Functional Servicing and Stormwater Management Report
Proposed 51 Lot Residential Development

TPC Marlwood Inc.
31 Marlwood Avenue
Wasaga Beach, ON L9Z 1S8

R.J. Burnside & Associates Limited
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February 2020
300037815.0000

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Record of Revisions

Revision	Date	Description
0	June 2017	Initial Draft Submission to Planner, Client and Team
1	July 2017	Town of Wasaga Beach 1st Submission
2	October 2017	Revised and Resubmitted 1st Submission
3	February 2020	Second Submission (Town & NVCA)

R.J. Burnside & Associates Limited

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1.0 Introduction

R.J. Burnside & Associates Limited (Burnside) has been retained by TPC at Marlwood Inc. to prepare a Functional Servicing and Stormwater Management Report (FSR) for the proposed residential development located east of Golf Course Road, just north of the Parkbridge Community (Park Place) and within a portion of the current Marlwood Golf and Country Club in the Town of Wasaga Beach.

This report presents a functional design of sanitary sewer, water supply, grading and stormwater management in support of an Official Plan Amendment (OPA), a Zoning By-Law Amendment (ZBA), and draft plan approval for the development. The site location plan is shown on Figure 1.

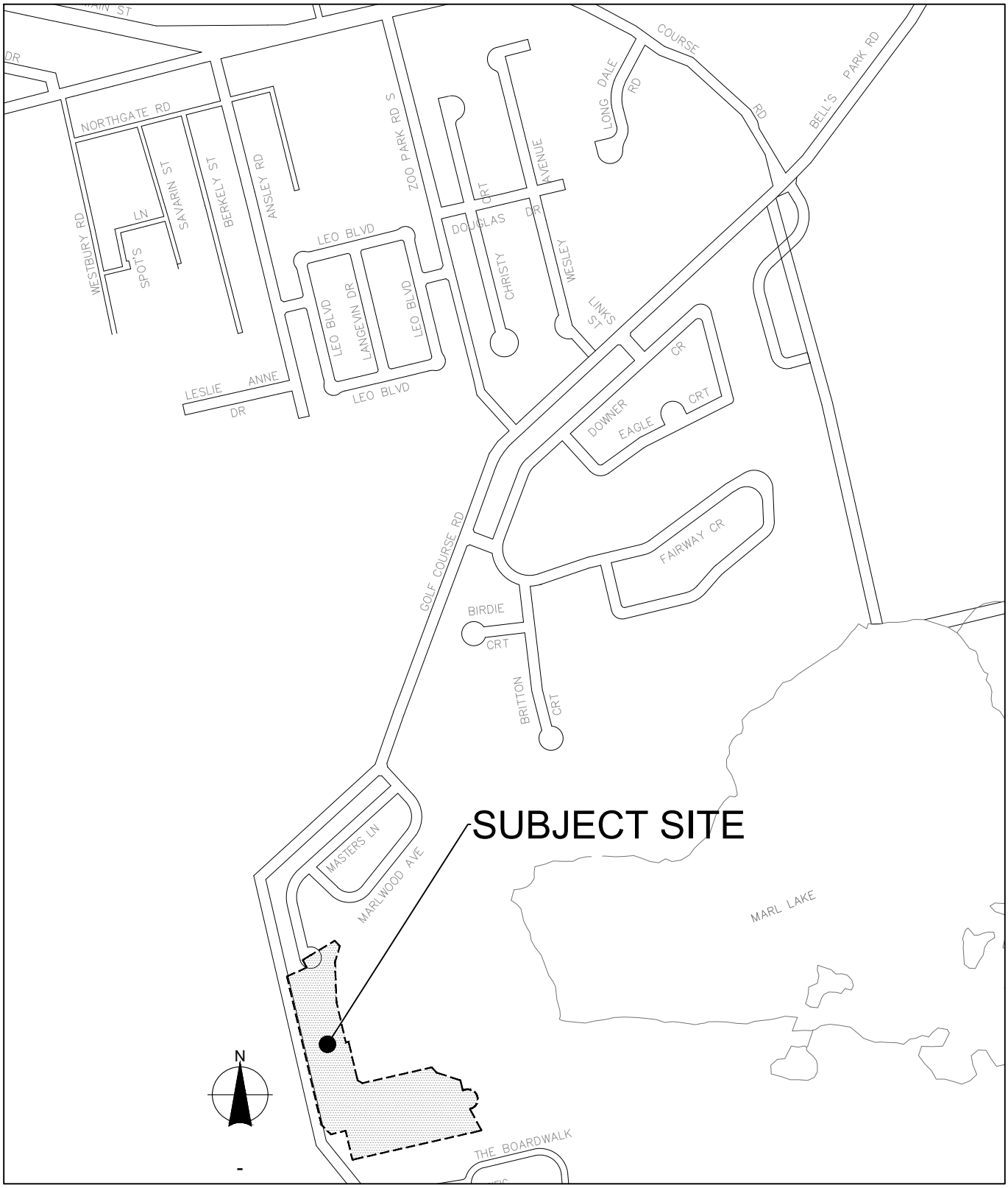
The same proponent is also proposing a 9-Lot single family subdivision, fronting onto Golf Course Road near the current 1st hole green of the Marlwood Golf and Country Club. The proposed 9-Lot development will be covered under a separate FSR since both developments are independent of each other from a grading, servicing and drainage perspective.

1.1 Site Description

A severance of approximately 7.4 ha from the Marlwood Golf and Country Club is intended to accommodate the proposed development of 51 single-family homes and a stormwater management (SWM) pond block. There is no existing infrastructure within the severance area except for existing golf course ponds and irrigation systems.

The development was originally proposed as an extension of Masters Lane in a southerly and then easterly direction. However, the Draft Plan has been updated to eliminate the proposed extension, with access to the site directly from Golf Course Road.

Refer to Figure 2 for the Draft Plan, dated January 14, 2020.



BURNSIDE

Figure Title

PROPOSED 51 LOT RESIDENTIAL DEVELOPMENT

SITE LOCATION PLAN

Client

TPC MARLWOOD INC.

Drawn	Checked	Date	Figure No.
HK	JS	20/01/14	1
Scale		Project No.	
NTS		300037815	

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STATISTICS

PROPOSED LAND USE	LOT/BLOCK	AREA
SINGLE DETACHED RESIDENTIAL	1-51	3.56ha
PROPOSED ROADS (544 LIN.M.)		1.19ha
OPEN SPACE & RESERVES	53, 55-62	2.00ha
STORMWATER MANAGEMENT	52	0.57ha
PUMPING STATION	54	0.11ha
TOTAL AREA		7.43ha

15m BUFFER

30m BUFFER

STAKED WETLAND BOUNDARY

BLOCK 54
Pumping Station
0.11ha

BLOCK 53
0.05ha

BLOCK 52
SWM Pond
0.57ha

BLOCK 55
Open Space
1.52ha

BLOCK 56
(OPEN SPACE)

BLOCK 57
(OPEN SPACE)

BLOCK 58
(OPEN SPACE)

BLOCK 59
(OPEN SPACE)

BLOCK 60
(OPEN SPACE)

BLOCK 61
(0.30m RESERVE)

BLOCK 62
(0.30m RESERVE)

BLOCK 63
(GOLF COURSE ROAD RIGHT-OF-WAY)

STREET 'A'

STREET 'B'

GOLF COURSE ROAD
GOLF COURSE ROAD

EXISTING RESIDENTIAL

EXISTING GOLF COURSE

PART 2, PLAN 51R - 37955

P.I.N. 58334-0254 (LT)

P.I.N. 58334-0322 (LT)

P.I.N. 58334-0001 (LT)

P.I.N. 58334-0044 (LT)

P.I.N. 58334-0277 (LT)

BUSH

EDGE OF WATER

EDGE OF ASPHALT

TOP OF BANK

SOUTH HALF LOT 26

NORTH HALF LOT 26

LIMIT BETWEEN NORTH AND SOUTH HALVES OF LOT 26

CONCESSION 1

MASTERS LANE
(BY REGISTERED PLAN 51M-743)

SITE BENCH MARK
TOP OF SPIGOT ON SIDE OF FIRE HYDRANT
ELEV. 190.10

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KEY PLAN
SCALE: N.T.S.

SUBJECT PROPERTY
ADDITIONAL LANDS OWNED BY APPLICANT

RIVER RD W
ZOO PARK RD
GOLF COURSE RD
RYTHER RD

ADDITIONAL INFORMATION
As required under Section 51(17) of the Planning Act.
a), b), e), f), g) & j) – on plan
c) – on key plan
d) – see statistics
h) – piped water to be installed by developer
i) – sandy
k) – all municipal services to be made available
l) – nil

APPROVED SUBJECT TO CONDITIONS IN ACCORDANCE WITH SECTION 51(31) OF THE PLANNING ACT, RSO, CAP. P.13, AS AMENDED,

THIS_____ DAY OF _____.

DIRECTOR OF PLANNING, DEVELOPMENT AND TOURISM, COUNTY OF SIMCOE

OWNER'S CERTIFICATE
We authorize LOFT Planning Inc. to prepare and submit this Plan of Subdivision for approval.

A.S.O.
TPC MARLWOOD INC. date

SURVEYOR'S CERTIFICATE
I hereby certify that the boundaries of the lands being subdivided and their relationship to the adjacent lands are accurately and correctly shown.

RUDY MAK SURVEYING LTD. date

LEGEND
PROPERTY LINE
LOT LINE

LOFT
LAND USE PLANNING | PROJECT MANAGEMENT
T 705.446.1168 | E EAdams@loftplanning.com

0 50 100 200 300 400
Metres

BURNSIDE

Client
TPC MARLWOOD INC.

Figure Title
PROPOSED 51 LOT RESIDENTIAL DEVELOPMENT
PRELIMINARY DRAFT PLAN

Drawn	Checked	Date	Figure No.
EDT	JO	20/01/14	2
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1:750		300037815	

M:\Jobs\300037815 - Marlwood Waterloo\3 Engineering\3.07 Figures\300037815 Draft Plan Options 20170120_2017-01-20.dwg, Draft Plan 2, 2020-1-24 PM

1.2 Background Reports

The design concepts and stormwater strategy presented in this submission have been developed in accordance with the following reports and guidelines. Pre-consultation notes are included as Appendix A.

- Preliminary Geotechnical Investigation, Marlwood Golf and Country Club, 31 Marlwood Avenue, Wasage Beach, Ontario, prepared by WSP, dated January 07, 2020.
- Environmental Impact Study (EIS), prepared by Azimuth Environmental Consulting Inc. (Azimuth), dated September 2017.
- Water Balance Assessment, 31 Marlwood Avenue, Town of Wasaga Beach, prepared by Azimuth, dated February 2020.
- Engineering Standards, Town of Wasaga Beach, dated March 2015.
- NVCA Stormwater Technical Guide, Nottawasaga Valley Conservation Authority (NVCA), dated December 2013.

1.3 Development Limits

The development is bound by the Golf Course Road right-of-way to the west, existing Marlwood Estates subdivision to the north, Park Place subdivision to the south, and Marl Lake to the east.

An existing easement along the south end of Masters Lane connects to Marlwood Avenue for servicing and drainage purposes. In addition, an existing servicing easement connects Golf Course Road and Masters Lane through Lots 20/21. Refer to As-Built Drawings located in Appendix B.

Development limits respecting existing natural features are summarized below.

1.3.1 Marl Lake and other Natural Heritage Features

The EIS report prepared by Azimuth characterized the natural heritage constraints of the site. The following key features are noted.

- Marl Lake (Jack's Lake Complex provincially significant wetland) was staked in June 2016 with Azimuth and the Ministry of Natural Resources and Forestry (MNRF). The boundary of the Jack's Lake Complex provincially significant wetland on the Marlwood Golf and Country Club property was then surveyed and incorporated into the legal survey fabric. Appendix A provides a reference map presenting the wetland boundary based on the survey coordinates resulting from the June 2016 staking. The resulting amendment to the wetland boundary (represented by the area between the two red bars on the Figure in Appendix A) was made to the study area on November 30, 2016, with the correspondence attached in Appendix A. The wetland is a high constraint area. The proposed draft plan presents both a 15 m and 30 m

buffers and illustrates the lot fabric well outside of the buffer zones. Minor grading and stormwater swale to the buffers and potentially into the buffers (medium constraint area) may be needed and will require the appropriate mitigation at detailed design.

- The development was originally proposed to extend into the densely vegetated woodlot block along the southern part of the site. Azimuth identified this woodlot as a medium constraint area. The updated Draft Plan has shifted the proposed lots to outside of this block.

1.3.2 Natural Hazards

As requested during the pre-consultation process, the NVCA requested confirmation of any natural hazards that may impact the development. This would include flood hazard, erosion hazard and stable slope.

1.3.2.1 Flood Hazard

The Regulatory flood elevation of Marl Lake, provided by the NVCA, is estimated to be 184.27 m. The proposed development has been set above the Regulatory flood elevation.

1.3.2.2 Erosion Hazard

There is no active watercourse near the site with the exception of Marl Lake, that is generally considered a zero-velocity flow. This hazard is not applicable to the development application.

1.3.2.3 Stable Slope

There are no slopes greater than 3:1 adjacent to the proposed development. This hazard is not applicable to this development application.

1.4 Geotechnical Investigation

The preliminary geotechnical report prepared by WSP is provided in Appendix B. Boreholes and groundwater monitoring wells were completed at the locations identified in Image 1 below.

Image 1: Borehole and Groundwater Monitoring Well Location Plan



1.4.1 Soil Types

In general, the subsurface conditions at the borehole locations comprised of a surficial layer of topsoil and disturbed soils, underlain by native cohesive and non-cohesive deposits of clayey silt, marl, sand to silty sand and sand and gravel. Sandy soils predominate the site and were encountered in all boreholes. The marl encountered in boreholes BH15-02, BH15-04 and BH15-06 to BH15-12 ranged in depths between 0.3 m to 2.3 m below ground surface.

Removal of all topsoil, disturbed soils and marl will be required to facilitate the development of the site.

1.4.2 Groundwater Conditions

Groundwater was encountered in all boreholes during the drilling and at the completion of drilling. On-site monitoring of the groundwater (in BH15-01, BH15-05 and BH15-12) began in September 2015 and continued until August 2016. A summary of the groundwater level measurements is provided in Table 1 and included in the geotechnical report in Appendix B.

Table 1: Groundwater Readings Master Lane Extension

Date	Groundwater Level Measurements					
	BH15-01 (Ground Elev. ~ 189)		BH15-05 (Ground Elev. ~ 187)		BH15-12 (Ground Elev. ~ 188)	
	mbg	masl	mbg	masl	mbg	masl
September 3-9, 2015	~3.1	~185.9	~1.4	~185.6	~2.1	~185.9
October 14, 2015	3.13	185.87	1.48	185.52	2.20	185.80
December 31, 2015	3.07	185.93	1.35	185.65	2.12	185.88
January 28, 2016	3.01	185.99	1.34	185.66	2.06	185.94
February 29, 2016	2.96	186.04	1.28	185.72	2.02	185.98
March 31, 2016	2.37	186.63	0.99	186.01	1.44	185.56
April 30, 2016	2.51	186.49	1.15	185.85	1.56	185.44
May 31, 2016	2.70	186.30	1.25	185.75	1.74	185.26
June 10, 2016	2.75	186.25	1.24	185.76	1.80	185.20
June 30, 2016	2.85	186.15	1.33	185.67	1.91	185.09
July 31, 2016	2.95	186.05	1.44	185.56	2.04	185.96
August 23, 2016	3.02	185.98	1.42	185.58	2.11	185.89

2.0 Water Supply and Distribution

Water servicing will be provided via connection to the existing 400 mm diameter watermain located within Golf Course Road. We understand that the Town's consultant will model the additional demand of these 51 lots when evaluating the watermain on Golf Course Road.

The water demand for the proposed development has been calculated to be 2.28 L/s. Local watermains will be 200-250 mm diameter. In keeping with Town of Wasaga Beach requirements, a 25 mm diameter water service will be provided to each individual lot. The proposed watermain is depicted on Figure 3.

Refer to Drawing P-3 in Appendix C for existing water servicing information and Appendix D for water demand calculations.

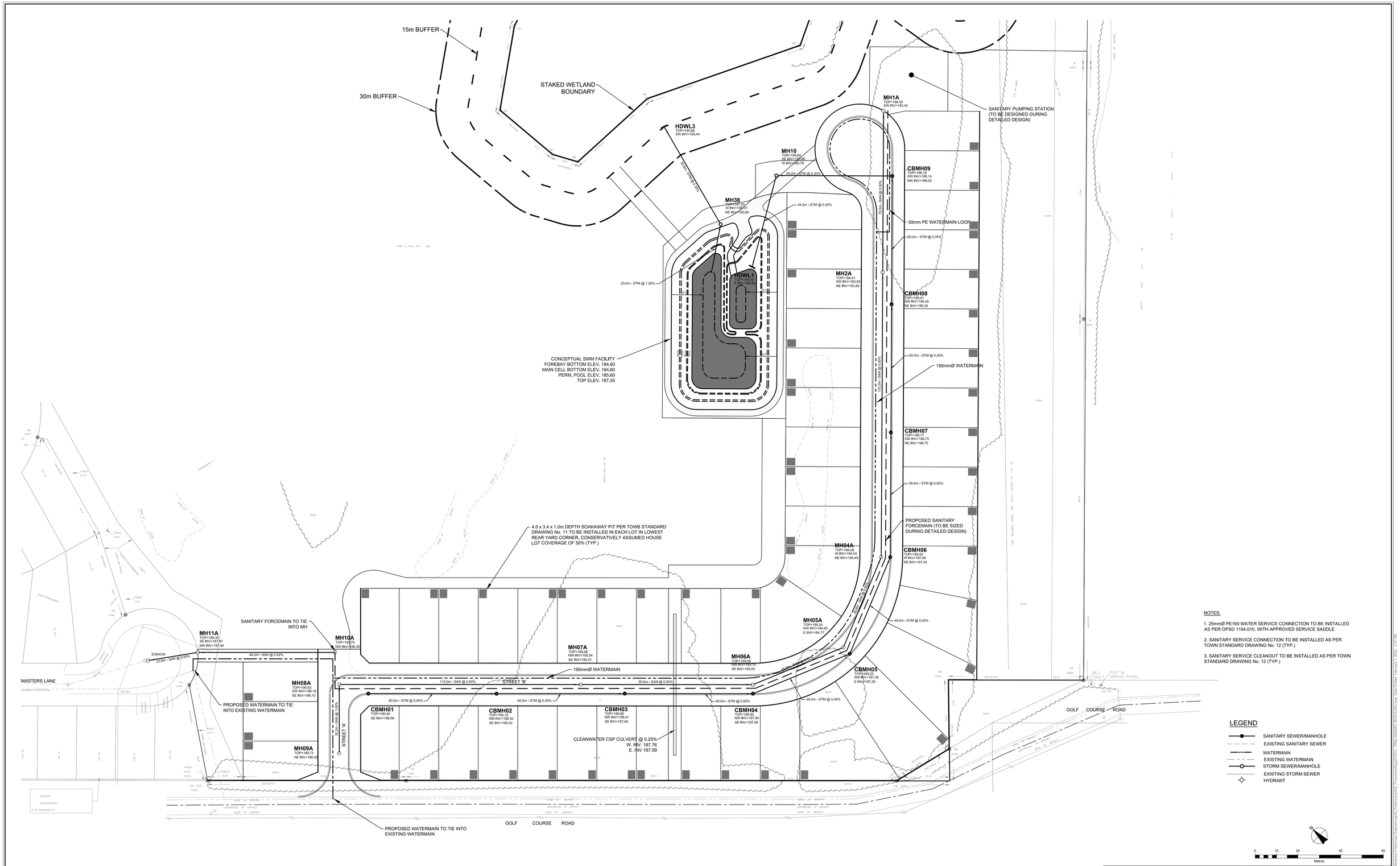
3.0 Sanitary Servicing

Sanitary servicing will be provided via a connection to the existing 250 mm diameter sanitary sewer located within Masters Lane to the west of the proposed development. The existing sewer does not have sufficient depth to allow for a full basement construction if desired for many of the lots in the future development. Therefore, a 200 mm dia. gravity sanitary sewer will be provided for all units along Street B which will flow south toward the end of the cul-de-sac. A sewage pump station will be provided at the end of the cul-de-sac which will pump sewage effluent back west and north to existing MH3A. Refer to Appendix D for the preliminary sanitary pumping station site plan. Block 54 has been provided within the draft plan, with an approximate dimension of 30 m by 30 m, for the sewage pump station. The sewage pump station will be designed as part of the detailed design works.

The sanitary service connection to each lot will be 125 mm and is to be constructed as per the Town of Wasaga Beach Standard Drawing No. 12.

Refer to Figure 3 for the proposed sanitary layout.

Refer to Appendix C drawings P-3 and G-2 for existing as-built conditions.



NOTES:

1. 25mmØ PE160 WATER SERVICE CONNECTION TO BE INSTALLED AS PER OPSD 1104.010, WITH APPROVED SERVICE SADDLE
2. SANITARY SERVICE CONNECTION TO BE INSTALLED AS PER TOWN STANDARD DRAWING No. 12 (TYP.)
3. SANITARY SERVICE CLEANOUT TO BE INSTALLED AS PER TOWN STANDARD DRAWING No. 12 (TYP.)

LEGEND

- SANITARY SEWER/MANHOLE
- EXISTING SANITARY SEWER
- WATERMAIN
- EXISTING WATERMAIN
- STORM SEWER/MANHOLE
- EXISTING STORM SEWER
- HYDRANT

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BURNSIDE

Figure Title
PROPOSED 51 LOT RESIDENTIAL DEVELOPMENT
PRELIMINARY UNDERGROUND SERVICING

Client	Drawn	Checked	Date	Figure No.
TPC MARLWOOD INC.	EDT	JO	20/01/14	3
	Scale 1:750		Project No. 300037815	

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4.0 Stormwater Management (SWM)

4.1 Design Criteria

This report will demonstrate that the stormwater management design adheres to the Town of Wasaga Beach, NVCA and MOECC design standards and guidelines. In the case of conflicting criteria between agencies, the more conservative design criteria were respected. Specific design criteria are summarized as follows:

- Quantity control shall be provided to maintain post-development flows to pre-development levels for the 2 through 100-year storm design storm events.
- Quality control shall be provided to a minimum 80% removal of total suspended solids (TSS), consistent with Enhanced level treatment per the March 2003 Ontario Ministry of the Environment (MOE) Planning and Design Guidelines.
- A phosphorus loading analysis of pre and post-development conditions with a “best efforts” target of achieving phosphorus balance for the site through SWM facilities and LID measures is required.
- Stormwater management facilities shall provide extended detention of the 25 mm rainfall event over a minimum 48 hours.
- At a minimum, the first 5 mm of rainfall shall be retained on site using Low Impact Development (LID) measures to achieve both water balance and erosion control requirements.
- Pre-development annual infiltration volume targets shall be maintained under post-development conditions using LID measures.
- Stormwater management facilities shall be provided with an outlet (overflow spillway) designed to accommodate flow from the greater of the 100-year storm event or the Regional (Timmins) storm event without failure.
- Provide an erosion and sediment control plan to be employed during construction of the project.

4.2 Existing Conditions

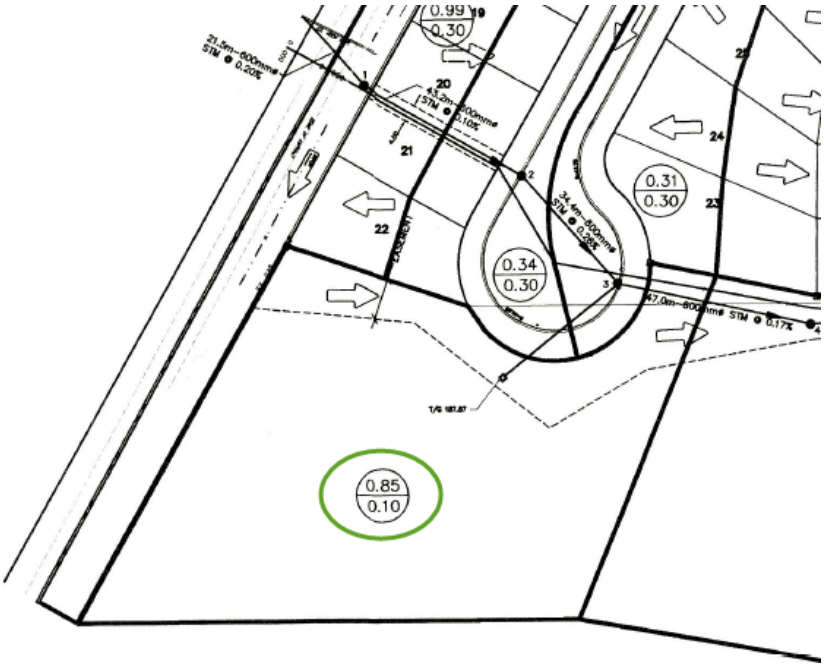
Existing stormwater infrastructure within the proposed development include golf course features that outlet to Marl Lake via subdrains and a catchbasin located south of the Masters Lane cul-de-sac (see Image 2).

The existing site is gently sloping and generally drains towards Marl Lake or to existing golf course water hazards. Portion of the site drain south towards the south woodlot block and north towards the Masters Lane cul-de-sac. A low point on Golf Course Road exists roughly midway between the north and south development limits along the frontage of the road while high points exist near the north and south limits of the development. Areas draining to the low point on Golf Course Road, including external areas (refer to Section 4.3), are conveyed to the existing low point within the right-of-way, into the golf course and eventually spill within the golf course to Marl Lake. Areas

draining to the woodlot are conveyed east through the woodlot, ultimately outletting to Marl Lake. Refer to Figure 4 for the pre-development drainage plan.

Approximately 0.85 ha of land located south of the Masters Lane cul-de-sac has been accommodated for in the existing Marlwood Estates subdivision design to the north at a runoff off coefficient of C=0.1. Approximately 0.17 ha falls within the severance and easement areas of the site.

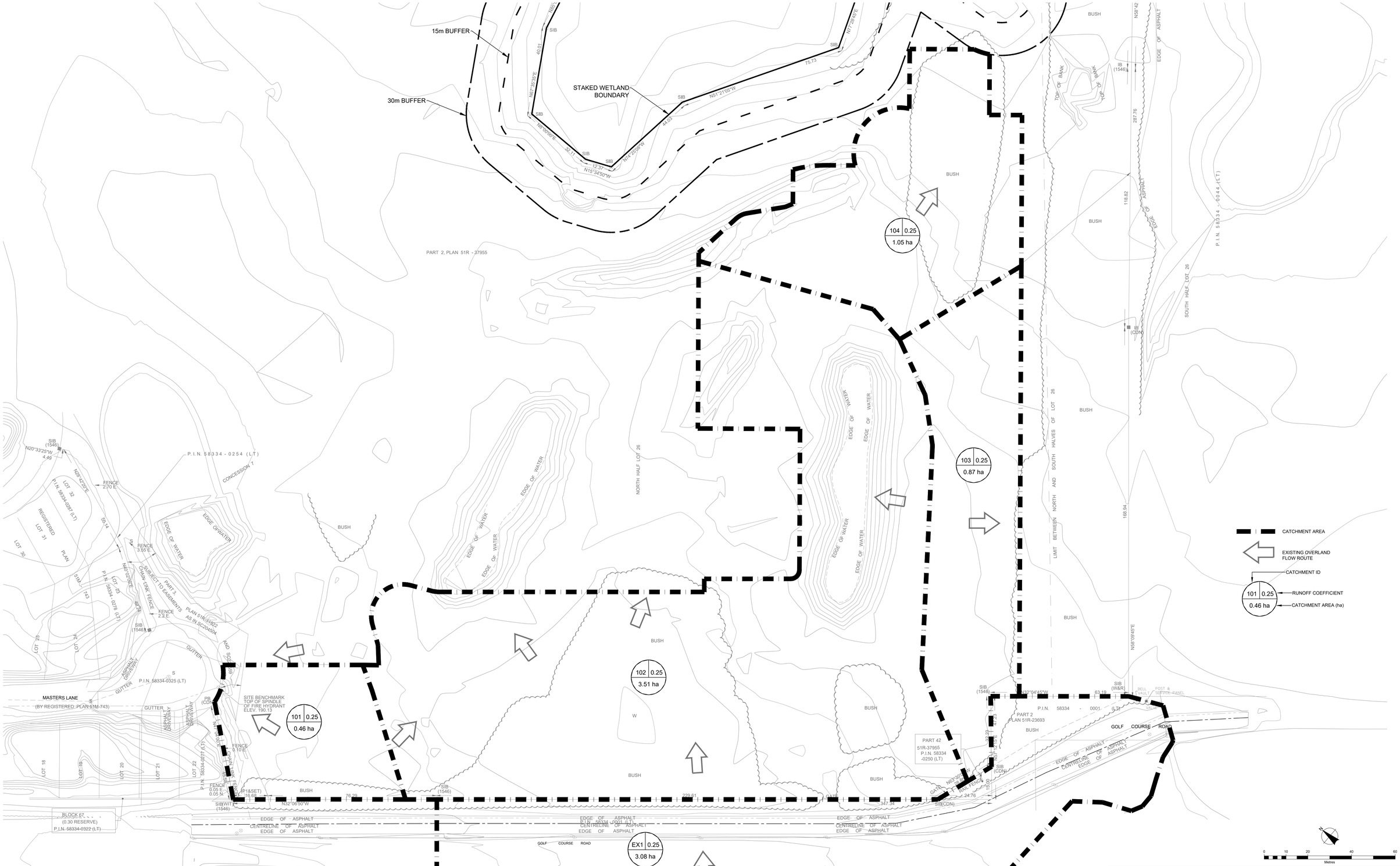
Image 2: External Drainage Allowance into Marlwood Estates



4.3 External Drainage

An external drainage area of approximately 3.1 ha currently drains towards the site to the low point on Golf Course road. Once stormwater spills over the crown of the road, it will pool in the existing ditch on the east side of Golf Course Road and into the golf course property. Stormwater continues to pool within the golf course until it spills within the golf course towards Marl Lake.

Under post-development conditions, external flows that spill over the crown at the low point on Golf Course Road will be routed through the proposed development via easements to the proposed SWM facility, which will ultimately outlet to Marl Lake. The easements will generally be graded and constructed as grassed swales to provide stormwater quality treatment.



BURNSIDE

Figure Title

PROPOSED 51 LOT RESIDENTIAL DEVELOPMENT

PRE-DEVELOPMENT DRAINAGE CONDITIONS

Client	Drawn	Checked	Date	Figure No.
TPC MARLWOOD INC.	HK	JS	20/01/14	4
	Scale 1:750		Project No. 300037815	

4.4 Hydrology Targets

A PCSWMM hydrology model was prepared to determine pre-development target flows and volumes. The Green-Ampt infiltration method was used within the model, with parameters consistent with silty clay loam applied due to the marl present on site. The required inputs for PCSWMM and how they were determined are summarized in Table 2.

Table 2: PCSWMM Parameters

Parameter	Unit	Method
Catchment Size	ha	Measured drainage area in AutoCAD
Catchment Width	m	Measured width of overland flow path in AutoCAD
Catchment Slope	%	Measured average slope of the overland flow route
Catchment Impervious	%	Measured impervious area from aerial image
Manning's 'n'	-	Pervious = 0.25 Impervious = 0.013
Depression Storage	mm	Values per Table 10.2 – NVCA Dec. 2013 Woods = 10 mm Lawns = 5 mm Impervious Areas = 2 mm
Green-Ampt Infiltration	-	Based on geotechnical analysis results - Values per Table 10.4 – NVCA Dec. 2013, modified for land use Saturated Hydraulic Conductivity, K_s = 1.0 mm/hr Suction Head, S = 209 mm/hr Initial Moisture Deficit, IMD = 0.154

Per NVCA standards, both the 4-hour Chicago and 24-hour SCS Type II storm distributions were modelled. Intensity-duration-frequency (IDF) rainfall data values were retrieved online using the Ontario Ministry of Transportation (MTO) IDF curve lookup tool.

The pre-development target flow rates were determined in PCSWMM by routing the drainage areas to an outfall at Marl Lake. External flows into the site were routed to the internal catchments and to the outfall element. Areas that drain to the south woodlot were routed through channeled conduit elements in the model and combined with the routed flows draining through the golf course to Marl Lake.

In addition, flows tributary to the Marwood Estates subdivision were also modelled to confirm target flow rates towards the Masters Lane cul-de-sac.

Pre-development target flow rates to both Marl Lake and Masters Lane are summarized in Table 3. Refer to the PCSWMM model, included in Appendix E, for more details.

