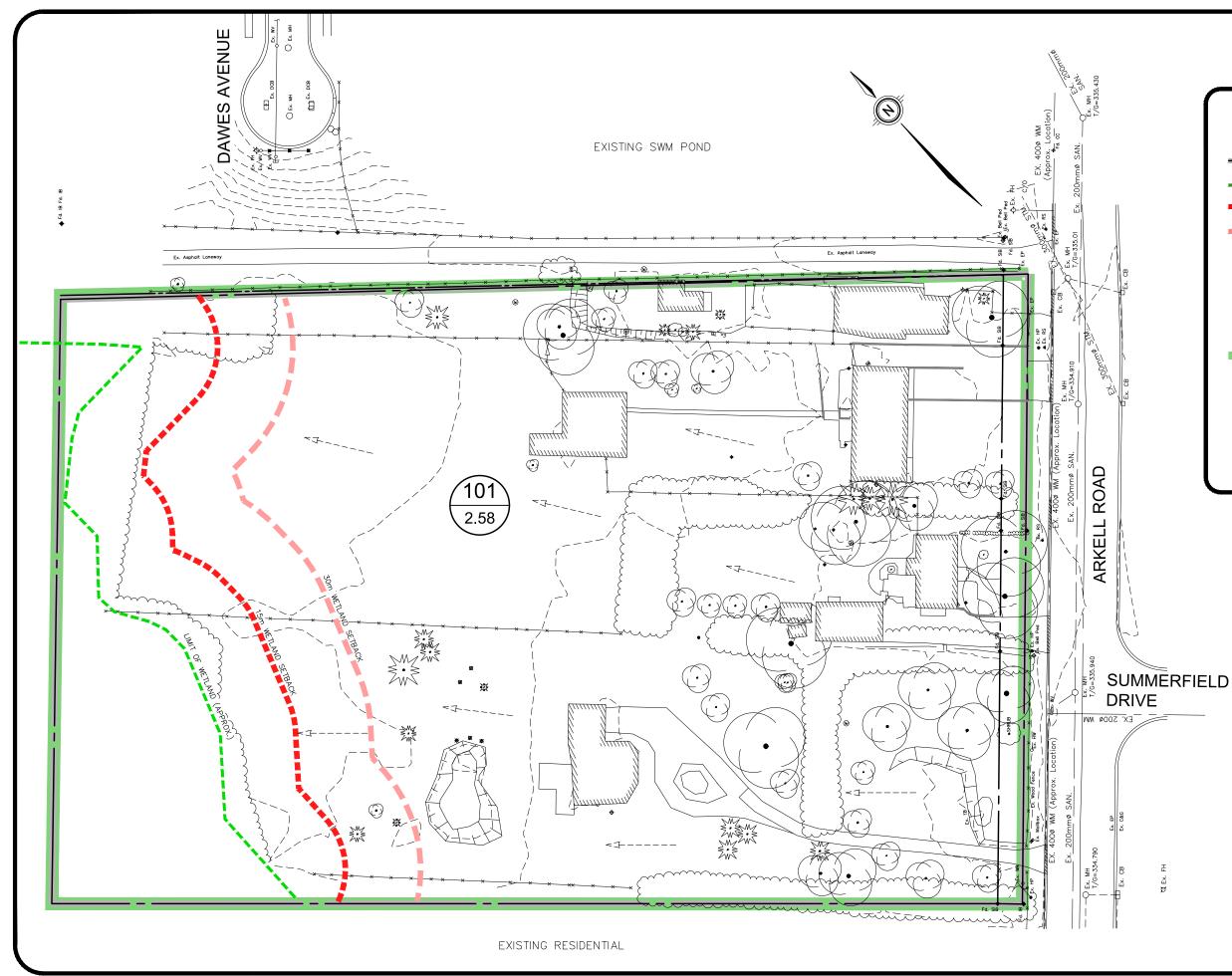
2.4 Hydrogeological Information

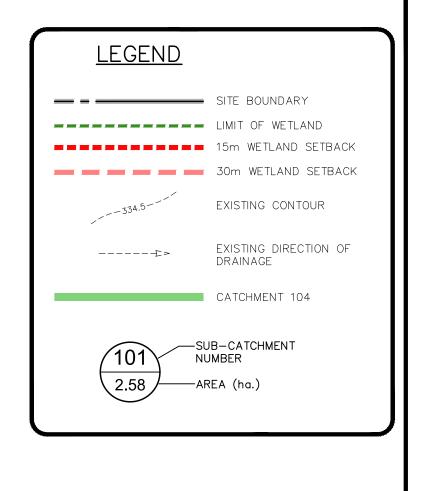
A hydrogeological investigation was conducted by MTE. Monitoring wells were installed in four (4) of the boreholes which had been advanced by Peto MacCallum.

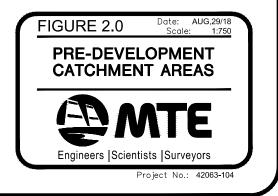
MTE has conducted continuous groundwater monitoring since March of 2017. The highest groundwater elevations were observed in April of 2017 and ranged from elevation 333.99masl in the northerly portion of the site to 333.24masl in the southerly portion of the site. These elevations represent depths of 1.05m below existing grade (southerly portion of the site) to above the existing grade (northerly portion of the site). 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 Hydrogeological Report under separate cover.

2.5 Drainage Outlets

Currently, runoff from the site travels overland in a northerly direction and contributes to the Torrance Creek Wetland Complex.







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3.0 STORMWATER MANAGEMENT

3.1 Stormwater Management Criteria

New developments are required to provide stormwater management in accordance with provincial and municipal policies including but not limited to:

- MOE/MNR Stormwater Quality Guidelines for New Development (May 1991);
- Stormwater Management Practices, Planning and Design Manual (MOE, March 2003);
- GRCA Policies and Guidelines regarding urban development and floodplain management;
- The Torrance Creek Subwatershed Study Management Strategy (1999); and
- The City of Guelph's Development Engineering Manual.

The stormwater management criteria discussed below have been established based on the above policies, background reports, agency requirements, and site specific considerations.

3.1.1 Quantity Control

The subject property is located within the Torrance Creek Subwatershed. As stated in the Torrance Creek Subwatershed Study (TCSS) completed in 1999, the primary objective of quantity control is to maintain hydrologic functions for existing conditions with both surface and subsurface flows. Water quantity targets to be met include:

- Infiltration for areas between Arkell Road and Torrence Creek shall maintain 150mm/year;
- Peak flow control for all design storm events (post- to pre-development for the 2 to 100-year design storm events); and
- 24 48 hour extended detention time for 25mm rainfall event, if necessary (given infiltration levels and water quality requirements).

3.1.2 Quality Control

The City of Guelph's Engineering Design Guidelines state that all developments shall provide Level 1 (Enhanced) treatment and that thermal impacts to the receiving stream shall be minimized using preventative methods which mimic the natural water balance (preferred) or mitigation techniques such as cooling trenches, plantings, etc.

The TCSS established quality targets for development within the subwatershed as follows:

- Quality Torrance Creek is considered a cold water watercourse and thus requires Level 1 (Enhanced) protection;
- Nutrients Total Phosphorus should be less than 30ug/L, use of grassed swales and buffer strips for direct drainage will reduce suspended solids and nutrients;
- Dissolved Oxygen Dissolved oxygen concentration should not be less than 4 mg/L during summer months. Reduction of temperature and nutrient concentrations will

assist DO levels. Aeration of direct runoff may also be helpful; and

• Temperature – Temperatures within Torrance Creek should be below 25 degrees Celsius. New developments can mitigate temperature increases by maximizing infiltration, minimizing the use of surface ponds, and using underground drainage elements before discharging to surface.

The City of Guelph requires that any OGS units intended to provide quality control for a site be verified by the Canadian Environmental Technology Verification Program. OGS products are permitted only as a pre-treatment device. For small sites (i.e. < 2ha) OGS units are permitted as part of a treatment train approach and are considered capable of achieving 50% TSS removal.

3.1.3 Proposed SWM Strategy

The proposed SWM facility will collect stormwater runoff from the right-of way and the front half of the on-street townhome roofs. The stormwater runoff from the right-of-way will be collected via storm sewers and drain through an oil/grit separator (OGS) unit for pre-treatment before discharging to a wet pond for quantity control prior to discharging to an infiltration gallery.

Stormwater runoff from the apartment block will also discharge to the wet pond and will also be pre-treated with an on-site OGS unit. The OGS unit for the Apartment Block will be designed as part of the Site Plan process for this Block. Stormwater runoff from the apartment building rooftops will discharge directly to a private infiltration gallery located on the apartment block.

Stormwater runoff from the rear yards of the townhomes located west of the proposed right-of-way will discharge un-attenuated directly to the wetland. These rear yards located are at a lower elevation than the storm sewers and due to the high groundwater, infiltration cannot be achieved without the required separation distance to the high groundwater.

3.2 Monitoring

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

Facility monitoring

Upon completion of construction, the SWM facility is to be inspected by Municipal Staff to ensure conformance to the design. Upon confirmation from Municipal staff that the facility is acceptable, the facility 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 infiltration cell. The facility shall also be monitored to determine how quickly sediment accumulates within the proposed OGS unit and wet 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.

Groundwater Monitoring

Ground water levels and quality shall be monitored. MTE has completed over 1 year 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.

3.3 Water Balance

The City of Guelph requires that Low Impact Design (LID) best management practices be used to mimic pre-development recharge rates. Site specific monthly and yearly water balances shall be completed.

The TCSS divided the subwatershed into three stormwater management 'zones' and laid out specific infiltration targets for each. The proposed site falls within zone 2 of the TCSS. Baseflow enhancement is encouraged on lands within this zone especially if they are close to the creek. An infiltration target of 150-200mm/year is suggested.

The TCSS provides a water balance summary for the south tributary to Torrance Creek in two locations, at the outflow south tributary and at the main confluence with Torrance Creek. The proposed site is located roughly halfway between the two locations and was assumed to have a greater correlation with the downstream location (i.e. the main confluence), thus the information for that location was utilized for the existing water budget.

Under proposed conditions, all runoff collected by the storm sewers will be pre-treated via OGS unit and the proposed wet pond prior to being infiltrated.

3.4 Wellhead Protection

The subject property is located near the Burke Well. Due to the proximity of the Burke well, the westerly portion of the subject property falls within the 100m zone around the well and has been assigned a vulnerability score of 10. The remainder of the site either falls within a vulnerability score of 6 or 8.

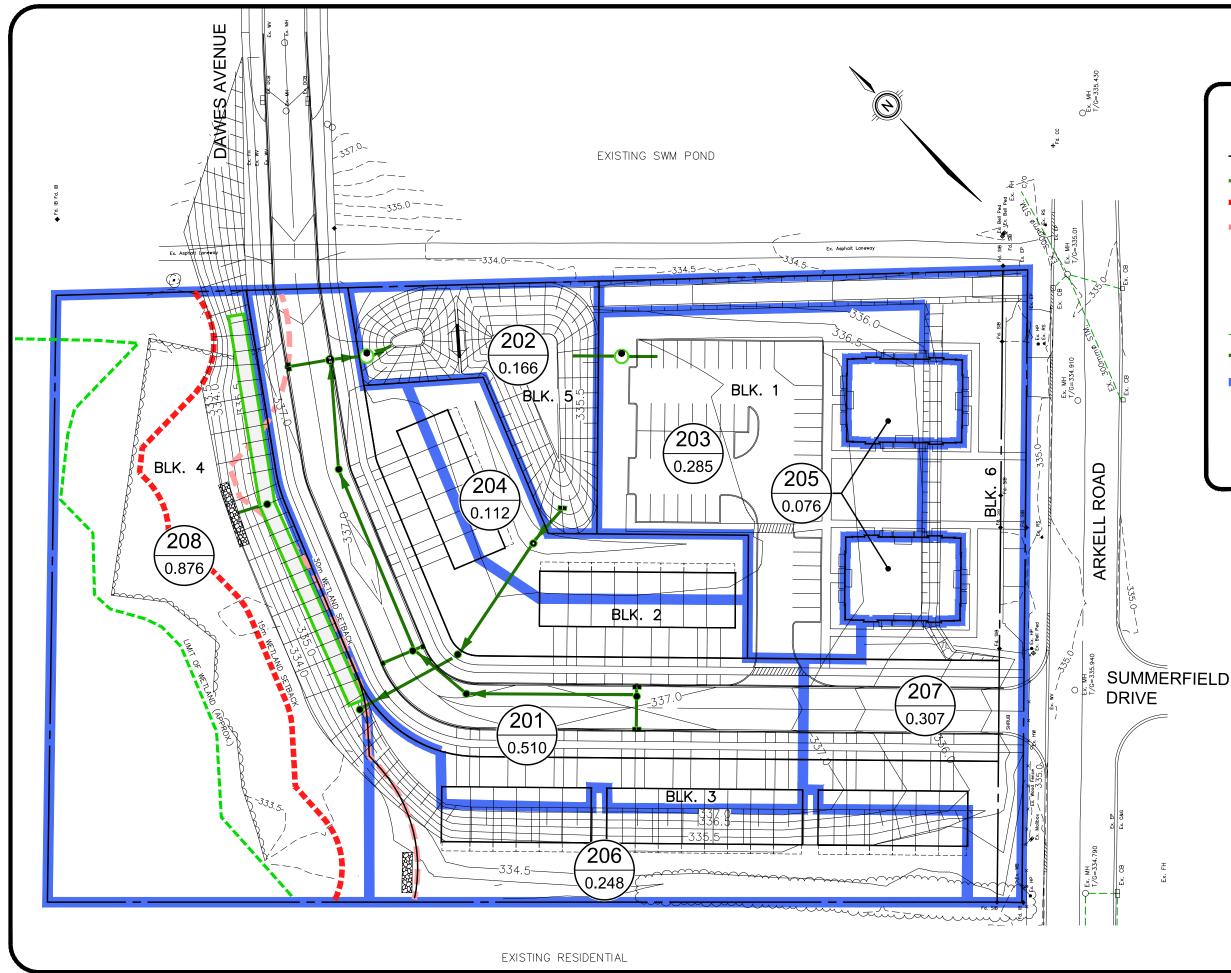
4.0 PROPOSED DEVELOPMENT AND SWM STRATEGY

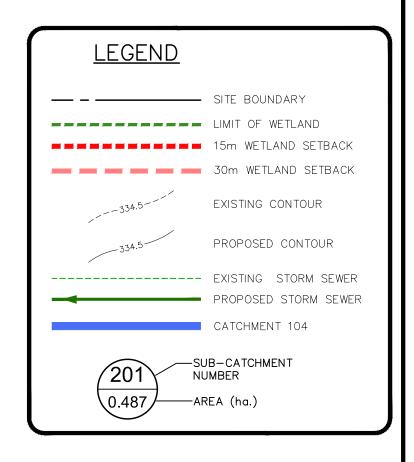
4.1 Post-Development Conditions

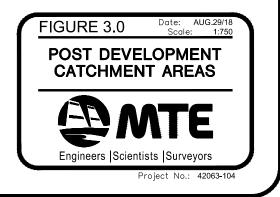
Under post-development conditions, the catchment area was delineated into eight catchments. Table 4.1 provides a brief description of each catchment area as well as the design parameters used in the hydrologic modeling.

Figure 3 provides an illustration of the catchment areas.

Catchment	Description	Area (ha.)	% Impervious	Flow Length (m)	Slope
201	Runoff discharging to SWM Facility	0.510	65	5	2
202	SWM Facility	0.166	50	5	2
203	Apartment Block	0.285	70	30	2
204	Townhouse Rear yards discharging to Infiltration Gallery	0.112	50	5	2
205	Apartment Rooftops	0.076	100	5	1
206	Runoff discharging un-attenuated to Wetland	0.248	25	13	2
207	Runoff discharging un-attenuated to Arkell Road	0.307	25	30	2
208	Wetland	0.876	5	35	5
	Total	2.58	36	n/a	n/a







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5.0 STORMWATER MANAGEMENT DESIGN

5.1 Hydrologic Modelling

As noted in previous sections, a hydrologic model was developed for the subject area to provide a quantitative estimate of peak flows from the site under existing and proposed development conditions. The rainfall event simulation model MIDUSS was used to simulate responses to the 25mm, 5 and 100-year design storm events. The City of Guelph does not specify parameters for a 25mm event, thus the City of Guelph's 1-year design storm event parameters were used. Additionally, the 25mm event was modelled as a 4 hour Chicago distribution as required by the City of Guelph.

The City of Guelph Horton Infiltration Parameters were used for impervious and pervious surfaces.

Peak flow rates for the above noted storm events under pre- and post-development conditions are shown in Table 5.3. The MIDUSS modelling output and hydrologic modelling schematics for pre- and post-development conditions are provided in Appendix 'A'.

5.2 Stormwater Quality Control

The proposed SWM facility has been designed using a 'treatment train' methodology. An OGS unit will be utilized to provide pre-treatment to runoff prior to discharging flows to the wet pond. The wet pond will then provide quality control to the runoff before discharging flows to the proposed infiltration gallery.

The OGS unit is designed to treat runoff from minor events (i.e. events ≤ 25 mm) before releasing flows to the wet pond. Flows from events greater than the 25mm event may bypass the OGS unit but 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 OGS unit in these less intense events. Therefore, the OGS unit is designed to target the smaller flows. Per City of Guelph standards, proposed OGS unit has been verified by the Canadian Environmental Technology Verification Program and has been sized to provide 50% TSS removal. A detailed sizing report for the OGS unit is included in Appendix 'C'.

The wet pond will have a depth of 1.0m. As per the City of Guelph's requirements, an Enhanced Level (formerly Level 1) of water quality protection is required. Quality control measures proposed will take the form of a wet pond, servicing a total drainage area imperviousness of 64%. Using a treatment train approach with an OGS discharging a wet pond prior to infiltration an Enhanced Level of water quality control will be achieved. Considering the total post-development drainage area discharging to the SWM facility is 0.961ha, this equates to a required volume of 203m³. The volume provided in the wet pond totals 655m³ which exceeds the required volume. Table 5.1 outlines the design of the proposed SWM facility.

General	Pond Characteristics	
Wet Pond Stormwater Management Facility	Level 1 Quality Control	
Total Contributing Area	0.961 ha	
Imperviousness (of whole drainage area)	64%	
Bottom Elevation	334.00m	
Storage		
Unit Area Storage Volume Requirements as per SWMMP (MOE 2003)	211m ³ /ha	
Required Total Volume	203m ³	
Permanent Pool		
Required Permanent Pool Volume	164m ³	
Permanent Pool Volume Provided	655m ³	
Permanent Pool Elevation	335.00m	
Extended Detention		
Minimum Required Volume (based on 40m ³ /ha)	39m ³	
Extended Detention Volume Provided	1075m ³	
Approximate Drawdown Time (based on 25 mm event)	23hr	
Extended Detention Elevation	335.00m	
Peak Release Rate for Extended Detention (Quality)	0.009m ³ /s	
Forebay		
Required Forebay Length	8m	
Actual Forebay Length	8m	
Permanent Pool Elevation	335.00m	
Bottom Elevation	334.40m	
Outlet Controls		
Orifice (Extended Detention)	300mm	
Ditch Inlet Catch Basin	600mm x 600mm	
Elevation (low side)	335.65m	
7.5 m wide Rip Rap Overflow Weir - Elevation	336.35m	

5.3 Stormwater Quantity Control

Flows for all storm events will be conveyed to the SWM facility by a combination of storm sewers and overland flow routes. The stage-storage-discharge relationship of the proposed SWM facility is shown below in **Table 5.2**. A detailed stage-storage-discharge relationship for the SWM facility is provided in Appendix 'A'.

Elevation (m)	Discharge (m³/s)	Volume (m ³)
335.00	0.000	0
335.10	0.006	88.6
335.20	0.022	181.4
335.30	0.044	278.4
335.40	0.088	379.6
335.50	0.108	485.0
335.60	0.125	594.6
335.70	0.140	708.4
335.80	0.153	826.4
335.90	0.165	948.6
336.00	0.176	1075.0

 TABLE 5.2 - STAGE-STORAGE-DISCHARGE INFORMATION

A summary of the peak flows for the pre- and post-development conditions is summarized in Table 5.3. Enough volume has been provided to store the 100-year storm event to maximum elevation of 355.44m. The MIDUSS output for the quantity control can be found in Appendix 'A'.

TABLE 5.3 - SUMMARY OF PEAK FLOWS

Drainage Area	25mm Storm Event (m³/s)	5-year Storm Event (m³/s)	100-year Storm Event (m ³ /s)
Pre-Development			
Total from site	0.045	0.090	0.396
Post-Development			
Area 201	0.058	0.114	0.230
Area 202	0.015	0.030	0.073
Area 203	0.031	0.063	0.131
Area 204	0.010	0.020	0.049
Area 205	0.013	0.025	0.039
Area 206	0.011	0.025	0.093
Area 207	0.013	0.027	0.097
Area 208	0.008	0.072	0.311
Total to wetland	0.018	0.094	0.398
Total from site	0.032	0.118	0.495

A summary of the maximum ponding elevations for the SWM facility is provided in Table 5.4.

Storm Event	Maximum Ponding Elevation (m)			
25mm Storm Event	335.12			
5-Year Storm Event	335.23			
100-Year Storm Event	335.44			

TABLE 5.4 - MAXIMUM WET POND PONDING ELEVATIONS

5.4 Stormwater Management Facility

The following list of SWM facility design characteristics outlines all significant design aspects and rationales.

- As previously described in Section 5.2, the SWM facility has been designed as a wet pond facility with sufficient storage volumes to achieve an Enhanced (formerly Level 1) degree of protection.
- The design of the SWM facility has incorporated internal side slopes of 3:1 throughout the facility. Fencing will be provided around the entire SWM facility.
- Operation and maintenance of the SWM facility will be the responsibility of the City
 of Guelph. Maintenance responsibilities include regular inspection of the basin. It
 should be noted that the estimated sediment clean-out frequencies outlined in the
 forebay calculation sheet might be reduced during the interval prior to complete
 stabilization of the upstream contributing drainage areas.

5.5 Overland Flow Control

For storms greater than the 100-year design storm, all excess runoff will be directed overland towards Arkell Road.

5.6 Water Budget Analysis

Under existing conditions the site provides surface inputs to the Torrance Creek Wetland Complex (TCWC). Infiltrated water contributes to the shallow groundwater table which flows southward. A water balance has been conducted to determine what impacts the proposed development may have on the existing wetlands. Furthermore, the site lies within the capture zone of the Burke well located on the north side of Arkell Road, roughly a hundred meters west of the site.

Annual precipitation was estimated to be 923.3mm/yr based on data gathered at the Guelph Arboretum weather station from 1971-2000. Infiltration, evapotranspiration, and runoff rates for pre- and post-development conditions were estimated using the Thornthwaite and Mather method (1957). Pre- and Post-development catchment areas are depicted in Figures 2 and 3 respectively.

Under pre-development conditions, the majority of the site drains north towards the wetland

complex while a small portion drains toward Arkell road. Both major and minor flows directed to Arkell road are directed west and then discharged into the wetland. The surface runoff balance seeks to keep post-development runoff rates to as near pre-development rates as possible. Due to site layout constraints, the majority of infiltration measures on the site will be concentrated along the north edge of the development. An end-of-pipe (EOP) gallery is proposed to allow runoff from the site to infiltration is proposed below the parking area of the proposed condo block for the roofs of the apartment buildings.

The main portion of the site, including the majority of the municipal road, SWM block, and condo block, drains to a wet pond SWM facility where flows will be released gradually to allow for settling of fines out of the effluent. Once released from the pond, flows will be directed to the proposed EOP gallery where the water will be allowed to infiltrate. As flows from road surfaces will be directed to the infiltration gallery, it is proposed that a winter by-pass be installed to allow salt laden flows to be discharged directly to the surface during the winter months.

Portions of the site which cannot be directed to the proposed SWM pond will be directed to areas of amended topsoil or enhanced grass swales where possible. Runoff from the roofs of the proposed apartment buildings will be directed to an infiltration gallery below the proposed condo block parking area which is sized to capture and infiltrate runoff from all events up to the 100-year storm.

The proposed strategy results in annual increases in infiltration and runoff from the site by 12% and 42% respectively. For more information please refer to the water balance calculations contained in Appendix 'B'.

6.0 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 will accompany the detailed design submission for the subject lands. 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 will be as follows:

- Placement of all sediment control fencing where required;
- Construction of permanent and temporary stormwater management 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;
- Stripping and strategic placement of topsoil stockpiles. Placement of sediment control fencing around all stockpile areas; and
- 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 paige 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 125m³/ha of live and dead storage respectively (total 250m³/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.

A mud mat will be placed at the entrance to the site and streets will be required to be swept on a weekly basis or as required.

As per requirements of the GRCA and the City of Guelph, monthly reports will be submitted to the GRCA and City of Guelph to keep them informed of the performance of the erosion and sedimentation control measures.

7.0 OPERATION AND MAINTENANCE

It is recommended that during construction of the SWM facility 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 Grand River Conservation Authority and the City of Guelph. If it is found that the erosion and sediment control measures are not working adequately, they shall be augmented to the satisfaction of the Grand River Conservation Authority and the City of Guelph, based on field decisions.

Furthermore, it is recommended that the owner initiate a post-construction monitoring program to ensure the long term effectiveness of the SWM facility. The post-construction monitoring program should include:

- Periodic inspection of the SWM control facility and other erosion control works;
- Inspection of the SWM facility and its outlet after significant rainfall events (generally in excess of 10mm of rainfall);
- Removal of debris that may accumulate and hinder functioning of the SWM facility;

• Implementation of remedial measures including erosion stabilization, repair of damaged vegetation and sediment removal, as required.

Frequency of the post-construction monitoring will be at the discretion of the Grand River Conservation Authority and the City of Guelph. It is recommended that a minimum of four (seasonal) inspections be made, annually. An Operation, Maintenance and Monitoring Report will be submitted to the City of Guelph under a separate cover.

All of which is respectfully submitted,



Jeff Lerch, P.Eng Design Engineer

Stormwater Management Report 190- 216 Arkell Road, Guelph



APPENDIX A

HYDROLOGIC MODELLING OUTPUT

Drawing on experience...Building on

gth.

			25MM PRE-D
4.8		MIDUSS Output MIDUSS version	Vorcion 2 75 nov 472"
		MIDUSS created	Version 2.25 rev. 473" Sunday, February 07, 2010"
		10 Units used:	ie METRIC"
		Job folder:	Q:\42063\104\SWM\FINAL"
84		Output filename: Licensee name:	42063-104 25MM PRE-D.out" ADMIN"
"		Company	Microsoft"
	20	Date & Time last used:	9/28/2018 at 11:09:30 AM"
	31	L TIME PARAMETERS" 5.000 Time Step"	
**		120.000 Max. Storm length"	
**		3600.000 Max. Hydrograph"	
**	32	STORM Chicago storm"	
		1 Chicago storm" 367.000 Coefficient A"	
		367.000 Coefficient A" 5.000 Constant B"	
**		0.700 Exponent C"	
		0.394 Fraction R"	
1		120,000 Duration"	
		1.000 Time step multiplier" Maximum intensity	72.993 mm/hr"
"		Total depth	24.995 mm"
**		7 2500hyd Hydrograph exte	ension used in this file"
	33	CATCHMENT 101" 1 Triangular SCS"	
**		2 Proportional to %"	
		2 Horton equation"	
		101 Entire site "	
		11.000 % Impervious" 2.580 Total Area"	
**		150.000 Flow length"	
		1.000 Overland Slope"	
		2.296 Pervious Area" 150.000 Pervious length"	
		1.000 Pervious slope"	
*		0.284 Impervious Area"	
		18.539 Impervious length"	
**		1.000 Impervious slope" 0.300 Pervious Manning 'n'"	
		75.000 Pervious Max.infiltration	1"
**		12.500 Pervious Min.infiltration	
		0.250 Pervious Lag constant (ho 5.000 Pervious Depression stora	ours)"
		5.000 Pervious Depression stora 0.013 Impervious Manning 'n'"	age
**		0.000 Impervious Max.intiitrat	ion"
3		0.000 Impervious Min.infiltrati	ion"
		0.001 Impervious Lag constant (1.500 Impervious Depression sto	(hours)"
22		0.045 0.000	0.000 0.000 c.m/sec"
		Catchment 101 Pervi	ious Impervious Total Area "
		Surface Area 2.296	o 0.284 2.580 hectare"
'n		Time to Centroid 0.000	2.130 2.130 minutes" 0 62.617 62.617 minutes"
22		Rainfall depth 24.99 Rainfall volume 573.5	95 24.995 24.995 mm"
		Rainfall volume 573.9	94 70.94 644.88 c.m"
		Kalijali jusses 74.99	
**		Runoff depth 0.000 Runoff volume 0.00 Runoff coefficient 0.000	65.63 65.63 c.m"
		Runoff coefficient 0.000	0.925 0.102 "
	40	Maximum flow 0.000	0 0.045 0.045 c.m/sec"
\mathcal{X}	40	4 Add Runoff "	

264.0	42063-104 25M 0.045 0.045 0.0		
		0.000	
" 40 " 40	HYDROGRAPH Copy to Outflow"		
	8 Copy to Outflow"		
1.1.1		045 0.000"	
" 40	HYDROGRAPH Combine 100"		
**	6 Combine "		
50000	100 Node #"		
0.00	Flow From Site"		223
	Maximum flow	0.045 c.m/sec 5.632 c.m"	
	Hydrograph volume 6	5.632 c.m"	
		045 0.045"	
11 20	START/RE-START TOTALS 101"	0.045	
11 10	START/RE-START TUTALS 101		
12-31	3 Runoff Totals on EXIT"		
	Total Catchment area	2.5	80 hectare"
100	Total Impervious area	0.2	84 hectare"
" 38 "	Total % impervious	11.0	
0 10	EXIT"	11.0	
19	EXTI		

			10000 10				
		MTDUSS OUT	42063-10 put				
"		MIDUSS ver	sion		Ve	ersion 2.25	rev. 473"
		MIDUSS cre			Sunda	y, February	/ 07, 2010"
		10 Units used Job folder			0.	\42063\104\	ie METRIC"
		Output fil				063-104 5YR	
		Licensee r	ame:				ADMIN"
		Company Date & Tim	e last used:		0/29	3/2018 at 11	Microsoft"
	31	TIME PARAMETE			5/20	72010 at 11	L.00.47 AM
**		5.000 Time Step'					
		170.000 Max. Storn 3600.000 Max. Hydro	length" graph"				
41	32	STORM Chicago	storm"				
		1 Chicago st	orm"				
- 2		1593.000 Coefficier 11.000 Constant E					
		0.879 Exponent C					
		0.400 Fraction F	н				
		170.000 Duration"					
**		1.000 Time step Maximum inter	multiplier" sitv	134.894	4 mm/hr"		
		Total depth	5	46.77	5 mm''		
1	33	4 Shyd Hyd CATCHMENT 101	rograph exten:	sion used	d in this f	ile"	
- 22	55	1 Triangular	SCS"				
		2 Proportion	al to %"				
		2 Horton equ 101 Entire sit	ation"				
		11.000 % Impervio	us"				
		2.580 Total Area					
		150.000 Flow lengt 1.000 Overland S	h" lopo"				
22		2.296 Pervious A					
**		150.000 Pervious 1	ength"				
- 20		1.000 Pervious s 0.284 Impervious					
		0.284 Impervious 18.539 Impervious	length"				
- 39			slope" anning 'n'"				
- 7		0.300 Pervious M 75.000 Pervious M	anning 'n'" ax.infiltratio				
**		12.500 Pervious M	in.infiltratio	on on			
1		0.250 Pervious L	ag constant (hours)"			
- 2		5.000 Pervious D 0.013 Impervious	epression stor Manning 'n'"	rage"			
		0.000 Impervious	Max.infiltrat	tion"			
- 10		0.000 Impervious	Min.infiltra	tion"			
		0.001 Impervious 1.500 Impervious	Lag constant Depression st	(hours)			
		0.090		0.000	0.000 c	.m/sec"	
"		Catchment 101	Perv	vious 1	Impervious	Total Area	
. 22		Surface Area	ntration 55.4			2.580 37.338	hectare" minutes"
2		Time to Centr	oid 123			109.780	minutes"
		Rainfall dept	h 46.1	775 4	46.775	46.775	mm "
		Rainfall dept Rainfall volu Rainfall loss	me 1074 es 35.8	4.05 881		1206.80 32.167	c.m" mm"
		Runott denth	10.8	894 4	44.658	14.608	mm"
		Runoff volume Runoff coeffi	250	.16 :	126.74	376.90	ç.m"
		Maximum flow	0.0			0.312	c.m/sec"
- 2	40	HYDROGRAPH AC	d Runoff "	- (0.000	cim/ 366
.1		4 Add Runoff		ade 1			
			P2	108 1			