Table 3: Pre-Development Target Flows

Return Period Storm	Peak Flows (m^3/s)			
	Marl Lake		Masters Lane Cul-De-Sac	
	4-hour Chicago Distribution	24-hour SCS Distribution	4-hour Chicago Distribution	24-hour SCS Distribution
2-Year	0.179	0.469	0.015	0.027
5-Year	0.338	0.827	0.025	0.044
10-Year	0.469	0.922	0.032	0.049
25-Year	0.663	1.214	0.044	0.062
50-Year	0.820	1.504	0.053	0.074
100-Year	0.989	1.783	0.063	0.087

4.5 Proposed Conditions

The site will be served by a local storm sewer system, sized to convey the 5-year storm event to a proposed wet pond SWM facility, as illustrated on Figure 4. Overland flows (in excess of the 5-year storm event) will be conveyed via the proposed local right-of-way to the SWM facility. The SWM facility will provide quantity, quality and erosion control with an emergency overflow to Marl Lake.

Private rear yard soakaway pits, sized to infiltrate the first 5 mm of rainfall from the roofs are proposed on all suitable lots. Flows in excess of the first 5 mm rainfall will either drain to the SWM facility or uncontrolled to the Golf Course Road right-of-way, the woodlot block, or into and through the golf course. Note that flows draining uncontrolled to Golf Course Road (i.e. external flows and rear yard overflows) will ultimately be conveyed through the proposed easements and SWM facility.

Refer to Figure 5 for the Post-Development Drainage Plan.

4.5.1 Quantity Control

The proposed wet pond will provide quantity control of post-development flows to pre-development targets for the 2 through 100-year storm event.

The PCSWMM model was used to confirm post-development flows and storage volumes required to the meet the target flow rates. Both the 4-hour Chicago and 24-hour SCS Type II storm distributions were modelled per design standards to confirm the most conservative design. To meet target flow rates, the combination of hydrographs from the pond and uncontrolled areas results in the following stage-storage-discharge characteristics in the pond, illustrated in Tables 4 and 5 below. The preliminary SWM facility has been graded sufficiently to provide the required storage.

15m BUFFER

30m BUFFER

STAKED WETLAND BOUNDARY

HDWL3

52.2m - STM @ 0.35%

MH10

54.2m - STM @ 0.30%

CBMH09

44.2m - STM @ 0.30%

MH38

60.0m - STM @ 0.35%

HDWL1

23.0m - STM @ 1.26%

CONCEPTUAL SWM FACILITY
FOREBAY BOTTOM ELEV. 184.60
MAIN CELL BOTTOM ELEV. 184.60
PERM. POOL ELEV. 185.60
TOP ELEV. 187.55

202 | 0.55
0.75 ha

CBMH08

60.0m - STM @ 0.50%

CBMH07

58.4m - STM @ 0.50%

CBMH06

4.0 x 3.4 x 1.0m DEPTH SOAKAWAY PIT PER TOWN OF WASAGA BEACH STANDARD DRAWING No. 11 TO BE INSTALLED IN EACH LOT IN LOWEST REAR YARD CORNER, CONSERVATIVELY ASSUMED HOUSE LOT COVERAGE OF 50% (TYP.)

UN3 | 0.55
0.52 ha

UN1 | 0.55
0.32 ha

49.0m - STM @ 0.40%

CBMH05

201 | 0.66
3.61 ha

49.0m - STM @ 0.45%

CBMH01

60.0m - STM @ 0.45%

CBMH02

60.0m - STM @ 0.35%

CBMH03

60.0m - STM @ 0.50%

CBMH04

UN2 | 0.25
0.17 ha

EX1 | 0.25
3.08 ha

203 | 0.55
0.53 ha

BELL VAULT

POST & SERVICE PANEL

VALVE

CATCHMENT AREA

PROPOSED OVERLAND FLOW ROUTE

CATCHMENT ID

201 | 0.66
3.61 ha

RUNOFF COEFFICIENT

CATCHMENT AREA (ha)

N

0 10 20 40 60
Metres

BURNSIDE

Client
TPC MARLWOOD INC.

Figure Title
PROPOSED 51 LOT RESIDENTIAL DEVELOPMENT
POST-DEVELOPMENT DRAINAGE CONDITIONS

Drawn	Checked	Date	Figure No.
HK	JS	20/01/14	5
Scale		Project No.	
1:750		300037815	

File: N:\GIS\Client Work Files\300037815 - Marlwood Development & Engineering\04 Processing\Drawings\300037815 - PCSD1 DEVELOPMENT CONCEPTS.dwg, Tank Index, February 7, 2020 - 3:39 PM

Table 4: SWM Facility Stage-Storage-Discharge Characteristics – 24-hour SCS

Return Period Storm	Inlet Flow (m^3/s)	Outlet Flow (m^3/s)	Total Storage Used (m^3)	Active Storage Used (m^3)	Elevation (m)
2 year	1.032	0.257	2,396	1,385	186.29
5 year	1.492	0.513	2,830	1,819	186.46
10 year	1.698	0.601	2,979	1,968	186.51
25 year	2.057	0.784	3,285	2,274	186.62
50 year	2.355	0.939	3,537	2,526	186.70
100 year	2.658	1.093	3,784	2,773	186.78

Table 5: SWM Facility Stage-Storage-Discharge Characteristics – 4-hour Chicago

Return Period Storm	Inlet Flow (m^3/s)	Outlet Flow (m^3/s)	Total Storage Used (m^3)	Active Storage Used (m^3)	Elevation (m)
2 year	1.246	0.059	1,969	958	186.11
5 year	1.831	0.165	2,217	1,206	186.21
10 year	2.231	0.250	2,383	1,372	186.28
25 year	2.755	0.374	2,602	1,591	186.37
50 year	3.142	0.474	2,766	1,755	186.43
100 year	3.533	0.576	2,936	1,925	186.49

The combination of hydrographs from the pond and uncontrolled areas confirms that target flow rates can be maintained under post-development conditions. Table 6 summarizes the pre and post-development flow rates at the target locations.

Table 6: Stormwater Release Rates

Return Period Storm	Peak Flows (m^3/s)							
	Marl Lake				Masters Lane Cul-De-Sac			
	4-hour Chicago Distribution		24-hour SCS Distribution		4-hour Chicago Distribution		24-hour SCS Distribution	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post
2-Year	0.179	0.076	0.469	0.314	0.015	0.008	0.027	0.017
5-Year	0.338	0.205	0.827	0.605	0.025	0.015	0.044	0.026
10-Year	0.469	0.309	0.922	0.708	0.032	0.020	0.049	0.029
25-Year	0.663	0.460	1.214	0.918	0.044	0.028	0.062	0.036
50-Year	0.820	0.579	1.504	1.094	0.053	0.035	0.074	0.042
100-Year	0.989	0.698	1.783	1.268	0.063	0.042	0.087	0.048

As illustrated, post-development peak flows are less than pre-development targets for all storm events.

4.5.2 Quality Control

Quality treatment for the proposed development will be provided using a combination of private rear yard soakaway pits on all suitable lots, a proposed downstream SWM facility, and grassed swales for the external areas entering the property and draining to the SWM facility.

Stormwater tributary to the SWM facility will be treated in the permanent pool, which has been sized to provide Enhanced water quality protection per the March 2003 MOE Planning and Design Guidelines. The volume required is based on a total weighted imperviousness of 40% for areas draining to and within the pond. The total required permanent pool volume is 114 m^3/ha or 904 m^3. The preliminary pond design provides a permanent pool volume of 1,011 m^3.

In addition to providing TSS removal, the proposed soakaway pits, SWM facility and enhanced grassed swale provided will help manage the phosphorus loading. Loading calculations for pre and post-development conditions have been completed using the online NVCA phosphorus loading tool. Results indicate no net increase in Phosphorus loading as a result of the proposed measures.

For further details, refer to the water quality calculations in Appendix E.

4.5.3 Erosion Control

Extended detention of the 25 mm rainfall event has been provided in the SWM facility. The 4-hour Chicago storm was simulated in PCSWMM to confirm that the 25 mm runoff volume entering the SWM facility will be detained over minimum 48 hours. The extended detention volume forms part of the active storage (2-100 year) quantity control. A 75 mm diameter orifice will provide the required extended detention drawdown.

4.5.4 Wet Pond Design Elements

The preliminary design of the wet pond SWM facility includes the following design elements.

- Maximum 5:1 side sloping
- Minimum 1.0 m deep permanent pool
- Maximum active storage depth of 2.0 m
- Minimum freeboard of 0.30 m
- Maintenance access road, 3 m wide, along the perimeter of the pond
- A 6 m by 6 m maintenance platform
- A forebay berm height set at or above the extended detention water level

4.5.5 Water Balance / Infiltration

In accordance with NVCA standards, LID measures are required to achieve water balance recharge requirements. At a minimum, the first 5 mm of rainfall from the roofs are to be retained on site using LID measures, however, the design criteria also state that pre-development annual infiltration volumes shall be maintained under post-development conditions. Individual lot soakaway pits, where practical, are proposed to achieve the water balance recharge requirements by infiltrating rooftop flows.

In support of the development, Azimuth was retained to complete a water balance analysis to confirm recharge volume requirements. As part of their analysis, Azimuth undertook the task of confirming if the on-site retention of the first 5 mm of rainfall from the roofs would satisfy the water balance requirements. The results indicate that infiltrating the first 12 mm of rainfall from the roofs will provide the sufficient recharge volume needed to meet pre-development conditions. The draft water balance report has been included for reference in Appendix B.

The design and placement of the proposed soakaway pits and/or other infiltration measures are dependent on several factors. This includes the infiltration capacity of the soils, as well as the local groundwater characteristics.

Based on the laboratory grain size analysis performed by WSP, estimated percolation time and permeability of the soils were completed. These values were converted to an estimated infiltration rate based on the 1997 "*Ontario Ministry of Municipal Affairs and House Supplementary Guidelines to the Ontario Building Code*" document which provides approximate relationships between hydraulic conductivity, percolation time and infiltration rate. Infiltration rates were therefore estimated to range from 75 mm/hr to 300 mm/hr. Given the estimated values were determined through laboratory analysis of borehole samples and not field conducted testing, a conservatively estimated infiltration rate of 15 mm/hr has been used for the functional design of the soakaway pits. Infiltration rates shall be confirmed using in-situ methods at the detailed design phase.

Based on the WSP geotechnical report, groundwater levels reported should not impact the design or placement of the proposed soakaway pits. Groundwater levels in the vicinity of the SWM facility, however, have been identified as too high to accommodate infiltration within the SWM block.

The soakaway pits, proposed in the rear yards of suitable lots, have been sized to accommodate the full roof areas of each lot, conservatively assuming that rooftops make up 50% of each lot. The Town of Wasaga Beach soakaway pit standard (STD. DWG. No. 11) is proposed with a minor revision to allow both the front and rear halves of the roof to drain into the soakaway pit. The soakaway pits will accommodate the 12 mm runoff volume from the roofs and drawdown within a maximum of 24 hours. A summary of the storage requirements is provided in Table 7.

Table 7: Infiltration Gallery Functional Design Summary

Typical Lot Size	18.5 m wide by 35 m long
Typical Lot Area	648 m^2
Area to be Infiltration (50% Lot Coverage is Rooftop)	324 m^2
Required Runoff Volume to be Infiltrated	3.9 m^3
Soakaway Footprint Area	13.5 m^2
Proposed Soakaway Length (Minimum 1.5 m)	4.0 m
Proposed Soakaway Width (Minimum 1.0 m)	3.4 m
Proposed Soakaway Depth (Minimum 1.0 m)	0.72 m

The soakaway pits will be designed to be a minimum of 1.0 m above the groundwater table. A maximum soakaway pit depth of 0.72 m was calculated based on the assumed infiltration rate and required drawdown time (per MECP standards), however, Town of Wasaga Beach standard drawing No. 11 requires a minimum gallery depth of 1.0 m.

Note that any marl layers encountered during construction of the soakaway pits shall be excavated (removed). Excavated marl will not be used as fill elsewhere within the development but disposed of off-site. Preliminary sizing calculations and details for the soakaway pits are provided in Appendix E.

4.5.6 Regional Storm Conveyance

The Timmins regional storm event, simulated in the PCSWMM model, produced a flowrate of 0.935 m^3/s entering the SWM facility. A spill weir has been provided in the SWM facility, at a maximum flow depth of 0.30 m, to safely convey this flow. Note the peak regional flow entering the SWM facility is less than the simulated 100-year peak flow generated by the 4-hour Chicago and 24-hour SCS Type II distributions.

5.0 Site Grading

The proposed development will be graded to ensure that runoff from the development will not adversely affect adjacent private property and will be directed to stormwater management system(s) including LID.

The site grading design will take into consideration the following requirements and constraints:

- Conform to the Town of Wasaga Beach grading criteria.
- Match existing and proposed boundary grading conditions.
- Minimize required earthworks.
- Provide more than minimum cover on proposed servicing (sanitary sewer is the driving factor in the design).
- Provide continuous road grades for overland flow conveyance.
- Provide a design that is compatible with the proposed grading for the adjacent lands.
- Achieve the stormwater management objectives required for the site.
- Excavated marl will not be used as fill elsewhere within the proposed development but disposed of off-site.

An emergency overland flow route will direct runoff to the proposed pond and through an emergency spillway to Marl Lake.

The Preliminary Grading Plan is illustrated on Figure 6.

15m BUFFER

30m BUFFER

STAKED WETLAND BOUNDARY

PROPOSED OVERLAND FLOW ROUTE FROM POND TO BE DIRECTED TO PROPOSED HEADWALL; MAJOR SYSTEM

HDWL3

BLOCK 53
0.05ha

BLOCK 54
Pumping Station
0.11ha

BLOCK 55
Open Space
1.52ha

MH10

CBMH09

188.10

188.25

MH38

INLET HEADWALL
INV. 185.65 m

HDWL1

100YR WL = 186.78
REGIONAL (TIMMINS) WL = 186.64
25mm WL = 186.01

BLOCK 52
SWM Pond
0.57ha

CONCEPTUAL SWM FACILITY
FOREBAY BOTTOM ELEV. 184.60
MAIN CELL BOTTOM ELEV. 184.60
PERM. POOL ELEV. 185.60
TOP ELEV. 187.55

DITCH TO OUTLET TO PROPOSED POND. ACCESS ROAD TO BE DEPRESSED IN AREA OF DITCH INLET TO PROVIDE POSITIVE OUTLET FOR DITCH FLOWS.

STREET 'B'

CBMH08

CBMH07

CBMH06

CBMH05

CBMH04

CBMH03

CBMH02

CBMH01

BLOCK 56
(OPEN SPACE)

BLOCK 57
(OPEN SPACE)

BLOCK 59
(OPEN SPACE)

BLOCK 60
(OPEN SPACE)

BLOCK 61
(0.30m RESERVE)

BLOCK 58
(OPEN SPACE)

BLOCK 62
(0.30m RESERVE)

BLOCK 63
(GOLF COURSE ROAD RIGHT-OF-WAY)

STREET 'A'

MASTERS LANE
(BY REGISTERED PLAN 51M-743)

EXISTING RESIDENTIAL

EXISTING GOLF COURSE

GOLF COURSE ROAD

MATCH INTO EXISTING GRADE AT LIMIT OF PROPERTY (TYP.)

PROPOSED DITCH TO PROVIDE OUTLET FOR EXISTING LOW POINT ON GOLF COURSE ROAD. SWALE TO BE AT A MINIMUM OF 0.25%

LEGEND

- 188.14 / 188.14 — PROPOSED GRADE WITH EXISTING GRADE
- PROPOSED SWALE
- MAXIMUM 3:1 SLOPE UNLESS OTHERWISE NOTED
- SD — SPLIT DRAINAGE LOT TYPE
- WO — WALK OUT DRAINAGE LOT TYPE
- SOAKAWAY PIT
- PROPOSED OVERLAND FLOW ROUTE
- EXISTING OVERLAND FLOW ROUTE

0 10 20 40 60
Metres

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BURNSIDE

Figure Title
PROPOSED 51 LOT RESIDENTIAL DEVELOPMENT
PRELIMINARY GRADING

Client
TPC MARLWOOD INC.

Drawn	Checked	Date	Figure No.
EDT	JO	20/01/14	6
Scale		Project No.	
1:750		300037815	

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6.0 Erosion and Sediment Control

Given the generally flat topography and the small drainage area, the site is considered to have a low to moderate erosive potential. Effective environmental and sedimentation controls must be in place on a temporary basis both during the construction period, and as permanent features of the completed development of the site.

To ensure stormwater quality control during construction, it is imperative that effective environmental and sedimentation control be in place on a temporary basis throughout the entire area prior to construction activities.

It is recommended that during the construction phase the following practices be implemented and maintained throughout to mitigate the off-site transportation of eroded soils:

- Restoration of exposed surfaces with vegetative and non-vegetative material as soon as construction schedules permit.
- Provision of silt control fences for the duration of construction activities in all areas where surface drainage flows over distributed area and off the site.
- Provide an erosion and sediment control pond in the location of the ultimate facility to provide 125 m^3/ha of permanent pool and 125 m^3/ha of active storage with a 24-hour drawdown as the primary sediment control facility during construction.

Prior to the commencement of construction activities, a siltation control fence and or environmental chain link should be installed in strategic locations so as to filter such surface runoff and limit the construction activities out of key natural heritage features. This fencing will delineate areas for construction activities.

All proposed catchbasins and landscape area drains on site shall have the underside of the grates covered with Terrafix 270R non-woven geotextile material and include a sediment containment ring around these inlets during construction period to protect them from filling with sediment. The contractor shall regularly clean the sediment and debris filtered out by these structures. The contractor shall remove and dispose of the geotextile material at the end of the construction period.



Through the implementation of the proposed construction practices discussed above and regular maintenance of these controls, it can be ensured that satisfactory protection of the surrounding areas will occur during the construction stage of the proposed development.

Bi-weekly erosion and sediment control inspection reports are to be completed and forwarded to the Town for their information. Any deficiencies noted within the reports are to be repaired by the contractor within 2 weeks or before any anticipated storm events with greater than 5 mm of precipitation.

7.0 Conclusions

This report has presented a functional-level analysis and design for the proposed development. Further refined will be performed at the detailed design stage. Functional design elements for the proposed development are summarized as follows:

- The development will be serviced by the extension of the Masters Lane 150 mm watermain and connecting to the existing 400 mm watermain on Golf Course Road at proposed Street B.
- Sanitary is to be serviced through extensions of the Masters Lane sewer network with a 200 mm diameter sanitary sewer.
- A local aboveground sewage pump station (SPS) is proposed at the lowest point of the sanitary catchment.
- The proposed drainage patterns will generally be maintained compared to pre-development conditions.
- Where feasible, private rear yard soakaway pits, sized to infiltrate the first 5 mm of rainfall from roof areas will be provided.
- External stormwater from areas west of Golf Course Road will be routed through proposed easements and into the SWM facility prior to outletting to Marl Lake.
- A centralized stormwater management pond will provide quality, erosion and quantity control.

BURNSIDE

[THE DIFFERENCE IS OUR PEOPLE]

Appendix A

Correspondence

Doug Herron

From: Lee Bull <lbull@nvca.on.ca>
Sent: March-03-16 2:14 PM
To: Doug Herron
Cc: Tracy Jarratt
Subject: Pre-Consultation Comments - 31 Marlwood Avenue - Town of Wasaga Beach
Attachments: marlwood_propdev.jpg

Good afternoon Doug

Nottawasaga Valley Conservation Authority [NVCA] staff appreciates the opportunity to provide pre-consultation comments on proposed 76 lot residential subdivision on the existing Marlwood Golf course in the Town of Wasaga Beach.

The subject property is designated 'Open Space', and Natural Hazards' on Schedules 'A-6 and A-7' Land Use Plan(s) of the Town of Wasaga Beach Official Plan and zoned 'Open Space' and 'Rural' on Schedule 'P' and 'Q' of the September 2014 Office Consolidation of The Town of Wasaga Beach Comprehensive Zoning By-law 2003-60. Amendments to the Official Plan and Zoning By-law are required to facilitate the proposed development.

The subject property is partially regulated pursuant to Ontario Regulation 172/06, the Authority's Regulation of Development Interference with Wetlands and Watercourses Regulation. NVCA Permits are required prior to any site alteration or construction on regulated portions of this property.

Upon review of the development concept for the subject property, NVCA staff offer the following comments:

ENGINEERING

Natural Hazards:

1. A site survey should be completed in order to determine if further flood information needs to be provided.
2. Hazardous soil - At this location there could be a risk of hazardous soils (peat or marl). This should be addressed by a geotechnical engineer and a report provided for review.

Stormwater Management:

3. A stormwater management report and associated plans will be required to current standards. More information can be found in the NVCA engineering guidelines available on our website at nvca.on.ca.

ECOLOGY

4. An Environmental Impact Study [EIS] will be required in support of the proposed development on this property due to its proximity to the provincially significant wetland [PSW] (likely within 120 m based on updated mapping) and its proximity to the provincially significant Life Science ANSI immediately to the west.

5. There are four unevaluated Ministry of Natural Resources and Forestry [MNRF] wetlands in/near the proposed development (identified by red letters in attachment):
    a. A/B/C – these areas are subject to confirmation/verification in the field.
    b. D – field investigations and boundary refinement (with MNRF/NVCA) are required; additional wetland would be contiguous with the existing provincially significant wetland and would be deemed part of the PSW by MNRF.
6. Threatened species (i.e. least bittern) nest along the Marl Lake shoreline – an assessment of impacts/mitigation of proposed development near the shoreline on these species would be required.
7. Forest cover associated with A, B and C could support Species at Risk [SAR] such as butternut or eastern hog-nosed snake. Eastern hog-nosed snake (and associated core habitats) are present immediately west of the property. MNRF should be consulted for an opinion, particularly for eastern hog-nosed snake.

NVCA staff appreciates the opportunity to comment at this stage of the process and look forward to working with the Town to develop and achieve the vision for this Area. NVCA staff will be in attendance at the pre-consultation meeting scheduled for Tuesday March 8, 2016 @ 10 am. We will liaise directly with the applicant with regards to the applicable NVCA review fees at the time of submission of formal applications. Should you require any further information, please feel free to contact the undersigned.

Should you have any questions regarding any of the above matters, please feel free to contact the undersigned.

Sincerely,

Lee J. Bull, MCIP, RPP | Manager, Planning Services

Nottawasaga Valley Conservation Authority
8195 8th Line, Utopia, ON L0M 1T0
T 705-424-1479 ext. 231 | **F** 705-424-2115
lbull@nvca.on.ca | **nvca.on.ca**

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Proposed Marlwood Subdivision

Date: 29-Feb-2016



Legend

- Benthics Stations
- Jurisdiction Boundary
- Municipal Boundary
- Wetlands_NVCA

Wetlands_MNR

MNR Classification

- Evaluated-Other
- Evaluated-Provincial
- Un-Evaluated
- LotConcessions
- Parcel Boundary (Reference Data)

Notes

Nottawasaga Valley Conservation Authority

8195 8th Line
Utopia, ON L0M 1T0
www.nvca.on.ca

0 120 240 480
Meters

1:6,816

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MEMORANDUM

TO: Doug Herron, Manager of Planning

C.C.: Mike Pincivero, Manager of Engineering Services

FROM: Patti Kennedy, Engineering Technologist

SUBJECT: TPC at Marlwood Inc.
Proposed 76 Lot Residential Subdivision
Golf Course Road
Pre-Consultation, File PRE-C01/16
Public Works/Engineering Comments

DATE: March 7, 2016

As requested, a review of the submitted Preliminary Concept Plan in support of a proposed Seventy-six (76) lot residential subdivision, received from the Planning Department on February 17, 2016, has been completed and the following is a summary of comments generated as a result.

General Comments

It appears from the Concept Plan that this development will proceed as a single family residential development, with municipal services and public roads. This will need to be confirmed by the Applicant.

The Plan provided is very preliminary, although it shows the proposed lot fabric and the proposed road layout, it does not detail the existing municipal servicing corridors located at the south end of Masters Lane, in the area of the existing cu-de-sac. This information is of significance, as the proposed lot fabric in this area will require revision to accommodate the existing infrastructure and the associated easements. Further, the Plan does not appear to account for stormwater management (quantity and quality control) which will be a requirement for the development. The currently proposed development lands contain an existing golf course with at least one (1) water feature/pond. From the proposed concept plan the water feature/pond will have to be decommissioned and filled to accommodate an area of the proposed residential lots. A Detailed geotechnical investigation and associated design will be required to ensure the area is restored to a state that will support the proposed house foundations.

Golf Course Road and Masters Lane, in the area of the proposed development are serviced with existing municipal water and sanitary sewers. Masters Lane is also serviced with storm sewer. It is noted that the development will be required to connect to municipal water and sanitary system, in accordance with Town Policies. Further, storm sewers along the proposed extension of Masters Lane will also be a requirement. It should be noted that the Town's preference for the water system is to ensure that the system is looped. The watermain along the proposed internal road to the cul-de-sac may have to be looped to provide sufficient flows, pressures and system water quality. This will have to be reviewed through the Town's Water Distribution System Model. Investigation with regard to whether the proposed development can be serviced from existing infrastructure, or if additional

services, foundation construction for dwellings, as well as details related to proposed stormwater management facilities.

4. A Traffic Impact Study (TIS) will be required to address traffic generated from the development and any impact on the surrounding roadway network. The Report should address the number of lots proposed along the cul-de-sac terminated roadway. Industry standards typically do not recommend exceeding 40 lots on a single access roadway, however if there is a proposal to provide a second connection to Golf Course Road, then the road layout may be acceptable as proposed.
5. Engineering Plans typically include, but shall not be limited to the following drawings:
    - Cover Sheet.
    - General Servicing Plan – including external works where applicable.
    - Sanitary Drainage Area Plan – including external drainage plan where applicable.
    - Storm Drainage Area Plan – including external drainage plan where applicable.
    - Lot Grading Plan.
    - Siltation and Erosion Control Plan.
    - Tree Preservation, Compensation and Landscaping Plans.
    - Overall Comprehensive Plan of Easements.
    - Plan/Profile drawings of all streets, easements and external works.
    - Detail Sheets.
    - Composite Utility Plan.
    - Landscaping Plans – including fencing locations and tree buffer zones.
6. A legal and topographic survey will be required. The topographic survey is to include Golf Course Road and Masters Lane adjacent to the proposed development, as well as sufficient existing grades on the adjacent properties to indicate the existing drainage pattern.
7. An Operation and Maintenance Manual will be required for the development to address the regular inspection and maintenance of infrastructure.

I trust the above is clear, however should you have any questions or require clarification on any of the above, please contact the undersigned.

Respectfully submitted by,

P. L Kennedy

Patti Kennedy, C.E.T.
Engineering Technologist, RMI

Doug Herron

From: Tracy Jarratt
Sent: March-08-16 9:20 AM
To: Doug Herron
Subject: Marlwood Pre Con Zoning Comments

Good Morning Doug

The lands located at the Marlwood Golf Course and the are currently Zoned Open Space (OS), Environmental Protection (EP), Accommodation Commercial 1st Exception (CA-1), within Zoning By-law 2003-60. To permit residential development, a zoning amendment would therefore be required. The Residential Type 1 Zone provisions are attached which provide details as to minimum lot size, coverage and height etc.

Tracy Jarratt
Zoning Administrator
Secretary Treasurer Committee of Adjustment/Consent

Town of Wasaga Beach
30 Lewis Street
Wasaga Beach, ON
L9Z 1A1
705-429-3847. ext. 2272
705-429-7603 Fax
zoningadmin@wasagabeach.com

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SECTION 4 - RESIDENTIAL TYPE 1 (R1) ZONE

4.1 No person shall within any Residential Type 1 (R1) Zone use any lot or erect, alter, enlarge, maintain or use any building or structure for any purpose or use other than as permitted for one or more of the following uses and in accordance with the following provisions or requirements as set out herein:

4.2 PERMITTED USES

4.2.1 Residential Uses:

a) single detached dwelling unit
b) one (1) attached accessory dwelling unit, subject to Subsection 3.28

4.2.2 Non-Residential Uses:

a) accessory use directly related to the uses permitted in the R1 Zone
b) home occupation
c) public use
d) bed and breakfast

4.3 ZONE PROVISIONS

4.3.1 Lot Area (minimum):

a)	lot served by a public water system and a sanitary sewer system	464.5sq.m
b)	lot served by a public water system	1,400 sq.m
c)	other lots	1,860 sq.m

4.3.2 Lot Frontage (minimum):

a)	lot served by a public water system and a sanitary sewer system	12 m
b)	lot served by a public water system	22m
c)	other lots	30m

4.3.3 Front Yard Depth (minimum): 6m

4.3.4 Exterior Side Yard Width (minimum): 4.5m

4.3.5 Interior Side Yard Width (minimum): 1.8m

4.3.6 Rear Yard Depth (minimum): 7.6m

4.3.7 Dwelling Unit Area (minimum): 93 sq.m

4.3.8	**Landscaped Open Space (minimum):**	30%
4.3.9	**Lot Coverage (maximum):**	35%
4.3.10	**Height of Building (maximum):**	10m

4.3.10.1 *(2007-17)* A single detached dwelling will be restricted to two storeys but may have a loft or living space located within the pitched roof area/attic of the said dwelling.

4.3.11 **Dwelling Units per Lot (maximum):**

a)	single-detached dwelling	1
b)	attached accessory dwelling unit	1

4.3.12 **Accessory Uses see Section 3.1**

4.3.13 **Parking Provisions see Section 3.38**

4.3.14 **Attached Accessory Dwelling in Residential Dwellings, see Subsection 3.28**

4.4 ZONE EXCEPTIONS

The following Zone categories shall have the same permitted uses and zone provisions as the regular R1 Zone except as noted.

4.4.1 **R1-1 Zone**

4.4.2 **R1-2 Zone Schedule "B"**

The front yard depth minimum shall be 5.7 m.

4.4.3 **R1-3 Zone**

A home medical office shall also be permitted.

4.4.4 **R1-4 Zone Schedule "H"**

The front yard depth minimum shall be 1.2 m; the north interior side yard width minimum shall be 0.6 m; the rear yard depth minimum shall be 1.2 m.

4.4.5 R1-5 Zone Schedule "H"

The rear yard depth minimum shall be 10.6 m.

4.4.6 R1-6 Zone Schedule "H"

A bed and breakfast shall also be permitted and the exterior side yard width minimum shall be 1.8 m.

4.4.7 R1-7 Zone Schedule "I"

The front lot line shall be the north lot line for the purpose of yards only and the Rear Yard Depth (minimum), as it applies to the south rear yard, shall be 12 m.

4.4.8 R1-8 Zone Schedule "P"

The minimum lot frontage shall be 15.2 m.

4.4.9 R1-9 Zone Schedule "P"

The minimum lot frontage shall be 18.2 m.

4.4.10 R1-10 Zone Schedule "I"

The minimum lot area shall be 380 square metres.

4.4.11 R1-11 Zone Schedule "I"

The minimum lot frontage shall be 7.6 metres; the minimum interior side yard depth, as it relates to the north and south interior side yards only, shall be 7.6 metres; and, the minimum rear yard depth shall be 1.8 metres.

4.4.12 R1-12 Zone Schedule "I"

The minimum front yard depth shall be 2.4, the minimum interior side yard depth, as it relates to the north and south interior side yards only, shall be 7.6 metres; and, the minimum rear yard depth shall be 1.8 metres.

4.4.13 R1-13 Zone Schedule "A"

The lot area minimum shall be 410 square metres; the lot frontage minimum shall be 15 metres; the front yard depth minimum shall be 4.5 metres and 6 metres from any attached garage; the exterior side yard width minimum shall be 3 metres and lot coverage maximum shall be

43%. For the purpose of this section a private street shall be deemed to be a public street. For those lots with two side lot lines backing onto the shoreline of Nottawasaga Bay, no buildings or structures shall be located within 7.6 metres of a rear lot line; no fence shall be permitted along a rear lot line and no fence shall encroach within 6 metres of a rear lot line. In addition to the list of permitted Non-Residential Uses, a private clubhouse shall be permitted.

4.4.14 R1-14 Zone Schedule "H"

A Bed and Breakfast use and an accessory building with the installation of plumbing shall be permitted. Such accessory building shall not exceed 28 square metres in area and shall not be used or human habitation.

4.4.15 R1-15 Zone Schedule "T"

The front yard depth minimum shall be 12.0 metres.

4.4.16 R1-16 Zone Schedule "C"

The minimum front yard depth shall be 10 m and the front wall of an attached garage shall project no more than 1m beyond the front wall of the habitable area of the dwelling.

4.4.17 R1-17 Zone Schedule "E"

A rest home shall also be permitted. The maximum number of residents shall be eight (8).

4.4.18 R1-18 Zone Schedule

A bed and breakfast use shall also be permitted and the maximum driveway width shall be 8.4 metres.

4.4.19 R1-19 Zone Schedule "T"

The minimum separation requirement of Zoning By-law 2003-60 for a driveway setback from a street line shall be 7.0 metres.

4.4.20 R1-20 Zone Schedule "T"

The minimum interior side yard width shall be 1.35 metres.

4.4.21 R1-21 Zone

The use permitted shall be non-residential and shall be restricted to a

Private Community Centre.

4.4.22 R1-22 Zone Schedule "F"

The minimum lot area shall be 585 sq.m. The Minimum Lot Frontage shall be 18 metres. The minimum Exterior Side Yard shall be 4.0 metres, except where the front elevation of a garage faces a street-line, in which case the Exterior Side Yard to the garage shall be 6 metres. The maximum distance from the main wall of the dwelling unit to the front elevation of a garage shall be 1.5 metres. The minimum Interior Side Yard shall be 1.5 metres. The maximum Lot Coverage shall be 40%.

4.4.23 R1-23 Zone Schedule "T"

The minimum front yard setback requirement shall be 5.3 metres, the minimum exterior side yard setback requirement shall be 2.1 metres, the minimum interior side yard setback shall be .8 metres.

4.4.24 R1-24 Zone Schedule "S"

A 2.0 metre wide planting strip consisting of existing vegetation shall be required along the east interior side lot line.

4.4.25 R1-25 Zone Schedule "R"

Permitted residential uses shall be limited to single-detached dwelling units;

Section 4.3, Zone Provisions, applies to the lands zoned R1-25, except where specifically identified below:

Minimum lot depth shall be 30 metres; Minimum lot area shall be 360 square metres; Minimum front yard depth shall be 4.0 metres to the building face and side of an attached garage and 6.0 metres to the front of an attached garage; Where a garage is attached to a residential dwelling unit, the maximum projection of the face of the attached garage from the building face shall be 2.4 metres; Minimum exterior side yard width shall be 4.0 metres to the building face and 6.0 metres to the front of an attached garage; Minimum interior side yard width shall be 1.2 metres to the building face and to the rear or side of an attached garage and 8.0 metres to the front of an attached garage when garage is facing the side yard; Minimum rear yard depth shall be 7.5 metres to the building face and 0.6 metres to the garage wall of a detached garage in the rear lot; Minimum landscaped open space shall be 30%;Maximum lot coverage shall be 55%; Maximum driveway width for single-detached dwelling units shall be 6.0 metres; Maximum height of building for single-detached

dwelling units shall be 11.0 metres; Minimum outdoor amenity space excluding the driveway for single-detached dwelling units shall be 90 square metres per unit and having no dimension less than 6.0 metres; and one (1) attached accessory dwelling unit per lot, subject to Subsection 3.28.

Notwithstanding the General Provisions, Section 3.3.4 and 3.3.6 to the contrary, the following provisions shall apply: porches/verandas shall be permitted to encroach by sixty (60%) percent and steps by eighty (80%) percent into any required front or exterior side yard setback depth. Porch/verandas shall not be subject to nor restricted to a maximum area size. Maximum height of porch/verandas and steps within permitted encroachment shall be 1.6 metres.

4.4.26 R1-26 Zone Schedule "O"

Notwithstanding Subsection 3.18 of the Zoning By-law, the existing single detached dwelling may be enlarged.

4.4.27 R1-27 Zone Schedule "G"

Notwithstanding Sections 3.1.2 and 3.18, the maximum lot area that shall be used by detached accessory buildings is 98 square metres , and the maximum horizontal dimension of a detached accessory building shall be 9.2 metres. A building or structure may be constructed on a lot which does not have frontage on a municipal street.

4.4.28 R1-28 Zone Schedule "F"

The minimum lot area shall be 585 square metres; the minimum lot frontage shall be 18 metres; the minimum exterior side yard shall be 4 metres, except where the front elevation of a garage faces a street-line, in which case the exterior side yard to the garage shall be 6 metres; the maximum distance from the main wall of the dwelling unit to the front elevation of a garage shall be 1.5 metres; the minimum interior side yard shall be 1.5 metres; the maximum lot coverage shall be 40%; notwithstanding General Provision 3.9.1 and the exterior side yard provisions of the R1.28 Zone, for corner lots at the intersection of a collector road and a local road where the conveyance of a 10 metre by 4 metre daylighting triangle affects the proposed building envelope, the exterior side yard setback shall be measured from a line created by projecting the lot line to the point of intersection of the two street lines, rather than the new lot line created by the dedication of the daylighting triangle.

4.4.29 R1-29 Zone Schedule "F"

The minimum lot area shall be 585 square metres; the minimum lot frontage shall be 18 metres; the minimum exterior side yard shall be 4 metres, except where the front elevation of a garage faces a street-line, in which case the exterior side yard to the garage shall be 6 metres; the maximum distance from the main wall of the dwelling unit to the front elevation of a garage shall be 1.5 metres; the minimum interior side yard shall be 1.5 metres; the maximum lot coverage shall be 40%.

4.4.30 R1-30 Zone Schedule "G"

In addition to Section 4.3, Zone Provisions, the following applies to the lands zoned R1-30:

A maximum of four existing accessory structures are permitted; the minimum side yard setback from the north interior lot line for existing accessory structures shall be .44 metres and the minimum interior side yard setback from the southern interior lot line for existing accessory structures shall be .9 metres; the minimum rear yard setback for existing accessory structures shall be .86 metres; the accessory structures shall not be connected to any private or municipal water and sewer services, shall not contain plumbing fixtures, may be used for storage or sleeping quarters only and shall not be used as a tourist establishment.

4.4.31 R1-31 Zone Schedule "H"

Notwithstanding Subsection 3.18 Street Requirements of the Zoning By-law, buildings and structures may be erected on lands that do not front onto a municipal street.

Ministry of Natural Resources and Forestry

Midhurst District Office
2284 Nursery Road
Midhurst, ON L9X 1N8

Ministère des Richesses Naturelles et des Forêts

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Ontario

November 30, 2016

Azimuth Environmental Consulting, Inc
642 Welham Street
Barrie, Ontario,
L4N 9A1

Attention: Melissa Fuller

Subject: Marl Lake Golf and Country Club – Jack's Lake Complex – Boundary Amendment

Ms. Fuller this letter follows up on our June 2016 site visit where we met to review your interpretation of part of the boundary of the Jack's Lake Complex provincially significant wetland on the Marlwood Golf and Country Club property, Wasaga Beach. Attached for your reference is a map presenting the wetland boundary based on the survey coordinates resulting from that meeting. As you indicated the development was proposed within the forested block adjacent to the length of the 13th golf hole, the wetland boundary reviewed was limited to the southern part of the subject property. The resulting amendment to the wetland boundary was made to that section between the two red bars.

With this letter we confirm the wetland boundary amendment of the Jack's Lake Complex PSW on the Marlwood Golf and Country Club property as shown in the attached map. Recent staff changes will delay briefly our updating the digital wetland data in Land Information Ontario, however we trust the attached serves the file going forward in the short term.

Should you have any questions contact the undersigned at this office.

Yours truly,

Graham Findlay
Management Biologist
Huronia Resource Management Team,
Midhurst District

c.c. (by email only)
Doug Herron, Town of Wasaga Beach
Dave Featherstone, NVCA

Marl Lake Golf and Country Club
Jack's Lake Complex Provincially Significant Wetland



0 45 90 180 Meters

N
W E
S

Legend

MarlLkGCC

The drawing, map or plan supplied is not a Plan of Survey but graphical illustration only. The true positional accuracy of the information shown hereon must not be used as evidence of the location of legal boundaries, township lot fabric, features, or routes. Any coordinates supplied are derived from the drawing and are approximate only. They cannot be used to establish the location of parcel corners.

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Ministry of Natural Resources and Forestry, 2016

NOTE:
MPAC, wetland, and imagery data layers from MNRF NRVIS database.

BURNSIDE

[THE DIFFERENCE IS OUR PEOPLE]

Appendix B

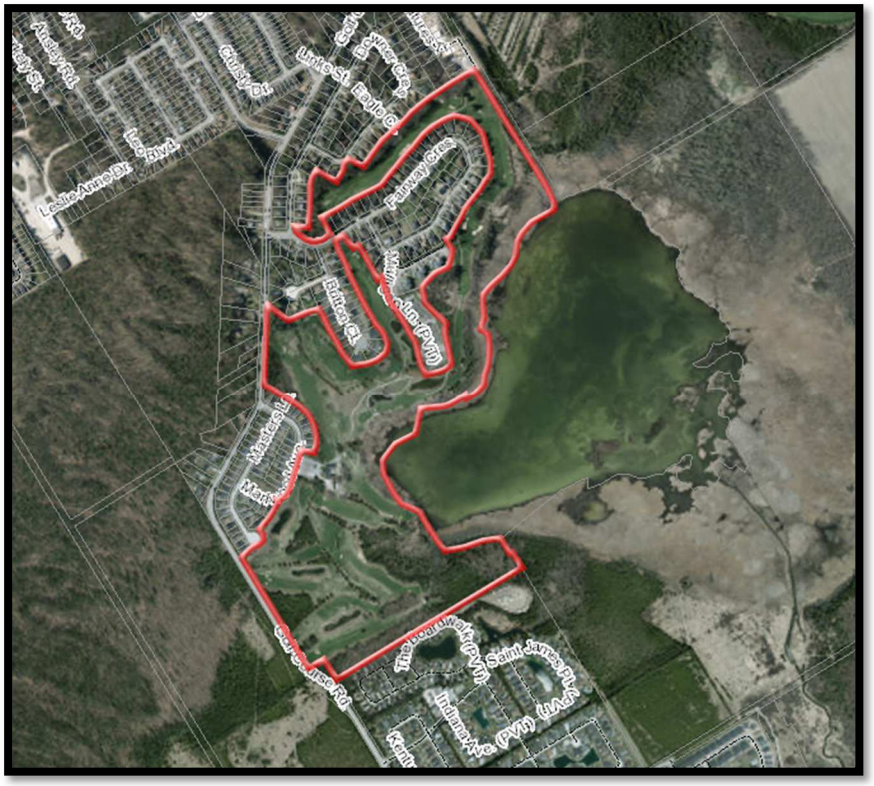
Geotechnical and Water Balance Reports

MARLWOOD GOLF & COUNTRY CLUB

31 MARLWOOD AVENUE, WASAGA BEACH, ONTARIO

PRELIMINARY GEOTECHNICAL INVESTIGATION

JANUARY 07, 2020



wsp

31 MARLWOOD AVENUE, WASAGA BEACH, ONTARIO

PRELIMINARY GEOTECHNICAL INVESTIGATION

MARLWOOD GOLF & COUNTRY CLUB

PRELIMINARY REPORT

PROJECT NO.: 151-62944-00

DATE: JANUARY 07, 2020

WSP
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561 BRYNE DRIVE
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January 07, 2020

Marlwood Golf & Country Club
c/o R.J. Burnside and Associates Limited
3 Ronnell Cresecent
Collingwood, ON
L9Y 4J6

Attention: Marlwood Golf & Country Club

Dear Mr. E. Tjeerdsma,

Subject: 31 Marlwood Avenue, Wasaga Beach, Ontario - Preliminary Geotechnical Investigation

WSP Canada Inc. was retained to update the Preliminary Geotechnical Investigation at the above noted site. The purpose of the preliminary investigation is to identify the subsurface conditions at the borehole locations and to provide design recommendations toward the design of the proposed development, as well as identify any potential geotechnical related constraints which may be encountered during construction.

Kind regards,

Kent Malcolm, P.Eng.
Senior Geotechnical Engineer

Gord Jarvis
Team Lead, Environment

MKM/ham

WSP ref.: 151-62944-00

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B ENGINEERED FILL

C SOIL QUALITY TESTING

1 INTRODUCTION

SPL Consultants Limited now operating as **WSP Canada Inc. (WSP),** was retained by R.J. Burnside and Associates Limited on behalf of the Marlwood Golf & Country Club to provide an update to the Preliminary Geotechnical Investigation for the proposed residential development of Marlwood Golf & Country Club located at 31 Marlwood Avenue, in Wasaga Beach, Ontario.

The scope of this preliminary investigation update was to obtain information about the subsurface conditions through the advancement of twelve (12) boreholes and based upon the findings of the boreholes ultimately provide recommendations herein pertaining to the following:

- General soil conditions;
- Soil parameters for excavations for grading, utilities, subdivision roads;
- Excavation and backfill;
- Groundwater levels and preliminary comments for a EASR or PTTW;
- Soil bearing capacity; and,
- Site seismic classification.

This report deals with geotechnical issues only.

This report is provided based on the terms of reference presented above and, on the assumption, that the design will be in accordance with the applicable codes and standards. If there are any changes in the design features relevant to the geotechnical analyses, or if any questions arise concerning the geotechnical aspects of the codes and standards, this office should be contacted to review the design.

The site investigation and recommendations follow generally accepted practice for Geotechnical Consultants in Ontario. The format and contents are guided by client specific needs and economics and do not conform to generalized standards for services. Laboratory testing follows ASTM or CSA Standards or modifications of these standards that have become standard practice.

This report has been prepared for R.J. Burnside and Associates Limited on behalf of Marlwood Golf & Country Club. Third party use of this report without WSP consent is prohibited.

2 SITE BACKGROUND AND PROJECT DESCRIPTION

The subject property (site) is identified by civic address 31 Marlwood Avenue in the Town of Wasaga Beach. The site is situated on a relatively flat to gently sloping terrain, and abuts Golf Course Road, Marlwood Avenue and Masters Lane on the west side, Birdie Court, Britton Court, Mulligan Lane on the north side. The residential development of Park Place is located along the south boundary and Marl Lake is located along the east boundary. The property currently occupies Marlwood Golf and Country Club.

It is understood that the proposed development will consist of single-family residential dwellings and will include internal roads and associated municipal sewers and water supply. Although the previously proposed new clubhouse is not depicted on the updated plans, we currently understand that the construction of a Storm Water Management Pond (SWMP) and Pumping Station are now being considered, within Blocks 52 and 54, respectively. The layout plan of the proposed development as shown on the R.J. Burnside preliminary drawings are provided in ***Appendix A***. Neither detailed drawings nor Plan and Profile drawings have not been prepared yet, as such, the proposed footing founding elevations of the proposed construction and the invert of the site services is not known to us at the time of writing this report.

3 INVESTIGATION METHODOLOGY

The field investigation consisted of drilling twelve (12) boreholes (BH15-01 to BH15-12), at the site between September 3 and 9, 2015. The locations of each site are shown on the attached ***Borehole Location Plan – Figure 1.***

The boreholes were advanced to depths ranging from 5.2 metres below site grades (mbgs) to 8.2 mbgs. The boreholes were drilled with hollow stem continuous flight auger equipment.

Drilling equipment was supplied and operated by a drilling sub-contractor under the direction and supervision of WSP personnel. Samples were retrieved at regular intervals with a 50 mm O.D. split-barrel sampler driven with a hammer in accordance with the Standard Penetration Test (ASTM D 1586) method. This sampling method recovers samples from the soil strata, and the number of blows required to drive the sampler a 0.3 m depth into the undisturbed soil (SPT 'N' values) gives an indication of the compactness condition or consistency of the sampled soil material. The SPT 'N' values are indicated on the ***Borehole Logs - Enclosures 1-12***.

Soil samples were visually classified in the field and re-evaluated by a senior engineer in our laboratory. All soil samples were tested for moisture contents. Laboratory Grain Size Analyses were carried out on representative samples and the results are provided in ***Laboratory Results - Enclosures 13.***

Water level observations were made during the drilling and in the open boreholes upon the completion of drilling operations. Monitoring wells (50mm diameter) were installed at five (5) borehole locations; WSP returned to the site after the drilling operations to obtain groundwater levels at the site.

Selected soil samples were subjected to chemical analysis to assess the environmental quality of the soils to assist in determining off-site disposal options. Chemical testing results are presented in ***Appendix C.***

4 SITE AND SUBSURFACE CONDITIONS

Details of the subsurface conditions encountered are presented on the Borehole Logs ***(Enclosures 1-12)*** and summarized in the following sections. It is noted that subsurface conditions can change between boreholes and the details provided below refer to soil conditions that were encountered at the borehole locations only.

4.1 GENERAL SUBSURFACE CONDITIONS

Based on the results of the field investigation, the subsurface conditions at the borehole locations generally comprised a surficial layer of topsoil. The surficial cover was underlain by both native cohesive and non-cohesive deposits, which extended beyond the final depth investigated. Some of the non-cohesive deposits appeared to be reworked and as such are considered to be Disturbed Soils.

4.1.1 SURFICIAL COVER

Topsoil was encountered surficially in each of the boreholes; while Disturbed Soils were encountered below the topsoil at BH15-01, BH15-05 and BH15-07. The Disturbed Soils comprised silty sand with trace organic matter and roots. A summary of the thicknesses at each of the borehole locations is summarized below.

It should be noted that topsoil/Disturbed Soil quantities should not be calculated from the borehole information, as large variations in depth may exist between boreholes. A detailed topsoil/Disturbed Soils layer thickness survey is required to determine an accurate evaluation of quantity.

BOREHOLE	MATERIAL TYPE	DEPTH (cm)	MATERIAL THICKNESS (cm)
15-01	Topsoil	23	23
	Disturbed Soil	23-80	57
15-02	Topsoil	18	18
15-03	Topsoil	13	13
15-04	Topsoil	13	13
15-05	Topsoil	10	10
	Disturbed Soil	10-80	70
15-06	Topsoil	15	15
15-07	Topsoil	15	15
	Disturbed Soil	15-60	45
15-08	Topsoil	15	15
15-09	Topsoil	13	13
15-10	Topsoil	5	5
15-11	Topsoil	18	18
15-12	Topsoil	20	20

4.1.2 COHESIVE SOIL

A cohesive deposit of clayey silt resembling Marl was encountered in boreholes BH15-02, BH15-04 and BH15-06 to BH15-12, at varying depths but generally underlying the topsoil and/or Disturbed Soils. The clayey silt, Marl, included some sand to sandy, trace organic matter and occasional shell fragments. The Marl was beige in colour, moist and extended to depths ranged between 0.3 meters below existing ground surface (mbgs) to 2.3 mbgs.

Standard Penetration Tests performed in the Marl deposit yielded 'N'-values generally ranging from 5 to 16 blows per 0.3 m penetration indicating a soft to firm condition. The measured natural moisture content of the samples from these materials ranges from 8% to 41%, indicating moist to saturated condition.

It should be noted that the Marl deposit encountered throughout the site is not considered suitable for supporting structures such as buildings and roads. These deposits should be completely removed in areas where such structures are proposed.

A grain size analyses of one sample of the cohesive deposit acquired from BH15-04/SS4 was completed and the gradation curve is presented in ***Enclosure 13***. A review of the grain size analysis indicates the following ranges of clay, silt, sand and gravel percentages:

- Gravel: 0%
- Sand: 20%
- Silt: 52%
- Clay: 28%

4.1.3 NON-COHESIVE SOIL

A non-cohesive deposit comprised of sand to silty sand and sand and gravel was encountered in each of the boreholes underlying the surface cover and cohesive Marl deposits. Marl seams or pockets within the non-cohesive deposit between 3 cm and 10 cm in thickness were encountered in BH15-05, BH15-06 and BH15-09, as deep as 3.1 mbgs.

Standard Penetration Tests performed of the non-cohesive deposits comprised predominantly of sand yielded 'N'-values generally ranging from 2 to 100 blows per 0.3 m penetration indicating a very loose to very dense condition. More importantly, very loose to loose conditions were encountered within the non-cohesive sand deposits at the depths tabulated below.

BOREHOLE	MATERIAL TYPE	N VALUES	DEPTH (cm)	MATERIAL THICKNESS (cm)
15-03	Sand	7 - 8	10 - 150	140
15-05	Sand some clayey silt layers	2 - 4	80 - 350	270
15-06	Sand some clayey pockets	5	310 - 390	80
15-07	Sand some gravel	4	460 - 540	90
15-08	Sand	4	20 - 80	60
15-09	Sand	5	10 - 80	70
15-10	Sand some silt trace clay	5	300 - 380	80
15-11	Sand some silt trace gravel	2 - 6	230 - >520	>290

The measured natural moisture content of the predominant sand samples ranged from 2% to 27%, indicating moist to saturated condition.

Grain size analyses of samples of the non-cohesive deposits predominantly of sand were acquired from BH15-07/SS6 and BH15-09/SS5 were completed and the gradation curves are presented in ***Enclosure 13***. A review of the grain size analyses indicates the following ranges of clay, silt, sand and gravel percentages:

- Gravel: 0%
- Sand: 95% to 96%
- Silt: 2% to 5%
- Clay: 0% to 2%

Standard Penetration Tests performed of the non-cohesive deposits predominantly comprised of sand and gravel at BH15-01, BH15-02, BH15-04, BH15-05 and BH15-12, yielded 'N'-values generally ranging from 20 to 88 blows per 0.3 m penetration indicating a compact to very dense condition. The measured natural moisture content of the samples from these materials ranged from 1% to 18%, indicating moist to saturated condition.

Grain size analyse of a sample of the non-cohesive deposits predominantly of sand and gravel were acquired from BH15-02/SS5 was completed and the gradation curve is presented in ***Enclosure 13***. A review of the grain size analyses indicates the following ranges of clay, silt, sand and gravel percentages:

- Gravel: 45%
- Sand: 48%
- Silt: 5%
- Clay: 2%

4.2 GROUNDWATER

During drilling and at the completion of drilling, groundwater and/or wet soil conditions were found in all boreholes at various depths as indicated in the individual borehole logs (***Enclosures 1-12***).

The water levels observed in the monitoring wells installed at borehole locations BH 15-01, BH 15-05, BH 15-07, BH 15-09 and BH 15-12 between September 3rd and August 23rd, 2016 were recorded at depths ranging between 0.99 m (BH15-05) and 4.91 m (BH15-09) below the existing ground surface and as high as an approximate elevation of 186.63 m (BH15-01) on March 31, 2016.

A summary of the groundwater conditions encountered at the site are summarized in the tables below.

BOREHOLE	DATE	GROUNDWATER DEPTH (MBGS)	MEASUREMENT SOURCE
15-01	September 9, 2015	~3.1	Open Borehole
15-02	September 9, 2015	~2.2	Open Borehole
15-03	September 8, 2015	~3.1	Open Borehole
15-04	September 8, 2015	~2.5	Open Borehole
15-05	September 8, 2015	~1.4	Open Borehole
15-06	September 4, 2015	~2.0	Open Borehole
15-07	September 4, 2015	~3.2	Open Borehole
15-08	September 3, 2015	~4.0	Open Borehole

BOREHOLE	DATE	GROUNDWATER DEPTH (MBGS)	MEASUREMENT SOURCE
15-09	September 3, 2015	~4.8	Open Borehole
15-10	September 3, 2015	~2.4	Open Borehole
15-11	September 4, 2015	~1.7	Open Borehole
15-12	September 9, 2015	~2.1	Open Borehole

BOREHOLE:	BH15-01		BH15-05		BH15-07		BH15-09		BH15-12	
GROUND ELEVATION (masl)	~189		~187		~187		~190		~188	
	Groundwater Level Measurements									
DATE	mbgs	masl	mbgs	masl	mbgs	masl	mbgs	masl	mbgs	masl
Oct. 14, 2015	3.13	185.87	1.48	185.52	3.22	183.78	4.87	185.13	2.20	185.80
Dec. 31, 2015	3.07	185.93	1.35	185.65	3.19	183.81	4.91	185.09	2.12	185.88
Jan. 28, 2016	3.01	185.99	1.34	185.66	3.16	183.84	4.91	185.09	2.06	185.94
Feb. 29, 2016	2.96	186.04	1.28	185.72	3.12	183.88	4.88	185.12	2.02	185.98
Mar. 31, 2016	2.37	**186.63**	**0.99**	186.01	2.77	184.23	4.54	185.46	1.44	185.56
Apr. 30, 2016	2.51	186.49	1.15	185.85	3.17	183.83	4.38	185.62	1.56	185.44
May 31, 2016	2.70	186.30	1.25	185.75	3.27	183.73	4.44	185.56	1.74	185.26
Jun. 10, 2016	2.75	186.25	1.24	185.76	3.09	183.91	4.48	185.52	1.80	185.20
Jun. 30, 2016	2.85	186.15	1.33	185.67	3.11	183.89	4.50	185.50	1.91	185.09
Jul. 31, 2016	2.95	186.05	1.44	185.56	3.14	183.86	4.56	185.44	2.04	185.96
Aug. 23, 2016	3.02	185.98	1.42	185.58	3.13	183.87	4.62	185.38	2.11	185.89

It should be noted that the groundwater levels can vary and are subject to seasonal fluctuations in response to major weather events.

5 DISCUSSIONS/RECOMMENDATIONS

5.1 GENERAL

The following recommendations for the proposed site development are based on the information obtained from the borehole investigation and laboratory testing, which we believe fairly represents the subsurface conditions of the site. These recommendations are intended for the guidance of the design engineer to establish constructability and should not be construed as instructions to contractors. If significant differences in the subsurface conditions described above are found, we request to be contacted immediately to review and revise our findings and recommendations, if necessary.

The construction methods described in this report must not be considered as being specifications or recommendations to the prospective contractors, or as being the only suitable methods. Prospective contractors should evaluate all the information, obtain additional subsurface information as they might deem necessary and should select their construction methods, sequencing and equipment based on their own experience in similar ground conditions. The readers of this report are also reminded that the conditions are known only at the borehole locations and in view of the generally wide spacing of the boreholes, conditions may vary significantly between boreholes.

5.2 SITE BACKGROUND

The subject property is situated on a relatively flat to gently sloping terrain, and abuts Golf Course Road, Marlwood Avenue and Masters Lane on the west side, Birdie Court, Britton Court, Mulligan Lane on the north side. The residential development of Park Place is located along the south boundary and Marl Lake is located along the east boundary. The property currently occupies Marlwood Golf and Country Club.

Based on the results of the field investigation, the subsurface conditions at the borehole locations generally comprised a surficial layer of topsoil and Disturbed Soils. The surface cover was underlain by native cohesive and non-cohesive deposits of clayey silt, Marl, sand to silty sand and sand and gravel. Sandy soils predominate the site and are encountered in all boreholes. Marl was encountered in boreholes BH15-02, BH15-04 and BH15-06 to BH15-12 and extended to depths ranged between 0.3 mbgs to 2.3 mbgs surface.

Groundwater levels varied across the site and measured as high as 1.4 mbgs.

It is understood that the proposed development will consist of single-family residential dwellings and will include internal roads, associated municipal sewers and water supply. Although the previously proposed new clubhouse is not included in the updated Preliminary drawings, we understand that the construction of a SWMP and Pumping Station is being considered within Blocks 52 and 54, respectively. The layout plan of the proposed development as shown on the R.J. Burnside preliminary drawings are provided in ***Appendix A***. Neither detailed drawings nor Plan and Profile drawings have not been prepared yet, as such, the proposed footing founding elevations of the proposed construction and the invert of the site services is not known to us at the time of writing this report.

5.3 SITE PREPARATION AND GRADING

Removal of all topsoil, Disturbed Soils and/or Marl as well as any fill materials in both cut and fill areas will be required to facilitate future development of the site. To avoid settlement of the proposed structures, the Disturbed Soils and Marl deposits must be completely removed.

The thicknesses and extents of unsuitable soil should be further refined across the site, it is therefore recommended that a test pit program be completed at the site by WSP prior to construction. Regarding the reuse of the site topsoil

and fill, these materials may be reused in landscaping applications or other non-structural fill applications. WSP should be contacted to review all proposed topsoil and fill reuse on site.

Any fill required for re-grading the site or backfill should be select, clean material, free of topsoil, organic or other foreign and unsuitable matter. It should be noted that some of the excavated native materials will be wet and must be aerated and left to dry out before they can be used as backfill. Non-structural fill should be placed in thin layers and compacted to at least 95% of its SPMDD. The degree of compaction should be increased to 98% within the top 1.0 m of the subgrade, or as per Town Standards. The compaction of the new fill should be checked by frequent field density tests.

It is unknown if engineered fill will be required at the site to facilitate grading. If fill thicknesses greater than 1 m are required at the site, WSP should be contacted to provide input toward potential long-term consolidation of the cohesive deposits.

After the completion of the required stripping and removal of all unsuitable materials, the sub-grade should be proof-rolled and inspected by experienced WSP geotechnical engineering personnel. The proof-rolling and compaction of the exposed sub-grade is recommended to be conducted using a vibratory compactor with a minimum static weight of 10 tonnes. The proof-rolling program should consist of a minimum of six (6) passes per unit area and be tested to assure that the sub-grade is compacted to a minimum of 98% of the exposed material's Standard Proctor Maximum Dry Density (SPMDD). Any loose/soft or wet areas identified at the time of proof-rolling that cannot be uniformly compacted are recommended to be sub-excavated and backfilled with approved engineered fill consistent with the recommendations provided in ***Appendix B***.

Where engineered fill is required to develop the design grades and elevations or for use in backfilling excavations created through the removal of unsuitable materials or soils as described above, the excavated on-site materials may be re-used, subject that these are free of organic and other unsuitable materials and have appropriate moisture content. Boulders or cobbles greater than 200 mm in size should be removed from the fill prior to or during placement.

Alternatively, Ontario Provincial Standard Specification (OPSS) Granular B – Type I, OPSS Select Subgrade Material (SSM) or approved equal may be used.

All fill materials imported to the site must meet all applicable municipal, provincial and federal guidelines and requirements associated with environmental characterization of the materials.

Engineered fill is to be placed in maximum 200 mm thick loose lifts under full time supervision of qualified geotechnical personnel. Each lift is to be uniformly compacted to achieve a minimum of 100% of the material's SPMDD. Additional information related to the placement and compaction of engineered fill can be found in ***Appendix B***.

5.4 TEMPORARY EXCAVATIONS AND GROUNDWATER CONTROL

The details for the proposed services installations are not available at the time of preparing this report. The recommendations provided below assume that conventional depths for services will be carried out (approximately 3 m to 5 m below existing site grades).

Based upon the subsurface conditions at the borehole locations, excavations can be carried out with heavy hydraulic back-hoes. It is recommended that provision be carried in the contract for the excavation and disposal of obstructions on site, including cobbles and boulders.

All temporary excavations must be carried out in accordance with the Occupational Health and Safety Act (OHSA). In accordance with OHSA, the soils (assuming they are above the groundwater table or properly dewatered) would be classified as a Type 3 soil. Below the groundwater level the soil would be classified as a Type 4 soil. If space limitations exist due to adjacent structures or facilities, consideration could be given to the construction of a

temporary support system to provide protection to the structures and/or facilities. All excavated spoil should be placed at least the depth of the trench away from the edge of the trench for safety reasons.

As noted above, at the time of investigation, the groundwater levels were encountered between 1.4 mbgs and 4.9 mbgs below the existing grades. Dewatering will be required for any excavation in the sand to silty sand, or sand and gravel deposits below the water table. Where the anticipated trench base is below the groundwater level, positive dewatering such as well points/eductors will be required to lower the water table to at least 1.0 m below the excavation base. Otherwise, it will result in an unstable base and flowing sides.

As such, depending on site grading requirements and excavation depths there is a strong likelihood that dewatering will be required at the Site and an Environmental Activity and Sector Registry (EASR) or a Permit to Take Water (PTTW) will be required for the excavations for general servicing and deep replacement of unsuitable soil / fill. It should be noted that the requirements for a PTTW, issued by the Ontario Ministry of the Environment and Climate Change (MOECC) have recently changed; daily water takings of 50 m^3/day require registration of the MOECC EASR database, and daily water takings of 400 m^3/day require a PTTW. Both the EASR and the PTTW require a hydrogeological assessment report to support the specific application. In addition, a permit to discharge the collected water to the sewer system/water body will be required from the applicable agency.

In the planning of the excavation and shoring of trenches, the presence of any adjacent existing buried service pipes should be considered. In addition to the stability of any existing adjacent pipes, which must be maintained without detrimental settlements; the backfill in these trenches and especially the granular bedding surrounding the existing service pipes, manholes, etc. may be a source of water, which, if encountered, must be dealt with.

In the sand to silty sand deposits where the soil exhibits dilatancy during construction and due to the high groundwater levels encountered, the soils may have to be stabilized. Any form of soil stabilization and/or dewatering to facilitate construction (e.g. well points, etc.) must be designed and performed being cognizant of the fact that dewatering may induce settlements of existing structures in the vicinity, including existing service pipes. Although unlikely, basal instability could possibly occur if a relatively coarser stratum (such as silty sand with gravel) under excess hydrostatic pressure occurs below the base of an excavation comprised of relatively impervious soils (e.g. sandy silt/clayey silt/silty clay). Should this occur, these layers must be depressurized. For this reason, the bases of the excavated trenches should be monitored for evidence of basal heave.

For all these reasons, it would be prudent to open the trenches in relatively short sections and carry out the laying of the pipe and backfilling expeditiously in order to reduce the length of time the trench would be open. It is further recommended that the excavations for service trenches below the groundwater table be carried out in short sections using a suitable ‘geofabric’ below the bedding (fine migration prevention) and backfilling the trench section immediately after service placement.