					5YR PRE-D			
					0.000	0.000"		
	40	HYDROGRAPH	CODV to	Outflow"				
		8 Copy to	Outflow'					
					0.090	0.000"		
	40	HYDROGRAPH	Combir	ie 100"				
		6 Combine	U .					
		100 Node #"						
			om Site"					
		Maximum fl			0.090	c_m/sec"		
		Hydrograph			376.897	c.m/sec" c.m"		
					0.090	0.090"		
**	38	START/RE-S			0.000	0.000		
	50	3 Runoff	Totals or	FYTT"				
17		Total Catc				2.58	0	hectare"
		Total Impe				0.28		hectare"
315		Total % im	nervious al	çα		11.00		neccale
	19	EXIT"	pervious			11.00	U	

				-104 100YR	PRE-D		
**			S Output~				>"
**			S version S created		Ve Sunda	ersion 2.25 Ay, February	rev. 4/3"
**			used:		Sunde	ly, rebluary	ie METRIC"
			older:		Q	\42063\104	\SWM\FINAL"
			t filename:		42063	3-104 100YR	PRE-D.out"
**		Compa	see name: nv				ADMIN" Microsoft"
••		Date	& Time last us	ed:	9/28	8/2018 at 1	1:07:57 AM"
	31	TIME PAR	AMETERS"		,		
		5.000 Time 210.000 Max.	Step"				
		3600.000 Max.	Storm length" Hydrograph"				
	32	STORM Ch	icago storm"				
		1 Chica	go storm"				
			icient A" ant B"				
			ent C"				
**		0.400 Fract	ion R"				
		210.000 Durat	ion"				
			step multiplie intensity	213.57	74 mm/hr'		
		Total de		88.83			
		6 100hy	d Hydrograph	extension u	used in this	; file"	
	33	CATCHMEN	т 101"				
		1 Trian 2 Propo	gular SCS" rtional to %"				
			n equation"				
		101 Entir	e site "				
		11.000 % Imp 2.580 Total	ervious" Area"				
			length"				
1		1.000 Overl	and Slope"				
- 2		2.296 Pervi	ous Area"				
			ous length" ous slope"				
			vious Area"				
		18.539 Imper	vious Area" vious length"				
		1.000 Imper 0.300 Pervi	vious slope" ous Manning 'n	T /1			
**		75.000 Pervi	ous Max.infilt	ration"			
:		12.500 Pervi	ous Min.intilt:	ration"			
		0.250 Pervi	ous Lag consta	nt (hours)"			
22		5.000 Pervi 0.013 Imper	ous Depression vious Manning	storage"			
*1		0.000 imper	vious Max.infi	". Itration"			
		0.000 Imper	vious Min.infi	ltration"			
			vious Lag const		1920		
			vious Depressio 0.396 0.000		0.000	.m/sec"	
		Catchmen			Impervious	Total Area	п
		Surface .	Area	2.296	0.284	2.580	hectare"
			concentration Centroid			27.496 121.513	minutes" minutes"
		Rainfall	depth	88.830	88.830	88.830	mm"
		Rainfall Rainfall	volume	88.830 2039.71	252.10	2291.81	c.m"
		Rainfall Runoff d	losses		2.967	38.782	mm ¹¹
		Runoff v			85.863 243.68	50.048 1291.23	mm'' C.m''
- 10		Runoff c	oefficient	0.514	0.967	0.563	c.m"
	40	Maximum	t low	0.368	0.144	0.396	c.m/sec"
	40	4 Add R	PH Add Runoff unoff "	5.W			
		i nad k					

		42063-104 10	OYR PRE-D)	
**				0.000"	
	40		.000	0.000	
	40	HYDROGRAPH Copy to Outflow"			
- 11		8 Copy to Outflow"			
		0,396 0,396 0	.396	0.000"	
	40	HYDROGRAPH Combine 100"			
	10	6 Combine "			
		o comprine			
		100 Node #"			
•••		Flow From Site"			
		Maximum flow	0.396	c.m/sec"	
			91.227	C.m"	
			.396	0.396"	
	38	START/RE-START TOTALS 101"			
		3 Runoff Totals on EXIT"			
	38	Total Catchment area		2 580	ha a transfille
		Total catchment area		2.580	hectare"
		Total Impervious area		0.284	hectare"
		Total % impervious		11.000"	
	19	EXIT"			

				-104 25MM P	OST-D		
			AIDUSS Output AIDUSS version				>"
••			AIDUSS created		v Sund	ersion 2.25 ay, February	v 07 2010"
**		10 ι	Jnits used:				10 METRIC"
			ob folder:		Q	:\42063\104	\SWM\FINAL"
			Output filename: _icensee name:		4206	3-104 25мм н	POST-D.out"
			Company				ADMIN" Microsoft
*		0	Date & Time last use	ed:	10/	10/2018 at 3	1:25:42 PM"
	31	TIME	PARAMETERS"				
**			Time Step"				
		3600.000	lax. Storm length" lax. Hydrograph"				
**	32	STOP	M Chicago storm"				
		1 (chicago storm"				
		367.000	Coefficient A"				
		5.000 C	Constant B" Exponent C"				
7			Fraction R"				
"		120.000 c	Duration"				
			ime step multiplie				
		Maxi	mum intensity	72.9	93 mm/hr		
				24.99 h extension		is filo"	
	33	CATO	HMENT 206"	excension	used in en	13 THE	
		1 1	Friangular SCS"				
			Proportional to %"				
		206 8	Horton equation" Easterly Rear Yards'				
2		25.000 %	s impervious"				
			otal Area"				
			low length"				
		0.186 F	Overland Slope" Pervious Area"				
		13.000	Pervious length"				
		2.000	Pervious slope"				
n		0.062	Impervious Area" Impervious length"				
		4.333 1	Impervious slope"				
31		0.300 F	Pervious Manning 'n'				
1		75.000 F	Pervious Max.infilt	ration"			
		12.500 F	ervious Min.intilta	ration"			
		0.250 F 5.000 F	Pervious Lag constar Pervious Depression	nt (nours)"			
**		0.013 1	Impervious Manning '	'n'"			
2		0.000 1	[mpervious Max.infi]	ltration"			
2		0.000 1	Impervious Min.infil	ltration"			
22			Impervious Lag const Impervious Depressio)		
**		1,000 1	0.011 0.000		0.000	c.m/sec"	
"		Cato	chment 206	Pervious	Impervious	Total Area	
		Surf	ace Area of concentration	0.186	0.062	0.248	hectare"
		lime Time	e of concentration e to Centroid	0.000	0.723 61.131	0.723	minutes"
#		Rair	ifall depth	24.995	24,995	61.131 24.995	minutes" mm"
-		Rair	ifall volume	46.49	15.50	61.99	c.m"
		Rair	Itali losses		2.773	19.440	mm
		RUDO	off depth off volume	0.000	22.222 13.78	5.556 13.78	mm"
**		Runo	off coefficient		0.889	0.222	Ç.m"
<u></u>	40	Maxi	mum flow	0 000	0.011	0.011	c.m/sec"
n	40	HYDR 4 A	OGRAPH Add Runoff '				
		- <i>P</i>					

		42063-104 25MM POST-D
	40	0.011 0.011 0.000 0.000"
	40	HYDROGRAPH Copy to Outflow" 8 Copy to Outflow"
		0.011 0.011 0.011 0.000"
	40	HYDROGRAPH Combine 1" 6 Combine "
.0		1 Node #"
		Flow to Wetland"
		Maximum flow 0.011 c.m/sec" Hydrograph volume 13.778 c.m"
		0.011 0.011 0.011 0.011"
	40	HYDROGRAPH Start - New Tributary" 2 Start - New Tributary"
		0.011 0.000 0.011 0.011"
	33	CATCHMENT 207"
		1 Triangular SCS" 2 Proportional to %"
		2 Horton equation"
		207 Unattenuated to Arkell" 25.000 % Impervious"
11		0.307 Total Area"
		30.000 Flow length"
		2.000 Overland Slope" 0.230 Pervious Area"
		30.000 Pervious length"
		2.000 Pervious slope"
		0.077 Impervious Area" 10.000 Impervious length"
		2.000 Impervious slope"
		0.300 Pervious Manning 'n'" 75.000 Pervious Max.infiltration"
		12.500 Pervious Min.infiltration"
		0.250 Pervious Lag constant (hours)" 5.000 Pervious Depression storage"
		5.000 Pervious Depression storage" 0.013 Impervious Manning 'n'"
		0.000 Impervious Max.infiltration"
**		0.000 Impervious Min.infiltration" 0.001 Impervious Lag constant (hours)"
		1.500 Impervious Depression storage"
		0.013 0.000 0.011 0.011 c.m/sec" Catchment 207 Pervious Impervious Total Area "
		Surface Area 0.230 0.077 0.307 hectare"
:		Time of concentration 1.194 1.194 minutes
		Time to Centroid 0.000 61.185 61.185 minutes" Rainfall depth 24.995 24.995 24.995 mm"
		Rainfall volume 57.55 19.18 76.74 c.m"
		Raintall losses 24.995 2.046 19.258 mm"
		Runoff depth 0.000 22.949 5.737 mm" Runoff volume 0.00 17.61 17.61 c.m" Runoff colume 0.00 0.018 0.220 "
		Runoff coefficient 0.000 0.918 0.230 "
	40	Maximum flow 0.000 0.013 0.013 c.m/sec" HYDROGRAPH Add RUNOff "
		4 Add Runott "
	40	0.013 0.013 0.011 0.011"
**	τv	HYDROGRAPH Copy to Outflow" 8 Copy to Outflow"
	40	0.013 0.013 0.013 0.011"
	40	HYDROGRAPH Combine 2" 6 Combine "
		2 Node #"
		Flow to Arkell Road " Maximum flow 0.013 c.m/sec"
		Maximum flow 0.013 c.m/sec" Hydrograph volume 17.613 c.m"
		Page 2

63		42063-104 25MM	
	40	0.013 0.013 0.0 HYDROGRAPH Start - New Tributar	
**		2 Start - New Tributary"	3
"		0.013 0.000 0.0	0.013"
	33	CATCHMENT 208"	
a.,		1 Triangular SCS" 2 Proportional to %"	
		2 Proportional to %" 2 Horton equation"	
		208 Wetland"	
"		5.000 % Impervious"	
		0.876 Total Area"	
		35.000 Flow length"	
		5.000 Overland Slope" 0.832 Pervious Area"	
		35.000 Pervious length"	
**		5.000 Pervious slope"	
60) 11 -		0.044 Impervious Area"	
		1.842 Impervious length"	
		5.000 Impervious slope" 0.300 Pervious Manning 'n'"	
"		75.000 Pervious Max.infiltration"	
11		12.500 Pervious Min.infiltration"	
		0.250 Pervious Lag constant (hours	s)"
		5.000 Pervious Depression storage"	1
		0.013 Impervious Manning 'n'" 0.000 Impervious Max.infiltration"	
••		0.000 Impervious Max.infiltration" 0.000 Impervious Min.infiltration"	
**		0.001 Impervious Lag constant (hou	irs)"
		1.500 Impervious Depression storag	je"
		0.008 0.000 0.0	
		Catchment 208 Pervious Surface Area 0.832	s impervious local Area
		Time of concentration	0.044 0.876 hectare" 0.329 0.329 minutes"
"		Time to Centroid 0.000	60.159 60.159 minutes"
		Rainfall depth 24.995	24.995 24.995 mm"
		Rainfall volume 208.01	10.95 218.96 c.m"
		Rainfall losses 24.995 Runoff depth 0.000	4.722 23.982 mm" 20.274 1.014 mm"
		Runoff depth 0.000 Runoff volume 0.00	20.274 1.014 mm" 8.88 8.88 c.m"
"		Runoff coefficient 0.000	8.88 8.88 c.m" 0.811 0.041
		Maximum flow 0.000	0.008 0.008 c.m/sec"
	40	HYDROGRAPH Add Runoff "	
		4 Add Runoff " 0.008 0.008 0.0	0.013"
•	40	HYDROGRAPH CODY to Outflow"	
**		HYDROGRAPH Copy to Outflow" 8 Copy to Outflow"	
	40	0.008 0.008 0.0	0.013"
	40	HYDROGRAPH Combine 1" 6 Combine "	
•		1 Node #"	
		Flow to Wetland"	
			0.018 c.m/sec"
			2.658 c.m"
	40	0.008 0.008 0.0 HYDROGRAPH Start - New Tributar	
"	40	2 Start - New Tributary"	y
••		0.008 0.000 0.0	0.018"
	33	CATCHMENT 201"	
		1 Triangular SCS"	
		2 Proportional to %" 2 Horton equation"	
		201 ROW"	
		65.000 % Impervious"	
		. Page 3	1

				42063-1	04 25MM P	OST-D		
**		0.510	Total Area"					
		5.000	Flow length"					
		2.000	Overland Slope					
		0.178	Pervious Area"	10				
		5.000	Pervious lengt Pervious slope					
		0.331	Impervious Are	a ¹¹				
		9.286	Impervious Are Impervious len	th"				
:		2.000	Impervious Sio	pe				
		0.250	Pervious Manni	ng 'n'"				
		75.000	Pervious Max.i	nfiltrat	ion"			
		12.500	Pervious Min.i Pervious Lag c	nri itrat	(hours)"			
		5.000	Pervious Depre	ssion st	orage"			
		0.013	Impervious Man	nina 'n'				
		0.000	Impervious Max	.infiltr	ation"			
:		0.000	Impervious Min	.infiltr	ation"			
		0.001	Impervious Lag	conștar	it (hours))"		
**		1.500	Impervious Dep 0.058	0.000	storage [®] 0.008	0.018	c.m/sec"	
		Ca	atchment 201		rvious		Total Area	
			irface Area		178	0.331	0.510	hectare"
			me of concentra			1.142	1.142	minutes"
			ime to Centroid		000	61.180	61.180	minutes"
			infall depth		.995	24.995	24.995	mm"
		Re	ainfall volume ainfall losses		.62	82.86 2.055	127.48 10.084	⊂.m" mm"
			noff depth		000	22.940	14.911	mm"
49		RL	unoff volume	0.	00	76.05	76.05	ç.m"
		RL	unoff coefficien		000	0.918	0.597	
			aximum flow		000	0.058	0.058	c.m/sec"
	40	4	DROGRAPH Add Ru Add Runoff "	NOTT "				
		4	0.058	0.058	0.008	0.018"		
	40	H)	DROGRAPH Copy_t	ooutflo	w"	0.010		
**		8	Copy to Outflo	N''				
			0.058	0.058	0.058	0.018"		
	40		DROGRAPH Next 1	ink "				
		5	Next link " 0.058	0.058	0.058	0.018"		
	33	CA	ATCHMENT 202"	0.050	0.050	0.010		
	1000	1	Triangular SCS					
::		2	Proportional t	י% כ				
		202	Horton equatio	n''				
		202 50,000	SWM Pond" % Impervious"					
**		0.166	Total Area"					
		5.000	Flow length"					
		2.000	overland Slope					
		0.083	Pervious Area"					
		5.000 2.000	Pervious lengt Pervious slope					
		0.083	Impervious Are	a''				
"		5.000	Impervious len	gth"				
		2.000	Impervious slo	ne"				
2		0.250	Pervious Manni	ng 'n'"				
		75.000	Pervious Max.i	nti Itrat	100"			
		12.500 0.250	Pervious Min.i Pervious Lag c	nn i i Lirat	(hours)*			
**		5.000	Pervious Depre	ssion st	orage"			
**		0.013	Tmpervious Man	nina 'n'	- n			
		0.000	Impervious Max	.infiltr	ation"			
		0.000	Impervious Min	.infiltr				
					Page 4			

				42063-	-104 2	5MM P	0ST-D		
		0.001 I 1.500 I	mpervious Lag mpervious Dep	const	ant (hours))"		
**			0.015	0.058		0.058		c.m/sec"	
-		Surf	hment 202 ace Area		Pervi 0.083	ous	Impervious 0.083	Total Area 0.166	" hectare"
2		Time	of concentra		0 000	••	0.788	0.788	minutes"
		Rain	to Centroid fall depth		0.000 24.99		61.170 24.995	61.170 24.995	minutes" mm"
"		Rain	fall volume fall losses		20.75	F	20.75	41.49	c.m"
		Runo	ff depth		0.000		2.563 22.433	13.779 11.216	mm" mm"
1		Runo	ff volume ff coefficien	t	0.00 0.000		18.62 0.897	18.62 0.449	ç.m"
2	40	Maxi	mum flow		0.000		0.015	0.015	c.m/sec"
**	40	4 A	OGRAPH Add Ru dd Runoff "	nott "					
	40		0.015	0.072		0.058	0.018		
	40	8 C	OGRAPH Copy to Outflo	o outt w"	low"				
2	40		0.015	0.072	1	0.072	0.018"		
	40		OGRAPH Next] ext link "	пк					
	33	CATC	0.015 HMENT 203"	0.072		0.072	0.018"		
		1 т	riangular SCS	P					
			roportional t orton equatio						
		203 A	partment Bloc	k"					
		0.285 To	Impervious" otal Area"						
1		30.000 F	low_length"						
		0.086 P	verland Slope ervious Area"						
		30.000 P 2.000 P	ervious lengt ervious slope	h'					
2		0.199 I	mpervious Are	a					
0		1 000 T	mpervious len mpervious slo	no"					
		0.250 P	ervious Manni	ng 'n'	"				
n.		75.000 P	ervious Max.i ervious Min.i	nriitr	ation				
		0.250 P	ervious Lag c	onstan	t (ho	urs)"			
		5.000 Pe 0.013 Ir	ervious Depre mpervious Man	ssion . nina '	stora n'"	ge"			
		0.000 In	mpervious Max	.infil	trati	on"			
12		0.001 In	npervious Min mpervious Lag	const	ant (hours)	, u		
ii.		1.500 In	npervious Dep 0.031	ressio 0.072	n sto	rage" 0.072		c.m/sec"	
2			hment 203		Pervi	ous	Impervious	Total Area	
10		Surta	of concentra	tion	0.086		0.199 4.726	0.285 4.726	hectare" minutes"
		time	LO CENTROID		0.000	-	66.178	66.178	minutes"
		Rain	fall depth fall volume	:	24.99 21.37	5	24.995 49.87	24.995 71.24	mm" c.m"
		Rain	fall losses		24.99	5	1.693	8.683	mm ''
"		Runo	ff depth ff volume		0.000		23.303 46.49	16.312 46.49	mm" Ç.m"
		Runot	ff coefficien num flow		0.000		0.932 0.031	0.653	
	40	HYDRO	OGRAPH Add Ru	noff "	0.000		0.031	0.031	c.m/sec"
		4 A0	dd Runoff " 0.031	0.097		0.072	0.018"		
					Page		0.010		

			42062	104	JENN DOCT	P
40	HY	DROGRAPH COP	V to Out1	-104 flow"	25MM POST	-0
	8	Copy to Out	tlow"			
40	5	0.031	0.097	7 3"	0.097	0.018"
40	6	Combine "	ombine	2		
	3	Node #"				
		Flow to SWM	Pond"		0.007	
		ximum flow - drograph vol	ume		0.097 141.156	c.m/sec" c.m"
	,	0.031	0.097		0.097	0.097"
40		DROGRAPH C	onfluence	2	3"	
	7 3	Confluence Node #"				
		Flow to SWM	Pond"			
		Flow to SWM			0.097	c.m/sec"
	Ну	drograph vol 0.031	ume 0.097	7	141.156	C.m"
54	PC	ND DESIGN"	0.097	r	0.097	0.000"
	0.097	Current pea		ç.m	/sec"	
	0.048 141.2	Target outf	low c.	.m/se c.m	c"	
	11.	Hydrograph Number of s	tages"	C.m		
	335.000	Minimum wat	er level	m	etre"	
	336.000	Maximum wat	er level	m	etre"	
	335.000 0	Starting wa Keep Design	Data: 1	 – тг	metre" Net 0 - E:	احم"
	•	Level Dis	charge	Vol	ume"	1150
		335.000	0.000	0.	000"	
			.00632	88.	600" 400"	
		335.300 0	.04416	278.	400"	
			.08821	379.	600"	
			0.1080 0.1248	485. 594.	000" 600"	
		335.700	0.1395	708.	400"	
		335.800	0.1528	826.	400"	
		335.900 336.000	0.1650 0.1764 1	948. L075.	600"	
	1.	ORIFICES"	0.1/04]		000	
		Orifice 0	rifice		ice Number	of"
		invert coe 335.000	fficie c 0.630	liame		ices"
	Pe	ak outflow	0.000	0.3	0.009	.000" c.m/sec"
	Ma	ximum level			335.117	metre"
	Ma	ximum storag ntroidal lag	e		104.525 4.769	c.m"
	Ce	0.031	0.097	0.		hours" .000 c.m/sec"
40		DROGRAPH Nex				,
	5	Next link "	0.000	`	0.009	0.000"
33	CA	0.031 TCHMENT 204"	0.009	,	0.009	0.000
100	1	Triangular	SCS"			
	2 2	Proportiona	l to %"			
	204	Horton equa Rear Yards"	LION			
	50.000	% Imperviou	s"			
	0.112	Total Area"				
	5.000 2.000	Flow length Overland Sl	one"			
	0.056	Overland Sl Pervious Ar	ea"			
	5.000	Pervious le	ngth"			
	2.000	Pervious sl Impervious				
	0.050	inpervious i	AI COL	Ра	ge 6	

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03		42063-104 25MM POST-D	
"		5.000 Impervious length"	
		2.000 Impervious slope"	
- 22		0.250 Pervious Manning 'n'"	
		75.000 Pervious Max.infiltration"	
		12.500 Pervious Min.infiltration"	
		0.250 Pervious Lag constant (hours)" 5.000 Pervious Depression storage"	
		5.000 Pervious Depression storage" 0.013 Impervious Manning 'n'"	
		0.000 Impervious Max.infiltration"	
		0.000 Impervious Min.infiltration"	
1		0.001 Impervious Lag constant (hours)"	
*		1.500 Impervious Depression storage"	
		0.010 0.009 0.009 0.000 c.m/sec"	
1		Catchment 204 Pervious Impervious Total Area	
		Surface Area 0.056 0.056 0.112 hectare"	
		Time of concentration 0.788 0.788 minutes"	
		Time to Centroid 0.000 61.170 61.170 minutes"	
		Rainfall depth 24.995 24.995 24.995 mm" Rainfall volume 14.00 14.00 27.99 c.m"	
		Rainfall volume 14.00 14.00 27.99 c.m" Rainfall losses 24.995 2.563 13.779 mm"	
**		Runoff depth 0.000 22.433 11.216 mm"	
**		Runoff volume 0.00 12.56 12.56 c.m"	
**			
		Maximum flow 0.000 0.010 0.010 c.m/sec"	
	40	HYDROGRAPH Add Runoff	
		4 Add Runoff "	
	40	0.010 0.013 0.009 0.000"	
÷	40	HYDROGRAPH COPY to Outflow" 8 Copy to Outflow"	
!!		0.010 0.013 0.013 0.000"	
**	40	HYDROGRAPH Combine 4"	
		6 Combine "	
		4 Node #"	
		Flow to Infiltration Gallery"	
- 6		Maximum flow 0.013 c.m/sec" Hydrograph volume 153.709 c.m"	
		Hydrograph volume 153.709 c.m"	
22	40	0.010 0.013 0.013 0.013" HYDROGRAPH Confluence 4"	
**	70	7 Confluence "	
		4 Node #"	
"		Flow to Infiltration Gallery"	
**		Maximum flow 0.013 c.m/sec"	
		Hydrograph volume 153.709 c.m"	
		0.010 0.013 0.013 0.000"	
	57	TRENCH Design d/s of 4"	
**		0.013 Peak inflow" 153.709 Hydrograph volume"	
		153.709 Hydrograph volume" 336.500 Ground elevation"	
**		334.500 Downstream trench invert"	
"		1.000 Trench height"	
11		333.000 Water table elevation"	
		2.000 Trench top width"	
		2.000 Trench bottom width"	
**		100.000 Voids ratio (%)"	
n		15.000 Hydraulic conductivity" 0.000 Trench gradient (%)"	
		0.000 Trench gradient (%)" 80.000 Trench length"	
**		1.000 Include base width"	
10		21. Number of stages"	
		Level Discharge Volume"	
		334.500 0.000 0.0"	
		334.600 0.000 16.0"	
		334.700 0.000 32.0"	
		Page 7	

				-104 25MM	POST-D		
		334.800 334.900	0.000	48.0" 64.0"			
		335.000	0.000	80.0"			
		335.100	0.000	96.0"			
		335.200 335.300	0.000	112.0" 128.0"			
		335.400	0.000	144.0"			
		335.500	0.000	160.0"			
		335.600 335.700	0.005 0.018	160.1" 160.2"			
		335.800	0.035	160.3"			
		335.900 336.000	0.055 0.073	160.5" 160.6"			
		336.100	0.075	160.7"			
		336.200	0.102	160.8"			
		336.300 336.400	0.114 0.125	160.9" 161.0"			
		336.500	0.135	161.1"			
	1.	TRENCH PI		Dine		-5142	055
	Du	wnstream Invert	Pipe length	Pipe diam.	grade%	o=Yes	Offset" distance"
		335.500	10.000	0.000	9.000	1.000	0.000"
	1.	MANHOLE"					
		diameter"					
	1	1.200"	TDC ¹				
	1. 0.	OUTFLOW P Inflow at	upstream e	and of tree	nch: 1=⊤rue	: 0=Fals	e"
		Upstream D	ownstr'm	Pipe	Pipe	Manning	Entry"
		invert 335.500	invert 334.600	Length (10.000	0.300	'n ¹ 0.013	loss Ke" 0.500"
		ak outflow		0.0	000 c.m/	sec"	0.500
	Ou	tflow volu ak exfiltr	ne	0.0	015 c.m'	'coc"	
	EX	filtration	volume	153.3	001 c.m/ 393 c.m″	sec"	
	Ma	ximum leve	1	335.3	140 metr	'e''	
	Ма	ximum stor: ntroidal l:	age	102.			
	In	filtration	area 2 sid	les 102.	329 sq.me	tre"	
	In	filtration 0.010	Base area 0.013	160.0 0.000	0.001 c.	tre"	
40	HY	DROGRAPH	Combine	1"	0.001 C.	M/Sec	
	6 1	Combine "					
	T	Node #" Flow to W	etland"				
		ximum flow	_		018 c.m/	sec"	
	Ну	drograph vo 0.010		22.0	572 c.m" 0.018		
40	HY	DROGRAPH ST	tart - New	Tributary'	, 0.010		
	2	Start - N 0.01	ew Tributar 0 0.000		0.018		
33	CA	TCHMENT 20	5"	0.000	0.010	•	
	1	Triangula Equal leng	r scs"				
	1 2	Horton eq	gth" Jation"				
	205	Apartment	Rooftops"				
	100.000 0.076	% Impervie	ous"				
	5.000	Total Area Flow leng	th"				
	1.000	Overland :	slope"				
	0.000 5.000	Pervious / Pervious	length"				
	1.000	Pervious		-			
				Page 8			

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		42063-104 25MM POST-D
- 2		0.076 Impervious Area"
		5.000 Impervious length" 1.000 Impervious slope"
		1.000 Impervious slope" 0.250 Pervious Manning 'n'" 7.000 Pervious Manning 'n'"
		75.000 Pervious Max.infiltration"
		12.500 Pervious Min.infiltration"
		0.250 Pervious Lag constant (hours)"
		5.000 Pervious Depression storage"
- 2		0.013 Impervious Manning 'n'"
		0.000 Impervious Max.intiltration"
		0.000 Impervious Min.infiltration" 0.001 Impervious Lag constant (hours)"
		1.500 Impervious Depression storage"
		0.013 0.000 0.000 0.018 c.m/sec"
		Catchment 205 Pervious Impervious Total Area "
		Surface Area 0.000 0.076 0.076 hectare
		Time of concentration 0.970 0.970 minutes"
		Time to Centroid 0.000 61.205 61.205 minutes" Rainfall depth 24.995 24.995 24.995 mm"
		Rainfall depth 24.995 24.995 24.995 mm" Rainfall volume 0.00 19.00 19.00 c.m"
		Rainfall losses 24.995 2.182 2.182 mm"
		Runoff depth 0.000 22.813 22.813 mm"
		Runott volume 0.00 17.34 17.34 c.m ^m
		Runoff coefficient 0.000 0.913 0.913
	40	Maximum flow 0.000 0.013 0.013 c.m/sec"
	40	HYDROGRAPH Add Runoff " 4 Add Runoff "
		0.013 0.013 0.000 0.018"
	40	HYDROGRAPH CODY to Outflow"
		8 Copy to Outflow"
- 2	40	0.013 0.013 0.013 0.018
	40	HYDROGRAPH Combine 9" 6 Combine "
- 22		9 Node #"
		Flow to Private Infiltration Gallery"
		Maximum flow 0.013 c.m/sec"
		Hydrograph Volume 17.338 c.m ²
	40	0.013 0.013 0.013 0.013"
	40	HYDROGRAPH Confluence 1" 7 Confluence "
		1 Node #"
		Flow to Wetland"
		Maximum flow0.018 c.m/sec"
		Hydrograph volume 22.672 c.m"
	40	0.013 0.018 0.013 0.000" HYDROGRAPH COPY to Outflow"
	40	8 Copy to Outflow"
		0.013 0.018 0.018 0.000"
n	40	HYDROGRAPH Combine 99"
		6 Combine "
- 2		99 Node #"
		Flow from the Site "
**		Maximum flow 0.018 c.m/sec" Hydrograph volume 22.672 c.m"
		0.013 0.018 0.018 0.018"
	40	HYDROGRAPH Confluence 2"
- 10		7 Confluence "
		2 Node #"
		Flow to Arkell Road " Maximum flow 0.013 c.m/sec"
		Maximum flow 0.013 c.m/sec" Hydrograph volume 17.613 c.m"
		0.013 0.013 0.018 0.000"
.11	40	HYDROGRAPH Copy to Outflow"
		Page 9

100		42063-104 25MM POST-D	
		8 Copy to Outflow"	
		0.013 0.013 0.013 0.000"	
"	40	HYDROGRAPH Combine 99"	
		6 Combine "	
.,,		99 Node #"	
		Flow from the site "	
		Maximum flow 0.032 c.m/sec"	
		Hydrograph volume 40.286 c.m"	
- 22		0.013 0.013 0.013 0.032"	
	38	START/RE-START TOTALS 2"	
11	38	3 Runoff Totals on EXIT"	
		Total Catchment area 2.580	hectare"
194			
		Total Impervious area 0.929	hectare"
- 32		Total % impervious 35.990"	
	19	EXIT"	