We provide the following soil parameters to determine the earth pressure acting on the sheeting and bracing.

γ = Unit weight of soil above groundwater table, assuming 20 kN/m^3;

γ_1 = Submerged unit weight of soil below water table, assuming 10 kN/m^3;

A determination of the actual lateral earth pressure can be provided, if required, after design has been finalized.

5.5 PIPE BEDDING AND COVER

The native soils above the groundwater level, or properly dewatered if encountered below the groundwater level, will provide adequate support for the sewer pipes and allow the use of normal Class B type bedding. The recommended minimum thickness of granular bedding below the invert of the pipes is 150 mm. The thickness of the bedding may, however, be increased depending on the pipe diameter or in accordance with local standards or if wet or weak subgrade conditions are encountered, especially when the soil at the trench base level consists of wet, dilatant silt. The bedding material should consist of well graded granular material such as Granular ‘A’ or equivalent. After installing the pipe on the bedding, a granular surround of approved bedding material, which extends at least 300 mm above the obvert of the pipe, or as set out by the local authority or municipality, should be

placed. It is recommended that WSP be on site during excavations to assess the suitability of the subgrade materials to support the pipes.

If localized wet trench conditions are encountered, a uniformly graded clear stone may be used provided a suitable, approved filter fabric (geotextile) is placed in conjunction with the clear stone. The geotextile must extend underneath the clear stone, along the sides of the trench, and wrapped on top of the clear stone such that **the clear stone is fully wrapped by the geotextile.** A minimum geotextile overlap of 1 m is required; alternatively stitching of the geotextile could be considered.

Alternatively, localized, wet and unstable soils encountered within generally stable soil zones can be commonly stabilized by 'punching' a 50 mm well graded crusher run limestone pad into the soft subgrade prior to bedding placement. The thickness of the 'pad' will depend on field conditions and should be examined by WSP personnel during the construction operations.

In areas where the soils become wet, unstable and dilatant (easily disturbed) such as saturated silts, careful construction techniques and dewatering should be followed, as discussed earlier. If the pipes are laid on disturbed, dilatant soil, significant post-construction settlements could occur after the trenches are backfilled. In such cases, the bottom of the trenches will have to be stabilized by dewatering.

Sewer pipe bedding recommended for wet, unstable soils is a Class 'A' bedding. The rigid concrete bedding (lean mix) should be laid from manhole to manhole and this concrete 'pad' may sit directly on disturbed native subgrade. In isolated situations, where exposed subgrade tends to be wet and unstable, the concrete 'pad' should be poured on a HL-6 stone layer. It is recommended that the HL-6 bed be encircled with an approved filter fabric to prevent the migration of fines.

Where the sewer pipe is placed in water bearing soils below the water table, the joints connecting the sewer sections should be very well sealed to prevent piping of fines into the sewer pipe and manhole catch basin risers.

5.6 TRENCH BACKFILL

Approved excavated soils can be used as construction backfill provided their moisture content at the time of placement is within 2% of the optimum moisture content and that the soils do not contain organic content. Some moisture conditioning may be required is excess pore air and pore water pressures are generated during compaction process. If bulking is noted, delaying the placement of subsequent lifts may be necessary, to allow for the dissipation of such induced excess pressures. Boulders or cobbles greater than 200 mm in size should be removed from the trench backfill. WSP should be on site during all trench backfilling operations to confirm the suitability of the material being used.

For the granular soils, smooth drum type vibratory rollers are recommended. Cohesive soils, if encountered, should be compacted with sheepsfoot type vibratory compactors. The trench backfill should be placed in maximum 0.3 m lift thickness and compacted to at least 98 percent of its SPMDD. Trench backfilling operations should be avoided during freezing weather.

It is preferable that the native soils be re-used from approximately the position at which they are excavated so that frost response characteristics of the soils after construction remain essentially similar. If required, consideration may also be given to backfilling trenches with a well graded, compacted granular soil such as Granular 'B' material or Select Subgrade Material. The use of such material, if thoroughly compacted, would reduce the post construction settlements to a negligible amount and may also expedite the compaction process. In this instance, however, frost response characteristics of non-frost susceptible granular fill and the frost susceptible indigenous soils would be different giving rise to differential frost heave. In this case, it would be prudent to use as backfill the on-site excavated naturally occurring soils to match the existing conditions within the frost zone (i.e. within about 1.5 m below the road surface elevation) as well as to provide a frost taper zone (i.e. to provide a zone of taper to prevent a sudden change in frost heave characteristics to reduce the effects of frost heave).

It should be noted that the excavated soils are subject to moisture content increase during wet weather which would make these materials too wet for adequate compaction. Stockpiles should therefore be compacted at the surface or be covered with tarpaulins to help minimize moisture uptake.

The degree of compaction of the trench backfill under the roads or other areas where future settlements would be of concern should be at least 98% Standard Proctor Maximum Dry Density (SPMDD) within 2 m of the road surface. The granular pavement sub-base and base materials should be compacted to at least 100% of their respective SPMDD.

5.7 PAVEMENT DESIGN

The investigation has shown that the predominant subgrade soils encountered at the site, after stripping any topsoil, Disturbed Soils, Marl, organic matter or otherwise unsuitable soil will be non-cohesive deposits, or possibly newly compacted fill.

Prior to the placement of granular materials as part of the pavement structure, the subgrade should be prepared and heavily proof-rolled under the supervision of WSP. Any poorly performing areas should be sub-excavated and replaced with either granular earth fill approved by WSP or imported Granular B, Type I material conforming to the requirements of OPSS.

Based on the above and if traffic usage will be residential minor local, the following minimum pavement thickness is recommended:

PAVEMENT LAYER	COMPACTION REQUIREMENTS	LOCAL ROADS	COLLECTOR ROADS
Asphaltic Concrete	92.0 to 96.5% Maximum Relative Density (MRD)	40 mm HL 3 or	50 mm HL 3
		50 mm HL 8	90 mm HL 8
OPSS Granular A Base	100% SPMDD	200 mm	200 mm
OPSS Granular B	100% SPMDD	300 mm	400 mm

We note that the pavement design noted above should be considered preliminary only. If required, a more refined pavement structure design can be performed based on specific traffic data and design life requirements and will involve specific laboratory tests to determine frost susceptibility and strength characteristics of the subgrade soils, as well as specific data input from the client.

The site subgrade and weather conditions (i.e. if wet) at the time of construction may necessitate the placement of geogrid/filter fabric and/or thicker granular sub-base layer in order to facilitate the construction. Furthermore, heavy construction equipment may have to be kept off the newly constructed roads before the placement of asphalt and/or immediately thereafter, to avoid damaging the weak subgrade by heavy truck traffic.

Installation of full-length subdrains is required on all roads. The subdrains should be properly filtered to prevent the loss of (and clogging by) soil fines.

All paved surfaces should be sloped to provide satisfactory drainage towards catch basins. All water trapped in the granular sub-base materials should be drained rapidly towards subdrains or other interceptors.

5.8 PRELIMINARY FOUNDATION RECOMMENDATIONS

Details of the proposed development such as underside of footing elevations were not available at the time when this report was prepared. When this information is available, the recommendations provided below should be reviewed by WSP to confirm that the recommendations are still valid based on the design information.

Currently, it is our understanding that single family residential dwellings are proposed to be constructed as well as a Pumping Station situated in Block 54.

Based on the borehole information, the proposed structures can be supported by conventional spread and strip footings founded on either undisturbed native soils or engineered fill.

5.8.1 FOOTINGS ON NATIVE SOILS

Boreholes BH15-01 to BH15-05 and BH15-08 to BH15-10 and BH15-12 advanced in the proposed residential development area revealed native sand and sand and gravel below the surface cover and deposits of Disturbed Soil and/or Marl. While boreholes BH15-06 and BH15-07 were advanced in the area that was previously being considered for a clubhouse relocation which revealed subsurface conditions comprised of similar materials.

Although the Pumping Station was not included at the time of the geotechnical field work, Borehole BH15-05 was situated relatively close to the proposed Pumping Station. Borehole BH15-05, revealed loose to very loose sand extended to an approximate depth of 3.5 mbgs. It is currently understood that the inlet for the station will be at an elevation of approximately 183.25 m which will require a cut in the order of 4.0 mbgs.

Based upon field testing and observations, it is our considered opinion that proposed structures may be supported by conventional spread and strip footings founded on the compact undisturbed sand and sand and gravel. Furthermore, Standard Penetration Testing has established that a Design Bearing Resistance of at least 75 kPa at the Serviceability Limit States (SLS), and for a factored geotechnical resistance of 125 kPa at the Ultimate Limit States (ULS).

The bearing values and the corresponding founding elevations at the borehole locations are summarized on Table 1.

BH NO.	MATERIAL	BEARING CAPACITY AT SLS (KPA)	FACTORED GEOTECHNICAL RESISTANCE AT ULS (KPA)	MINIMUM DEPTH BELOW EXISTING GROUND (M)	NOTE (IF ANY)
BH15-01	Sand	100	150	0.9	Reworked soil in area
BH15-02	Sand	150	225	0.9	Marl in area
BH15-03	Sand	150	225	1.6	Fill in area
BH15-04	Sand	150	225	2.1	Marl in area
BH15-05	Sand	150	225	3.5	Very loose soil in area
BH15-06	Sand	150	225	0.9	Marl in area
BH15-07	Sand	100	150	1.8	Marl in area

BH NO.	MATERIAL	BEARING CAPACITY AT SLS (KPA)	FACTORED GEOTECHNICAL RESISTANCE AT ULS (KPA)	MINIMUM DEPTH BELOW EXISTING GROUND (M)	NOTE (IF ANY)
BH15-08	Sand	100	150	1.8	Marl in area
BH15-09	Sand	150	225	2.4	Marl in area
BH15-10	Sand	150	225	0.6	Marl in area
BH15-11	Sand	75	125	0.7	Marl in area
BH15-12	Sand	150	225	1.1	Marl in area

Variations in the soil conditions are expected in between the borehole locations, and during construction, the soil bearing pressures should be confirmed by the Geotechnical Engineer.

Foundations designed to the specified bearing capacities at the serviceability limit states (SLS) are expected to settle less than 25 mm total and 20 mm differential.

5.8.2 FOUNDATIONS ON ENGINEERED FILL

For the construction of single-family dwellings, where the grades need to be raised, proposed structures may be supported by spread and strip footings founded on engineered fill. The engineered fill can provide a geotechnical reaction of 75 kPa at SLS, and a factored geotechnical resistance of 125 kPa at ULS, provided the requirements for the Construction of Engineered Fill as provided in ***Appendix B*** are adhered to.

Prior to the placement of the engineered fill, all unsuitable soils and surficially softened/loosened native soils must be removed and the exposed subgrade proof-rolled. Any soft spots revealed during proof-rolling must be sub-excavated and re-engineered. To reduce the risk of improperly placed engineered compacted fill, full-time supervision of the contractor is essential.

Where engineered fill is used to support the foundations, the floor slab can also be supported by engineered fill.

5.8.3 GENERAL FOUNDATION COMMENTS

All footings exposed to seasonal freezing conditions should be provided with at least 1.5 m of earth cover or equivalent thermal insulation against frost. It is recommended to keep footings as high as possible to avoid or minimize penetration below groundwater levels while considering the minimum frost cover requirement.

Where it is necessary to place footings at different levels, the upper footing must be founded below an imaginary 10 horizontal to 7 vertical line drawn up from the base of the lower footing. The lower footing must be installed first to help minimize the risk of undermining the upper foundations.

Silty soils at the base of footings can be easily disturbed by construction machinery and foot traffic or lose their strength in contact with surface water. We recommend that an allowance be made for placing a 50-mm thick skim coat of low-strength concrete on the founding subgrade immediately after its approval, to prevent its disturbance by construction activities and from ground or surface water, where necessary.

During winter construction, foundations and slab on grades must not be poured on frozen soil. Foundations must be adequately protected always from cold weather and freezing conditions.

In the vicinity of the existing buried utilities, all footings must be lowered to undisturbed native soils, or alternatively the services must be structurally bridged.

Based upon preliminary findings, dewatering will be required for any excavation in the sand to silty sand, or gravelly sand below the water table level. Otherwise, it will result in an unstable excavation base and flowing sides. The groundwater table must be lowered one (1) meter below the lowest excavation level. Test pits should be carried out in the area prior to the excavation to further explore the groundwater and seepage conditions. A specialized dewatering contractor should install the dewatering system.

Standard geotechnical site investigations will not determine dewatering requirements for situations where there is planned excavation or construction below the groundwater table. To quantify conditions for dewatering purposes and to apply for required permits, both for construction and long-term drainage, hydrogeological study and carefully controlled pumping tests are necessary to adequately engineer a construction dewatering system and/or permanent groundwater control. WSP advises that the geotechnical conditions at this site require such hydrogeological study and analysis. The company is qualified and prepared to undertake this analysis upon proper authorization. Otherwise WSP accepts no responsibility for the design and construction of the dewatering details.

Depending on site grading requirements and excavation depths an Environmental Activity and Sector Registry (EASR) or a Permit to Take Water (PTTW) may be required for the excavations. A hydrogeological investigation would assess potential dewatering rates and determine the need for an EASR or PTTW from the MOECC, and is recommended for this site.

It is essential that imported free-draining OPSS Granular 'B' type fill be used as backfill against foundation walls and used as 'under-floor' (structural fill). Backfilling of the footing wall excavations (and under-floor) is recommended to be placed in 200 mm thick lifts, compacted to 100% SPMDD to proposed sub-grade elevations (***Figure 2***).

It should be noted that the recommended geotechnical resistances have been calculated by WSP from the borehole information for the preliminary design stage only. Additional input may be required as new design information becomes available and is refined. For example, more specific information is available with respect to conditions between boreholes when construction is underway. In this regard, the interpretation between boreholes and the recommendations of this report must therefore be checked through field inspections provided by WSP to validate the information for use during the construction stage.

5.9 EARTHQUAKE CONSIDERATIONS

The parameters for determination of Site Classification for Seismic Site Response are set out in Table 4.1.8.4A of the Ontario Building Code (2012). The classification is based on the determination of the average shear wave velocity in the top 30 meters of the site stratigraphy, where shear wave velocity measurements have been taken or alternatively estimated based on rational analysis of un-drained shear strength or penetration resistance.

It is our opinion that the Average Standard Penetration Resistance (N_{60}) can be taken as between 15 and 50. Therefore, for seismic design purposes, the site designation for seismic analysis is Class D (OBC 4.1.8.4 Table 4.1.8.4.A.).

5.10 FLOOR SLAB CONSTRUCTION AND DRAINAGE

If basements are being considered in the proposed design of the residential buildings and/or clubhouse, these floor slabs as well as the lowest slab of the Pumping Station can be supported on the stripped prepared grade. The floor slabs can be supported on grade provided the base is thoroughly proof rolled and any soft and unstable areas detected are sub-excavated and replaced with compacted fill materials. Fill required to raise the grade can consist of inorganic soil, placed in shallow lifts and compacted to at least 98 percent of Standard Proctor Maximum Dry Density (SPMDD).

For bedding and moisture barrier purposes, a 200-mm thick layer of 19 mm clear crushed stone must be provided under the concrete basement floor slab. Where wet and/or fine-grained soil conditions exist, the moisture barrier should be separated from the subgrade by a geotextile fabric to avoid loss of soil/fines and settlement problems.

Where the floor slab is below the water table, the foundation walls must be water proofed and both perimeter and underfloor drainage must be installed. A typical drainage and excavation scheme are shown on ***Figure 2***. As sandy soils with varying silt content are exposed below the groundwater table, filter cloth such as Terrafix 270R or equivalent must cover the subgrade, all drains, clear stone and other openings.

It is recommended to keep footings as high as possible to avoid or minimize penetration below groundwater levels, as de-watering will be required below the groundwater table.

5.11 INFILTRATION CHARACTERISTICS

Graphical depictions of the laboratory grain size analysis performed on samples recovered from the boreholes are attached as ***Enclosure 13***. Based on the gradation results, the materials encountered are tabulated below.

MATERIAL	BOREHOLE SAMPLE	PERMEABILITY (CM/SEC)	PERCOLATION TIME PERMEABILTY (MIN/CM)	COMMENT
Sand and Gravel	BH15-02, Sample 5	10^{-1} to 10^{-3}	2 to 10*	Below groundwater level
Marl	BH15-04, Sample 3	--	--	Unsuitable
Sand	BH15-07, Sample 6	10^{-1} to 10^{-3}	2 to 8*	Below groundwater level
Sand	BH15-09, Sample 5	10^{-1} to 10^{-3}	2 to 8	In an unsaturated state

*Applicable to unsaturated soil

We note that the Percolation Time ("T" time) or Permeability of the subsoil sampled was estimated. The material, as defined in the Ministry of the Environment Manual of Policy, Procedures and Guidelines for Onsite Sewage Systems, in the appendices 6.3.1 and 6.3.2, mostly resembles soil with medium permeability. We must state that this value is strictly for an unsaturated soil.

The value is solely based on the grain size distribution analysis shown in appendices 6.3.1 and 6.3.2 in the Ministry of the Environment Manual of Policy, Procedures and Guidelines for Onsite Sewage Systems. Furthermore, the estimate provided is indicative of the sample in a disturbed state only. We must emphasize that factors between boreholes such as, but not limited to, structure, consistency, density, organic content and degree of saturation influence the estimates.

An accurate analysis of soil infiltration characteristic is best determined with on-site permeameter testing at the location and level of the proposed infiltration condition.

5.12 CHEMICAL CHARACTERIZATION OF SOILS

Forty-four (44) selected soil samples and five (5) duplicate samples (DUP 1 to DUP 5) were collected from the geotechnical boreholes advanced on the property in September 2015 to assess the environmental quality of the soils, to assist in determining off-site disposal options. The chemical testing report and results are enclosed in ***Appendix C.***

5.13 DESIGN REVIEW, TESTING AND INSPECTIONS

WSP requests to be afforded the opportunity to complete a final review of the proposed development discussed in this report to verify that geotechnical recommendations are appropriate. If not given this opportunity, we cannot assume liability for omissions, misinterpretations or deficiencies in our recommendations.

WSP should be contacted to provide geotechnical testing and inspections during construction operations. Exposed subgrade soils for all structures are to be inspected to confirm the material is stable and competent. Inspections of seepage and groundwater conditions during construction are also required, as discussed in this report. Testing and inspections for general QA/QC are to include sampling and laboratory testing of fill materials and asphalt, compaction testing for the placement of fill materials and asphalt, and field and laboratory testing of concrete (including mix design reviews)

ENCLOSURES

ENCLOSURES 1 – 12: BOREHOLE LOGS

ENCLOSURES 13: LABORATORY RESULTS

LOG OF BOREHOLE BH15-01

PROJECT: Geotechnical Investigation
CLIENT: Marlwood Golf & Country Club
PROJECT LOCATION: 31 Marlwood Avenue, Wasaga Beach, ON
DATUM: Geodetic
BH LOCATION:

DRILLING DATA
Method: Hollow Stem Auger
Diameter: 200mm
Date: Sep/09/2015

REF. NO.: 10002397
ENCL NO.: 2

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS / 0.3 m	GROUND WATER CONDITIONS	ELEVATION	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	**TOPSOIL:** 230mm							OC Pesticides
0.2	**SILTY SAND(reworked):** some sand layers, trace organics, trace rootlets, brown, moist, loose		1	SS	9			
0.8	**SAND:** trace silt, light brown, damp, compact		2	SS	13			OC Pesticides, Metals & Inorganics
			3	SS	16			
2.0	stratified colours							
2.3	some gravel to gravelly, large gravel/cobble pieces at 2.4 and 2.7m, very dense		4	SS	100			
3.1	**SAND AND GRAVEL:** trace silt, brown, wet, very dense		5	SS	74		W. L. 3.1 mBGL Oct 14, 2015	PHCs & VOCs
4.7	**SAND:** some silt to silty, grey, wet, very dense		6	SS	78			
5.2	**END OF BOREHOLE**							

Notes:
-Installed monitoring well upon completion
-Water level was 3.06 mbg upon completion

DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)

SHEAR STRENGTH (kPa) (20 40 60 80 100)
○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%) (10 20 30)

POCKET PEN. (C_U) (kPa)
NATURAL UNIT WT (kN/m³)

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES
+ 3, × 3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

SPL SOIL LOG 10002397 BH LOGS.GPJ SPL.GDT 11/20/15

LOG OF BOREHOLE BH15-02

PROJECT: Geotechnical Investigation
CLIENT: Marlwood Golf & Country Club
PROJECT LOCATION: 31 Marlwood Avenue, Wasaga Beach, ON
DATUM: Geodetic
BH LOCATION:

DRILLING DATA
Method: Hollow Stem Auger
Diameter: 200mm
Date: Sep/08/2015

REF. NO.: 10002397
ENCL NO.: 3

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS / 0.3 m	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	**TOPSOIL:** 180mm					OC Pesticides
0.2	**MARL (Clayey Silt):** some sand to sandy, beige, moist, very stiff		1	SS	16	
0.8	**SAND:** trace silt, light brown, damp, compact		2	SS	23	OC Pesticides, Metals & Inorganics
1.5	some gravel		3	SS	22	
2.3	**SAND AND GRAVEL:** trace silt, trace clay, trace cobble pieces, brown, wet, very dense		4	SS	72	
			5	SS	73	45 48 5 2
4.6	trace to some silt		6	SS	53	
5.2	**END OF BOREHOLE**					

Notes:
-Borehole caved to 2.2mbg upon completion.

GROUND WATER CONDITIONS
ELEVATION

DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)
SHEAR STRENGTH (kPa) (20 40 60 80 100)
○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%) (10 20 30)

POCKET PEN. (C_U) (kPa)
NATURAL UNIT WT (kN/m³)

GRAPH NOTES: $+^3$, $\times^3$: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

SPL SOIL LOG 10002397 BH LOGS.GPJ SPL.GDT 11/20/15

LOG OF BOREHOLE BH15-03

PROJECT: Geotechnical Investigation
CLIENT: Marlwood Golf & Country Club
PROJECT LOCATION: 31 Marlwood Avenue, Wasaga Beach, ON
DATUM: Geodetic
BH LOCATION:

DRILLING DATA
Method: Hollow Stem Auger
Diameter: 200mm
Date: Sep/08/2015

REF. NO.: 10002397
ENCL NO.: 4

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS / 0.3 m	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) (10 20 30)	POCKET PEN. (C_u) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	**TOPSOIL:** 130mm											
0.1	**SAND (reworked):** trace silt, trace rootlets, light brown, damp, loose		1	SS	8							OC Pesticides
1			2	SS	7				○			OC Pesticides, Metals & Inorganics
1.5	**SAND:** trace silt, light brown, damp, stratified colours, compact		3	SS	20				○			
2			4	SS	28				○			
3.1	some gravel to gravelly, wet		5	SS	26				○			
4												
4.6	trace to some silt, trace gravel, wet, compact to dense		6	SS	32				○			
5												
6			7	SS	12				○			
7												
8			8	SS	37				○			PHCs & VOCs
8.2	**END OF BOREHOLE** Notes: -Borehole caved to 3.1mbg upon completion.											

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: + 3, × 3: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

SPL SOIL LOG 10002397 BH LOGS.GPJ SPL.GDT 11/20/15

LOG OF BOREHOLE BH15-04

PROJECT: Geotechnical Investigation
CLIENT: Marlwood Golf & Country Club
PROJECT LOCATION: 31 Marlwood Avenue, Wasaga Beach, ON
DATUM: Geodetic
BH LOCATION:

DRILLING DATA
Method: Hollow Stem Auger
Diameter: 200mm
Date: Sep/08/2015

REF. NO.: 10002397
ENCL NO.: 5

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS / 0.3 m	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) (10 20 30)	POCKET PEN. (C_u) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	**TOPSOIL:** 130mm											
0.1	**SAND(reworked):** trace silt, trace rootlets, orangish brown, damp, loose		1	SS	6							OC Pesticides
0.4	**MARL (Clayey Silt):** some sand to sandy, beige, moist, layers of topsoil/organics, firm		2	SS	6							OC Pesticides, Metals & Inorganics
1			3	SS	5					40.6		0 20 52 28
2.0	**SAND:** trace silt, brown, moist, loose compact to dense		4	SS	30				○			
2.6	**SAND AND GRAVEL:** trace silt, brown, some black, wet, compact to dense		5	SS	20				○			
3												
4												
5			6	SS	25				○			
5.2	**END OF BOREHOLE** Notes: -Borehole caved to 2.5mbg upon completion.											

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: $+^3$, $\times^3$: Numbers refer to Sensitivity; ○ $^{\varepsilon}$=3% Strain at Failure

SPL SOIL LOG 10002397 BH LOGS.GPJ SPL.GDT 11/20/15

LOG OF BOREHOLE BH15-05

PROJECT: Geotechnical Investigation
CLIENT: Marlwood Golf & Country Club
PROJECT LOCATION: 31 Marlwood Avenue, Wasaga Beach, ON
DATUM: Geodetic
BH LOCATION:

DRILLING DATA
Method: Hollow Stem Auger
Diameter: 200mm
Date: Sep/08/2015

REF. NO.: 10002397
ENCL NO.: 6

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS / 0.3 m	GROUND WATER CONDITIONS	ELEVATION	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	**TOPSOIL:** 100mm							
0.1	**SILTY SAND(reworked):** some sand layers, trace organics, trace rootlets, brown, moist, compact		1	SS	14			OC Pesticides
0.8	**SAND:** trace silt, brown, moist, very loose		2	SS	2			Metals & Inorganics
1.3	some clayey silt layers, wet, very loose to loose		3	SS	2		W. L. 1.5 mBGL Oct 14, 2015	OC Pesticides
			4	SS	4			
3.1	30mm clayey silt seam at 3.1 mbg, loose		5	SS	9			
3.5	**SAND AND GRAVEL:** trace silt, brown, wet, loose							
4.9	**SAND:** some silt to silty, grey, wet, dilitant, compact		6	SS	22			
5.2	**END OF BOREHOLE**							

Notes:
-Installed monitoring well upon completion
-Water level was 1.44 mbg upon completion

DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)
SHEAR STRENGTH (kPa) (20 40 60 80 100)
○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE
PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%) (10 20 30)
POCKET PEN. (C_U) (kPa)
NATURAL UNIT WT (kN/m³)

GROUNDWATER ELEVATIONS
Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES: $+^3$, $\times^3$: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

SPL SOIL LOG 10002397 BH LOGS.GPJ SPL.GDT 11/20/15

LOG OF BOREHOLE BH15-06

PROJECT: Geotechnical Investigation
CLIENT: Marlwood Golf & Country Club
PROJECT LOCATION: 31 Marlwood Avenue, Wasaga Beach, ON
DATUM: Geodetic
BH LOCATION:

DRILLING DATA
Method: Hollow Stem Auger
Diameter: 200mm
Date: Sep/04/2015

REF. NO.: 10002397
ENCL NO.: 7

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS / 0.3 m	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) (10 20 30)	POCKET PEN. (C_u) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	**TOPSOIL:** 150mm											
0.2	**MARL (Clayey Silt):** some sand to sandy, beige, moist, layers of topsoil/organics, stiff		1	SS	12							OC Pesticides
0.8	**SAND:** trace silt, brown, moist, gravel piece at 1.3 mbg, compact		2	SS	19				○			Metals & Inorganics
1.5	very dense		3	SS	52				○			OC Pesticides
2.3	trace gravel, wet, compact		4	SS	13				○			PHCs & VOCs
3.1	clayey pockets at 3.1 mbg, loose		5	SS	5				○			
3.5	orangish brown											
4.6	some gravel to gravelly, compact		6	SS	18				○			
5.2	**END OF BOREHOLE** Notes: -Borehole caved to 2.0mbg upon completion.											

SPL SOIL LOG 10002397 BH LOGS.GPJ SPL.GDT 11/20/15

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: $+^3$, $\times^3$: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

LOG OF BOREHOLE BH15-07

PROJECT: Geotechnical Investigation
CLIENT: Marlwood Golf & Country Club
PROJECT LOCATION: 31 Marlwood Avenue, Wasaga Beach, ON
DATUM: Geodetic
BH LOCATION:

DRILLING DATA
Method: Hollow Stem Auger
Diameter: 200mm
Date: Sep/04/2015

REF. NO.: 10002397
ENCL NO.: 8

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS 0.3 m	GROUND WATER CONDITIONS	ELEVATION	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	**TOPSOIL:** 150mm							OC Pesticides
0.2	**SILTY SAND(reworked):** some sand layers, trace organics, trace rootlets, brown, moist, compact		1	SS	22			
0.6	**MARL (Clayey Silt):** some sand to sandy, beige, moist, trace topsoil/organics, stiff		2	SS	14			OC Pesticides, Metals & Inorganics
1.7	**SAND:** trace silt, brown, damp to moist, compact		3	SS	12			
2.3	trace gravel, dense		4	SS	31			
3.1	some gravel, wet, compact		5	SS	22	W. L. 3.2 mBGL Oct 14, 2015		PHCs & VOCs
4.6	occassional gravel, very loose to loose		6	SS	4			0 96 2 2
6.1	compact		7	SS	12			
			8	SS	25			
8.2	**END OF BOREHOLE**							

Notes:
-Installed monitoring well upon completion
-Water level was 3.19 mbg upon completion

DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)
SHEAR STRENGTH (kPa) (20 40 60 80 100)
○ UNCONFINED + FIELD VANE & Sensitivity
● QUICK TRIAXIAL × LAB VANE
PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%) (10 20 30)
POCKET PEN. (C_U) (kPa)
NATURAL UNIT WT (kN/m³)

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES
+3, ×3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

SPL SOIL LOG 10002397 BH LOGS.GPJ SPL.GDT 11/20/15

LOG OF BOREHOLE BH15-08

PROJECT: Geotechnical Investigation
CLIENT: Marlwood Golf & Country Club
PROJECT LOCATION: 31 Marlwood Avenue, Wasaga Beach, ON
DATUM: Geodetic
BH LOCATION:

DRILLING DATA
Method: Hollow Stem Auger
Diameter: 200mm
Date: Sep/03/2015

REF. NO.: 10002397
ENCL NO.: 9

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS / 0.3 m	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) (10 20 30)	POCKET PEN. (C_U) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	**TOPSOIL:** 150mm											
0.2	**SAND:** trace organics, dry to damp, very loose to loose		1	SS	4							OC Pesticides
0.8	**MARL (Clayey Silt):** some sand to sandy, beige, moist, layers of topsoil/organics, firm to stiff		2	SS	8				○			Metals & Inorganics
1.7	**SAND:** trace silt, brown, damp to moist, stratified colours, compact		3	SS	11				○			OC Pesticides
			4	SS	22				○			
3.1	loose to compact		5	SS	10				○			
4.6	trace to some silt, wet, dilitant, dense		6	SS	35				○			
5.2	**END OF BOREHOLE** Notes: -Borehole caved to 3.96mbg upon completion.											

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: $+^3$, $\times^3$: Numbers refer to Sensitivity; ○ $^{\varepsilon}$=3% Strain at Failure

SPL SOIL LOG 10002397 BH LOGS.GPJ SPL.GDT 11/20/15

LOG OF BOREHOLE BH15-09

PROJECT: Geotechnical Investigation
CLIENT: Marlwood Golf & Country Club
PROJECT LOCATION: 31 Marlwood Avenue, Wasaga Beach, ON
DATUM: Geodetic
BH LOCATION:

DRILLING DATA
Method: Hollow Stem Auger
Diameter: 200mm
Date: Sep/03/2015

REF. NO.: 10002397
ENCL NO.: 10

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS 0.3 m	GROUND WATER CONDITIONS	ELEVATION	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	**TOPSOIL:** 130mm							OC Pesticides
0.1	**SAND:** trace silt, trace organics, orangish brown, dry to damp, loose		1	SS	5			
0.8	100mm wood/organic layer							Metals & Inorganics
0.9	brown, moist, stratified colours, loose to compact		2	SS	10			
			3	SS	10			OC Pesticides
1.8	**MARL (Clayey Silt):** some sand to sandy, beige, moist, layers of topsoil/organics, stiff							
2.3	**SAND:** trace silt, trace mollusks, brown, moist, compact		4	SS	26			
			5	SS	27			0 95 5 0
								PHCs & VOCs
4.9	wet, compact to dense		6	SS	30		W. L. 4.9 mBGL Oct 14, 2015	
6.1	some silt to silty, brown/grey, 50mm orange layer, dense		7	SS	40			
7.6	trace to some gravel, compact		8	SS	29			
8.2	**END OF BOREHOLE** -Installed monitoring well upon completion -Water level was 4.78 mbg upon completion							

DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)

SHEAR STRENGTH (kPa) (20 40 60 80 100)
○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%) (10 20 30)

POCKET PEN. (C_U) (kPa)
NATURAL UNIT WT (kN/m³)

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES
$+^3$, $\times^3$: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

SPL SOIL LOG 10002397 BH LOGS.GPJ SPL.GDT 11/20/15

LOG OF BOREHOLE BH15-10

PROJECT: Geotechnical Investigation
CLIENT: Marlwood Golf & Country Club
PROJECT LOCATION: 31 Marlwood Avenue, Wasaga Beach, ON
DATUM: Geodetic
BH LOCATION:

DRILLING DATA
Method: Hollow Stem Auger
Diameter: 200mm
Date: Sep/03/2015

REF. NO.: 10002397
ENCL NO.: 11

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: "N" BLOWS / 0.3 m	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (kPa): ○ UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE & Sensitivity, × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) (10 20 30)	POCKET PEN. (C_u) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	**TOPSOIL:** 50mm											
0.1	**MARL (Clayey Silt):** some sand to sandy, beige, moist, layers of topsoil/organics, stiff		1	SS	11							OC Pesticides
0.3	**SAND:** trace silt, brown, moist, compact											
1			2	SS	21				○			OC Pesticides, Metals & Inorganics
2			3	SS	26				○			
2.3	stratified colours		4	SS	15				○			
3												
3.1	some silt to silty, trace clay, greyish brown, wet, dilitant, loose		5	SS	5				○			
4												
4.9	grey, some silt, very dense		6	SS	57				○			
5												
5.2	**END OF BOREHOLE**											

Notes:
-Borehole caved to 2.44mbg upon completion.