			63-104 5YR P			
		MIDUSS Output MIDUSS version			ancion 2 25	477
**		MIDUSS created		Sund	av Februar	rev. 473" y 07, 2010"
**		10 Units used:				ie MFTRTC"
		Job folder:		Q	:\42063\104	\SWM\FINAL"
		Output filename:		420	63-104 5YR	POST-D.out"
'n		Licensee name:				ADMIN"
		Company Date & Time last u	cod.	10/	10/2018 -+	Microsoft" 3:02:43 PM"
30	31	TIME PARAMETERS"	seu.	10/	10/2010 at	5:02:45 PM
		5.000 Time Step"				
		170.000 Max. Storm length"				
		3600.000 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"				
**		170.000 Duration"				
		1.000 Time step multipli		<i>"</i>		
		Maximum intensity	134.8	94 mm/hr		
		Total depth 4 Shyd Hydrograph	46.7 extension us		file	
**	33	CATCHMENT 206"	excension us	eu m uns	THE	
		1 Triangular SCS"				
		2 Proportional to %"				
<i></i>		2 Horton_equation"				
		206 Easterly Rear Yard 25.000 % Impervious"	s"			
		25.000 % Impervious" 0.248 Total Area"				
		13.000 Flow length"				
••		2.000 Overland Slope"				
**		0.186 Pervious Area"				
::		13.000 Pervious length"				
		2.000 Pervious slope"				
\mathcal{D}		0.062 Impervious Area" 4.333 Impervious length"				
		2.000 Impervious slope" 0.300 Pervious Manning '	n'"			
"		75.000 Pervious Max.infi]	tration"			
÷.		12.500 Pervious Min.infil	tration"			
		0.250 Pervious Lag const 5.000 Pervious Depressio				
		5.000 Pervious Depressio 0.013 Impervious Manning	n storage			
1		0.000 Impervious Max.inf	iltration"			
"		0.000 Impervious Min.inf	iltration"			
		0.001 Impervious Lag con	stant (hours)"		
2		1.500 Impervious Depress				
		0.025 0.0 Catchment 206			c.m/sec"	
		Surface Area	Pervious 0.186	0.062	Total Area 0.248	hectare"
**		Surface Area Time of concentration	10.375	0.566	4.886	minutes"
**		Time to Centroid	84.265	80.760	82.304	minutes"
		Rainfall depth	46.775	46.775	46.775	mm ''
ü.		Rainfall volume	87.00 35.938	29.00 5.479	116.00	c.m"
		Rainfall losses	35.938 10.837	5.479 41.296	28.324	mm''
**		Runoff depth Runoff volume	20.16	25.60	18.451 45.76	mm" ç.m"
<u>*</u>		Runoff coefficient	0.232	0.883	0.394	11
"		Maximum flow	0 019	0.020	0.025	c.m/sec"
	40	HYDROGRAPH Add Runoff				
		4 Add Runoff "	Bago 1			

		42063-104 5YR POST-D 0.025 0.025 0.000 0.000"
	40	HYDROGRAPH Copy to Outflow" 8 Copy to Outflow"
	40	0.025 0.025 0.025 0.000" HYDROGRAPH Combine 1"
	40	HYDROGRAPH Combine 1" 6 Combine "
		1 Node #"
		Flow to Wetland" Maximum flow 0.025 c.m/sec"
**		Maximum flow 0.025 c.m/sec" Hydrograph volume 45.760 c.m"
**		0.025 0.025 0.025 0.025"
	40	HYDROGRAPH Start - New Tributary"
		2 Start - New Tributary" 0.025 0.000 0.025 0.025"
	33	CATCHMENT 207"
::		1 Triangular SCS" "
		2 Proportional to %" 2 Horton equation"
		207 Unattenuated to Arkell"
		25.000 % Impervious"
		0.307 Total Area" 30.000 Flow length"
		2.000 Overland Slope"
		0.230 Pervious Area"
		30.000 Pervious length" 2.000 Pervious slope"
		0.077 Impervious Area"
		10.000 Impervious length"
- Gi		2.000 Impervious slope" 0.300 Pervious Manning 'n'"
100		75.000 Pervious Max.infiltration"
		12.500 Pervious Min.infiltration"
- 24		0.250 Pervious Lag constant (hours)" 5.000 Pervious Depression storage"
		5.000 Pervious Depression storage" 0.013 Impervious Manning 'n'"
**		0.000 Impervious Max.infiltration"
		0.000 Impervious Min.infiltration" 0.001 Impervious Lag constant (hours)"
		0.001 Impervious Lag constant (hours)" 1.500 Impervious Depression storage"
		0.027 0.000 0.025 0.025 c.m/sec"
30		Catchment 207 Pervious Impervious Total Area " Surface Area 0.230 0.077 0.307 hectare"
		Surface Area 0.230 0.077 0.307 hectare" Time of concentration 17.136 0.934 7.877 minutes"
		Time to Centroid 90.234 80.890 84.894 minutes"
		Rainfall depth 46.775 46.775 46.775 mm" Rainfall volume 107.70 35.90 143.60 c.m"
		Rainfall losses 35,892 3,239 27,729 mm"
		Runoff depth 10.883 43.536 19.046 mm"
		Runott Volume 25.06 33.41 58.47 c.m"
	40	HYDROGRAPH Add Runoff "
	40	0.027 0.027 0.025 0.025" _HYDROGRAPH Copy_to_outflow"
:	(T	8 Copy to Outflow"
	40	0.027 0.027 0.027 0.025" HYDROGRAPH Combine 2"
	-10	6 Combine "
		2 Node #"
		Flow to Arkell Road " Maximum flow 0.027 c.m/sec"
		Maximum flow 0.027 c.m/sec" Hydrograph volume 58.471 c.m"
		Page 2

		42063-104 5YR POST-D	
	40	0.027 0.027 0.027 0.02	27"
	40		
		2 Start - New Tributary"	
		0.027 0.000 0.027 0.0)27"
	33		
		1 Triangular SCS"	
		2 Proportional_to_%"	
		2 Horton equation"	
		208 Wetland"	
2		5.000 % Impervious"	
		0.876 Total Area	
		35.000 Flow_length"	
		5.000 Overland Slope"	
		0.832 Pervious Area"	
8		35.000 Pervious length"	
		5.000 Pervious slope"	
а.		0.044 Impervious Area"	
		1.842 Impervious length"	
		5.000 Impervious slope"	
		0.300 Pervious Manning 'n'"	
<u>.</u>		75.000 Pervious Max.infiltration"	
		12.500 Pervious Min.infiltration"	
**		0.250 Pervious Lag constant (hours)"	
		5.000 Pervious Depression storage"	
		0.013 Impervious Manning 'n'"	
"		0.000 Impervious Max.infiltration"	
		0.000 Impervious Min.infiltration"	
		0.001 Impervious Lag constant (hours)"	
		1.500 Impervious Depression storage"	
.0			27 c.m/sec"
			ous Total Area "
**		Surface Area 0.832 0.044	0.876 hectare"
н		Time of concentration 14.279 0.257	12.055 minutes"
•		Time to Centroid 87.776 79.816	86.514 minutes"
		Rainfall depth 46.775 46.775	46.775 mm"
		Rainfall volume 389.26 20.49	409.75 c.m"
		Rainfall losses 35,887 7,789	34.483 mm"
		Runoff depth 10.888 38.986	12.292 mm"
ч.		Runoff volume 90.61 17.08	107.68 c.m"
**		Runoff coefficient 0.233 0.833	107.68 c.m" 0.263 "
		Maximum flow 0.070 0.014	0.072 c.m/sec"
	40		0.072 C.III/SEC
		4 Add Runoff "	
			27"
**	40) HYDROGRAPH Copy to Outflow"	27
		8 Copy to Outflow"	
			27"
88	40		27
ю.	10	6 Combine "	
		1 Node #"	
		Flow to Wetland"	
39		Maximum flow 0.094 c.	w / a a = 11
		Maximum flow 0.094 c.	m/sec"
		Hydrograph volume 153.442 c.	m ¹¹
22	40	0.072 0.072 0.072 0.0	94"
**	40		
		2 Start - New Tributary"	0.4K
	22		94"
	33		
		1 Triangular SCS"	
**		2 Proportional to %"	
÷.		2 Horton equation"	
		201 ROW"	
		65.000 % Impervious"	
		Page 3	

		4206	3-104 5YR I	POST-D		
	0.510 Total A					
•	5.000 Flow le	nath"				
	2.000 Overlan	d Slope"				
	0.178 Perviou	s Area"				
	5.000 Perviou	s length"				
		s slope"				
	0.331 Impervi	ous Area"				
	9.286 Impervi	ous length"				
	2,000 Tmpervi	ous slope"				
	0.250 Perviou	s Manning 'n	1.0			
	75.000 Perviou	s Max.infilt	ration"			
10 C	12.500 Perviou	s Min.infilt	ration"			
	0.250 Perviou	s Lag conșta	nt (hours)			
	5.000 Perviou	s Depression	storage"			
•	0.013 Impervi	ous Manning	'n''			
•	0.000 Impervi	ous Max.inŤi	ltration"			
•	0.000 Impervi	ous Min.infi	ltration"			
8	0.001 Impervi	ous Lag cons	tant (hour	s)"		
		ous Depressi				
		114 0.00		2 0.094	c.m/sec"	
	Catchment		Pervious	Impervious	Total Area	500)
	Surface Ar	ea	0.178	0.331	0.510	hectare"
		ncentration	5.242	0.894	1.411	minutes"
! !	Time to Ce		79.908	80.832	80.722	minutes"
	Rainfall d		46.775	46.775	46.775	mm"
"	Rainfall v	olume	83.49	155.06	238.55	c.m"
	Rainfall 1	osses	35.889	3.387	14.763	mm''
	Runoff dep	th	10.886	43.388	32.012	mm''
	Runoff vol	ume	19.43	143.83	163.26	ç.m"
**	Runoff coe	fficient	0.233	0.928	0.684	0
	Maximum fl	ow	0.020	0.108	0.114	c.m/sec"
40	HYDROGRAPH	Add Runoff	10			
	4 Add Run	off "				
	0.	114 0.11	4 0.07	2 0.094"		
40	HYDROGRAPH	Copy to Out	flow"			
	8 Copy to	Outflow"				
		114 0.11	4 0.114	4 0.094"		
40		Next link "				
1807 1807	5 Nextli	nk "				
	0.	114 0.11	4 0.114	4 0.094"		
33	CATCHMENT	202"				
	1 Triangu	lar scs"				
		ional_to_%"				
	2 Horton	eguation"				
÷)	202 SWM Pon	d''				
20	50.000 % Imper	vious"				
14 C	0.166 Total A	rea"				
	5.000 Flow le	ngth"				
	2.000 Overlan	d Slope"				
	0.083 Perviou					
	5.000 Perviou	s length"				
	2.000 Perviou	s slope"				
T	0.083 Impervi	ous Area"				
		ous length"				
	2.000 Impervi	ous slope"				
18	0.250 Perviou	s Manning 'n				
	75.000 Perviou	s Max. Intilt	ration			
	12.500 Perviou	s Min.infilt	ration"			
4	0.250 Perviou	s Lag consta	nt (nours)			
907	5.000 Perviou 0.013 Impervi	s Depression	scorage			
	0.000 Impervi	ous Manning ous Max.infi	ltration"			
•		ous Min.infi				
	aroos TuberAl					
			Page 4			

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0.			42063	3-104 5YR PC	DST-D		
	0.001	Impervious La	g const	tant (hours))"		
8	1.300	Impervious De 0.030	0.114		0.094	.m/sec"	
		tchment 202		Pervious	Impervious	Total Area	
5 2	Su	rface Area		0.083	0.083	0.166	hectare"
Ğ.		me of concentr me to Centroid		5.242 79.908	0.616 80.779	1.572 80.599	minutes" minutes"
6		infall depth		46.775	46.775	46.775	mm"
8	Ra	infall volume infall losses		38.82	38.82	77.65	c.m"
	Ra	infall losses		35.889	4.995	20.442	mm ''
51	RU	noff depth noff volume		10.886 9.04	41.780 34.68	26.333 43.71	mm"
8	Ru	noff coefficie	nt	0.233	0.893	0.563	ç.m"
	Ма	ximum flow		0.009	0.027	0.030	c.m/sec"
40	НҮ 4	DROGRAPH Add R Add Runoff "	unott	~			
Q	4	0.030	0.144	0.114	0.094"		
40	HY	DROGRAPH CODV	to Outf	Flow"	0.054		
e e	8	Copy to Outfl	ow"				
40		0.030	0.144	4 0.144	0.094"		
40	5	DROGRAPH Next Next link "	TTNK				
9	-	0.030	0.144	0.144	0.094"		
33	CA	TCHMENT 203"	- 11				
1	1 2	Triangular SC Proportional	5" +^ %"				
ŝ.	2	Horton equati	00 %				
	203	Apartment Blo	ck"				
	70.000	% Impervious"					
6	0.285 30.000	Total Area" Flow_length"					
9	2.000	Overland Slop	e"				
	0.086	Pervious Area					
	30.000	Pervious leng					
94	2.000 0.199	Pervious slop Impervious Ar					
8	70.000	Impervious le	nath"				
63 67	1.000	Impervious sl	ope"				
ii	0.250 75.000	Pervious Mann Pervious Max.					
65	12.500	Pervious Min.					
li i	0.250	Pervious Lag	constar	it (hours)"			
2	5.000	Pervious Depr	ession	storage"			
i.	0.013 0.000	Impervious Ma Impervious Ma	nning '	'n'" trotion"			
8	0.000	Impervious Mi	n.infi]	tration"			
2	0.001	Impervious La	g const	ant (hours))**		
8	1.500	Impervious De	pressio	on storage"			
8	Ca	0.063 tchment 203	0.144	4 0.144 Pervious		:.m/sec" Total Area	0
ų.	Su	rface Area		0.086	0.199	0.285	hectare"
	ті	me of concentr	ation	15.360	3.697	4.804	minutes"
ð.	T1 P2	me to Centroid infall depth		88.710 46.775	84.905	85.266	minutes"
8	Ra	infall volume		39.99	46.775 93.32	46.775 133.31	mm" c.m
	Ra	infall losses		35.929	2.431	12.481	
ŝ	Ru	noff depth noff volume noff coefficie		10.846	44.344	34.294	mm"
8	RU	noir volume noff coefficie	nt	9.27 0.232	88.47 0.948	97.74 0.733	ç.m"
91 1	Ma	ximum flow		0.007	0.060	0.063	c.m/sec"
40	HY	ximum flow DROGRAPH Add R Add Runoff "	unoff				.,
6	4	Add Runoff " 0.063	0.196	5 0.144	0.094"		
		0.003	0.190	Page 5	0.094		
				. age J			

42063-104 5YR POST-D

	40			42063-104	5YR POST-I	D
	40	8	ROGRAPH Copy to Copy to Outflo			
		0	0.063	0 106	0.196	0.094"
	40	HYD	ROGRAPH Comb		01150	01001
		6	Combine "			
		3	Node #"			
		Max	Flow to SWM Po	nd''	0 106	
			(imum flow Irograph volume		0.196 304.713	c.m/sec" c.m"
		iiy c	0.063	0.196	0.196	0.196"
+7	40	HYD		luence	3"	
		7	Confluence "			
		3	Node #"	ndl		
		May	Flow to SWM Po cimum flow	na	0.196	c.m/sec"
			lrograph volume		304.713	C.m"
			0.063	0.196	0.196	0.000"
	54	PON	ID DESIGN"	_		
		0.196	Current peak f	low c.m	/sec"	
		0.048 304.7	Target outflow		C.	
"		11.	Hydrograph vol Number of stag	une C.1		
		335.000	Minimum water	level m	etre"	
		336.000	Maximum water	level m	etre"	
		335.000	Starting water	level	metre"	-
		0	Keep Design Da Level Discha	ta: L = Tr	'ue; U = Fa	Ise"
			335.000 0.4		000"	
"			335,100 0.00	632 88.	600"	
			335.200 0.02	225 181.	400"	
			335.300 0.04		400"	
			335.400 0.08 335.500 0.1	821 379. 080 485	600" 000"	
			335.600 0.1	248 594.	600"	
"			335.700 0.1	395 708.	400"	
			335.800 0.1	528 826.	400"	
			335.900 0.1	650 948. 764 1075	600"	
		1.	336.000 0.1 ORIFICES"	764 1075.	000	
			Orifice Orif	ice Orif	ice Number	of"
			invert coeffi	cie diame	ter orifi	ces"
				630 0.3	000 1.	000
			ik outflow		0.029	c.m/sec"
			cimum level cimum storage		335.233 213.190	metre" c.m"
- 17		Cer	troidal lag		4.235	hours"
			0.063 0.1	196 0.	029 0.	000 c.m/sec"
:	40	HYD	ROGRAPH Next 1	ink "		
		5	Next link "	0.029	0.029	0.000"
	33	CAT	0.063 CHMENT 204"	0.023	0.023	0.000
	939	1	Triangular SCS			
		22	Proportional t	o%"		
			Horton equatio	n		
		204 50.000	Rear Yards" % Impervious"			
**		0.112	Total Area"			
		5.000	Flow length"			
		2.000	Overland Slope			
		0.056 5.000	Pervious Area" Pervious lengt	h"		
**		2.000	Pervious slope			
		0.056	Impervious Are	a"		
					.ge 6	

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-30		42063-104 5YR POST-D	
		5.000 Impervious length"	
		2.000 Impervious slope"	
**		0.250 Pervious Manning 'n'"	
		75.000 Pervious Max.infiltration"	
		12.500 Pervious Min.infiltration" 0.250 Pervious Lag constant (hours)"	
		5.000 Pervious Depression storage" 0.013 Impervious Manning 'n'	
		0.000 Impervious Max.infiltration"	
		0.000 Impervious Min.infiltration"	
2		0.001 Impervious Lag constant (hours)"	
		1.500 Impervious Depression storage"	
		0.020 0.029 0.029 0.000 c.m/sec"	
		Catchment 204 Pervious Impervious Total Area "	
		Surface Area 0.056 0.056 0.112 hectare"	
		Time of concentration 5.242 0.616 1.572 minutes"	
		Time to Centroid 79.908 80.779 80.599 minutes" Rainfall depth 46.775 46.775 46.775 mm"	
		Rainfall depth 46.775 46.775 46.775 mm" Rainfall volume 26.19 26.19 52.39 c.m"	
		Rainfall losses 35.889 4.995 20.442 mm"	
.13		Runoff depth 10.886 41.780 26.333 mm"	
"		RUNOTT VOIUME 6.10 23.40 29.49 c.m"	
		Runoff coefficient 0.233 0.893 0.563 "	
1		Maximum flow 0.006 0.018 0.020 c.m/sec"	
	40	HYDROGRAPH Add Runoff "	
- 10		4 Add Runoff "	
	40	0.020 0.034 0.029 0.000" HYDROGRAPH Copy_to Outflow"	
	40	8 Copy to Outflow"	
25		0.020 0.034 0.034 0.000"	
**	40	HYDROGRAPH Combine 4"	
		6 Combine "	
		4 Node #"	
		Flow to Infiltration Gallery"	
.,		Maximum flow 0.034 c.m/sec"	
		Hydrograph volume 334.153 c.m"	
	40	0.020 0.034 0.034 0.034" HYDROGRAPH Confluence 4"	
.,	40	7 Confluence "	
		4 Node #"	
		Flow to Infiltration Gallery"	
**		Maximum flow 0.034 c.m/sec"	
"		Hydrograph volume 334,153 c.m"	
		0.020 0.034 0.034 0.000"	
	57	TRENCH Design d/s of 4"	
**		0.034 Peak inflow" 334.153 Hydrograph volume"	
		336.500 Ground elevation"	
**		334.500 Downstream trench invert"	
**		1.000 Trench height"	
		333.000 Water table elevation"	
		2.000 Trench top width"	
		2.000 Trench bottom width"	
**		100.000 Voids ratio (%)"	
		15.000 Hydraulic conductivity" 0.000 Trench gradient (%)"	
		0.000 Trench gradient (%)" 80.000 Trench length"	
		1.000 Include base width"	
		21. Number of stages"	
		Level Discharge Volume"	
		334.500 0.000 0.0"	
1		334.600 0.000 16.0"	
00		334.700 0.000 32.0"	
		Page 7	

ç Ç	42063-104 5YR POST-D 334.800 0.000 48.0" 334.900 0.000 64.0"	
	335.000 0.000 80.0" 335.100 0.000 96.0" 335.200 0.000 112.0"	
н. 1. 1.	335.300 0.000 128.0" 335.400 0.000 144.0" 335.500 0.000 160.0"	
	335.600 0.005 160.1" 335.700 0.018 160.2" 335.800 0.035 160.3"	
	335.900 0.055 160.5" 336.000 0.073 160.6" 336.100 0.088 160.7"	
	336.200 0.102 160.8" 336.300 0.114 160.9" 336.400 0.125 161.0"	
	336.500 0.135 161.1" 1. TRENCH PIPES"	Fset"
	Invert length diam. grade% O=Yes dist	ance" .000"
	Access" diameter" 1.200"	
	 OUTFLOW PIPE" Inflow at upstream end of trench: 1=True; 0=False" 	
	invert invert Length Diameter 'n' loss 335.500 334.600 10.000 0.300 0.013 0.	ntry" 5 Ke" .500"
	Outflow volume 98,390 c.m" Peak exfiltration 0.002 c.m/sec"	
	Exfiltration volume 234.567 c.m" Maximum level 335.699 metre" Maximum storage 160.224 c.m"	
	Centroidal lag	
40	0.020 0.034 0.017 0.002 c.m/sec" HYDROGRAPH Combine 1" 6 Combine	
	1 Node #" Flow to wetland" Maximum flow	
40	Hydrograph volume 251.836 c.m" 0.020 0.034 0.017 0.094" HYDROGRAPH Start - New Tributary"	
33	2 Start - New Tributary" 0.020 0.000 0.017 0.094" _CATCHMENT 205"	
	1 Triangular SCS" 1 Equal length" 2 Horton equation"	
	205 Apartment Rooftops" 100.000 % Impervious" 0.076 Total_Area"	
	5.000 Flow length" 1.000 Overland Slope" 0.000 Pervious Area"	
	5.000 Pervious length" 1.000 Pervious slope" Page 8	

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> 11 144 10

> 144

... 210 .. . 66

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		42063-104 5YR POST-D	
		0.076 Impervious Area"	
**		5.000 Impervious length"	
		1.000 Impervious slope"	
		0.250 Pervious Manning 'n'"	
		75.000 Pervious Max.infiltration"	
		12.500 Pervious Min.infiltration"	
32.5		0.250 Pervious Lag constant (hours)" 5.000 Pervious Depression storage"	
		5.000 Pervious Depression storage" 0.013 Impervious Manning 'n'"	
**		0.000 Impervious Max.infiltration"	
		0.000 Impervious Min.infiltration"	
		0.001 Impervious Lag constant (hours)"	
		1.500 Impervious Depression storage"	
		0.025 0.000 0.017 0.094 c.m/sec"	
		Catchment 205 Pervious Impervious Total Area "	
		Surface Area 0.000 0.076 0.076 hectare"	
		Time of concentration 6.454 0.759 0.759 minutes"	
		Time to Centroid 80.838 80.773 80.773 minutes" Rainfall depth 46.775 46.775 46.775 mm"	
		Rainfall depth 46.775 46.775 46.775 mm" Rainfall volume 0.00 35.55 35.55 c.m"	
		Rainfall volume 0.00 35.55 35.55 c.m" Rainfall losses 36.132 3.996 3.996 mm"	
		Runoff depth 10.643 42.779 42.779 mm"	
4.8			
		Runoff coefficient 0.000 0.915 0.915 "	
		Maximum flow 0,000 0,025 0,025 c.m/sec"	
	40	HYDROGRAPH Add Runoff "	
		4 Add Runoff "	
	40	0.025 0.025 0.017 0.094"	
30	40	HYDROGRAPH Copy to Outflow" 8 Copy to Outflow"	
**		0.025 0.025 0.025 0.094"	
	40	HYDROGRAPH Combine 9"	
"		6 Combine "	
		9 Node #"	
		Flow to Private Infiltration Gallery"	
		Maximum flow 0.025 c.m/sec"	
30.3		Hydrograph volume 32.512 c.m"	
	40	0.025 0.025 0.025 0.025" HYDROGRAPH Confluence 1"	
	40	7 Confluence "	
- 22		1 Node #"	
**		Flow to Wetland"	
11 11		Maximum flow 0.094 c.m/sec"	
		Hydrograph volume 251.836 c.m"	
- 20	40	0.025 0.094 0.025 0.000"	
	40	HYDROGRAPH Copy to Outflow" 8 Copy to Outflow"	
		0.025 0.094 0.094 0.000"	
	40	HYDROGRAPH Combine 99"	
		6 Combine "	
		99 Node #"	
"		Flow from the site "	
- 30		Maximum flow 0.094 c.m/sec"	
**		Hydrograph_volume251.836c.m"	
	40	0.025 0.094 0.094 0.094"	
	40	HYDROGRAPH Confluence 2" 7 Confluence "	
		2 Node #"	
		Flow to Arkell Road "	
**		Maximum flow _ 0.027 c.m/sec"	
**		Hydrograph volume 58.471 c.m"	
		0.025 0.027 0.094 0.000"	
"	40	HYDROGRAPH Copy to Outflow"	
		Page 9	

			5YR POST-	D	
••		8 Copy to Outflow" 0.025 0.027	0.027	0.000"	
	40	HYDROGRAPH Combine 99 6 Combine "	1		
"	40	99 Node #"			
"		Flow from the Site " Maximum flow	0.118	c.m/sec"	
:: .:		Hydrograph volume 0.025 0.027	310.306 0.027	с.m ^{''} 0.118''	
"	38	START/RE-START TOTALS 2"	0.027	0.110	
"		3 Runoff Totals on EXIT" Total Catchment area		2,580	hectare"
		Total Impervious area Total % impervious		0.929 35.990"	hectare"
	19	EXIT"		.990	

			1200	104 100 -			
			MIDUSS Output	3-104 100YR			
			MIDUSS version				rev. 473"
			MIDUSS created		Sund	lay, Februar	y 07, 2010"
		10	Units used: Job folder:				ie METRIC"
			Output filename:		4206	2:\42063\104 -104 100vp	\SWM\FINAL" POST-D.out"
			Licensee name:		4200.	, TOA TOOLU	ADMIN"
			Company				Microsoft"
	31	тт	Date & Time last u ME PARAMETERS"	sed:	10/	10/2018 at	3:12:06 PM"
	11	5.000	Time Step"				
		210.000	Max. Storm length"				
	32	3600.000	Max. Hydrograph"				
	32	1	ORM Chicago storm" Chicago storm"				
		4688.000	Coefficient A"				
		17.000	Constant B"				
		0.962	Exponent C"				
		0.400 210.000	Fraction R" Duration"				
			Time step multipli	er"			
		Ma	Time step multipli ximum intensity	213.5		,11	
		то 6	tal depth	88.8		- 6:1-N	
	33		100hyd Hydrograp TCHMENT 206"	h extension	used in thi	s tile	
		1	Triangular SCS"				
		2 2	Proportional to %"				
		206	Horton equation" Easterly Rear Yard	e 11			
		25.000	% Impervious"	2			
		0.248	Total Area"				
		13.000	Flow length"				
. 12		2.000 0.186	Overland Slope" Pervious Area"				
48		13.000	Pervious length"				
		2.000	Pervious slope"				
		0.062 4.333	Impervious Area" Impervious length"				
27		2.000	Impervious slope"				
		0.300	Pervious Manning	n'"			
		75.000	Pervious Max.intil	tration"			
		12.500 0.250	Pervious Min.infil Pervious Lag const	tration ant (hours)"			
		5.000	Pervious Depression	n storage"			
		0.013	Pervious Depression Impervious Manning Impervious Max.inf	.'n''			
200		0.000 0.000	Impervious Max.inf	iltration"			
		0.001	Impervious Lag con		יינ		
		1.500	Impervious Depress	ion storage"			
		C -	0.093 0.00			c.m/sec"	Ξ.
			tchment 206 rface Area	Pervious 0.186	1mpervious 0.062	Total Area 0.248	hectare"
**		Ti	me of concentration	6.286	0.471	4.164	minutes"
		Ti	me_to_Centroid	99.156	96.173	98.067	minutes"
		Ra	infall depth infall volume	88.830	88.830	88.830	mm"
		Ra	infall losses	165.22 43.925	55.07 11.424	220.30 35.800	c.m" mm"
"		Ru	noff depth	44.904 83.52	77.406	53.030	
		Ru	noff depth noff volume noff coefficient	83.52	47.99	131.51	Ç.m"
		Ma	YIMUM TIOW	0.506 0.074	0.871 0.031	0.597 0.093	c.m/sec"
"	40	HY	DROGRAPH Add Runoff Add Runoff "		0.001	0.000	camy acc
		4	Add Runoff "				
				Page 1			

		42063-104 100YR POST-D
	40	0.093 0.093 0.000 0.000" HYDROGRAPH Copy_to_outflow"
:		8 Copy to Outflow" 0.093 0.093 0.093 0.000"
	40	HYDROGRAPH Combine 1" 6 Combine "
		1 Node #"
		Flow to Wetland" Maximum flow 0.093 c.m/sec"
		Hydrograph volume 131.514 c.m"
	40	0.093 0.093 0.093 0.093" HYDROGRAPH Start - New Tributary"
		2 Start - New Tributary"
	33	CATCHMENT 207"
		1 Triangular SCS" 2 Proportional to %"
		2 Horton equation"
		207 Unattenuated to Arkell"
		25.000 % Impervious" 0.307 Total Area"
		30.000 Flow length"
		2.000 Overland Slope
**		0.230 Pervious Area" 30.000 Pervious length"
		2.000 Pervious slope"
		0.077 Impervious Area" 10.000 Impervious length"
:		2,000 Impervious slope"
		0.300 Pervious Manning 'n'" 75.000 Pervious Max.infiltration"
		12.500 Pervious Min.infiltration"
		0.250 Pervious Lag constant (hours)"
		5.000 Pervious Depression storage" 0.013 Impervious Manning 'n'"
		0.000 Impervious Max.infiltration"
		0.000 Impervious Min.infiltration" 0.001 Impervious Lag constant (hours)"
		1.500 Impervious Depression storage"
		0.097 0.000 0.093 0.093 c.m/sec"
		Catchment 207 Pervious Impervious Total Area " Surface Area 0.230 0.077 0.307 hectare"
		Time of concentration 10.381 0.777 6.769 minutes"
		Time to Centroid 103.328 96.385 100.717 minutes" Rainfall depth 88.830 88.830 88.830 mm"
:		Rainfall volume 204.53 68.18 272.71 c.m"
		Raintall losses 43.360 6.595 34.169 mm"
		Runoff depth 45.470 82.235 54.661 mm" Runoff volume 104.69 63.12 167.81 c.m"
		RUNOTT COETTICIENT 0.512 0.926 0.615
	40	Maximum flow 0.076 0.040 0.097 c.m/sec" HYDROGRAPH Add_RUNOff "
		4 Add Runott "
	40	0.097 0.097 0.093 0.093" HYDROGRAPH Copy_to_Outflow"
	70	8 Copy to Outflow"
	40	0.097 0.097 0.097 0.093"
	40	6 Combine "
		2 Node #"
		Flow to Arkell Road " Maximum flow0.097 c.m/sec"
		Hydrograph volume 167.809 c.m"
		Page 2

		42063-104	100YR F	POST-D		
		0.097 0.097	0.097	0.097"		
	40	HYDROGRAPH Start - New Trib	utary"			
en.		2 Start - New Tributary" 0.097 0.000	0.097	0.097"		
**	33	CATCHMENT 208"	0.097	0.097		
		1 Triangular SCS"				
"		2 Proportional to %"				
		2 Horton equation"				
		208 Wetland"				
		5.000 % Impervious"				
ю,		0.876 Total Area" 35.000 Flow_length"				
**		5.000 Overland Slope"				
		0.832 Pervious Area"				
		35.000 Pervious length"				
		5.000 Pervious slope"				
		0.044 Impervious Area"				
		1.842 Impervious length" 5.000 Impervious slope"				
9		5.000 Impervious slope" 0.300 Pervious Manning 'n'"				
••		75.000 Pervious Max.infiltratio	n''			
••		12.500 Pervious Min.infiltratio				
		0.250 Pervious Lag constant (h	ours)"			
		5.000 Pervious Depression stor	age"			
		0.013 Impervious Manning 'n'"	÷ 0			
		0.000 Impervious Max.infiltrat 0.000 Impervious Min.infiltrat				
		0.001 Impervious Lag constant) ''		
"		1.500 Impervious Depression st		,		
		0.311 0.000	0.097	0.097 0	.m/sec"	
		Catchment 208 Perv		Impervious		
		Surface Area 0.83		0.044	0.876	hectare"
		Time of concentration 8.65 Time to Centroid 101.		0.214 95.204	7.975 101.011	minutes" minutes"
		Rainfall depth 88.8		88.830	88.830	mm"
••		Rainfall volume 739.		38.91	778.15	c.m"
		Rainfall losses 43.3		13.638	41.873	mm''
		Runoff depth 45.4 Runoff volume 378.		75.192	46.957	mm''
		Runoff volume 378. Runoff coefficient 0.51		32.93 0.846	411.34	ç.m"
••		Maximum flow 0.30		0.023	0.529 0.311	c.m/sec"
"	40	HYDROGRAPH Add Runoff "	-	01025	0.511	cilly see
		4 Add Runoff "				
	40	0.311 0.311	0.097	0.097"		
	40	HYDROGRAPH Copy to Outflow" 8 Copy to Outflow"				
•		8 Copy to Outflow" 0.311 0.311	0.311	0.097"		
**	40	HYDROGRAPH Combine 1"	0.511	0.037		
"		6 Combine "				
"		1 Node #"				
		Flow to Wetland"	0.00			
		Maximum flow Hydrograph volume	0.39		ec"	
•		0.311 0.311	0.311	0.398"		
"	40	HYDROGRAPH Start - New Trib		0.550		
**		2 Start - New Tributary"				
	~ ~	0.311 0.000	0.311	0.398"		
	33	CATCHMENT 201"				
		1 Triangular SCS" 2 Proportional to %"				
••		2 Horton equation"				
**		201 ROW"				
"		65.000 % Impervious"				
		Pa	ge 3			

40 40 33	SL TT Ra Ra Ra RL RL RL MJ 4 HY 8 HY 5	Total Area" Flow length" Overland Slope Pervious Area" Pervious lengt Impervious Slope Impervious Slope Impervious Manni Pervious Manni Pervious Manni Pervious Lag Co Pervious Lag Co Decofficient Noff Colume Inoff colume Inoff colume Noff Coefficient Noff Colume Noff Coefficient Noff Colume Noff Co Pervious Lag Co Pervious Lag Co Pervious Manni Pervious Manni Pervious Max.i Pervious Max Impervious Max	" h" " " " " " " " " " " " " " " " " "	<pre>ion" (hours)" ation" ation" ation" ation" t (hours: storage" 0.311 rvious 178 .810 .830 8.56 .572 .258 .00 498 0.311 w" 0.230 0.230 0.230 0.230 corage" ation" (hours)" orage" ation"</pre>)" 0.398	c.m/sec" Total Area 0.510 1.292 96.222 88.830 453.03 20.150 68.680 350.27 0.773 0.230	" hectare" minutes" mm" c.m" c.m" c.m/sec"

..