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: +3, ×3: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

SPL SOIL LOG 10002397 BH LOGS.GPJ SPL.GDT 11/20/15

LOG OF BOREHOLE BH15-11

PROJECT: Geotechnical Investigation
CLIENT: Marlwood Golf & Country Club
PROJECT LOCATION: 31 Marlwood Avenue, Wasaga Beach, ON
DATUM: Geodetic
BH LOCATION:

DRILLING DATA
Method: Hollow Stem Auger
Diameter: 200mm
Date: Sep/04/2015

REF. NO.: 10002397
ENCL NO.: 12

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS / 0.3 m	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (10 20 30)	POCKET PEN. (C_U) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	**TOPSOIL:** 180mm											
0.2	**MARL (Clayey Silt):** some sand to sandy, beige, moist, layers of topsoil/organics, stiff		1	SS	12							
0.5	**SAND:** trace silt, brown, damp, compact											
0.8	100mm silty sand layer, brown, moist		2	SS	18				○			
1												
			3	SS	14				○			
2												
2.3	trace to some silt, wet, loose		4	SS	6				○			
3												
3.1	trace to some gravel		5	SS	6				○			
4												
4.6	very loose		6	SS	2				○			
5												
5.2	**END OF BOREHOLE**											

Notes:
-Borehole caved to 1.7mbg upon completion.

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: $+^3$, $\times^3$: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

SPL SOIL LOG 10002397 BH LOGS.GPJ SPL.GDT 11/20/15

LOG OF BOREHOLE BH15-12

PROJECT: Geotechnical Investigation
CLIENT: Marlwood Golf & Country Club
PROJECT LOCATION: 31 Marlwood Avenue, Wasaga Beach, ON
DATUM: Geodetic
BH LOCATION:

DRILLING DATA
Method: Hollow Stem Auger
Diameter: 200mm
Date: Sep/09/2015

REF. NO.: 10002397
ENCL NO.: 13

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS / 0.3 m	GROUND WATER CONDITIONS	ELEVATION	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	**TOPSOIL:** 200mm							OC Pesticides
0.2	**MARL (Clayey Silt):** some sand to sandy, beige, moist, layers of topsoil/organics, stiff		1	SS	10			
1.0	**SAND:** trace silt, brown, damp, dense		2	SS	32			Metals & Inorganics
1.5	some gravel		3	SS	33			OC Pesticides
2.3	**SAND AND GRAVEL:** trace silt, brown, wet, compact		4	SS	27		W. L. 2.2 mBGL Oct 14, 2015	
3.1	very dense		5	SS	88/ 280mm			PHCs & VOCs
4.6	**SAND:** trace silt, trace gravel, brown, wet, compact		6	SS	29			
5.2	**END OF BOREHOLE** Notes: -Borehole caved to 1.7mbg upon completion.							

DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)

SHEAR STRENGTH (kPa) (20 40 60 80 100)
○ UNCONFINED + FIELD VANE & Sensitivity
● QUICK TRIAXIAL × LAB VANE

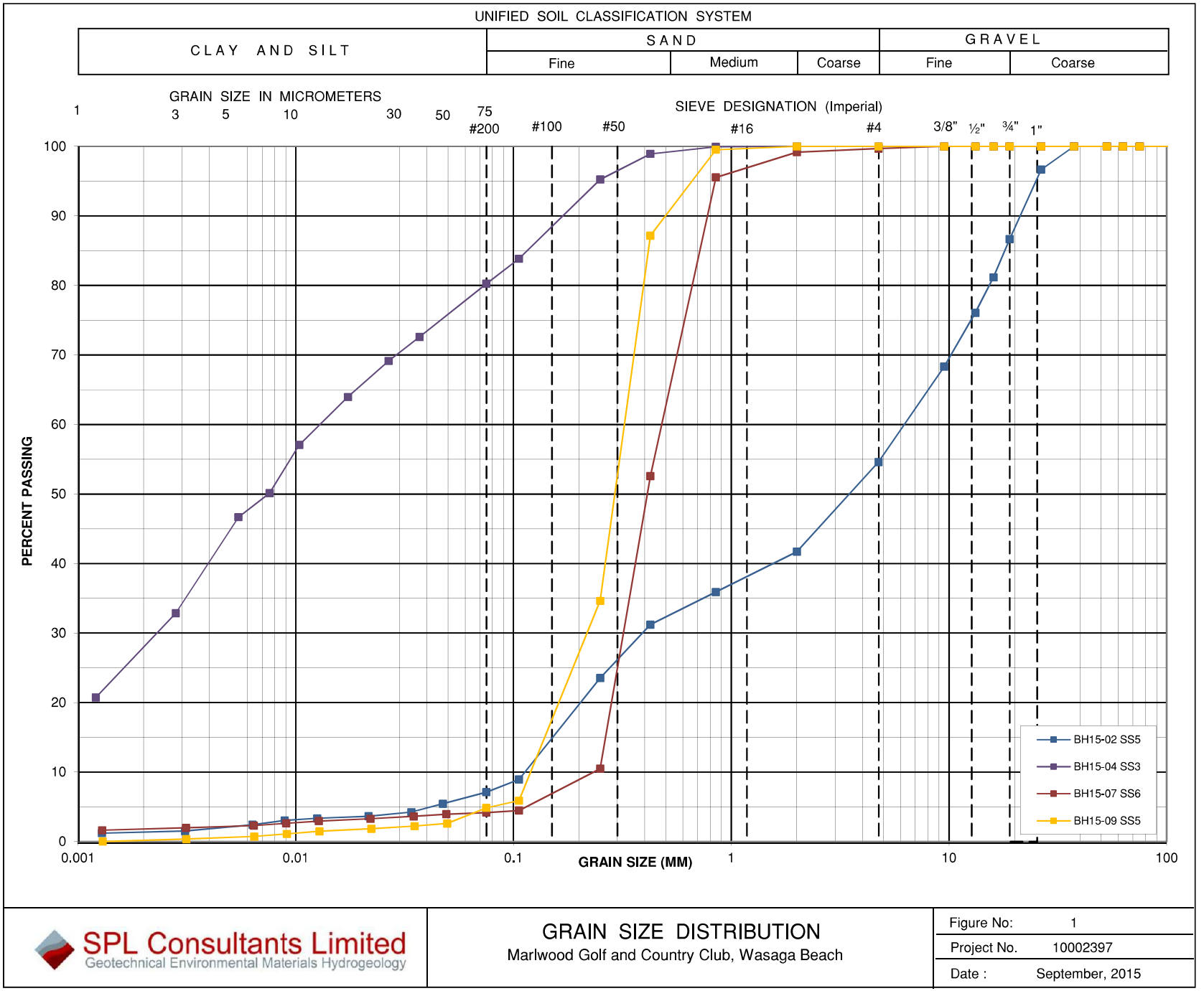
PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%) (10 20 30)

POCKET PEN. (C_U) (kPa)
NATURAL UNIT WT (kN/m³)

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES
$+^3$, $\times^3$: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

SPL SOIL LOG 10002397 BH LOGS.GPJ SPL.GDT 11/20/15



SPL Consultants Limited
Geotechnical Environmental Materials Hydrogeology

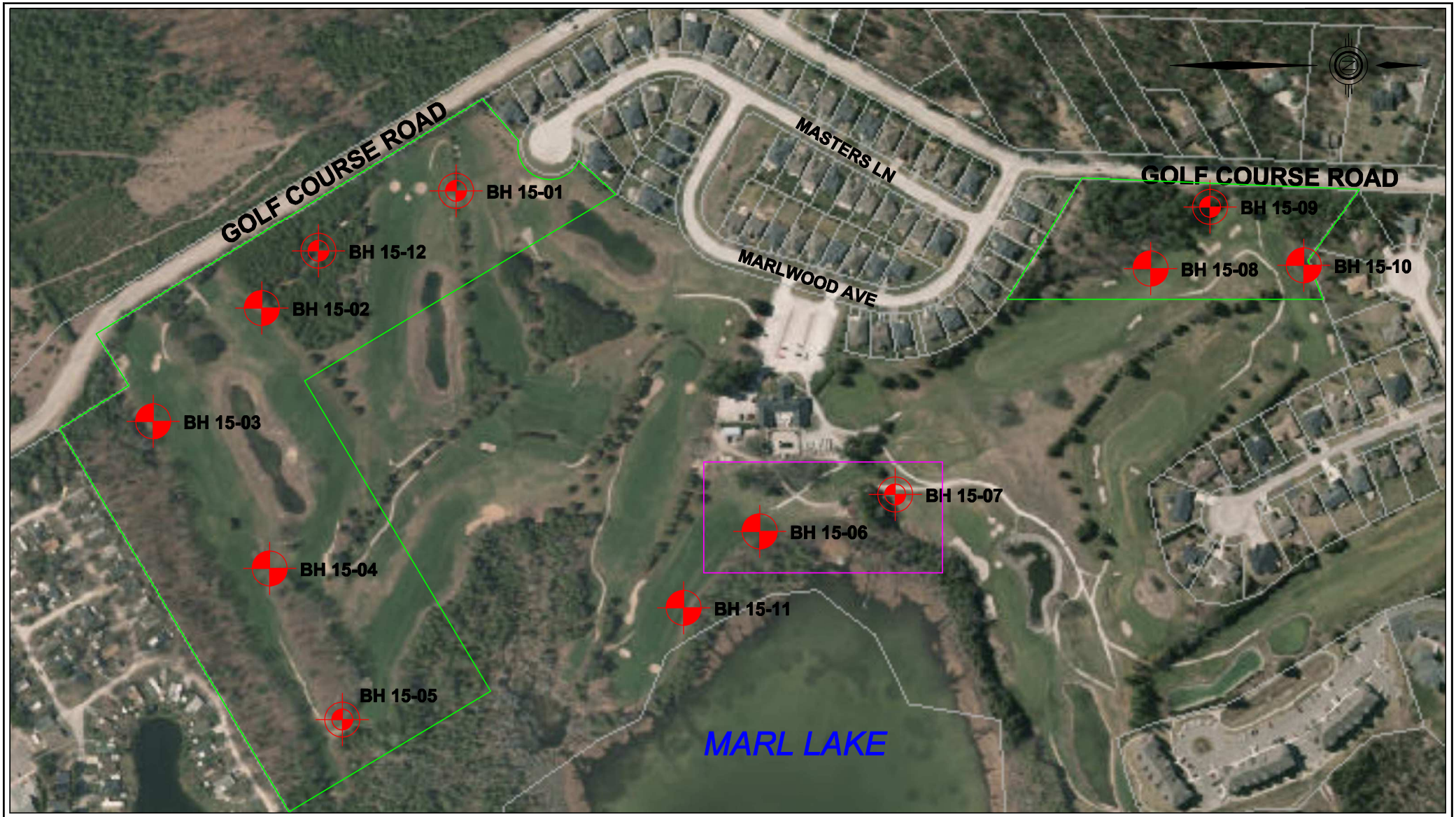
GRAIN SIZE DISTRIBUTION

Marlwood Golf and Country Club, Wasaga Beach

Figure No:	1
Project No.	10002397
Date :	September, 2015

FIGURES

FIGURE 1: BOREHOLE LOCATION PLAN
FIGURE 2: BACKFILL AND BASEMENT DRAINAGE PLAN



LEGEND

BH 15-XX Borehole Location

BH 15-XX Borehole Location with Groundwater Monitoring Well Installed

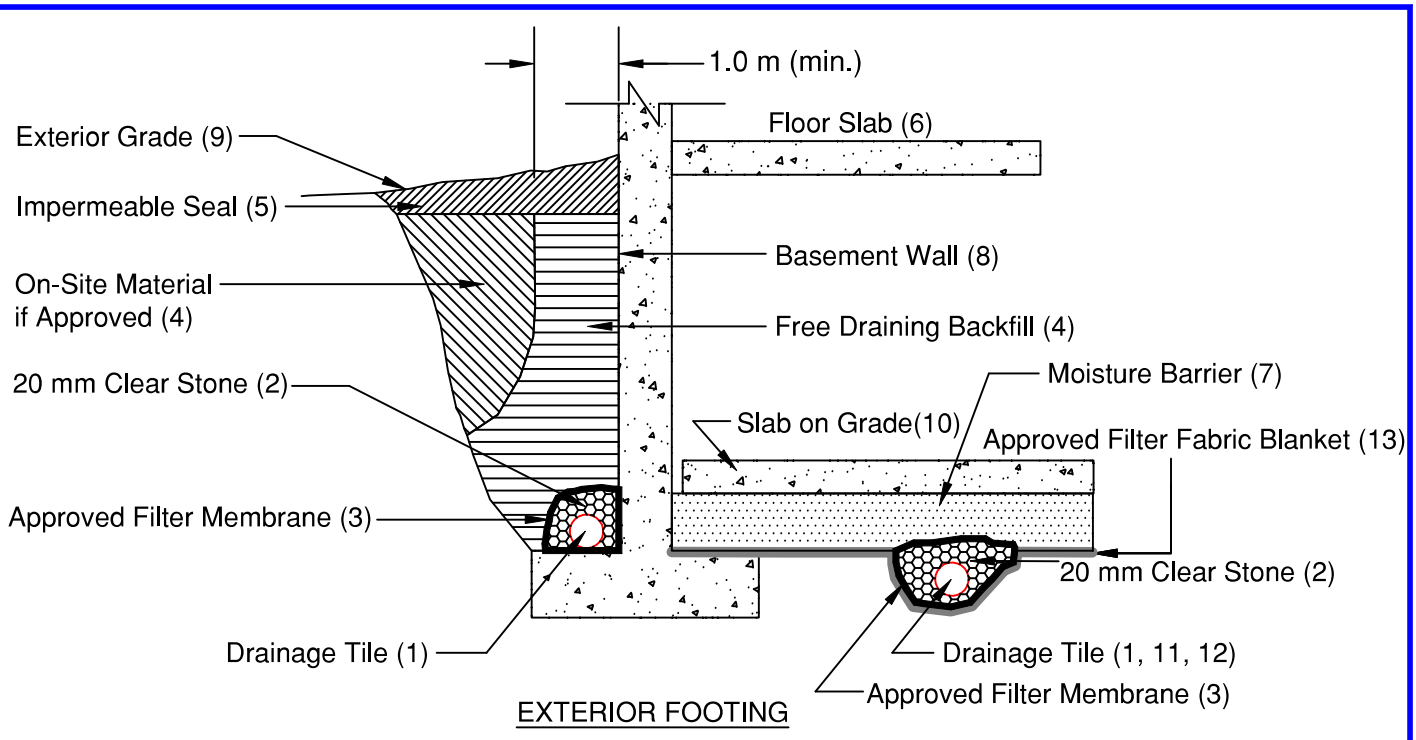
APRROXIMATE SCALE

0m 10m 25m 50m 100m

Approximate Area of Investigation for Proposed Residential Development

Approximate Area of Investigation for Proposed Relocation of Clubhouse

Client:	MARLWOOD GOLF AND COUNTRY CLUB			Project No.: 10002397	Figure No.: 1
Drawn:	MV	Approved:	GJ	Title:	BOREHOLE LOCATION PLAN
Date:	NOVEMBER, 2015	Scale:	AS SHOWN	Project:	PRELIMINARY GEOTECHNICAL INVESTIGATION 31 MARLWOOD AVE, WASAGA BEACH, ONTARIO
Original Size:	TABLOID	Rev:	1		SPL Consultants Limited | ENGINEERING SOLUTIONS



Notes

1. Drainage tile to consist of 100 mm (4") diameter weeping tile or equivalent perforated pipe leading to a positive sump or outlet.
2. 20 mm (3/4") clear stone - 150 mm (6") top and side of drain. If drain is not on footing, place100 mm (4 inches) of stone below drain .
3. Wrap the clear stone with an approved filter membrane (Terrafix 270R or equivalent).
4. Free Draining backfill - OPSS Granular B or equivalent compacted to the specified density. Do not use heavy compaction equipment within 450 mm (18") of the wall. Use hand controlled light compaction equipment within 1.8 m (6') of wall. The minimum width of the Granular 'B' backfill must be 1.0 m.
5. Impermeable backfill seal - compacted clay, clayey silt or equivalent. If original soil is free-draining, seal may be omitted. Maximum thickness of seal to be 0.5 m.
6. Do not backfill until wall is supported by basement and floor slabs or adequate bracing.
7. Moisture barrier to be at least 200 mm (8") of compacted clear 20 mm (3/4") stone or equivalent free draining material. A vapour barrier may be required for specialty floors.
8. Basement wall to be damp proofed /water proofed.
9. Exterior grade to slope away from building.
10. Slab on grade should not be structurally connected to the wall or footing.
11. Underfloor drain invert to be at least 300 mm (12") below underside of floor slab.
12. Drainage tile placed in parallel rows 6 to 8 m (20 to 25') centers one way. Place drain on 100 mm (4") clear stone with 150 mm (6") of clear stone on top and sides. Enclose stone with filter fabric as noted in (3).
13. The entire subgrade to be sealed with approved filter fabric (Terrafix 270R or equivalent) if non-cohesive (sandy) soils below ground water table encountered.
14. Do not connect the underfloor drains to perimeter drains.
15. Review the geotechnical report for specific details.

DRAINAGE AND BACKFILL RECOMMENDATIONS
Basement with Underfloor Drainage

(not to scale)

APPENDIX

A R.J. BURNSIDE DEVELOPMENT PLANS

STATISTICS

PROPOSED LAND USE	LOT/BLOCK	AREA
SINGLE DETACHED RESIDENTIAL	1-51	3.56ha
PROPOSED ROADS (544 LIN.M.)		1.19ha
OPEN SPACE & RESERVES	53, 55-62	2.00ha
STORMWATER MANAGEMENT	52	0.57ha
PUMPING STATION	54	0.11ha
TOTAL AREA		7.43ha

15m BUFFER

30m BUFFER

BLOCK 53
0.05ha

BLOCK 54
Pumping Station
0.11ha

BLOCK 55
Open Space
1.52ha

BLOCK 52
SWM Pond
0.87ha

BLOCK 56
(OPEN SPACE)

BLOCK 57
(OPEN SPACE)

BLOCK 58
(OPEN SPACE)

BLOCK 59
(OPEN SPACE)

BLOCK 60
(OPEN SPACE)

BLOCK 61
(0.30m RESERVE)

BLOCK 62
(0.30m RESERVE)

BLOCK 63
(GOLF COURSE ROAD RIGHT-OF-WAY)

STREET 'A'

STREET 'B'

MASTER'S LANE
(BY REGISTERED PLAN 51M-743)

GOLF COURSE ROAD

EXISTING RESIDENTIAL

EXISTING GOLF COURSE

PART 2, PLAN 51R - 37955

P.I.N. 58334-0254 (LT)

P.I.N. 58334-0322 (LT)

P.I.N. 58334-0001 (LT)

P.I.N. 58334-0044 (LT)

P.I.N. 58334-0277 (LT)

P.I.N. 58334-0278 (LT)

P.I.N. 58334-0276 (LT)

P.I.N. 58334 - 0001 (LT)

SOUTH HALF LOT 26

NORTH HALF LOT 26

LIMIT BETWEEN NORTH AND SOUTH HALVES OF LOT 26

BUSH

EDGE OF ASPHALT

EDGE OF WATER

TOP OF BANK

SIB (1546)

SIB (W&R)

PB (CON)

IB (CON)

IB (1546)

FENCE 2.70 E

FENCE 3.55 E

FENCE 2.2 E

CHAIN LINK FENCE

SUBJECT TO EASEMENTS PLAN 51R-31922 AS IN SCHEDULE 'A' AND SCHEDULE 'B'

ASPHALT DRIVEWAY

GUTTER

EXIST SAN SEWER

EXIST STRM SEWER

SITE BENCH MARK
TOP OF SPIGOT
OF FIRE HYDRANT
ELEV. 190.15

VALVE

KEY PLAN
SCALE: N.T.S.

RIVER RD W
ZOO PARK RD
GOLF COURSE RD
RYTHER RD
SUBJECT PROPERTY
ADDITIONAL LANDS OWNED BY APPLICANT

ADDITIONAL INFORMATION
As required under Section 51(17) of the Planning Act.
a), b), e), f), g) & j) – on plan
c) – on key plan
d) – see statistics
h) – piped water to be installed by developer
i) – sandy
k) – all municipal services to be made available
l) – nil

APPROVED SUBJECT TO CONDITIONS IN ACCORDANCE WITH SECTION 51(31) OF THE PLANNING ACT, RSO, CAP. P.13, AS AMENDED,

THIS_____ DAY OF _____.

DIRECTOR OF PLANNING, DEVELOPMENT AND TOURISM, COUNTY OF SIMCOE

OWNER'S CERTIFICATE
We authorize LOFT Planning Inc. to prepare and submit this Plan of Subdivision for approval.

A.S.O.
TPC MARLWOOD INC. date

SURVEYOR'S CERTIFICATE
I hereby certify that the boundaries of the lands being subdivided and their relationship to the adjacent lands are accurately and correctly shown.

RUDY MAK SURVEYING LTD. date

LOFT
LAND USE PLANNING | PROJECT MANAGEMENT
T 705.446.1168 | E Kirsten@loftplanning.com

0 50 100 200 300 400
Metres

BURNSIDE

Client
TPC MARLWOOD INC.

Figure Title
MARLWOOD MASTER'S LANE EXTENSION
PRELIMINARY DRAFT PLAN

Drawn	Checked	Date	Figure No.
EDT	JO	19/02/15	2
Scale		Project No.	
1:750		300037815	

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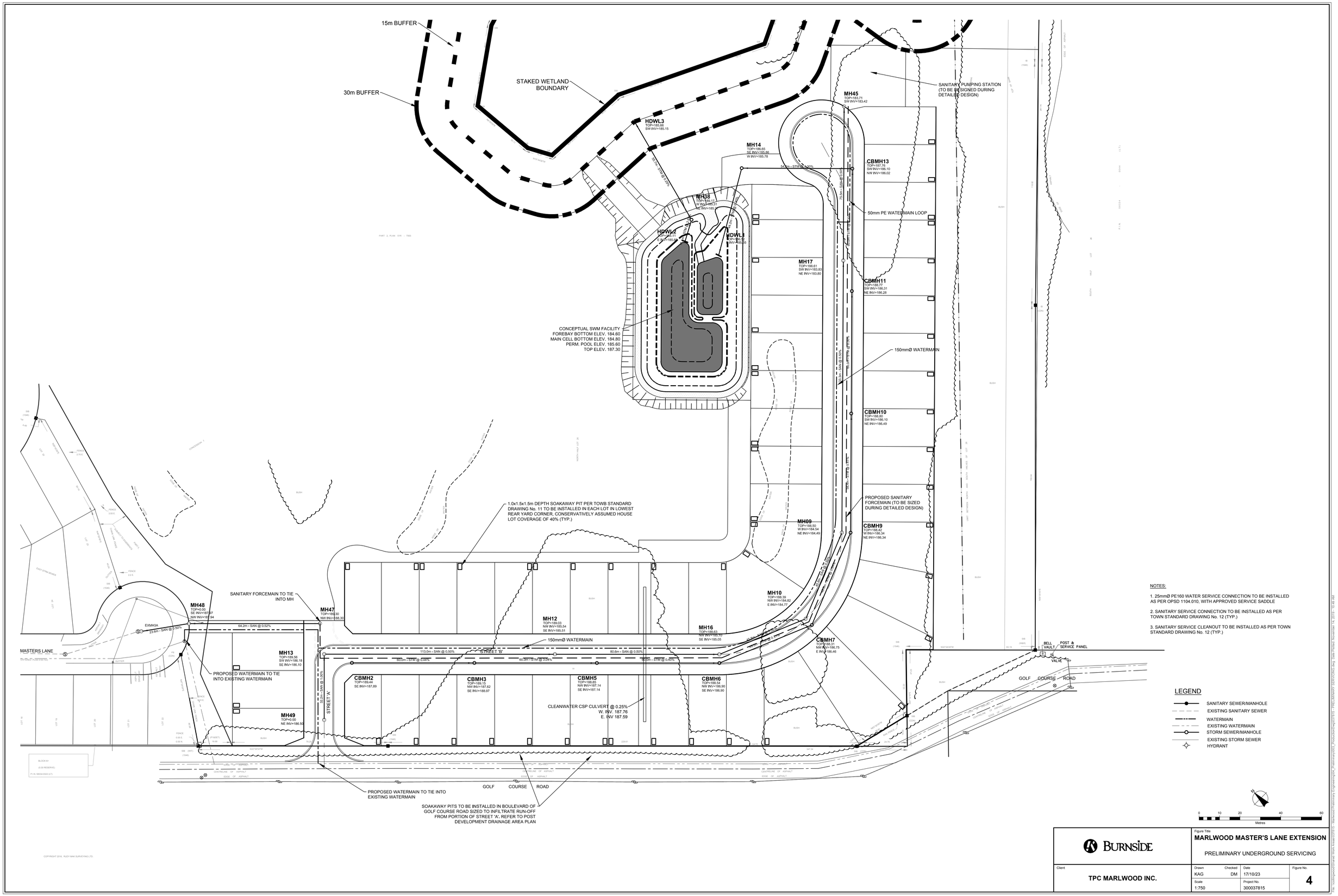
M:\Jobs\300037815 - Marlwood\Planning\Engineering\DP\Figures\300037815 - DP Prelim Draft Plan Marlwood 19.02.2015 - 9:23:21 AM



NOTES:

1. 25mmØ PE160 WATER SERVICE CONNECTION TO BE INSTALLED AS PER OPSD 1104.010, WITH APPROVED SERVICE SADDLE
2. SANITARY SERVICE CONNECTION TO BE INSTALLED AS PER TOWN STANDARD DRAWING No. 12 (TYP.)
3. SANITARY SERVICE CLEANOUT TO BE INSTALLED AS PER TOWN STANDARD DRAWING No. 12 (TYP.)

LEGEND

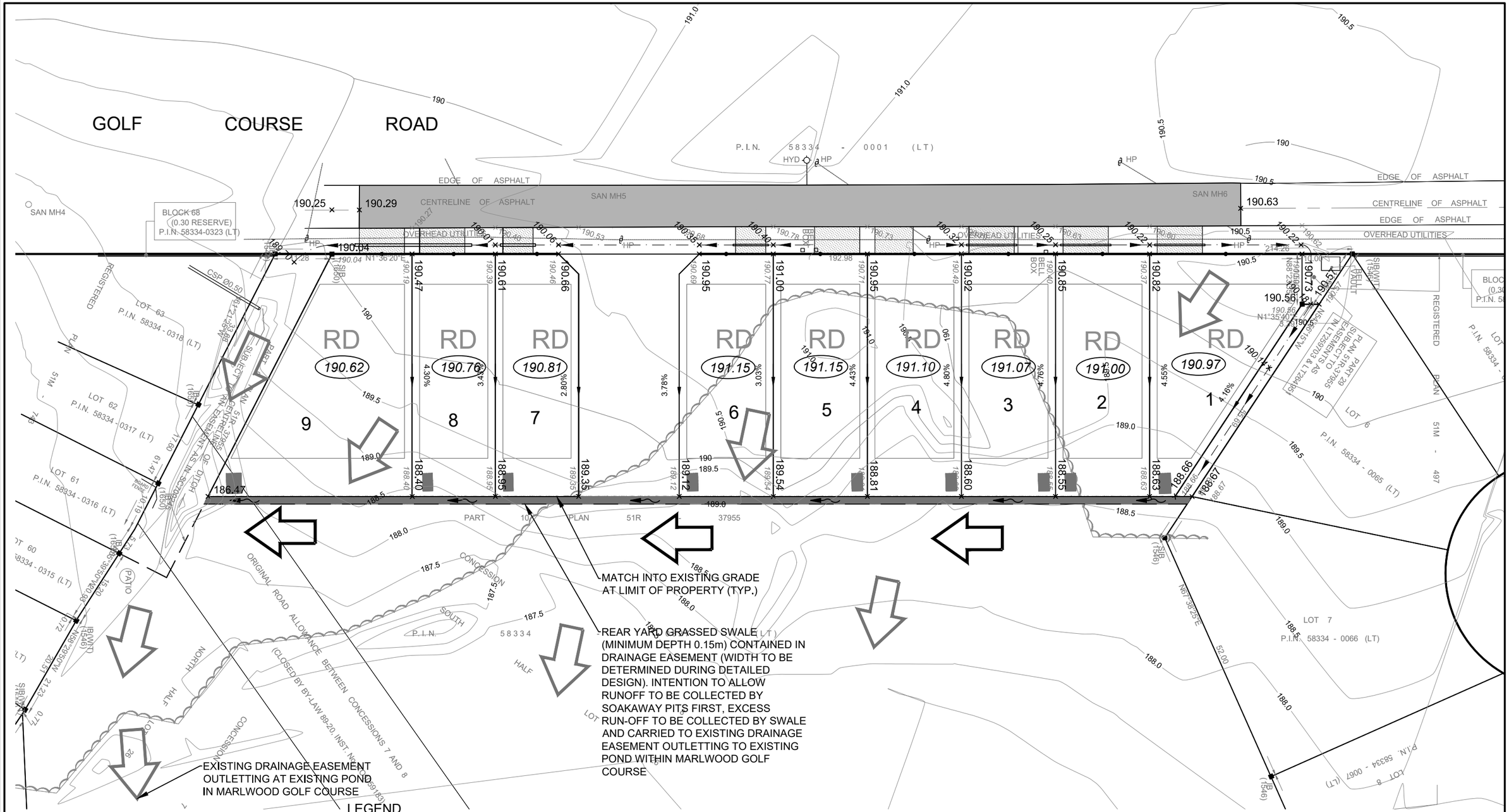
- SANITARY SEWER/MANHOLE
- EXISTING SANITARY SEWER
- WATERMAIN
- EXISTING WATERMAIN
- STORM SEWER/MANHOLE
- EXISTING STORM SEWER
- HYDRANT

BURNSIDE

Figure Title
MARLWOOD MASTER'S LANE EXTENSION
PRELIMINARY UNDERGROUND SERVICING

Client
TPC MARLWOOD INC.

Drawn	Checked	Date	Figure No.
KAG	DM	17/10/23	4
Scale		Project No.	
1:750		300037815	



LEGEND

227.20 / 227.20	PROPOSED GRADE WITH EXISTING GRADE
227.20	APRON GRADE (MINIMUM 300mm ABOVE EDGE OF PAVEMENT)
	PROPOSED SWALE
	MAXIMUM 3:1 SLOPE UNLESS OTHERWISE NOTED
SD	SPLIT DRAINAGE LOT TYPE
	SOAKAWAY PIT
	EXISTING OVERLAND FLOW ROUTE
	PROPOSED OVERLAND FLOW ROUTE

N

0 10 20 40 60
Metres

BURNSIDE

Figure Title: **MARLWOOD (9 LOTS)**

PRELIMINARY GRADING

Client: **TPC MARLWOOD INC.**

Drawn	Checked	Date	Figure No.
KAG	EDT	17/09/25	5

Scale: 1:750

Project No.: 300039210

File: \\OSCAR\Shared Work Areas\039210 - Marlwood Golf Course 10 Lots\04_Preliminary\003_ProductionDwg\039210 - PRELIMINARY GRADING.dwg Date Plotted: November 26, 2019 - 5:55 PM

15m BUFFER

30m BUFFER

STAKED WETLAND BOUNDARY

PROPOSED OVERLAND FLOW ROUTE FROM POND TO BE DIRECTED TO PROPOSED HEADWALL; MAJOR SYSTEM

HDWL3

BLOCK 54
Pumping Station
0.11ha

BLOCK 53
0.05ha

BLOCK 55
Open Space
1.52ha

MH10

CBMH09

188.10

188.25

MH38

INLET HEADWALL
INV. 185.65 m

HDWL1

100YR WL = 186.78
REGIONAL (TIMMINS) WL = 186.64
25mm WL = 186.01

BLOCK 52
SWM Pond
0.57ha

CONCEPTUAL SWM FACILITY
FOREBAY BOTTOM ELEV. 184.60
MAIN CELL BOTTOM ELEV. 184.60
PERM. POOL ELEV. 185.60
TOP ELEV. 187.55

DITCH TO OUTLET TO PROPOSED POND. ACCESS ROAD TO BE DEPRESSED IN AREA OF DITCH INLET TO PROVIDE POSITIVE OUTLET FOR DITCH FLOWS.