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1 2				42063-	-104 100YR F	POST-D		
		0.001	Impervious La	g const	ant (hours))"		
		1.500	Impervious De	pressio	on storage"			
			0.073	0.230			:.m/sec"	
			atchment 202		Pervious		Total Area	н
		SL	rface Area		0.083	0.083	0.166	hectare"
		Τ-	me of concentr	ation	3.176	0.513	1.477	minutes"
		T-	ime_to_Centroid	l	95.810	96.238	96.083	minutes"
		Ra	ainfall depth		88.830	88.830	88.830	mm".
			ainfall volume		73.73	73.73	147.46	c.m"
		Ra	infall losses		44.572	10.857	27.714	mm''
		RL	unoff depth unoff volume unoff coefficie		44.258	77.973	61.115	mm"
		RI	inott volume		36.73	64.72	101.45	c.m"
		RL	inott coetticie	nt	0.498	0.878	0.688	
	40	Ma	aximum flow		0.039	0.042	0.073	c.m/sec"
	40	H	DROGRAPH Add R	unott '	•			
		4	Add Runoff "					
			0.073	0.303	.230	0.398"		
	40	H	DROGRAPH Copy	to_Out1	rlow"			
		8	Copy to Outfl	ow"				
	4.0		0.073	0.303	3 0.303	0.398"		
	40		DROGRAPH Next	link "				
		5	Next link "					
		-	0.073	0.303	3 0.303	0.398"		
	33	10	ATCHMENT 203"	- 11				
		1	Triangular SC	S				
		2	Proportional	to %				
		2	Horton equati	on				
		203	Apartment Blo	CK				
		70.000	% Impervious"					
		0.285 30.000	Total Area"					
		2.000	Flow length"					
		0.086	Overland Slop					
		30.000	Pervious Area	- 1. P				
		2.000	Pervious leng					
0.1		0.199	Pervious slop					
		70.000	Impervious Ar	ed nath"				
		1.000	Impervious le Impervious sl	ope"				
		0.250	Pervious Mann	ing 'n'				
		75.000	Pervious Max,	infilt,	ation"			
		12.500	Pervious Min.					
0		0.250	Pervious Lag	constar	t (hours)"			
		5.000	Pervious Depr	ession	storade"			
		0.013	Impervious Ma	nning	'n'"			
•		0.000	Impervious Ma	x infil	tration"			
		0.000	Impervious Mi					
•		0.001	Impervious La		ant (hours)) ⁰⁰		
		1.500	Impervious De	pressio	on storade"	·		
			0.131	0.303	0.303	0.398	.m/sec"	
۳.		Ca	atchment 203		Pervious		Total Area	н
			rface Area		0.086	0.199	0.285	hectare"
		Ti	ime of concentr	ation	9.306	3.076	4.226	minutes"
"		T-1	ime to Controid		102.153	99.503	99.992	minutes"
		Ra	infall depth		88.830	88.830	88.830	mm "
		Ra	aintall volume		75.95	177.22	253.16	c.m"
		Ra	ainfall losses		43.655	3.273	15.387	mm''
		RL	noff depth noff volume noff coefficie		45.175	85.557	73.443	mm''
"		RL	noff volume		38.62	170.69	209.31	ç.m"
		RL	unoff coefficie	nt	0.509	0.963	0.827	
		Ma	wolt mumrxr		0.030	0.108	0.131	c.m/sec"
	40	H	DROGRAPH Add R	unoff '				
		4						
			0.131	0.434	0.303	0.398"		
					Page 5			
					-			

40		DROGRAPH Copy to O	63-104 utflow	100YR POS	r-d
40	8	Copy to Outflow"			
		0.131 0.4	434	0.434	0.398"
40	H) 6	DROGRAPH Combine	3"		
	3	Combine " Node #"			
		Flow to SWM Pond"			
		aximum flow		0.434	c.m/sec" c.m"
	ну	drograph volume/drograph/0.131 0.4	434	661.029 0.434	0.434"
40	H)	DROGRAPH Conflue		3"	0.434
	7	Confluence "			
	3	Node #"			
	Ma	Flow to SWM Pond" Eximum flow		0.434	c.m/sec"
		drograph volume		661.029	C.M''
	-	0.131 0.4	434	0.434	0.000"
54	PC	ND DESIGN"			
	0.434	Current peak flow	C.I	n/sec"	
	0.048 661.0	Target outflow Hydrograph volume	c.m/s	ec n''	
	11,	Number of stages"			
	335.000	Minimum water leve	e] r	netre"	
	336.000 335.000	Maximum water lev	1 19	netre"	
	333.000	Starting water le Keep Design Data:	1 = T	rue: $0 = F$	alse"
	Ū	Level Discharge	Vo	lume"	
		335.000 0.000	0	.000"	
		335.100 0.00632 335.200 0.02225	191	.600" .400"	
		335.300 0.04416	278	.400"	
		335,400 0.08821	379	.600"	
		335.500 0.1080	485	.000"	
		335.600 0.1248 335.700 0.1395	708	.600" .400"	
		335.800 0.1528	826	.400"	
		335.900 0.1650	948	.600"	
	1.	336.000 0.1764	1075	.000"	
	1.	ORIFICES" Orifice Orifice	Ori	Fice Numbe	r of"
		invert coefficie		eter orif	ices"
	_	335.000 0.630		3000 1	.000"
		ak outflow		0.096 335.438	c.m/sec"
		uximum level uximum storage		419.508	metre" c.m"
	Ce	entroidal lag		3.631	hours"
40		0.131 0.434		.096 0	.000 c.m/sec"
40	н) 5	́DROGRAPH Next link Next link "			
	2		096	0.096	0.000"
33		TCHMENT 204"			
	1	Triangular SCS"			
	2	Proportional to % Horton equation"			
	204	Rear Yards"			
	50.000	% Impervious"			
	0.112 5.000	Total Area"			
	2.000	Flow length" Overland Slope"			
	0.056	Pervious Area"			
	5.000	Pervious length"			
	2.000	Pervious slope" Impervious Area"			
	0.010	Tuber Along Miled	P	age 6	
				-90 0	

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		42063-104 100YR POST-D	
		5.000 Impervious length"	
		2.000 Impervious slope"	
		0.250 Pervious Manning 'n'"	
		75.000 Pervious Max.infiltration"	
		12.500 Pervious Min.infiltration"	
		0.250 Pervious Lag constant (hours)"	
:00		5.000 Pervious Depression storage"	
		0.013 Impervious Manning 'n'"	
		0.000 Impervious Max.infiltration" 0.000 Impervious Min.infiltration"	
		1.500 Impervious Depression storage" 0.049 0.096 0.096 0.000 c.m/sec"	
**		Catchment 204 Pervious Impervious Total Area "	
**		Surface Area 0.056 0.056 0.112 hectare"	
		Time of concentration 3.176 0.513 1.477 minutes"	
		Time to Centroid 95.810 96.238 96.083 minutes"	
		Rainfall depth 88.830 88.830 88.830 mm"	
		Raintali volume 49.74 49.74 99.49 c.m"	
		Raintall Losses 44 572 10 857 27 714 mm"	
		Runoff depth 44.258 77.973 61.115 mm"	
		Runoff volume 24.78 43.66 68.45 c.m" Runoff coefficient 0.498 0.878 0.688 "	
		0.000 0.000	
**	40	Maximum flow 0.026 0.029 0.049 c.m/sec"	
	40	HYDROGRAPH Add Runoff " 4 Add Runoff "	
31		0.049 0.109 0.096 0.000"	
**	40	HYDROGRAPH Copy_to_Outflow"	
		8 Copy to Outflow"	
		0.049 0.109 0.109 0.000"	
"	40	HYDROGRAPH Combine 4"	
		6 Combine "	
		4 Node #"	
		Flow to Infiltration Gallery"	
		Maximum flow 0.109 c.m/sec"	
		Hydrograph volume 728.924 c.m"	
	40	0.049 0.109 0.109 0.109" HYDROGRAPH Confluence 4"	
**	40	7 Confluence "	
		4 Node #"	
		Flow to Infiltration Gallery"	
		Maximum flow 0.109 c.m/sec" Hydrograph volume 728.924 c.m"	
		Hydrograph volume 728.924 c.m"	
		0.049 0.109 0.109 0.000"	
30	57	TRENCH Design d/s of 4"	
**		0.109 Peak inflow" 728.924 Hydrograph volume"	
		336,500 Ground elevation" 334,500 Downstream trench invert"	
**		1.000 Trench height"	
"		333.000 Water table elevation"	
**		2.000 Trench top width"	
- 11		2.000 Trench bottom width"	
		100.000 voids ratio (%)"	
1		15.000 Hydraulic conductivity"	
		0.000 Trench gradient (%)"	
		80.000 Trench length" 1.000 Include base width"	
		1.000 Include base width" 21. Number of stages"	
,,		Level Discharge Volume"	
		334.500 0.000 0.0"	
1		334.600 0.000 16.0"	
"		334.700 0.000 32.0"	
		Page 7	
		-	

		42002 104 10000 0000 0	
0.00		42063-104 100YR POST-D 334.800 0.000 48.0"	
		334.900 0.000 64.0"	
		335.000 0.000 80.0"	
		335.100 0.000 96.0"	
		335.200 0.000 112.0"	
		335.300 0.000 128.0"	
		335.400 0.000 144.0" 335.500 0.000 160.0"	
		335.500 0.000 160.0" 335.600 0.005 160.1"	
		335.700 0.018 160.2"	
		335.800 0.035 160.3"	
		335.900 0.055 160.5"	
		336,000 0.073 160.6"	
		336.100 0.088 160.7"	
		336.200 0.102 160.8" 336.300 0.114 160.9"	
		336.400 0.125 161.0"	
		336.500 0.135 161.1"	
		1. TRENCH PIPES"	
		Downstream Pipe Pipe Pipe Perf'ted? Offset	
- G		Invert length diam. grade% 0=Yes distance	1
1.00		335.500 10.000 0.000 9.000 1.000 0.000' 1. MANHOLE"	
		Access	
		diameter"	
		1.200"	
		1. OUTFLOW PIPE"	
		0. Inflow at upstream end of trench: 1=True; 0=False"	
		Upstream Downstr'm Pipe Pipe Manning Entry' invert invert Length Diameter 'n' loss Ke'	
		335.500 334.600 10.000 0.300 0.013 0.500	
**		Peak outflow 0.103 c.m/sec"	
		Outflow volume 485.846 c.m"	
		Peak extiltration 0.002 c.m/sec"	
		Exfiltration volume 244.152 c.m" Maximum level 336.210 metre"	
		Maximum level 336.210 metre" Maximum storage 160.803 c.m"	
**		Centroidal lag 3.151 hours"	
		Infiltration area 2 sides 160.000 sg.metre"	
		Infiltration Base area 160.000 sq.metre"	
1000	40	0.049 0.109 0.103 0.002 c.m/sec" HYDROGRAPH Combine 1"	
	40	HYDROGRAPH Combine 1" 6 Combine "	
		1 Node #"	
		Flow to Wetland"	
**		Maximum flow 0.398 c.m/sec"	
		Hydrograph volume 1028.682 c.m"	
	40	0.049 0.109 0.103 0.398"	
	40	HYDROGRAPH Start - New Tributary" 2 Start - New Tributary"	
		0.049 0.000 0.103 0.398"	
	33	CATCHMENT 205"	
		1 Triangular SCS"	
		1 Equal length" 2 Horton equation"	
		2 Horton equation" 205 Apartment Rooftops"	
		100.000 % Impervious"	
**		0.076 Total Area"	
		5.000 Flow length"	
		1.000 Overland Slope"	
		0.000 Pervious Area" 5.000 Pervious length"	
3992		1.000 Pervious slope"	
		Page 8	

		42063-104 100YR POST-D
		0.076 Impervious Area"
		5.000 Impervious length"
		1.000 Impervious slope"
		0.250 Pervious Manning 'n'"
1		75.000 Pervious Max.intiltration"
		12.500 Pervious Min.infiltration"
		0.250 Pervious Lag constant (hours)"
		5.000 Pervious Depression storage"
		0.013 Impervious Manning 'n'"
		0.000 Impervious Max.infiltration"
		0.000 Impervious Min.infiltration"
		0.001 Impervious Lag constant (hours)" 1.500 Impervious Depression storage"
		1.500 Impervious Depression storage" 0.039 0.000 0.103 0.398 c.m/sec"
100		Catchment 205 Pervious Impervious Total Area "
122		Surface Area 0.000 0.076 0.076 hectare
		Time of concentration 3.910 0.631 0.631 minutes"
		Time to Centroid 96.661 96.278 96.278 minutes"
		Rainfall depth 88.830 88.830 88.830 mm"
		Rainfall volume 0.00 67.51 67.51 c.m"
		Raintall losses 44.299 8.603 8.603 mm"
		Runoff depth 44.531 80.227 80.227 mm"
111		Runoff volume 0.00 60.97 60.97 c.m"
		Kunorr coerricient 0.000 0.903 0.903 "
	40	Maximum flow 0.000 0.039 0.039 c.m/sec" HYDROGRAPH Add Runoff "
11	40	4 Add Runoff "
		0.039 0.039 0.103 0.398"
	40	HYDROGRAPH Copy to Outflow"
**		8 Copy to Outflow"
		0 039 0 039 0 039 0 398"
	40	HYDROGRAPH Combine 9"
		o combine
		9 Node #"
- 22		Flow to Private Infiltration Gallery"
		Maximum flow 0.039 c.m/sec"
10		Hydrograph volume 60.973 c.m" 0.039 0.039 0.039 0.039"
	40	0.039 0.039 0.039 0.039 HYDROGRAPH Confluence 1"
	10	7 Confluence "
		1 Node #"
		Flow to Wetland"
		Maximum flow _ 0.398 c.m/sec**
		Hydrograph volume 1028.682 c.m"
	10	0.039 0.398 0.039 0.000"
	40	HYDROGRAPH Copy to Outflow" 8 Copy to Outflow"
3.92		8 COPY to OUTFIOW 0.039 0.398 0.398 0.000"
	40	0.039 0.398 0.398 0.000" HYDROGRAPH Combine 99"
	10	6 Combine "
		99 Node #"
48		Flow from the Site "
**		Maximum flow 0.398 cm/sec"
"		Hydrograph volume 1028,682 c.m"
		0.039 0.398 0.398 0.398
	40	HYDROGRAPH Confluence 2"
		7 Confluence "
		2 Node #"
44		Flow to Arkell Road " Maximum flow 0.097 c.m/sec"
		Maximum flow 0.097 c.m/sec" Hydrograph volume 167.809 c.m"
		0.039 0.097 _ 0.398 _ 0.000"
**	40	HYDROGRAPH Copy to Outflow"
		Page 9

		42063-104 100YR POST-D
		8 Copy to Outflow"
		0.039 0.097 0.097 0.000"
	40	HYDROGRAPH Combine 99"
		6 Combine "
		99 Node #"
, u		Flow from the Site "
194		Hydrograph volume 1196.491 c.m" 0.039 0.097 0.097 0.495"
	38	START/RE-START TOTALS 2"
		3 Runoff Totals on EXIT"
	38	
		Total Catchment area 2.580 hectare"
		Total Impervious area 0.929 hectare"
- 879		Total % impervious 35.990"
."	19	EXIT"



APPENDIX B

WATER BUDGET CALCULATIONS

Drawing on experience...Building on

gth.