STREET 'B'

CBMH08

CBMH07

CBMH06

CBMH05

CBMH04

CBMH03

CBMH02

CBMH01

BLOCK 56
(OPEN SPACE)

BLOCK 57
(OPEN SPACE)

BLOCK 59
(OPEN SPACE)

BLOCK 60
(OPEN SPACE)

BLOCK 61
(0.30m RESERVE)

BLOCK 58
(OPEN SPACE)

BLOCK 62
(0.30m RESERVE)

BLOCK 63
(GOLF COURSE ROAD RIGHT-OF-WAY)

STREET 'A'

MASTERS LANE
(BY REGISTERED PLAN 51M-747)

EXISTING RESIDENTIAL

EXISTING GOLF COURSE

GOLF COURSE ROAD

MATCH INTO EXISTING GRADE AT LIMIT OF PROPERTY (TYP.)

PROPOSED DITCH TO PROVIDE OUTLET FOR EXISTING LOW POINT ON GOLF COURSE ROAD. SWALE TO BE AT A MINIMUM OF 0.25%

LEGEND

- 188.14 / 188.14 — PROPOSED GRADE WITH EXISTING GRADE
- PROPOSED SWALE
- MAXIMUM 3:1 SLOPE UNLESS OTHERWISE NOTED
- SD — SPLIT DRAINAGE LOT TYPE
- WO — WALK OUT DRAINAGE LOT TYPE
- SOAKAWAY PIT
- PROPOSED OVERLAND FLOW ROUTE
- EXISTING OVERLAND FLOW ROUTE

0 10 20 40 60
Metres

BURNSIDE

Figure Title
MARLWOOD MASTER'S LANE EXTENSION
PRELIMINARY GRADING

Client
TPC MARLWOOD INC.

Drawn	Checked	Date
EDT	JO	19/11/26

Scale 1:750
Project No. 300037815
Figure No. **6**

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APPENDIX

B ENGINEERED FILL

GENERAL REQUIREMENTS FOR ENGINEERED FILL

Compacted imported soil that meets specific engineering requirements and is free of organics and debris and that has been continually monitored on a full-time basis by a qualified geotechnical representative is classified as engineered fill. Engineered fill that meets these requirements and is bearing on suitable native subsoil can be used for the support of foundations.

Imported soil used as engineered fill can be removed from other portions of a site or can be brought in from other sites. In general, most of Ontario soils are too wet to achieve the 100% Standard Proctor Maximum Dry Density (SPMDD) and will require drying and careful site management if they are to be considered for engineered fill. Imported non-cohesive granular soil is preferred for all engineered fill. For engineered fill, we recommend use of OPSS Granular 'B' sand and gravel fill material.

Adverse weather conditions such as rain make the placement of engineered fill to the required degree of density difficult or impossible; engineered fill cannot be placed during freezing conditions, i.e. normally not between December 15 and April 1 of each year.

The location of the foundations on the engineered fill pad is critical and certification by a qualified surveyor that the foundations are within the stipulated boundaries is mandatory. Since layout stakes are often damaged or removed during fill placement, offset stakes must be installed and maintained by the surveyors during the course of fill placement so that the contractor and engineering staff are continually aware of where the engineered fill limits lie. Excavations within the engineered fill pad must be backfilled with the same conditions and quality control as the original pad.

To perform satisfactorily, engineered fill requires the cooperation of the designers, engineers, contractors and all parties must be aware of the requirements. The minimum requirements are as follows, however, the geotechnical report must be reviewed for specific information and requirements.

1. Prior to site work involving engineered fill, a site meeting to discuss all aspects must be convened. The surveyor, contractor, design engineer and geotechnical engineer must attend the meeting. At this meeting, the limits of the engineered fill will be defined. The contractor must make known where all fill material will be obtained from and samples must be provided to the geotechnical engineer for review, and approval before filling begins.

2. Detailed drawings indicating the lower boundaries as well as the upper boundaries of the engineered fill must be available at the site meeting and be approved by the geotechnical engineer.

3. The building footprint and base of the pad, including basements, garages, etc. must be defined by offset stakes that remain in place until the footings and service connections are all constructed. Confirmation that the footings are within the pad, service lines are in place, and that the grade conforms to drawings, must be obtained by the owner in writing from the surveyor and WSP Canada Inc. Without this confirmation no responsibility for the performance of the structure can be accepted by WSP Canada Inc. Survey drawing of the pre and post fill location and elevations will also be required.

4. The area must be stripped of all topsoil and fill materials. Subgrade must be proof-rolled. Soft spots must be dug out. The stripped native subgrade must be examined and approved by a WSP Canada Inc. engineer prior to placement of fill.

5. The approved engineered fill material must be compacted to 100% Standard Proctor Maximum Dry Density throughout. Engineered fill should not be placed during the winter months. Engineered fill compacted to 100% SPMDD will settle under its own weight approximately 0.5% of the fill height and the structural engineer must be aware of this settlement. In addition to the settlement of the fill, additional settlement due to consolidation of the underlying soils from the structural and fill loads will occur and should be evaluated prior to placing the fill.

6. Full-time geotechnical inspection by WSP Canada Inc. during placement of engineered fill is required. Work cannot commence or continue without the presence of the WSP Canada Inc. representative.

7. The fill must be placed such that the specified geometry is achieved. Refer to the attached sketches for minimum requirements. Take careful note that the projection of the compacted pad beyond the footing at footing level is a minimum of 2 m. The base of the compacted pad extends 2 m plus the depth of excavation beyond the edge of the footing.

8. A bearing capacity of 150 kPa at SLS (225 kPa at ULS) can be used provided that all conditions outlined above are adhered to. A minimum footing width of 500 mm (20 inches) is suggested and footings must be provided with nominal steel reinforcement.

9. All excavations must be done in accordance with the Occupational Health and Safety Regulations of Ontario.

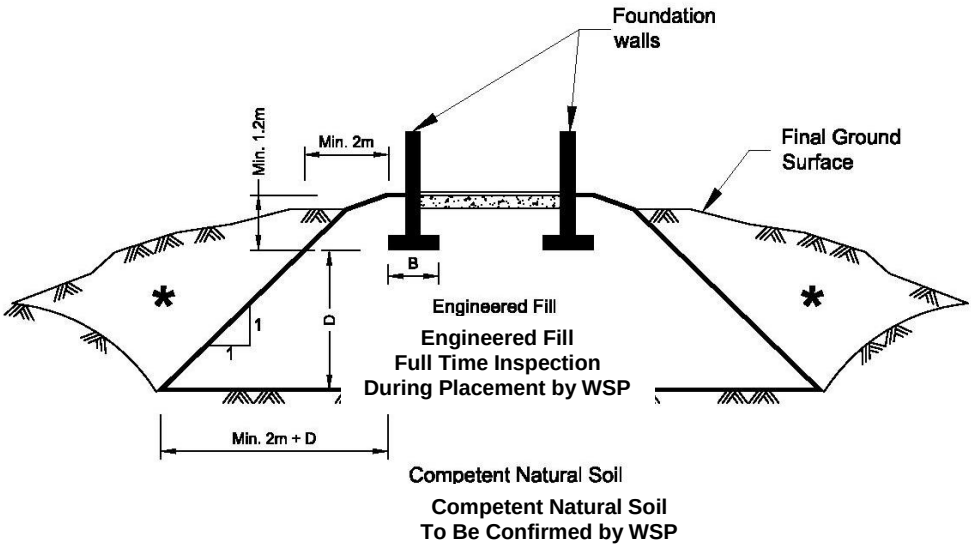
10. After completion of the engineered fill pad a second contractor may be selected to install footings. The prepared footing bases must be evaluated by engineering staff from WSP Canada Inc. prior to footing concrete placements. All excavations must be backfilled under full time supervision by WSP Canada Inc. to the same degree as the engineered fill pad. Surface water cannot be allowed to pond in excavations or to be trapped in clear stone backfill. Clear stone backfill can only be used with the approval of WSP Canada Inc.

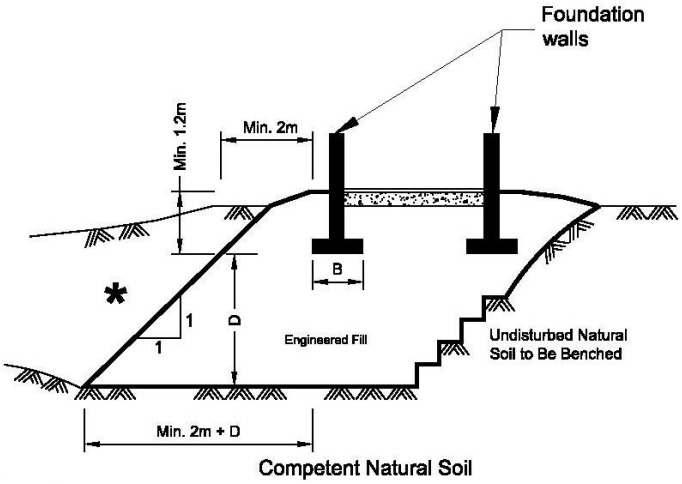
11. After completion of compaction, the surface of the engineered fill pad must be protected from disturbance from traffic, rain and frost. During the course of fill placement, the engineered fill must be smooth-graded, proof-rolled and sloped/crowned at the end of each day, prior to weekends and any stoppage in work in order to promote rapid runoff of rainwater and to avoid any ponding surface water. Any stockpiles of fill intended for use as engineered fill must also be smooth-bladed to promote runoff and/or protected from excessive moisture take up.

12. If there is a delay in construction, the engineered fill pad must be inspected and accepted by the geotechnical engineer. The location of the structure must be reconfirmed that it remains within the pad.

13. The geometry of the engineered fill as illustrated in these General Requirements is general in nature. Each project will have its own unique requirements. For example, if perimeter sidewalks are to be constructed around the building, then the projection of the engineered fill beyond the foundation wall may need to be greater.

14. These guidelines are to be read in conjunction with WSP Canada Inc. report attached.





* **Backfill in this area to be as per WSP report.**

APPENDIX

C SOIL QUALITY TESTING

SPL Consultants Limited | ENGINEERING SOLUTIONS

Project: 10002397-110 **October 7, 2015**

Marlwood Golf and Country Club
31 Marlwood Avenue
Wasaga Beach, Ontario
L9Z 1S8

Attention: Mr. Alex Smardenka

Re: Soil Quality Assessment Letter
Marlwood Golf and Country Club, Wasaga Beach, Ontario

SPL Consultants (SPL) was retained by Marlwood Golf and Country Club to provide a soil quality assessment at the Marlwood Golf and Country Club in Wasaga Beach, Ontario.

In order to assess options for potential offsite disposal of soils during the proposed residential development, a total of forty-four (44) soil samples and five (5) duplicate soil samples (DUP 1 to DUP 5) were collected from the geotechnical boreholes advanced on the property in September 2015. The borehole locations are shown on the attached Figure 1. Soil samples were collected by SPL and submitted for analysis of Organochlorine pesticides (OC Pesticides), metals and inorganics (M&Is), petroleum hydrocarbons (PHCs) and volatile organic compounds (VOCs), as set out in O.Reg. 153/04 as amended, Section XV.1 of the Environmental Protection Act (EPA). The **Certificates of Analysis** are attached. Sampling locations and parameters analyzed are provided in the following table.

TABLE 1: SOIL QUALITY SAMPLING AND ANALYSIS PROGRAM

Sample ID	Sample Date	Parameter(s)	Location	Depth (mbg)
BH15-01 SS1	September 9, 2015	OC Pesticides	South portion of the site	0-0.6 Top soil overlying sandy silt with trace organics
BH15-01 SS2	September 9, 2015	OC Pesticides, M&Is	South portion of the site	0.8-1.4 Sand, trace silt
BH15-01 SS5	September 9, 2015	PHCs, VOCs	South portion of the site	3.1-3.7 Sand and Gravel, trace silt
BH15-02 SS1	September 8, 2015	OC Pesticides (DUP 4)	South portion of the site	0-0.6 Top soil overlying clayey silt, some sand
BH15-02 SS2	September 8, 2015	OC Pesticides, M&Is	South portion of the site	0.8-1.4 Sand, trace silt
BH15-03 SS1	September 8, 2015	OC Pesticides	South portion of the site	0-0.6 Top soil overlying sand, trace silt
BH15-03 SS2	September 8, 2015	OC Pesticides, M&Is	South portion of the site	0-0.6 Sand, trace silt

Sample ID	Sample Date	Parameter(s)	Location	Depth (mbg)
BH15-03 SS8	September 8, 2015	PHCs, VOCs	South portion of the site	7.6-8.2 Sand, trace silt, trace gravel
BH15-04 SS1	September 8, 2015	OC Pesticides (DUP 3)	South portion of the site	0-0.6 Top soil overlying sand trace silt
BH15-04 SS2	September 8, 2015	OC Pesticides, M&Is	South portion of the site	0.8-1.4 Clayey silt, some sand
BH15-05 SS1	September 8, 2015	OC Pesticides	South portion of the site	0-0.6 Top soil overlying sandy silt with trace organics
BH15-05 SS2	September 8, 2015	M&Is	South portion of the site	0.8-1.4 Sand, trace silt
BH15-05 SS3	September 8, 2015	OC Pesticides	South portion of the site	1.5-2.1 Sand, trace silt
BH15-06 SS1	September 4, 2015	OC Pesticides	Central portion of the site	0-0.6 Top soil overlying clayey silt, some sand
BH15-06 SS2	September 4, 2015	M&Is	Central portion of the site	0.8-1.4 Sand, trace silt
BH15-06 SS3	September 4, 2015	OC Pesticides	Central portion of the site	1.5-2.1 Sand, trace silt
BH15-06 SS4	September 4, 2015	PHCs, VOCs (DUP 4)	Central portion of the site	2.3-2.9 Sand, trace silt, trace gravel
BH15-07 SS1	September 4, 2015	OC Pesticides (DUP 1)	Central portion of the site	0-0.6 Top soil overlying sandy silt with trace organics
BH15-07 SS2	September 4, 2015	OC Pesticides, M&Is	Central portion of the site	0.8-1.4 Clayey silt, some sand
BH15-07 SS5	September 4, 2015	PHCs, VOCs	Central portion of the site	3.1-3.7 Sand, some gravel
BH15-08 SS1	September 3, 2015	OC Pesticides	West Central portion of the site	0-0.6 Top soil overlying sand, trace silt with trace organics
BH15-08 SS2	September 3, 2015	M&Is	West Central portion of the site	0.8-1.4 Clayey silt, some sand
BH15-08 SS3	September 3, 2015	OC Pesticides	West Central portion of the site	1.5-2.1 Sand, trace silt
BH15-09 SS1	September 3, 2015	OC Pesticides	West Central portion of the site	0-0.6 Top soil overlying, trace silt with trace organics

Sample ID	Sample Date	Parameter(s)	Location	Depth (mbg)
BH15-09 SS2	September 3, 2015	M&Is	West Central portion of the site	0.8-1.4 Sand, trace silt
BH15-09 SS3	September 3, 2015	OC Pesticides	West Central portion of the site	1.5-2.1 Sand, trace silt overlying clayey silt, some sand
BH15-09 SS6	September 3, 2015	PHCs, VOCs	West Central portion of the site	4.6-5.2 Sand, trace silt
BH15-10 SS1	September 3, 2015	OC Pesticides	West Central portion of the site	0-0.6 Top soil overlying clayey silt, some sand
BH15-10 SS2	September 3, 2015	OC Pesticides, M&Is	West Central portion of the site	0.8-1.4 Sand, trace silt
BH15-12 SS1	September 9, 2015	OC Pesticides (DUP 5)	South portion of the site	0-0.6 Top soil overlying clayey silt, some sand
BH15-12 SS2	September 9, 2015	M&Is	South portion of the site	Clayey Silt, some sand overlying sand, trace silt
BH15-12 SS3	September 9, 2015	OC Pesticides	South portion of the site	1.5-2.1 Silt, trace silt, some gravel
BH15-12 SS5	September 9, 2015	PHCs, VOCs	South portion of the site	3.1-3.7 Sand and Gravel

Soil samples were collected and handled in accordance with generally accepted procedures used by the environmental consulting industry. Prior to each sampling event, new disposable gloves were used to transfer samples in plastic bags and glass jars supplied by the laboratory. All soil samples were kept under refrigerated conditions during field storage and transportation to the environmental analytical laboratory.

No visual or olfactory evidence of environmental impact (debris or staining) was noted in any of the soil samples collected.

The chemical analysis was conducted by ALS Environmental (ALS) located in Mississauga, Ontario. ALS is a member of the Canadian Association for Laboratory Accreditation (CALA) and meets the requirements of Section 47 of O.Reg. 153/04 certifying that the analytical laboratory be accredited in accordance with the International Standard ISO/IEC 17025 and with standards developed by the Standards Council of Canada.

For the purposes of soil disposal, the results of chemical analyses were compared to the Background Site Condition Standards for Use within 30 m of a Water Body in a Non-Potable Groundwater Condition for All Property Uses other than Agricultural as contained in Table 9 of the “Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act,” published by the Ministry of Environment (MOE) on April 15, 2011.

Based on the results of the chemical analysis, SPL provides the following conclusions/recommendations:

- When compared to MOE Table 9 property use standards all samples meet with the exception of Dieldrin from sample BH13-07 SS1;
- When compared to MOE Table 9 property use standards, assessment against the guide limit could not be made due to the detection limit exceeding the guide limit for Endrin in BH15-09 SS1;
- The vertical and lateral extents of the exceedances are unknown.
- Separation and re-testing may be an option to reduce disposal cost.
- The results of this testing evaluates the environmental quality of the soil and does not pertain to the geotechnical suitability of the material.
- Acceptance of any excavated soil will be at the discretion of the receiving site.

The purpose of this testing was to chemically characterize the soils analyzed and does not constitute a Phase Two Environmental Site Assessment as defined in O.Reg.153/04, as amended.

It should be noted that if any aesthetically impacted soils are identified during excavation it is recommended that SPL be notified in order to conduct further assessment and/or testing of the material in question.

This report was prepared for Marlwood Golf and Country Club. The material in this report reflects SPL's judgment in light of the information available to it at the time of preparation. Any use, which a Third Party not noted above makes of this report, or any reliance on decisions to be made based on it, are the responsibility of such Third Parties. SPL Consultants Limited accepts no responsibility for damages, if any, suffered by any Third Party as a result of decisions made or actions based on this report.

Thank you for the opportunity to be of service on this project. Should you have any questions or wish to review the contents of this letter in more detail, please do not hesitate to contact the undersigned.

Yours Very Truly,

SPL Consultants Limited



Gord Jarvis
Branch Manager, Collingwood

Attachments:

Figure 1

Laboratory Certificates of Analysis

SPL CONSULTANTS LIMITED (Collingwood)
ATTN: NICOLE COLLINS
14 Ronell Crescent, Unit 1
Collingwood ON L9Y 4J7

Date Received: 11- SEP- 15
Report Date: 22- SEP- 15 14:57 (MT)
Version: FINAL

Client Phone: 705- 445- 0064

Certificate of Analysis

Lab Work Order #: L1672015

Project P.O. #: NOT SUBMITTED
Job Reference: 10002397
C of C Numbers: 14- 465016, 14- 465017, 14- 465018, 14- 465019
Legal Site Desc:

Emerson Perez, B.S.E
Account Manager

[This report shall not be reproduced except in full without the written authority of the Laboratory.]

Ontario Regulation 153/04 - April 15, 2011 Standards - Physical Tests (SOIL)

			ALS ID	L1672015-1	L1672015-2	L1672015-3	L1672015-4	L1672015-5	L1672015-6
			Sampled Date	09-SEP-15	09-SEP-15	09-SEP-15	08-SEP-15	08-SEP-15	08-SEP-15
			Sampled Time	-	-	-	12:00	12:00	12:00
			Sample ID	**BH15-01 SS1**	**BH15-01 SS2**	**BH15-01 SS5**	**BH15-02 SS1**	**BH15-02 SS2**	**BH15-03 SS1**
Analyte	Unit	**Guide Limit							
Conductivity	mS/cm	0.7		0.0801			0.0749	
% Moisture	%	-	17.0	9.13	13.1	16.0	21.0	10.8
pH	pH units	-		7.96			7.94	

**T9-Soil-Res/Park/Inst/Ind/Com/Commu Property Use

Detection Limit for result exceeds Guide Limit. Assessment against Guide Limit cannot be made.
Analytical result for this parameter exceeds Guide Limit listed on this report.
* Please refer to the Reference Information section for an explanation of any qualifiers noted.

Ontario Regulation 153/04 - April 15, 2011 Standards - Physical Tests (SOIL)

			ALS ID	L1672015-7	L1672015-8	L1672015-9	L1672015-10	L1672015-11	L1672015-12
			Sampled Date	08-SEP-15	08-SEP-15	08-SEP-15	08-SEP-15	08-SEP-15	08-SEP-15
			Sampled Time	12:00	12:00	-	-	-	-
			Sample ID	**BH15-03 SS2**	**BH15-03 SS8**	**BH15-04 SS1**	**BH15-04 SS2**	**BH15-05 SS1**	**BH15-05 SS2**
Analyte	Unit	**Guide Limit							
Conductivity	mS/cm	0.7		0.0774			0.140		0.145
% Moisture	%	-		22.5	19.7	36.2	21.6	14.0	7.12
pH	pH units	-		8.01			7.67		7.60

**T9-Soil-Res/Park/Inst/Ind/Com/Commu Property Use

Detection Limit for result exceeds Guide Limit. Assessment against Guide Limit cannot be made.
Analytical result for this parameter exceeds Guide Limit listed on this report.
* Please refer to the Reference Information section for an explanation of any qualifiers noted.

Ontario Regulation 153/04 - April 15, 2011 Standards - Physical Tests (SOIL)

			ALS ID	L1672015-13	L1672015-14	L1672015-15	L1672015-16	L1672015-17	L1672015-18
			Sampled Date	08-SEP-15	04-SEP-15	04-SEP-15	04-SEP-15	04-SEP-15	04-SEP-15
			Sampled Time	-	-	-	-	-	-
			Sample ID	**BH15-05 SS3**	**BH15-06 SS1**	**BH15-06 SS2**	**BH15-06 SS3**	**BH15-06 SS4**	**BH15-07 SS1**
Analyte	Unit	**Guide Limit							
Conductivity	mS/cm	0.7				0.0937			
% Moisture	%	-		21.1	25.4	7.01	5.87	19.8	24.2
pH	pH units	-				7.92			

**T9-Soil-Res/Park/Inst/Ind/Com/Commu Property Use

Detection Limit for result exceeds Guide Limit. Assessment against Guide Limit cannot be made.
Analytical result for this parameter exceeds Guide Limit listed on this report.
* Please refer to the Reference Information section for an explanation of any qualifiers noted.

Ontario Regulation 153/04 - April 15, 2011 Standards - Physical Tests (SOIL)

			ALS ID	L1672015-19	L1672015-20	L1672015-21	L1672015-22	L1672015-23	L1672015-24
			Sampled Date	04-SEP-15	04-SEP-15	03-SEP-15	03-SEP-15	03-SEP-15	03-SEP-15
			Sampled Time	-	-	-	-	-	-
			Sample ID	**BH15-07 SS2**	**BH15-07 SS5**	**BH15-08 SS1**	**BH15-08 SS2**	**BH15-08 SS3**	**BH15-09 SS1**
Analyte	Unit	**Guide Limit							
Conductivity	mS/cm	0.7		0.128			0.135		
% Moisture	%	-		22.3	20.4	25.1	23.6	30.7	6.36
pH	pH units	-		7.81			7.71		

**T9-Soil-Res/Park/Inst/Ind/Com/Commu Property Use

Detection Limit for result exceeds Guide Limit. Assessment against Guide Limit cannot be made.
Analytical result for this parameter exceeds Guide Limit listed on this report.
* Please refer to the Reference Information section for an explanation of any qualifiers noted.

Ontario Regulation 153/04 - April 15, 2011 Standards - Physical Tests (SOIL)

			ALS ID	L1672015-25	L1672015-26	L1672015-27	L1672015-28	L1672015-29	L1672015-30
			Sampled Date	03-SEP-15	03-SEP-15	03-SEP-15	03-SEP-15	03-SEP-15	09-SEP-15
			Sampled Time	-	-	-	12:00	12:00	-
			Sample ID	**BH15-09 SS2**	**BH15-09 SS3**	**BH15-09 SS6**	**BH15-10 SS1**	**BH15-10 SS2**	**BH15-12 SS1**
Analyte	Unit	**Guide Limit							
Conductivity	mS/cm	0.7		0.0722				0.0593	
% Moisture	%	-		17.3	16.1	21.4	6.54	19.1	31.3
pH	pH units	-		7.78				8.01	

**T9-Soil-Res/Park/Inst/Ind/Com/Commu Property Use

Detection Limit for result exceeds Guide Limit. Assessment against Guide Limit cannot be made.
Analytical result for this parameter exceeds Guide Limit listed on this report.
* Please refer to the Reference Information section for an explanation of any qualifiers noted.

Ontario Regulation 153/04 - April 15, 2011 Standards - Physical Tests (SOIL)

			ALS ID	L1672015-31	L1672015-32	L1672015-33	L1672015-34	L1672015-35	L1672015-36
			Sampled Date	09-SEP-15	09-SEP-15	09-SEP-15	09-SEP-15	09-SEP-15	09-SEP-15
			Sampled Time	-	-	-	-	-	-
			Sample ID	**BH15-12 SS2**	**BH15-12 SS3**	**BH15-12 SS5**	**DUP1**	**DUP2**	**DUP3**
Analyte	Unit	**Guide Limit							
Conductivity	mS/cm	0.7		0.139					
% Moisture	%	-		22.9	7.54	11.9	16.6	19.8	15.0
pH	pH units	-		8.02					

**T9-Soil-Res/Park/Inst/Ind/Com/Commu Property Use

Detection Limit for result exceeds Guide Limit. Assessment against Guide Limit cannot be made.
Analytical result for this parameter exceeds Guide Limit listed on this report.
* Please refer to the Reference Information section for an explanation of any qualifiers noted.

Ontario Regulation 153/04 - April 15, 2011 Standards - Physical Tests (SOIL)

		ALS ID	L1672015-37	L1672015-38
		Sampled Date	09-SEP-15	09-SEP-15
		Sampled Time	-	-
		Sample ID	**DUP4**	**DUP5**
Analyte	Unit	**Guide Limit		
Conductivity	mS/cm	0.7		
% Moisture	%	-	16.3	28.9
pH	pH units	-		

**T9-Soil-Res/Park/Inst/Ind/Com/Commu Property Use

Detection Limit for result exceeds Guide Limit. Assessment against Guide Limit cannot be made.
Analytical result for this parameter exceeds Guide Limit listed on this report.
* Please refer to the Reference Information section for an explanation of any qualifiers noted.

Ontario Regulation 153/04 - April 15, 2011 Standards - Cyanides (SOIL)

			ALS ID	L1672015-2	L1672015-5	L1672015-7	L1672015-10	L1672015-12	L1672015-15
			Sampled Date	09-SEP-15	08-SEP-15	08-SEP-15	08-SEP-15	08-SEP-15	04-SEP-15
			Sampled Time	-	12:00	12:00	-	-	-
			Sample ID	**BH15-01 SS2**	**BH15-02 SS2**	**BH15-03 SS2**	**BH15-04 SS2**	**BH15-05 SS2**	**BH15-06 SS2**
Analyte	Unit	**Guide Limit							
Cyanide, Weak Acid Diss	ug/g	0.051		<0.050	<0.050	<0.050	<0.050	<0.050	<0.050

**T9-Soil-Res/Park/Inst/Ind/Com/Commu Property Use

Ontario Regulation 153/04 - April 15, 2011 Standards - Cyanides (SOIL)

			ALS ID	L1672015-19	L1672015-22	L1672015-25	L1672015-29	L1672015-31
			Sampled Date	04-SEP-15	03-SEP-15	03-SEP-15	03-SEP-15	09-SEP-15
			Sampled Time	-	-	-	12:00	-
			Sample ID	**BH15-07 SS2**	**BH15-08 SS2**	**BH15-09 SS2**	**BH15-10 SS2**	**BH15-12 SS2**
Analyte	Unit	**Guide Limit						
Cyanide, Weak Acid Diss	ug/g	0.051		<0.050	<0.050	<0.050	<0.050	<0.050

**T9-Soil-Res/Park/Inst/Ind/Com/Commu Property Use

Detection Limit for result exceeds Guide Limit. Assessment against Guide Limit cannot be made.
Analytical result for this parameter exceeds Guide Limit listed on this report.
* Please refer to the Reference Information section for an explanation of any qualifiers noted.

Ontario Regulation 153/04 - April 15, 2011 Standards - Saturated Paste Extractables (SOIL)

Analyte	Unit	**Guide Limit	ALS ID: L1672015-2 Sampled Date: 09-SEP-15 Sampled Time: - Sample ID: **BH15-01 SS2**	ALS ID: L1672015-5 Sampled Date: 08-SEP-15 Sampled Time: 12:00 Sample ID: **BH15-02 SS2**	ALS ID: L1672015-7 Sampled Date: 08-SEP-15 Sampled Time: 12:00 Sample ID: **BH15-03 SS2**	ALS ID: L1672015-10 Sampled Date: 08-SEP-15 Sampled Time: - Sample ID: **BH15-04 SS2**	ALS ID: L1672015-12 Sampled Date: 08-SEP-15 Sampled Time: - Sample ID: **BH15-05 SS2**	ALS ID: L1672015-15 Sampled Date: 04-SEP-15 Sampled Time: - Sample ID: **BH15-06 SS2**
SAR	SAR	5	<0.10 SAR:Q	<0.10 SAR:Q	<0.10 SAR:Q	<0.10 SAR:Q	<0.10 SAR:Q	<0.10 SAR:Q
Calcium (Ca)	mg/L	-	30.7	45.1	50.9	64.3	51.2	49.7
Magnesium (Mg)	mg/L	-	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Sodium (Na)	mg/L	-	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0

**T9-Soil-Res/Park/Inst/Ind/Com/Commu Property Use

Ontario Regulation 153/04 - April 15, 2011 Standards - Saturated Paste Extractables (SOIL)

Analyte	Unit	**Guide Limit	ALS ID: L1672015-19 Sampled Date: 04-SEP-15 Sampled Time: - Sample ID: **BH15-07 SS2**	ALS ID: L1672015-22 Sampled Date: 03-SEP-15 Sampled Time: - Sample ID: **BH15-08 SS2**	ALS ID: L1672015-25 Sampled Date: 03-SEP-15 Sampled Time: - Sample ID: **BH15-09 SS2**	ALS ID: L1672015-29 Sampled Date: 03-SEP-15 Sampled Time: 12:00 Sample ID: **BH15-10 SS2**	ALS ID: L1672015-31 Sampled Date: 09-SEP-15 Sampled Time: - Sample ID: **BH15-12 SS2**
SAR	SAR	5	<0.10 SAR:Q	<0.10	<0.10 SAR:Q	<0.10 SAR:Q	<0.10 SAR:Q
Calcium (Ca)	mg/L	-	26.7	26.3	37.2	18.4	60.9
Magnesium (Mg)	mg/L	-	<1.0	1.0	<1.0	<1.0	<1.0
Sodium (Na)	mg/L	-	<1.0	1.7	<1.0	<1.0	<1.0

**T9-Soil-Res/Park/Inst/Ind/Com/Commu Property Use

Detection Limit for result exceeds Guide Limit. Assessment against Guide Limit cannot be made.
Analytical result for this parameter exceeds Guide Limit listed on this report.
* Please refer to the Reference Information section for an explanation of any qualifiers noted.

Ontario Regulation 153/04 - April 15, 2011 Standards - Metals (SOIL)

Analyte	Unit	**Guide Limit	ALS ID: L1672015-2 Sampled Date: 09-SEP-15 Sampled Time: - Sample ID: BH15-01 SS2	L1672015-5 08-SEP-15 12:00 BH15-02 SS2	L1672015-7 08-SEP-15 12:00 BH15-03 SS2	L1672015-10 08-SEP-15 - BH15-04 SS2	L1672015-12 08-SEP-15 - BH15-05 SS2	L1672015-15 04-SEP-15 - BH15-06 SS2
Antimony (Sb)	ug/g	1.3	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Arsenic (As)	ug/g	18	<1.0	<1.0	<1.0	1.8	1.4	<1.0
Barium (Ba)	ug/g	220	8.8	14.9	13.7	129	89.2	16.5
Beryllium (Be)	ug/g	2.5	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Boron (B)	ug/g	36	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Boron (B), Hot Water Ext.	ug/g	1.5	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Cadmium (Cd)	ug/g	1.2	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Chromium (Cr)	ug/g	70	5.1	5.2	4.1	8.0	7.4	4.3
Cobalt (Co)	ug/g	22	1.3	1.6	1.4	2.0	2.0	1.1
Copper (Cu)	ug/g	92	1.1	1.6	1.3	8.9	5.3	1.5
Lead (Pb)	ug/g	120	1.2	1.4	<1.0	2.1	3.2	<1.0
Mercury (Hg)	ug/g	0.27	<0.0050	<0.0050	<0.0050	0.0068	0.0187	<0.0050
Molybdenum (Mo)	ug/g	2	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Nickel (Ni)	ug/g	82	3.6	3.7	3.3	8.3	4.8	2.5
Selenium (Se)	ug/g	1.5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Silver (Ag)	ug/g	0.5	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Thallium (Tl)	ug/g	1	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Uranium (U)	ug/g	2.5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Vanadium (V)	ug/g	86	14.1	10.9	8.3	15.6	11.3	9.3
Zinc (Zn)	ug/g	290	<5.0	5.6	5.4	9.1	12.3	<5.0

**T9-Soil-Res/Park/Inst/Ind/Com/Commu Property Use

Detection Limit for result exceeds Guide Limit. Assessment against Guide Limit cannot be made.
Analytical result for this parameter exceeds Guide Limit listed on this report.
* Please refer to the Reference Information section for an explanation of any qualifiers noted.

Ontario Regulation 153/04 - April 15, 2011 Standards - Metals (SOIL)

	ALS ID	L1672015-19	L1672015-22	L1672015-25	L1672015-29	L1672015-31
	Sampled Date	04-SEP-15	03-SEP-15	03-SEP-15	03-SEP-15	09-SEP-15
	Sampled Time	-	-	-	12:00	-
	Sample ID	**BH15-07 SS2**	**BH15-08 SS2**	**BH15-09 SS2**	**BH15-10 SS2**	**BH15-12 SS2**
Analyte	Unit	**Guide Limit				
Antimony (Sb)	ug/g	1.3	<1.0	<1.0	<1.0	<1.0	<1.0
Arsenic (As)	ug/g	18	<1.0	<1.0	<1.0	<1.0	<1.0
Barium (Ba)	ug/g	220	159	107	6.8	11.3	121
Beryllium (Be)	ug/g	2.5	<0.50	<0.50	<0.50	<0.50	<0.50
Boron (B)	ug/g	36	<5.0	<5.0	<5.0	<5.0	<5.0
Boron (B), Hot Water Ext.	ug/g	1.5	<0.10	<0.10	<0.10	<0.10	<0.10
Cadmium (Cd)	ug/g	1.2	<0.50	<0.50	<0.50	<0.50	<0.50
Chromium (Cr)	ug/g	70	6.5	6.2	4.6	10.3	4.1
Cobalt (Co)	ug/g	22	2.0	<1.0	1.2	2.1	1.3
Copper (Cu)	ug/g	92	6.6	1.9	<1.0	1.7	9.5
Lead (Pb)	ug/g	120	1.9	1.8	<1.0	1.2	1.3
Mercury (Hg)	ug/g	0.27	0.0137	0.0205	<0.0050	<0.0050	<0.0050
Molybdenum (Mo)	ug/g	2	<1.0	<1.0	<1.0	<1.0	<1.0
Nickel (Ni)	ug/g	82	4.7	2.3	2.9	3.8	2.9
Selenium (Se)	ug/g	1.5	<1.0	<1.0	<1.0	<1.0	<1.0
Silver (Ag)	ug/g	0.5	<0.20	<0.20	<0.20	<0.20	<0.20
Thallium (Tl)	ug/g	1	<0.50	<0.50	<0.50	<0.50	<0.50
Uranium (U)	ug/g	2.5	<1.0	<1.0	<1.0	<1.0	<1.0
Vanadium (V)	ug/g	86	11.0	5.6	10.5	33.4	7.1
Zinc (Zn)	ug/g	290	8.1	7.5	<5.0	7.2	<5.0

**T9-Soil-Res/Park/Inst/Ind/Com/Commu Property Use

Detection Limit for result exceeds Guide Limit. Assessment against Guide Limit cannot be made.
Analytical result for this parameter exceeds Guide Limit listed on this report.
* Please refer to the Reference Information section for an explanation of any qualifiers noted.

Ontario Regulation 153/04 - April 15, 2011 Standards - Speciated Metals (SOIL)

			ALS ID	L1672015-2	L1672015-5	L1672015-7	L1672015-10	L1672015-12	L1672015-15
			Sampled Date	09-SEP-15	08-SEP-15	08-SEP-15	08-SEP-15	08-SEP-15	04-SEP-15
			Sampled Time	-	12:00	12:00	-	-	-
			Sample ID	**BH15-01 SS2**	**BH15-02 SS2**	**BH15-03 SS2**	**BH15-04 SS2**	**BH15-05 SS2**	**BH15-06 SS2**
Analyte	Unit	**Guide Limit							
Chromium, Hexavalent	ug/g	0.66		<0.20	<0.20	<0.20	0.24	<0.20	<0.20

**T9-Soil-Res/Park/Inst/Ind/Com/Commu Property Use

Ontario Regulation 153/04 - April 15, 2011 Standards - Speciated Metals (SOIL)

			ALS ID	L1672015-19	L1672015-22	L1672015-25	L1672015-29	L1672015-31
			Sampled Date	04-SEP-15	03-SEP-15	03-SEP-15	03-SEP-15	09-SEP-15
			Sampled Time	-	-	-	12:00	-
			Sample ID	**BH15-07 SS2**	**BH15-08 SS2**	**BH15-09 SS2**	**BH15-10 SS2**	**BH15-12 SS2**
Analyte	Unit	**Guide Limit						
Chromium, Hexavalent	ug/g	0.66		<0.20	<0.20	<0.20	<0.20	<0.20

**T9-Soil-Res/Park/Inst/Ind/Com/Commu Property Use

Detection Limit for result exceeds Guide Limit. Assessment against Guide Limit cannot be made.
Analytical result for this parameter exceeds Guide Limit listed on this report.
* Please refer to the Reference Information section for an explanation of any qualifiers noted.

Ontario Regulation 153/04 - April 15, 2011 Standards - Volatile Organic Compounds (SOIL)

Analyte	Unit	**Guide Limit	ALS ID: L1672015-3 Sampled Date: 09-SEP-15 Sampled Time: - Sample ID: BH15-01 SS5	L1672015-8 08-SEP-15 12:00 BH15-03 SS8	L1672015-17 04-SEP-15 - BH15-06 SS4	L1672015-20 04-SEP-15 - BH15-07 SS5	L1672015-27 03-SEP-15 - BH15-09 SS6	L1672015-33 09-SEP-15 - BH15-12 SS5
Acetone	ug/g	0.5	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Benzene	ug/g	0.02	<0.0068	<0.0068	<0.0068	<0.0068	<0.0068	<0.0068
Bromodichloromethane	ug/g	0.05	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Bromoform	ug/g	0.05	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Bromomethane	ug/g	0.05	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Carbon tetrachloride	ug/g	0.05	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Chlorobenzene	ug/g	0.05	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Dibromochloromethane	ug/g	0.05	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Chloroform	ug/g	0.05	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
1,2-Dibromoethane	ug/g	0.05	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
1,2-Dichlorobenzene	ug/g	0.05	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
1,3-Dichlorobenzene	ug/g	0.05	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
1,4-Dichlorobenzene	ug/g	0.05	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Dichlorodifluoromethane	ug/g	0.05	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
1,1-Dichloroethane	ug/g	0.05	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
1,2-Dichloroethane	ug/g	0.05	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
1,1-Dichloroethylene	ug/g	0.05	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
cis-1,2-Dichloroethylene	ug/g	0.05	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
trans-1,2-Dichloroethylene	ug/g	0.05	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
1,3-Dichloropropene (cis & trans)	ug/g	0.05	<0.042	<0.042	<0.042	<0.042	<0.042	<0.042
Methylene Chloride	ug/g	0.05	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
1,2-Dichloropropane	ug/g	0.05	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
cis-1,3-Dichloropropene	ug/g	-	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
trans-1,3-Dichloropropene	ug/g	-	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Ethylbenzene	ug/g	0.05	<0.018	<0.018	<0.018	<0.018	<0.018	<0.018
n-Hexane	ug/g	0.05	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Methyl Ethyl Ketone	ug/g	0.5	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Methyl Isobutyl Ketone	ug/g	0.5	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
MTBE	ug/g	0.05	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Styrene	ug/g	0.05	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
1,1,1,2-Tetrachloroethane	ug/g	0.05	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
1,1,2,2-Tetrachloroethane	ug/g	0.05	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Tetrachloroethylene	ug/g	0.05	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Toluene	ug/g	0.2	<0.080	<0.080	<0.080	<0.080	<0.080	<0.080
1,1,1-Trichloroethane	ug/g	0.05	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050

**T9-Soil-Res/Park/Inst/Ind/Com/Commu Property Use

Detection Limit for result exceeds Guide Limit. Assessment against Guide Limit cannot be made.
Analytical result for this parameter exceeds Guide Limit listed on this report.
* Please refer to the Reference Information section for an explanation of any qualifiers noted.

Ontario Regulation 153/04 - April 15, 2011 Standards - Volatile Organic Compounds (SOIL)

	ALS ID	L1672015-35
	Sampled Date	09-SEP-15
	Sampled Time	-
	Sample ID	DUP2
Analyte	Unit	**Guide Limit	
Acetone	ug/g	0.5	<0.50
Benzene	ug/g	0.02	<0.0068
Bromodichloromethane	ug/g	0.05	<0.050
Bromoform	ug/g	0.05	<0.050
Bromomethane	ug/g	0.05	<0.050
Carbon tetrachloride	ug/g	0.05	<0.050
Chlorobenzene	ug/g	0.05	<0.050
Dibromochloromethane	ug/g	0.05	<0.050
Chloroform	ug/g	0.05	<0.050
1,2-Dibromoethane	ug/g	0.05	<0.050
1,2-Dichlorobenzene	ug/g	0.05	<0.050
1,3-Dichlorobenzene	ug/g	0.05	<0.050
1,4-Dichlorobenzene	ug/g	0.05	<0.050
Dichlorodifluoromethane	ug/g	0.05	<0.050
1,1-Dichloroethane	ug/g	0.05	<0.050
1,2-Dichloroethane	ug/g	0.05	<0.050
1,1-Dichloroethylene	ug/g	0.05	<0.050
cis-1,2-Dichloroethylene	ug/g	0.05	<0.050
trans-1,2-Dichloroethylene	ug/g	0.05	<0.050
1,3-Dichloropropene (cis & trans)	ug/g	0.05	<0.042
Methylene Chloride	ug/g	0.05	<0.050
1,2-Dichloropropane	ug/g	0.05	<0.050
cis-1,3-Dichloropropene	ug/g	-	<0.030
trans-1,3-Dichloropropene	ug/g	-	<0.030
Ethylbenzene	ug/g	0.05	<0.018
n-Hexane	ug/g	0.05	<0.050
Methyl Ethyl Ketone	ug/g	0.5	<0.50
Methyl Isobutyl Ketone	ug/g	0.5	<0.50
MTBE	ug/g	0.05	<0.050
Styrene	ug/g	0.05	<0.050
1,1,1,2-Tetrachloroethane	ug/g	0.05	<0.050
1,1,2,2-Tetrachloroethane	ug/g	0.05	<0.050
Tetrachloroethylene	ug/g	0.05	<0.050
Toluene	ug/g	0.2	<0.080
1,1,1-Trichloroethane	ug/g	0.05	<0.050

**T9-Soil-Res/Park/Inst/Ind/Com/Commu Property Use

Detection Limit for result exceeds Guide Limit. Assessment against Guide Limit cannot be made.
Analytical result for this parameter exceeds Guide Limit listed on this report.
* Please refer to the Reference Information section for an explanation of any qualifiers noted.

Ontario Regulation 153/04 - April 15, 2011 Standards - Volatile Organic Compounds (SOIL)

	ALS ID	L1672015-3	L1672015-8	L1672015-17	L1672015-20	L1672015-27	L1672015-33
	Sampled Date	09-SEP-15	08-SEP-15	04-SEP-15	04-SEP-15	03-SEP-15	09-SEP-15
	Sampled Time	-	12:00	-	-	-	-
	Sample ID	**BH15-01 SS5**	**BH15-03 SS8**	**BH15-06 SS4**	**BH15-07 SS5**	**BH15-09 SS6**	**BH15-12 SS5**
Analyte	Unit	**Guide Limit					
1,1,2-Trichloroethane	ug/g	0.05	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Trichloroethylene	ug/g	0.05	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Trichlorofluoromethane	ug/g	0.25	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Vinyl chloride	ug/g	0.02	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
o-Xylene	ug/g	-	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
m+p-Xylenes	ug/g	-	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Xylenes (Total)	ug/g	0.05	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Surrogate: 4-Bromofluorobenzene	%	-	91.2	93.0	89.1	91.7	87.1	97.1
Surrogate: 1,4-Difluorobenzene	%	-	96.8	96.9	95.1	96.3	95.6	97.5

**T9-Soil-Res/Park/Inst/Ind/Com/Commu Property Use

Detection Limit for result exceeds Guide Limit. Assessment against Guide Limit cannot be made.
Analytical result for this parameter exceeds Guide Limit listed on this report.
* Please refer to the Reference Information section for an explanation of any qualifiers noted.

Ontario Regulation 153/04 - April 15, 2011 Standards - Volatile Organic Compounds (SOIL)

	ALS ID	L1672015-35
	Sampled Date	09-SEP-15
	Sampled Time	-
	Sample ID	DUP2
Analyte	Unit	**Guide Limit
1,1,2-Trichloroethane	ug/g	0.05	<0.050
Trichloroethylene	ug/g	0.05	<0.010
Trichlorofluoromethane	ug/g	0.25	<0.050
Vinyl chloride	ug/g	0.02	<0.020
o-Xylene	ug/g	-	<0.020
m+p-Xylenes	ug/g	-	<0.030
Xylenes (Total)	ug/g	0.05	<0.050
Surrogate: 4-Bromofluorobenzene	%	-	91.3
Surrogate: 1,4-Difluorobenzene	%	-	97.3

**T9-Soil-Res/Park/Inst/Ind/Com/Commu Property Use

Ontario Regulation 153/04 - April 15, 2011 Standards - Hydrocarbons (SOIL)

	ALS ID	L1672015-3	L1672015-8	L1672015-17	L1672015-20	L1672015-27	L1672015-33
	Sampled Date	09-SEP-15	08-SEP-15	04-SEP-15	04-SEP-15	03-SEP-15	09-SEP-15
	Sampled Time	-	12:00	-	-	-	-
	Sample ID	BH15-01 SS5	BH15-03 SS8	BH15-06 SS4	BH15-07 SS5	BH15-09 SS6	BH15-12 SS5
Analyte	Unit	**Guide Limit					
F1 (C6-C10)	ug/g	25	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
F1-BTEX	ug/g	25	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
F2 (C10-C16)	ug/g	10	<10	<10	<10	<10	<10	<10
F3 (C16-C34)	ug/g	240	<50	<50	<50	<50	<50	50
F4 (C34-C50)	ug/g	120	<50	<50	<50	<50	<50	<50
Total Hydrocarbons (C6-C50)	ug/g	-	<72	<72	<72	<72	<72	<72
Chrom. to baseline at nC50	No Unit	-	YES	YES	YES	YES	YES	YES
Surrogate: 2-Bromobenzotrifluoride	%	-	86.1	90.0	94.5	91.1	85.0	81.3
Surrogate: 3,4-Dichlorotoluene	%	-	98.3	97.7	93.1	94.0	80.5	113.5

**T9-Soil-Res/Park/Inst/Ind/Com/Commu Property Use

Detection Limit for result exceeds Guide Limit. Assessment against Guide Limit cannot be made.
Analytical result for this parameter exceeds Guide Limit listed on this report.
* Please refer to the Reference Information section for an explanation of any qualifiers noted.

Ontario Regulation 153/04 - April 15, 2011 Standards - Organochlorine Pesticides (SOIL)

			L1672015-1	L1672015-2	L1672015-4	L1672015-5	L1672015-6	L1672015-7
ALS ID								
Sampled Date			09-SEP-15	09-SEP-15	08-SEP-15	08-SEP-15	08-SEP-15	08-SEP-15
Sampled Time			-	-	12:00	12:00	12:00	12:00
Sample ID			**BH15-01 SS1**	**BH15-01 SS2**	**BH15-02 SS1**	**BH15-02 SS2**	**BH15-03 SS1**	**BH15-03 SS2**
Analyte	Unit	**Guide Limit						
Aldrin	ug/g	0.05	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
gamma-hexachlorocyclohexane	ug/g	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
a-chlordane	ug/g	-	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Chlordane (Total)	ug/g	0.05	<0.028	<0.028	<0.028	<0.028	<0.028	<0.028
g-chlordane	ug/g	-	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
op-DDD	ug/g	-	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
pp-DDD	ug/g	-	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Total DDD	ug/g	0.05	<0.028	<0.028	<0.028	<0.028	<0.028	<0.028
o,p-DDE	ug/g	-	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
pp-DDE	ug/g	-	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Total DDE	ug/g	0.05	<0.028	<0.028	<0.028	<0.028	<0.028	<0.028
op-DDT	ug/g	-	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
pp-DDT	ug/g	-	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Total DDT	ug/g	1.4	<0.028	<0.028	<0.028	<0.028	<0.028	<0.028
Dieldrin	ug/g	0.05	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Endosulfan I	ug/g	-	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Endosulfan II	ug/g	-	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Endosulfan (Total)	ug/g	0.04	<0.028	<0.028	<0.028	<0.028	<0.028	<0.028
Endrin	ug/g	0.04	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Heptachlor	ug/g	0.05	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Heptachlor Epoxide	ug/g	0.05	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Hexachlorobenzene	ug/g	0.02	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Hexachlorobutadiene	ug/g	0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Hexachloroethane	ug/g	0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Methoxychlor	ug/g	0.05	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Surrogate: 2-Fluorobiphenyl	%	-	93.8	97.3	94.5	96.7	93.5	96.2
Surrogate: d14-Terphenyl	%	-	98.1	106.8	94.2	99.9	95.3	101.9

**T9-Soil-Res/Park/Inst/Ind/Com/Commu Property Use

Detection Limit for result exceeds Guide Limit. Assessment against Guide Limit cannot be made.
Analytical result for this parameter exceeds Guide Limit listed on this report.
* Please refer to the Reference Information section for an explanation of any qualifiers noted.

Ontario Regulation 153/04 - April 15, 2011 Standards - Organochlorine Pesticides (SOIL)

Analyte	Unit	**Guide Limit	ALS ID / Sampled Date / Sampled Time / Sample ID: L1672015-9 / 08-SEP-15 / - / BH15-04 SS1	L1672015-10 / 08-SEP-15 / - / BH15-04 SS2	L1672015-11 / 08-SEP-15 / - / BH15-05 SS1	L1672015-13 / 08-SEP-15 / - / BH15-05 SS3	L1672015-14 / 04-SEP-15 / - / BH15-06 SS1	L1672015-16 / 04-SEP-15 / - / BH15-06 SS3
Aldrin	ug/g	0.05	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
gamma-hexachlorocyclohexane	ug/g	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
a-chlordane	ug/g	-	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Chlordane (Total)	ug/g	0.05	<0.028	<0.028	<0.028	<0.028	<0.028	<0.028
g-chlordane	ug/g	-	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
op-DDD	ug/g	-	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
pp-DDD	ug/g	-	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Total DDD	ug/g	0.05	<0.028	<0.028	<0.028	<0.028	<0.028	<0.028
o,p-DDE	ug/g	-	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
pp-DDE	ug/g	-	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Total DDE	ug/g	0.05	<0.028	<0.028	<0.028	<0.028	<0.028	<0.028
op-DDT	ug/g	-	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
pp-DDT	ug/g	-	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Total DDT	ug/g	1.4	<0.028	<0.028	<0.028	<0.028	<0.028	<0.028
Dieldrin	ug/g	0.05	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Endosulfan I	ug/g	-	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Endosulfan II	ug/g	-	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Endosulfan (Total)	ug/g	0.04	<0.028	<0.028	<0.028	<0.028	<0.028	<0.028
Endrin	ug/g	0.04	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Heptachlor	ug/g	0.05	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Heptachlor Epoxide	ug/g	0.05	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Hexachlorobenzene	ug/g	0.02	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Hexachlorobutadiene	ug/g	0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Hexachloroethane	ug/g	0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Methoxychlor	ug/g	0.05	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Surrogate: 2-Fluorobiphenyl	%	-	93.8	94.9	99.7	96.9	92.7	97.6
Surrogate: d14-Terphenyl	%	-	99.3	99.0	104.0	101.4	104.7	98.9

**T9-Soil-Res/Park/Inst/Ind/Com/Commu Property Use

Detection Limit for result exceeds Guide Limit. Assessment against Guide Limit cannot be made.
Analytical result for this parameter exceeds Guide Limit listed on this report.
* Please refer to the Reference Information section for an explanation of any qualifiers noted.

Ontario Regulation 153/04 - April 15, 2011 Standards - Organochlorine Pesticides (SOIL)

Analyte	Unit	**Guide Limit	ALS ID: L1672015-18 Sampled Date: 04-SEP-15 Sampled Time: - Sample ID: BH15-07 SS1	L1672015-19 04-SEP-15 - BH15-07 SS2	L1672015-21 03-SEP-15 - BH15-08 SS1	L1672015-23 03-SEP-15 - BH15-08 SS3	L1672015-24 03-SEP-15 - BH15-09 SS1	L1672015-26 03-SEP-15 - BH15-09 SS3
Aldrin	ug/g	0.05	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
gamma-hexachlorocyclohexane	ug/g	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
a-chlordane	ug/g	-	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Chlordane (Total)	ug/g	0.05	<0.028	<0.028	<0.028	<0.028	<0.028	<0.028
g-chlordane	ug/g	-	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
op-DDD	ug/g	-	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
pp-DDD	ug/g	-	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Total DDD	ug/g	0.05	<0.028	<0.028	<0.028	<0.028	<0.028	<0.028
o,p-DDE	ug/g	-	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
pp-DDE	ug/g	-	0.033	<0.020	<0.020	<0.020	<0.020	<0.020
Total DDE	ug/g	0.05	0.033	<0.028	<0.028	<0.028	<0.028	<0.028
op-DDT	ug/g	-	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
pp-DDT	ug/g	-	0.027	<0.020	<0.020	<0.020	<0.020	<0.020
Total DDT	ug/g	1.4	<0.028	<0.028	<0.028	<0.028	<0.028	<0.028
Dieldrin	ug/g	0.05	0.063	<0.020	<0.020	<0.020	<0.020	<0.020
Endosulfan I	ug/g	-	<0.020	<0.020	<0.020	<0.020	<0.045 DLUI	<0.020
Endosulfan II	ug/g	-	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Endosulfan (Total)	ug/g	0.04	<0.028	<0.028	<0.028	<0.028	<0.049	<0.028
Endrin	ug/g	0.04	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Heptachlor	ug/g	0.05	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Heptachlor Epoxide	ug/g	0.05	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Hexachlorobenzene	ug/g	0.02	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Hexachlorobutadiene	ug/g	0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Hexachloroethane	ug/g	0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Methoxychlor	ug/g	0.05	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Surrogate: 2-Fluorobiphenyl	%	-	93.7	94.7	92.8	89.7	93.4	91.4
Surrogate: d14-Terphenyl	%	-	93.2	94.8	92.2	93.8	89.8	98.1

**T9-Soil-Res/Park/Inst/Ind/Com/Commu Property Use

Detection Limit for result exceeds Guide Limit. Assessment against Guide Limit cannot be made.
Analytical result for this parameter exceeds Guide Limit listed on this report.
* Please refer to the Reference Information section for an explanation of any qualifiers noted.

Ontario Regulation 153/04 - April 15, 2011 Standards - Organochlorine Pesticides (SOIL)

	ALS ID	L1672015-28	L1672015-29	L1672015-30	L1672015-32	L1672015-34	L1672015-36
	Sampled Date	03-SEP-15	03-SEP-15	09-SEP-15	09-SEP-15	09-SEP-15	09-SEP-15
	Sampled Time	12:00	12:00	-	-	-	-
	Sample ID	**BH15-10 SS1**	**BH15-10 SS2**	**BH15-12 SS1**	**BH15-12 SS3**	**DUP1**	**DUP3**
Analyte	Unit	**Guide Limit					
Aldrin	ug/g	0.05	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
gamma-hexachlorocyclohexane	ug/g	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
a-chlordane	ug/g	-	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Chlordane (Total)	ug/g	0.05	<0.028	<0.028	<0.028	<0.028	<0.028	<0.028
g-chlordane	ug/g	-	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
op-DDD	ug/g	-	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
pp-DDD	ug/g	-	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Total DDD	ug/g	0.05	<0.028	<0.028	<0.028	<0.028	<0.028	<0.028
o,p-DDE	ug/g	-	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
pp-DDE	ug/g	-	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Total DDE	ug/g	0.05	<0.028	<0.028	<0.028	<0.028	<0.028	<0.028
op-DDT	ug/g	-	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
pp-DDT	ug/g	-	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Total DDT	ug/g	1.4	<0.028	<0.028	<0.028	<0.028	<0.028	<0.028
Dieldrin	ug/g	0.05	<0.020	<0.020	<0.020	<0.020	0.025	<0.020
Endosulfan I	ug/g	-	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Endosulfan II	ug/g	-	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Endosulfan (Total)	ug/g	0.04	<0.028	<0.028	<0.028	<0.028	<0.028	<0.028
Endrin	ug/g	0.04	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Heptachlor	ug/g	0.05	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Heptachlor Epoxide	ug/g	0.05	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Hexachlorobenzene	ug/g	0.02	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Hexachlorobutadiene	ug/g	0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Hexachloroethane	ug/g	0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Methoxychlor	ug/g	0.05	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Surrogate: 2-Fluorobiphenyl	%	-	92.8	100.6	93.1	94.8	95.5	93.4
Surrogate: d14-Terphenyl	%	-	94.3	102.9	99.5	103.3	100.6	93.9

**T9-Soil-Res/Park/Inst/Ind/Com/Commu Property Use

Detection Limit for result exceeds Guide Limit. Assessment against Guide Limit cannot be made.
Analytical result for this parameter exceeds Guide Limit listed on this report.
* Please refer to the Reference Information section for an explanation of any qualifiers noted.

Ontario Regulation 153/04 - April 15, 2011 Standards - Organochlorine Pesticides (SOIL)

	ALS ID	L1672015-37	L1672015-38
	Sampled Date	09-SEP-15	09-SEP-15
	Sampled Time	-	-
	Sample ID	**DUP4**	**DUP5**
Analyte	Unit	**Guide Limit	
Aldrin	ug/g	0.05	<0.020	<0.020
gamma-hexachlorocyclohexane	ug/g	-	<0.010	<0.010
a-chlordane	ug/g	-	<0.020	<0.020
Chlordane (Total)	ug/g	0.05	<0.028	<0.028
g-chlordane	ug/g	-	<0.020	<0.020
op-DDD	ug/g	-	<0.020	<0.020
pp-DDD	ug/g	-	<0.020	<0.020
Total DDD	ug/g	0.05	<0.028	<0.028
o,p-DDE	ug/g	-	<0.020	<0.020
pp-DDE	ug/g	-	<0.020	<0.020
Total DDE	ug/g	0.05	<0.028	<0.028
op-DDT	ug/g	-	<0.020	<0.020
pp-DDT	ug/g	-	<0.020	<0.020
Total DDT	ug/g	1.4	<0.028	<0.028
Dieldrin	ug/g	0.05	<0.020	<0.020
Endosulfan I	ug/g	-	<0.020	<0.020
Endosulfan II	ug/g	-	<0.020	<0.020
Endosulfan (Total)	ug/g	0.04	<0.028	<0.028
Endrin	ug/g	0.04	<0.020	<0.020
Heptachlor	ug/g	0.05	<0.020	<0.020
Heptachlor Epoxide	ug/g	0.05	<0.020	<0.020
Hexachlorobenzene	ug/g	0.02	<0.010	<0.010
Hexachlorobutadiene	ug/g	0.01	<0.010	<0.010
Hexachloroethane	ug/g	0.01	<0.010	<0.010
Methoxychlor	ug/g	0.05	<0.020	<0.020
Surrogate: 2-Fluorobiphenyl	%	-	93.0	96.9
Surrogate: d14-Terphenyl	%	-	98.2	100.9

**T9-Soil-Res/Park/Inst/Ind/Com/Commu Property Use

Detection Limit for result exceeds Guide Limit. Assessment against Guide Limit cannot be made.
Analytical result for this parameter exceeds Guide Limit listed on this report.
* Please refer to the Reference Information section for an explanation of any qualifiers noted.

Reference Information

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DLUI	Detection Limit Raised: Unknown Interference generated an apparent false positive test result.
SAR:Q	Qualified SAR value: actual SAR is lower but is incalculable due to Na, Ca or Mg below detection limit.

Methods Listed (if applicable):

ALS Test Code	Matrix	Test Description	Method Reference**
B-HWS-R511-WT	Soil	Boron-HWE-O.Reg 153/04 (July 2011)	HW EXTR, EPA 6010B

A dried solid sample is extracted with calcium chloride, the sample undergoes a heating process. After cooling the sample is filtered and analyzed by ICP/OES.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

CHLORDANE-T-CALC-WT	Soil	Chlordane Total sums	CALCULATION

Aqueous sample is extracted by liquid/liquid extraction with a solvent mix. After extraction, a number of clean up techniques may be applied, depending on the sample matrix and analyzed by GC/MS.

CN-WAD-R511-WT	Soil	Cyanide (WAD)-O.Reg 153/04 (July 2011)	MOE 3015/APHA 4500CN I-WAD

The sample is extracted with a strong base for 16 hours, and then filtered. The filtrate is then distilled where the cyanide is converted to cyanogen chloride by reacting with chloramine-T, the cyanogen chloride then reacts with a combination of barbituric acid and isonicotinic acid to form a highly colored complex.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

CR-CR6-IC-WT	Soil	Hexavalent Chromium in Soil	SW846 3060A/7199

This analysis is carried out using procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846, Method 7199, published by the United States Environmental Protection Agency (EPA). The procedure involves analysis for chromium (VI) by ion chromatography using diphenylcarbazide in a sulphuric acid solution.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

DDD-DDE-DDT-CALC-WT	Soil	DDD, DDE, DDT sums	CALCULATION

Aqueous sample is extracted by liquid/liquid extraction with a solvent mix. After extraction, a number of clean up techniques may be applied, depending on the sample matrix and analyzed by GC/MS.

EC-R511-WT	Soil	Conductivity-O.Reg 153/04 (July 2011)	MOEE E3138

A representative subsample is tumbled with de-ionized (DI) water. The ratio of water to soil is 2:1 v/w. After tumbling the sample is then analyzed by a conductivity meter.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

ENDOSULFAN-T-CALC-WT	Soil	Endosulfan Total sums	CALCULATION

Aqueous sample is extracted by liquid/liquid extraction with a solvent mix. After extraction, a number of clean up techniques may be applied, depending on the sample matrix and analyzed by GC/MS.

F1-F4-511-CALC-WT	Soil	F1-F4 Hydrocarbon Calculated Parameters	CCME CWS-PHC, Pub #1310, Dec 2001-S

Analytical methods used for analysis of CCME Petroleum Hydrocarbons have been validated and comply with the Reference Method for the CWS PHC.

Hydrocarbon results are expressed on a dry weight basis.

In cases where results for both F4 and F4G are reported, the greater of the two results must be used in any application of the CWS PHC guidelines and the gravimetric heavy hydrocarbons cannot be added to the C6 to C50 hydrocarbons.
In samples where BTEX and F1 were analyzed , F1-BTEX represents a value where the sum of Benzene, Toluene, Ethylbenzene and total Xylenes has been subtracted from F1.