ARKELL NORTH (CONDO DEVELOPMENT) SITE WATER BUDGET (INFILTRATION) ANALYSIS Guelph, Ontario



45-85% 10-15%

Project Number:	42063-104	
Date:	October 10, 2018	
Design By:	JJM	
File:	Q:\42063\104\Water Balance\Copy of Water Balance S	Sep 2018-JJM.xls
	Value Units	Source
Site Information		
Annual Precipitation	923.2 mm/yr	Canadian Climate Centre 1971-
Mean Annual Temperature	6.5 deg.C	Canadian Climate Centre 1971-
Latitude	43 deg N	Site Plan
Elevation	~335 m	Site Plan

			Precipitation	ET	Runoff	Infiltration	
	Lawn, Flat	В	923.2	563	126	234	
71-2000 Normals	Pstr/Shrb, Flat	В	923.2	578	86	259	
71-2000 Normals	Mat. Frst., Flat	В	923.2	587	67	269	
	Lawn, Flat	В	923.2	574	122	227	Amended Soil
	Vegetated, Flat	В	923.2	574	87	262	Amended Soil
	Roof/Drive		923.2	179	744	0	
	Roof Infilt (25mm)				51.8	692	

Dry Swale(DS) Runoff Reduction Ammended Topsoil (ATS) Runoff Reduction

Assume

Soil Information Surficial Soil Hydrologic Soil Group Sand and Gravel B

Peto MacCallum Limited MOE SWM Planning & Design Manual, 2003

ANNUAL SITE INFILTRATION

		Pre-developme	nt
Location	Site Area	Infiltration Rate	Infiltration Volume
(Landuse - Slope)	ha	mm/yr/m*	m°/yr
101A Developed/Urban Area (Pervious) 101A Developed/Urban Area (Imperv) 101B - Woodlot 101C - Agrl./Pastr. Land Wetland Area	1.37 0.27 0.33 0.37 0.24	234 0 269 259 0	3206 0 892 946 0
Total Pervious	2.07	244	5044
Total Impervious	0.51	0	0
Total	2.58	196	5044
Torrance Creek SWS Target	2.58	150	3864

		Post-develop	ment					
	Pe	rvious - Passiv	e		Active Infiltratio	n		
Location	Site Area	Infiltration Rate	Infiltration Volume	Area Draining to Location	Infiltration Rate	volume		Comments
	ha	mm/yr/m⁻	m°/yr	ha	mm/yr/m⁻	m°/yr		
201 - Lawns/Boulevards	0.184	234	431					Municipal ROW and Street
201 - Mun. R.O.W./Roofs/Dvwys	0.326	0	0					Fronting Townhomes
202 - Lawn	0.083	234	194					SWM Block
202 - Impervious	0.083	0	0					
203 - Lawn	0.085	234	199					Condon Block to Pond
203 - Impervious	0.200	0	0					
204 - Lawn	0.057	234	133					Rear Yards of Townhomes
204 - Impervious	0.055	0	0					Backing onto SWM Block
								Roof Area of Condo Block
205 - Impervious	0.076	0	0	0.076	744	566	Ap	artments to Infiltration Gallery
206 - Lawn	0.180	234	421					Uncontroled to TCWC
206 - Impervious	0.068	0	0			51	0.10	Enhd. Swale RO Reduction =10%
207 - Lawn	0.239	234	559					Uncontroled to Arkell Road
207 - Impervious	0.068	0	0			51	0.10	Runoff Directed to ATS
208 - Natural Area/Wetland Buffer	0.420	269	1130					Wetland/Woodlot Area
208 - Wetland	0.456	0	0					
	0.400				10	105		Infiltration Gallery
Pervious Area Directed to EOP	0.409			0.409	40	165		of annual rainfall volume
Impervious Area Directed to EOP	0.664			0.664	261	1732		lery: Sized for 30mm of Imp. Runoff
							Perv. Infil	
	2.580		3067	1.149	1045	2563	Imp. Infi	. %: 28%
				2.58	466	5630		
				Net Gain of	Infilt'n over Pre-I	Dev	587	m³/yr
				Net Surplus	of Infilt'n over ta	rget	1766	m³/yr
							112%	

ANNUAL SURFACE RUNOFF TO WETLAND

		Pre-developme	ent
Location	Site Area	Runoff Rate	Runoff Volume
	ha	mm/yr/m²	m [°] /yr
101A Developed/Urban Area (Pervious)	1.37	126	1726
101A Developed/Urban Area (Imperv)	0.27	744	2009
101B - Woodlot	0.33	67	222 314
101C - Agrl./Pastr. Land Wetland Area	0.37 0.24	86 744	314 1781
Total Pervious Total	2.07	109	2262
Total Impervious	0.51	744	3791
Total to Wetland	2.58	235	6053
Site Averaged Pre-Development Paran Average Annual Precipitation (mm) Average Annual Evapotrans. (mm) Average Annual Water Surplus (mm) Average Annual Runoff (mm) Average Annual Infiltration (mm) Urban Lawn	neters	923 492 431 235 196 349	

			Post-de	velopment				
		Local Runoff			LID Measure		1	
Location	Site Area	Runoff Rate	Runoff Volume	Area Draining to Location	Runoff Rate	Runoff Volume		Comments
	ha	mm/yr/m²	m°/yr	ha	mm/yr/m*	m°/yr	Runoff Redu	ction
201 - Lawns/Boulevards	0.184	126	232					
201 - Mun. R.O.W./Roofs/Dvwys	0.326	744	2426					
201 Man. 11.0.14.3110013/D4Wy3	0.020	744	2420					
202 - Lawn	0.083	126	105					
202 - Impervious	0.083	744	618					
203 - Lawn	0.085	126	107					
203 - Impervious	0.200	744	1488					
204 - Lawn	0.057	126	72					
204 - Impervious	0.055	744	409					
								Bunoff directed to
005	o o o		500	0.070				
205 - Impervious	0.076	744	566	0.076		-566	0.00	Private Infil. Gallery
206 - Lawn	0.180	87	157			-51	0.10	Fishel Quelo DO Baduation (100)
206 - Impervious 207 - Lawn	0.068	744	506 301			-51	0.10	Enhd. Swale RO Reduction =10% Runoff Directed to ATS
207 - Lawn 207 - Impervious	0.239 0.068	744	506			-51	0.10	ATS RO Reduction = 10%
207 - Impervious 208 - Natural Area/Wetland Buffer	0.008	67	281			-01	0.10	ATS NO Reduction = 10%
208 - Wetland	0.420	744	3393					
208 - Wetland	0.450	/44	3383					
Site Area to Wetland (uncontrolled)	1.431		5145					
End of pipe Infiltration Gallery			-1896					
ntroled Site RO (From EOP Infil. Galle	1.07	332	3560					
Uncontrolled Site RO	1.51	379	5711	1				
Total Site RO	2.58	359	9271	1.507	-44	-667	211	Avg Imp. runoff rate to inf gall
	2.58		9271	1.507		-667]	
				2.580		8604		Post-Dev Total
				Net Gain of F	lunoff over Pre-D)ev	2551	m³/yr
							142%	

MONTHLY DISTRIBUTIONS

Post-Develo	opment Parameters		Urban	∟awn (Per)	-	Impervious (Roof	s/Road)	
Month	Mean Air Temp (deg. C)	Avg. Precip (mm)	ET (mm) ¹	Total Runoff (mm) ²	INF	ET (mm) ³	Total Surplus/Runoff (mm) ⁴	Imperv. Infiltration (mm)
Jan	-7.6	56.4	2	5	50	9	48	48
Feb	-6.9	50.8	2	9	40	8	43	42
Mar	-1.3	72.1	8	20	45	10	62	62
Apr	5.9	78.3	31	12	35	19	59	59
May	12.3	79.9	71	9	0	21	59	59
Jun	16.9	76	108	10	-43	18	58	56
Jul	19.7	88.5	124	11	-46	19	70	66
Aug	18.6	95.9	103	11	-18	21	75	68
Sep	14.1	92.1	69	10	13	19	73	71
Oct	7.9	69.2	40	9	20	15	54	54
Nov	2.4	86.3	13	11	62	13	74	73
Dec	-4	77.7	3	8	67	8	69	69
		923.2	574	126	223	179	744	727

 1
 923.2
 574
 126
 223
 179
 744

 ¹ Typical monthly Pervious Area ET Distribution (various calibrated continuous hydrologic model distributions)
 ² Typical monthly Rural Pervious Area Runoff Distribution (various calibrated continuous hydrologic model distributions)
 ³ Typical monthly Impervious Area ET distribution for 2mm depression storage (calibrated continuous hydrologic model distribution)
 ⁴ Remainder of Precip - ET

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		Pre-d	evelopment (P	ervious)	Pre-			
Month	Total Monthly Precipitation	Area Draining to Location	Runoff Rate	Runoff Volume	Area Draining to Location	Runoff Rate	Runoff Volume	Total Runoff Volume
	mm/mth/m ²	ha	mm/mth/m ²	m³/mth	ha	mm/mth/m ²	m ³ /mth	
January	56.4	2.07	4	92	0.51	48	243	334
February	50.8	2.07	8	160	0.51	43	220	380
March	72.1	2.07	17	355	0.51	62	318	673
April	78.3	2.07	11	223	0.51	59	303	526
May	79.9	2.07	8	160	0.51	59	299	460
June	76	2.07	9	183	0.51	58	296	479
July	88.5	2.07	9	195	0.51	70	355	550
August	95.9	2.07	9	195	0.51	75	382	577
September	92.1	2.07	9	183	0.51	73	372	555
October	69.2	2.07	8	160	0.51	54	275	436
November	86.3	2.07	10	206	0.51	74	376	582
December	77.7	2.07	7	149	0.51	69	353	502
	923.2		109	2262		744	3791	6053

¹ Typical monthly Pervious Area RO Distbn. (various calibrated continuous hydrologic model distbns)

			Pos	st-development (C	ontrolled RC	D)		
		Pervious			rvious - Roo	Total Runoff		
Month	Area Draining to Location	Runoff Rate ²	Runoff Volume TO EOP	Area Draining to Location	Runoff Rate	Runoff Volume TO EOP	Volume TO EOP	Total Runoff Volume
	ha	mm/mth/m²	m³/mth	ha	mm/mth/m²	m³/mth	m ³ /mth	m ³ /mth
January	0.41	5	21	0.66	48	316	337	337
February	0.41	9	37	0.66	43	286	323	323
March	0.41	20	81	0.66	62	414	495	495
April	0.41	12	51	0.66	59	395	445	445
May	0.41	9	37	0.66	59	390	427	139
June	0.41	10	42	0.66	58	385	427	144
July	0.41	11	44	0.66	70	463	507	172
August	0.41	11	44	0.66	75	498	542	191
September	0.41	10	42	0.66	73	485	526	175
Öctober	0.41	9	37	0.66	54	359	395	126
November	0.41	11	47	0.66	74	490	537	537
December	0.41	8	34	0.66	69	460	494	494
	0.41	126	515	0.66	744	4941	5457	3579
			23%			130%		66%

		Pervious		Imper	Impervious - Roof/Road				
Month	Area Draining to Location	Runoff Rate ²	Runoff Volume	Area Draining to Location	Runoff Rate	Runoff Volume from Site	Total Runo Volume		
	ha	mm/mth/m²	m³/mth	ha	mm/mth/m²	m³/mth	m³/mth		
January	0.84	5	43	0.59	43	255	298		
February	0.84	9	75	0.59	39	231	306		
March	0.84	20	166	0.59	56	334	500		
April	0.84	12	104	0.59	54	318	423		
May	0.84	9	75	0.59	53	315	390		
June	0.84	10	86	0.59	53	311	397		
July	0.84	11	91	0.59	63	374	465		
August	0.84	11	91	0.59	68	402	493		
September	0.84	10	86	0.59	66	391	477		
October	0.84	9	75	0.59	49	290	364		
November	0.84	11	96	0.59	67	395	491		
December	0.84	8	70	0.59	63	372	441		
		126	1057 47%	0.59	673	3987 105%	5044		

8623 142%

Post Dev	veloment		
Month	Total Monthly Runoff	Net Gain/Loss of Surface Runoff	Net Gain/Lo of Surface Runoff
	m ³ /mnth	m ³ /mnth	%
January	635	301	90%
February	629	249	65%
March	996	323	48%
April	868	342	65%
May	528	69	15%
June	541	62	13%
July	637	87	16%
August	684	107	19%
September	651	96	17%
October	491	55	13%
November	1028	446	77%
December	936	433	86%
	8623	2570	42%
Net Gain above F		2570	42%



APPENDIX C

OGS SUMMARY

Drawing on experience...Building on

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Brief Stormceptor Sizing Report - Arkell Hills

	Project Inform	nation & Location	
Project Name	Arkell Hills	Project Number	8243
City	Guelph	State/ Province	Ontario
Country	Canada	Date	7/26/2018
Designer Information		EOR Information (option	onal)
Name	Jeff Lerch	Name	
Company	MTE	Company	
Phone #	519-743-6500	Phone #	
Email	jlerch@mte85.com	Email	

Stormwater Treatment Recommendation

The recommended Stormceptor Model(s) which achieve or exceed the user defined water quality objective for each site within the project are listed in the below Sizing Summary table.

Site Name	
Target TSS Removal (%)	80
TSS Removal (%) Provided	82
Recommended Stormceptor Model	STC 750

The recommended Stormceptor Model achieves the water quality objectives based on the selected inputs, historical rainfall records and selected particle size distribution.

Stor	Stormceptor Sizing Summary		
Stormceptor Model	% TSS Removal Provided	% Runoff Volume Captured Provided	
STC 300	72	88	
STC 750	82	95	
STC 1000	83	95	
STC 1500	83	95	
STC 2000	86	98	
STC 3000	87	98	
STC 4000	90	99	
STC 5000	90	99	
STC 6000	92	100	
STC 9000	94	100	
STC 10000	94	100	
STC 14000	96	100	
StormceptorMAX	Custom	Custom	

Stormceptor*

FORTERRA

	Sizing Det	ails	
Draina	age Area	Water Qua	lity Objective
Total Area (ha)	0.537	TSS Removal (%)	
Imperviousness %	64.0	Runoff Volume Capt	ure (%) 90.00
Ra	infall	Oil Spill Capture Vol	ume (L)
Station Name	WATERLOO WELLINGTON A	Peak Conveyed Flow Rate (L/s)	
State/Province	Ontario	Water Quality Flow R	ate (L/s)
Station ID #	9387	Up Stream Storage	
Years of Records	34	Storage (ha-m)	Discharge (cms)
Latitude	43°27'N	0.000	0.000
Longitude	80°23'W	Up Stream Flow Diversion	
the second s			

Max. Flow to Stormceptor (cms)

Particle Size Distribution (PSD) The selected PSD defines TSS removal			
Distribution %	Specific Gravity		
20.0	1.30		
20.0	1.80		
20.0	2.20		
20.0	2.65		
20.0	2.65		
	cted PSD defines TS Fine Distribution Distribution % 20.0 20.0 20.0 20.0 20.0		

• Stormceptor performance estimates are based on simulations using PCSWMM for Stormceptor, which uses the EPA Rainfall and Runoff modules.

• Design estimates listed are only representative of specific project requirements based on total suspended solids (TSS) removal defined by the selected PSD, and based on stable site conditions only, after construction is completed.

• For submerged applications or sites specific to spill control, please contact your local Stormceptor representative for further design assistance.

For Stormceptor Specifications and Drawings Please Visit: http://www.imbriumsystems.com/technical-specifications