In samples where PAHs, F2 and F3 were analyzed, F2-Naphth represents the result where Naphthalene has been subtracted from F2. F3-PAH represents a result where the sum of Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Dibenzo(a,h)anthracene,

Reference Information

Methods Listed (if applicable):

ALS Test Code	Matrix	Test Description	Method Reference**

Fluoranthene, Indeno(1,2,3-cd)pyrene, Phenanthrene, and Pyrene has been subtracted from F3.

Unless otherwise qualified, the following quality control criteria have been met for the F1 hydrocarbon range:
1. All extraction and analysis holding times were met.
2. Instrument performance showing response factors for C6 and C10 within 30% of the response factor for toluene.
3. Linearity of gasoline response within 15% throughout the calibration range.

Unless otherwise qualified, the following quality control criteria have been met for the F2-F4 hydrocarbon ranges:
1. All extraction and analysis holding times were met.
2. Instrument performance showing C10, C16 and C34 response factors within 10% of their average.
3. Instrument performance showing the C50 response factor within 30% of the average of the C10, C16 and C34 response factors.
4. Linearity of diesel or motor oil response within 15% throughout the calibration range.

F1-HS-511-WT Soil F1-O.Reg 153/04 (July 2011) E3398/CCME TIER 1-HS

Fraction F1 is determined by extracting a soil or sediment sample as received with methanol, then analyzing by headspace-GC/FID.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011), unless a subset of the Analytical Test Group (ATG) has been requested (the Protocol states that all analytes in an ATG must be reported).

F2-F4-511-WT Soil F2-F4-O.Reg 153/04 (July 2011) MOE DECPH-E3398/CCME TIER 1

Fractions F2, F3 and F4 are determined by extracting a soil sample with a solvent mix. The solvent recovered from the extracted soil sample is dried and treated to remove polar material. The extract is analyzed by GC/FID.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011), unless a subset of the Analytical Test Group (ATG) has been requested (the Protocol states that all analytes in an ATG must be reported).

HG-200.2-CVAA-WT Soil Mercury in Soil by CVAAS EPA 200.2/1631E (mod)

Soil samples are digested with nitric and hydrochloric acids, followed by analysis by CVAAS.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

MET-200.2-CCMS-WT Soil Metals in Soil by CRC ICPMS EPA 200.2/6020A (mod)

Soil samples are digested with nitric and hydrochloric acids, followed by analysis by CRC ICPMS.

Method Limitation: This method is not a total digestion technique. It is a very strong acid digestion that is intended to dissolve those metals that may be environmentally available. This method does not dissolve all silicate materials and may result in a partial extraction. depending on the sample matrix, for some metals, including, but not limited to Al, Ba, Be, Cr, Sr, Ti, Tl, and V.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011), unless a subset of the Analytical Test Group (ATG) has been requested (the Protocol states that all analytes in an ATG must be reported).

MOISTURE-WT Soil % Moisture Gravimetric: Oven Dried

PEST-OC-511-WT Soil OC Pesticides-O.Reg 153/04 (July 2011) SW846 8270 (511)

Soil sample is extracted in a solvent, after extraction a number of clean up techniques may be applied, depending on the sample matrix and analyzed by GC/MS.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011), unless a subset of the Analytical Test Group (ATG) has been requested (the Protocol states that all analytes in an ATG must be reported).

PH-R511-WT Soil pH-O.Reg 153/04 (July 2011) MOEE E3137A

A minimum 10g portion of the sample is extracted with 20mL of 0.01M calcium chloride solution by shaking for at least 30 minutes. The aqueous layer is separated from the soil and then analyzed using a pH meter and electrode.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

SAR-R511-WT Soil SAR-O.Reg 153/04 (July 2011) SW846 6010C

A dried, disaggregated solid sample is extracted with deionized water, the aqueous extract is separated from the solid, acidified and then analyzed using a ICP/OES.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

Reference Information

Methods Listed (if applicable):

ALS Test Code	Matrix	Test Description	Method Reference**
VOC-1,3-DCP-CALC-WT	Soil	Regulation 153 VOCs	SW8260B/SW8270C
VOC-511-HS-WT	Soil	VOC-O.Reg 153/04 (July 2011)	SW846 8260 (511)

Soil and sediment samples are extracted in methanol and analyzed by headspace-GC/MS.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011), unless a subset of the Analytical Test Group (ATG) has been requested (the Protocol states that all analytes in an ATG must be reported).

XYLENES-SUM-CALC-WT	Soil	Sum of Xylene Isomer Concentrations	CALCULATION

Total xylenes represents the sum of o-xylene and m&p-xylene.

**ALS test methods may incorporate modifications from specified reference methods to improve performance.

Chain of Custody numbers:

14-465016 14-465017 14-465018 14-465019

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
WT	ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA

GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.
mg/kg - milligrams per kilogram based on dry weight of sample
mg/kg wwt - milligrams per kilogram based on wet weight of sample
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight
mg/L - unit of concentration based on volume, parts per million.
< - Less than.
D.L. - The reporting limit.
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Application of guidelines is provided "as is" without warranty of any kind, either expressed or implied, including, but not limited to fitness for a particular purpose, or non-infringement. ALS assumes no responsibility for errors or omissions in the information.

Quality Control Report

Workorder: L1672015 Report Date: 22-SEP-15

Client: SPL CONSULTANTS LIMITED (Collingwood)
14 Ronell Crescent, Unit 1
Collingwood ON L9Y 4J7
Contact: NICOLE COLLINS

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
B-HWS-R511-WT	Soil							
Batch R3267134								
WG2171575-3 DUP		**L1672107-1**						
Boron (B), Hot Water Ext.		0.48	0.47		ug/g	1.1	40	16-SEP-15
WG2171575-2 IRM		**SALINITY_SOIL4**						
Boron (B), Hot Water Ext.			83.0		%		70-130	16-SEP-15
WG2171575-1 MB								
Boron (B), Hot Water Ext.			<0.10		ug/g		0.1	16-SEP-15
WG2171575-4 MS		**L1672107-1**						
Boron (B), Hot Water Ext.			87.2		%		60-140	16-SEP-15
CN-WAD-R511-WT	Soil							
Batch R3267097								
WG2171216-3 DUP		**L1672015-12**						
Cyanide, Weak Acid Diss		<0.050	<0.050	RPD-NA	ug/g	N/A	35	16-SEP-15
WG2171216-2 LCS								
Cyanide, Weak Acid Diss			94.1		%		80-120	16-SEP-15
WG2171216-1 MB								
Cyanide, Weak Acid Diss			<0.050		ug/g		0.05	16-SEP-15
WG2171216-4 MS		**L1672015-12**						
Cyanide, Weak Acid Diss			93.7		%		70-130	16-SEP-15
Batch R3268457								
WG2170709-3 DUP		**L1671979-1**						
Cyanide, Weak Acid Diss		<0.050	<0.050	RPD-NA	ug/g	N/A	35	17-SEP-15
WG2170709-2 LCS								
Cyanide, Weak Acid Diss			100.3		%		80-120	17-SEP-15
WG2170709-1 MB								
Cyanide, Weak Acid Diss			<0.050		ug/g		0.05	17-SEP-15
WG2170709-4 MS		**L1671979-1**						
Cyanide, Weak Acid Diss			91.4		%		70-130	17-SEP-15
CR-CR6-IC-WT	Soil							
Batch R3267157								
WG2171215-4 CRM		**WT-SQC012**						
Chromium, Hexavalent			85.0		%		70-130	16-SEP-15
WG2171215-3 DUP		**L1672015-2**						
Chromium, Hexavalent		<0.20	<0.20	RPD-NA	ug/g	N/A	35	16-SEP-15
WG2171215-2 LCS								
Chromium, Hexavalent			87.8		%		80-120	16-SEP-15
WG2171215-1 MB								
Chromium, Hexavalent			<0.20		ug/g		0.2	16-SEP-15

Quality Control Report

Client: SPL CONSULTANTS LIMITED (Collingwood)
14 Ronell Crescent, Unit 1
Collingwood ON L9Y 4J7
Contact: NICOLE COLLINS

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
EC-R511-WT	Soil							
Batch R3267005								
WG2171578-4 DUP		**WG2171578-3**						
Conductivity		0.0593	0.0681		mS/cm	14	20	16-SEP-15
WG2171760-1 LCS								
Conductivity			98.9		%		90-110	16-SEP-15
WG2171578-1 MB								
Conductivity			<0.0040		mS/cm		0.044	16-SEP-15
F1-HS-511-WT	Soil							
Batch R3266043								
WG2169950-4 DUP		**WG2169950-3**						
F1 (C6-C10)		<5.0	<5.0	RPD-NA	ug/g	N/A	50	15-SEP-15
WG2169950-2 LCS								
F1 (C6-C10)			89.9		%		80-120	15-SEP-15
WG2169950-1 MB								
F1 (C6-C10)			<5.0		ug/g		5	15-SEP-15
Surrogate: 3,4-Dichlorotoluene			82.9		%		60-140	15-SEP-15
WG2169950-7 MS		**WG2169950-6**						
F1 (C6-C10)			96.8		%		60-140	15-SEP-15
Batch R3266448								
WG2170539-4 DUP		**WG2170539-3**						
F1 (C6-C10)		<5.0	<5.0	RPD-NA	ug/g	N/A	50	15-SEP-15
WG2170539-2 LCS								
F1 (C6-C10)			100.4		%		80-120	15-SEP-15
WG2170539-1 MB								
F1 (C6-C10)			<5.0		ug/g		5	15-SEP-15
Surrogate: 3,4-Dichlorotoluene			84.9		%		60-140	15-SEP-15
WG2170539-7 MS		**WG2170539-6**						
F1 (C6-C10)			93.0		%		60-140	15-SEP-15
F2-F4-511-WT	Soil							
Batch R3267561								
WG2170737-3 CRM		**ALS PHC2 IRM**						
F2 (C10-C16)			103.8		%		70-130	16-SEP-15
F3 (C16-C34)			118.4		%		70-130	16-SEP-15
F4 (C34-C50)			123.5		%		70-130	16-SEP-15
WG2170737-5 DUP		**WG2170737-4**						
F2 (C10-C16)		<10	<10	RPD-NA	ug/g	N/A	40	16-SEP-15
F3 (C16-C34)		<50	<50	RPD-NA	ug/g	N/A	40	16-SEP-15
F4 (C34-C50)		<50	<50	RPD-NA	ug/g	N/A	40	16-SEP-15

Quality Control Report

Client: SPL CONSULTANTS LIMITED (Collingwood)
14 Ronell Crescent, Unit 1
Collingwood ON L9Y 4J7
Contact: NICOLE COLLINS

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
F2-F4-511-WT	Soil							
Batch R3267561								
WG2170737-2 LCS								
F2 (C10-C16)			93.8		%		80-120	16-SEP-15
F3 (C16-C34)			107.4		%		80-120	16-SEP-15
F4 (C34-C50)			108.6		%		80-120	16-SEP-15
WG2170737-1 MB								
F2 (C10-C16)			<10		ug/g		10	16-SEP-15
F3 (C16-C34)			<50		ug/g		50	16-SEP-15
F4 (C34-C50)			<50		ug/g		50	16-SEP-15
Surrogate: 2-Bromobenzotrifluoride			84.9		%		60-140	16-SEP-15
WG2170737-6 MS		**WG2170737-4**						
F2 (C10-C16)			89.5		%		60-140	16-SEP-15
F3 (C16-C34)			105.3		%		60-140	16-SEP-15
F4 (C34-C50)			110.5		%		60-140	16-SEP-15
Batch R3269040								
WG2169937-3 CRM		**ALS PHC2 IRM**						
F2 (C10-C16)			87.7		%		70-130	16-SEP-15
F3 (C16-C34)			109.2		%		70-130	16-SEP-15
F4 (C34-C50)			111.1		%		70-130	16-SEP-15
WG2169937-8 DUP		**WG2169937-7**						
F2 (C10-C16)		<10	<10	RPD-NA	ug/g	N/A	40	16-SEP-15
F3 (C16-C34)		<50	<50	RPD-NA	ug/g	N/A	40	16-SEP-15
F4 (C34-C50)		<50	<50	RPD-NA	ug/g	N/A	40	16-SEP-15
WG2169937-2 LCS								
F2 (C10-C16)			84.4		%		80-120	16-SEP-15
F3 (C16-C34)			108.3		%		80-120	16-SEP-15
F4 (C34-C50)			113.1		%		80-120	16-SEP-15
WG2169937-1 MB								
F2 (C10-C16)			<10		ug/g		10	16-SEP-15
F3 (C16-C34)			<50		ug/g		50	16-SEP-15
F4 (C34-C50)			<50		ug/g		50	16-SEP-15
Surrogate: 2-Bromobenzotrifluoride			87.0		%		60-140	16-SEP-15
WG2169937-9 MS		**WG2169937-7**						
F2 (C10-C16)			92.9		%		60-140	16-SEP-15
F3 (C16-C34)			111.9		%		60-140	16-SEP-15
F4 (C34-C50)			125.2		%		60-140	16-SEP-15
HG-200.2-CVAA-WT	Soil							

Quality Control Report

Client: SPL CONSULTANTS LIMITED (Collingwood)
14 Ronell Crescent, Unit 1
Collingwood ON L9Y 4J7
Contact: NICOLE COLLINS

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
HG-200.2-CVAA-WT	Soil							
Batch R3267026								
WG2171581-2 CRM		**WT-CANMET-TILL1**						
Mercury (Hg)			90.6		%		70-130	16-SEP-15
WG2171581-6 DUP		**WG2171581-5**						
Mercury (Hg)		<0.0050	<0.0050	RPD-NA	ug/g	N/A	40	16-SEP-15
WG2171581-4 LCS								
Mercury (Hg)			96.6		%		80-120	16-SEP-15
WG2171581-1 MB								
Mercury (Hg)			<0.0050		mg/kg		0.005	16-SEP-15
MET-200.2-CCMS-WT	Soil							
Batch R3268559								
WG2171581-2 CRM		**WT-CANMET-TILL1**						
Antimony (Sb)			114.6		%		70-130	16-SEP-15
Arsenic (As)			119.7		%		70-130	16-SEP-15
Barium (Ba)			122.1		%		70-130	16-SEP-15
Beryllium (Be)			113.2		%		70-130	16-SEP-15
Cadmium (Cd)			116.3		%		70-130	16-SEP-15
Chromium (Cr)			122.6		%		70-130	16-SEP-15
Cobalt (Co)			117.4		%		70-130	16-SEP-15
Copper (Cu)			113.9		%		70-130	16-SEP-15
Lead (Pb)			107.1		%		70-130	16-SEP-15
Molybdenum (Mo)			109.6		%		70-130	16-SEP-15
Nickel (Ni)			117.5		%		70-130	16-SEP-15
Selenium (Se)			102.6		%		70-130	16-SEP-15
Silver (Ag)			118.2		%		70-130	16-SEP-15
Thallium (Tl)			121.1		%		70-130	16-SEP-15
Uranium (U)			129.8		%		70-130	16-SEP-15
Vanadium (V)			125.1		%		70-130	16-SEP-15
Zinc (Zn)			115.8		%		70-130	16-SEP-15
WG2171581-6 DUP		**WG2171581-5**						
Antimony (Sb)		<0.10	<0.10	RPD-NA	ug/g	N/A	30	16-SEP-15
Arsenic (As)		0.62	0.51		ug/g	21	30	16-SEP-15
Barium (Ba)		8.83	7.28		ug/g	19	40	16-SEP-15
Beryllium (Be)		<0.10	<0.10	RPD-NA	ug/g	N/A	30	16-SEP-15
Boron (B)		<5.0	<5.0	RPD-NA	ug/g	N/A	30	16-SEP-15
Cadmium (Cd)		<0.020	<0.020	RPD-NA	ug/g	N/A	30	16-SEP-15

Quality Control Report

Client: SPL CONSULTANTS LIMITED (Collingwood)
14 Ronell Crescent, Unit 1
Collingwood ON L9Y 4J7
Contact: NICOLE COLLINS

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-200.2-CCMS-WT	Soil							
Batch R3268559								
WG2171581-6 DUP		**WG2171581-5**						
Chromium (Cr)		5.09	4.05		ug/g	23	30	16-SEP-15
Cobalt (Co)		1.30	1.14		ug/g	13	30	16-SEP-15
Copper (Cu)		1.13	1.01		ug/g	11	30	16-SEP-15
Lead (Pb)		1.18	0.77	J	ug/g	0.41	1	16-SEP-15
Molybdenum (Mo)		0.14	<0.10	RPD-NA	ug/g	N/A	40	16-SEP-15
Nickel (Ni)		3.65	3.10		ug/g	16	30	16-SEP-15
Selenium (Se)		<0.20	<0.20	RPD-NA	ug/g	N/A	30	16-SEP-15
Silver (Ag)		<0.10	<0.10	RPD-NA	ug/g	N/A	40	16-SEP-15
Thallium (Tl)		<0.050	<0.050	RPD-NA	ug/g	N/A	30	16-SEP-15
Uranium (U)		0.453	0.309	DUP-H	ug/g	38	30	16-SEP-15
Vanadium (V)		14.1	11.0		ug/g	25	30	16-SEP-15
Zinc (Zn)		4.8	4.4		ug/g	7.9	30	16-SEP-15
WG2171581-3 LCS								
Antimony (Sb)			115.3		%		80-120	16-SEP-15
Arsenic (As)			109.6		%		80-120	16-SEP-15
Barium (Ba)			111.5		%		80-120	16-SEP-15
Beryllium (Be)			110.7		%		80-120	16-SEP-15
Boron (B)			104.2		%		80-120	16-SEP-15
Cadmium (Cd)			113.7		%		80-120	16-SEP-15
Chromium (Cr)			107.7		%		80-120	16-SEP-15
Cobalt (Co)			108.4		%		80-120	16-SEP-15
Copper (Cu)			106.3		%		80-120	16-SEP-15
Lead (Pb)			111.3		%		80-120	16-SEP-15
Molybdenum (Mo)			112.5		%		80-120	16-SEP-15
Nickel (Ni)			107.0		%		80-120	16-SEP-15
Selenium (Se)			108.4		%		80-120	16-SEP-15
Silver (Ag)			116.4		%		80-120	16-SEP-15
Thallium (Tl)			114.3		%		80-120	16-SEP-15
Uranium (U)			113.6		%		80-120	16-SEP-15
Vanadium (V)			110.4		%		80-120	16-SEP-15
Zinc (Zn)			103.7		%		80-120	16-SEP-15
WG2171581-1 MB								
Antimony (Sb)			<0.10		mg/kg		0.1	16-SEP-15
Arsenic (As)			<0.10				0.1	

Quality Control Report

Client: SPL CONSULTANTS LIMITED (Collingwood)
14 Ronell Crescent, Unit 1
Collingwood ON L9Y 4J7
Contact: NICOLE COLLINS

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-200.2-CCMS-WT	Soil							
Batch R3268559								
WG2171581-1 MB								
Arsenic (As)			<0.10		mg/kg		0.1	16-SEP-15
Barium (Ba)			<0.50		mg/kg		0.5	16-SEP-15
Beryllium (Be)			<0.10		mg/kg		0.1	16-SEP-15
Boron (B)			<5.0		mg/kg		5	16-SEP-15
Cadmium (Cd)			<0.020		mg/kg		0.02	16-SEP-15
Chromium (Cr)			<0.50		mg/kg		0.5	16-SEP-15
Cobalt (Co)			<0.10		mg/kg		0.1	16-SEP-15
Copper (Cu)			<0.50		mg/kg		0.5	16-SEP-15
Lead (Pb)			<0.50		mg/kg		0.5	16-SEP-15
Molybdenum (Mo)			<0.10		mg/kg		0.1	16-SEP-15
Nickel (Ni)			<0.50		mg/kg		0.5	16-SEP-15
Selenium (Se)			<0.20		mg/kg		0.2	16-SEP-15
Silver (Ag)			<0.10		mg/kg		0.1	16-SEP-15
Thallium (Tl)			<0.050		mg/kg		0.05	16-SEP-15
Uranium (U)			<0.050		mg/kg		0.05	16-SEP-15
Vanadium (V)			<0.20		mg/kg		0.2	16-SEP-15
Zinc (Zn)			<2.0		mg/kg		2	16-SEP-15
MOISTURE-WT	Soil							
Batch R3265992								
WG2170362-3 DUP		**L1672015-8**						
% Moisture		19.7	19.3		%	2.2	20	15-SEP-15
WG2170362-2 LCS								
% Moisture			97.2		%		90-110	15-SEP-15
WG2170362-1 MB								
% Moisture			<0.10		%		0.1	15-SEP-15
Batch R3266783								
WG2170782-3 DUP		**L1672015-25**						
% Moisture		17.3	17.8		%	2.8	20	16-SEP-15
WG2170782-2 LCS								
% Moisture			104.1		%		90-110	16-SEP-15
WG2170782-1 MB								
% Moisture			<0.10		%		0.1	16-SEP-15

Quality Control Report

Client: SPL CONSULTANTS LIMITED (Collingwood)
14 Ronell Crescent, Unit 1
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Contact: NICOLE COLLINS

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MOISTURE-WT	Soil							
Batch R3266786								
WG2170740-3 DUP		**L1672015-27**						
% Moisture		21.4	21.5		%	0.8	20	16-SEP-15
WG2170740-2 LCS								
% Moisture			102.0		%		90-110	16-SEP-15
WG2170740-1 MB								
% Moisture			<0.10		%		0.1	16-SEP-15
Batch R3266788								
WG2171157-3 DUP		**L1672015-1**						
% Moisture		17.0	16.3		%	3.8	20	16-SEP-15
WG2171157-2 LCS								
% Moisture			96.2		%		90-110	16-SEP-15
WG2171157-1 MB								
% Moisture			<0.10		%		0.1	16-SEP-15
Batch R3271950								
WG2175261-2 LCS								
% Moisture			95.7		%		90-110	22-SEP-15
WG2175261-1 MB								
% Moisture			<0.10		%		0.1	22-SEP-15
PEST-OC-511-WT	Soil							
Batch R3269371								
WG2170719-4 DUP		**WG2170719-3**						
Aldrin		<0.020	<0.020	RPD-NA	ug/g	N/A	40	18-SEP-15
a-chlordane		<0.020	<0.020	RPD-NA	ug/g	N/A	40	18-SEP-15
g-chlordane		<0.020	<0.020	RPD-NA	ug/g	N/A	40	18-SEP-15
op-DDD		<0.020	<0.020	RPD-NA	ug/g	N/A	40	18-SEP-15
pp-DDD		<0.020	<0.020	RPD-NA	ug/g	N/A	40	18-SEP-15
o,p-DDE		<0.020	<0.020	RPD-NA	ug/g	N/A	40	18-SEP-15
pp-DDE		<0.020	<0.020	RPD-NA	ug/g	N/A	40	18-SEP-15
op-DDT		<0.020	<0.020	RPD-NA	ug/g	N/A	40	18-SEP-15
pp-DDT		<0.020	<0.020	RPD-NA	ug/g	N/A	40	18-SEP-15
Dieldrin		<0.020	<0.020	RPD-NA	ug/g	N/A	40	18-SEP-15
Endosulfan I		<0.020	<0.020	RPD-NA	ug/g	N/A	40	18-SEP-15
Endosulfan II		<0.020	<0.020	RPD-NA	ug/g	N/A	40	18-SEP-15
Endrin		<0.020	<0.020	RPD-NA	ug/g	N/A	40	18-SEP-15
gamma-hexachlorocyclohexane		<0.010	<0.010	RPD-NA	ug/g	N/A	40	18-SEP-15
Heptachlor		<0.020	<0.020	RPD-NA	ug/g	N/A	40	18-SEP-15

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Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PEST-OC-511-WT	Soil							
Batch R3269371								
WG2170719-4 DUP		**WG2170719-3**						
Heptachlor Epoxide		<0.020	<0.020	RPD-NA	ug/g	N/A	40	18-SEP-15
Hexachlorobenzene		<0.010	<0.010	RPD-NA	ug/g	N/A	40	18-SEP-15
Hexachlorobutadiene		<0.010	<0.010	RPD-NA	ug/g	N/A	40	18-SEP-15
Hexachloroethane		<0.010	<0.010	RPD-NA	ug/g	N/A	40	18-SEP-15
Methoxychlor		<0.020	<0.020	RPD-NA	ug/g	N/A	40	18-SEP-15
WG2170719-2 LCS								
Aldrin			106.1		%		50-140	18-SEP-15
a-chlordane			98.0		%		50-140	18-SEP-15
g-chlordane			101.1		%		50-140	18-SEP-15
op-DDD			88.4		%		50-140	18-SEP-15
pp-DDD			87.4		%		50-140	18-SEP-15
o,p-DDE			91.2		%		50-140	18-SEP-15
pp-DDE			89.1		%		50-140	18-SEP-15
op-DDT			100.6		%		50-140	18-SEP-15
pp-DDT			96.4		%		50-140	18-SEP-15
Dieldrin			91.8		%		50-140	18-SEP-15
Endosulfan I			94.2		%		50-140	18-SEP-15
Endosulfan II			96.6		%		50-140	18-SEP-15
Endrin			89.0		%		50-140	18-SEP-15
gamma-hexachlorocyclohexane			90.5		%		50-140	18-SEP-15
Heptachlor			91.2		%		50-140	18-SEP-15
Heptachlor Epoxide			93.9		%		50-140	18-SEP-15
Hexachlorobenzene			88.2		%		50-140	18-SEP-15
Hexachlorobutadiene			93.2		%		50-140	18-SEP-15
Hexachloroethane			90.9		%		50-140	18-SEP-15
Methoxychlor			87.4		%		50-140	18-SEP-15
WG2170719-1 MB								
Aldrin			<0.020		ug/g		0.02	18-SEP-15
a-chlordane			<0.020		ug/g		0.02	18-SEP-15
g-chlordane			<0.020		ug/g		0.02	18-SEP-15
op-DDD			<0.020		ug/g		0.02	18-SEP-15
pp-DDD			<0.020		ug/g		0.02	18-SEP-15
o,p-DDE			<0.020		ug/g		0.02	18-SEP-15
pp-DDE			<0.020		ug/g		0.02	18-SEP-15

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14 Ronell Crescent, Unit 1
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Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PEST-OC-511-WT	Soil							
Batch	**R3269371**							
WG2170719-1	**MB**							
op-DDT			<0.020		ug/g		0.02	18-SEP-15
pp-DDT			<0.020		ug/g		0.02	18-SEP-15
Dieldrin			<0.020		ug/g		0.02	18-SEP-15
Endosulfan I			<0.020		ug/g		0.02	18-SEP-15
Endosulfan II			<0.020		ug/g		0.02	18-SEP-15
Endrin			<0.020		ug/g		0.02	18-SEP-15
gamma-hexachlorocyclohexane			<0.010		ug/g		0.01	18-SEP-15
Heptachlor			<0.020		ug/g		0.02	18-SEP-15
Heptachlor Epoxide			<0.020		ug/g		0.02	18-SEP-15
Hexachlorobenzene			<0.010		ug/g		0.01	18-SEP-15
Hexachlorobutadiene			<0.010		ug/g		0.01	18-SEP-15
Hexachloroethane			<0.010		ug/g		0.01	18-SEP-15
Methoxychlor			<0.020		ug/g		0.02	18-SEP-15
Surrogate: 2-Fluorobiphenyl			101.0		%		50-140	18-SEP-15
Surrogate: d14-Terphenyl			101.9		%		50-140	18-SEP-15
WG2170719-5	**MS**	**WG2170719-3**						
Aldrin			101.0		%		50-140	18-SEP-15
a-chlordane			101.3		%		50-140	18-SEP-15
g-chlordane			111.9		%		50-140	18-SEP-15
op-DDD			96.7		%		50-140	18-SEP-15
pp-DDD			94.6		%		50-140	18-SEP-15
o,p-DDE			102.4		%		50-140	18-SEP-15
pp-DDE			97.8		%		50-140	18-SEP-15
op-DDT			110.1		%		50-140	18-SEP-15
pp-DDT			104.0		%		50-140	18-SEP-15
Dieldrin			92.2		%		50-140	18-SEP-15
Endosulfan I			98.1		%		50-140	18-SEP-15
Endosulfan II			90.3		%		50-140	18-SEP-15
Endrin			106.8		%		50-150	18-SEP-15
gamma-hexachlorocyclohexane			87.6		%		50-140	18-SEP-15
Heptachlor			95.8		%		50-140	18-SEP-15
Heptachlor Epoxide			99.7		%		50-140	18-SEP-15
Hexachlorobenzene			86.5		%		50-140	18-SEP-15
Hexachlorobutadiene			93.3		%		50-140	18-SEP-15

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Contact: NICOLE COLLINS

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PEST-OC-511-WT	Soil							
Batch R3269371								
WG2170719-5 MS		WG2170719-3						
Hexachloroethane			91.3		%		50-140	18-SEP-15
Methoxychlor			95.3		%		50-140	18-SEP-15
Batch R3270747								
WG2170866-4 DUP		WG2170866-3						
Aldrin		<0.020	<0.020	RPD-NA	ug/g	N/A	40	21-SEP-15
a-chlordane		<0.020	<0.020	RPD-NA	ug/g	N/A	40	21-SEP-15
g-chlordane		<0.020	<0.020	RPD-NA	ug/g	N/A	40	21-SEP-15
op-DDD		<0.020	<0.020	RPD-NA	ug/g	N/A	40	21-SEP-15
pp-DDD		<0.020	<0.020	RPD-NA	ug/g	N/A	40	21-SEP-15
o,p-DDE		<0.020	<0.020	RPD-NA	ug/g	N/A	40	21-SEP-15
pp-DDE		<0.020	<0.020	RPD-NA	ug/g	N/A	40	21-SEP-15
op-DDT		<0.020	<0.020	RPD-NA	ug/g	N/A	40	21-SEP-15
pp-DDT		<0.020	<0.020	RPD-NA	ug/g	N/A	40	21-SEP-15
Dieldrin		<0.020	<0.020	RPD-NA	ug/g	N/A	40	21-SEP-15
Endosulfan I		<0.020	<0.020	RPD-NA	ug/g	N/A	40	21-SEP-15
Endosulfan II		<0.020	<0.020	RPD-NA	ug/g	N/A	40	21-SEP-15
Endrin		<0.020	<0.020	RPD-NA	ug/g	N/A	40	21-SEP-15
gamma-hexachlorocyclohexane		<0.010	<0.010	RPD-NA	ug/g	N/A	40	21-SEP-15
Heptachlor		<0.020	<0.020	RPD-NA	ug/g	N/A	40	21-SEP-15
Heptachlor Epoxide		<0.020	<0.020	RPD-NA	ug/g	N/A	40	21-SEP-15
Hexachlorobenzene		<0.010	<0.010	RPD-NA	ug/g	N/A	40	21-SEP-15
Hexachlorobutadiene		<0.010	<0.010	RPD-NA	ug/g	N/A	40	21-SEP-15
Hexachloroethane		<0.010	<0.010	RPD-NA	ug/g	N/A	40	21-SEP-15
Methoxychlor		<0.020	<0.020	RPD-NA	ug/g	N/A	40	21-SEP-15
WG2170866-2 LCS								
Aldrin			95.4		%		50-140	21-SEP-15
a-chlordane			97.2		%		50-140	21-SEP-15
g-chlordane			101.1		%		50-140	21-SEP-15
op-DDD			90.6		%		50-140	21-SEP-15
pp-DDD			93.6		%		50-140	21-SEP-15
o,p-DDE			86.4		%		50-140	21-SEP-15
pp-DDE			92.9		%		50-140	21-SEP-15
op-DDT			98.5		%		50-140	21-SEP-15

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Client: SPL CONSULTANTS LIMITED (Collingwood)
14 Ronell Crescent, Unit 1
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Contact: NICOLE COLLINS

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PEST-OC-511-WT	Soil							
Batch	**R3270747**							
WG2170866-2	**LCS**							
pp-DDT			95.7		%		50-140	21-SEP-15
Dieldrin			87.4		%		50-140	21-SEP-15
Endosulfan I			89.0		%		50-140	21-SEP-15
Endosulfan II			92.4		%		50-140	21-SEP-15
Endrin			122.0		%		50-140	21-SEP-15
gamma-hexachlorocyclohexane			92.6		%		50-140	21-SEP-15
Heptachlor			92.7		%		50-140	21-SEP-15
Heptachlor Epoxide			95.7		%		50-140	21-SEP-15
Hexachlorobenzene			89.9		%		50-140	21-SEP-15
Hexachlorobutadiene			95.7		%		50-140	21-SEP-15
Hexachloroethane			95.2		%		50-140	21-SEP-15
Methoxychlor			101.0		%		50-140	21-SEP-15
WG2170866-1	**MB**							
Aldrin			<0.020		ug/g		0.02	21-SEP-15
a-chlordane			<0.020		ug/g		0.02	21-SEP-15
g-chlordane			<0.020		ug/g		0.02	21-SEP-15
op-DDD			<0.020		ug/g		0.02	21-SEP-15
pp-DDD			<0.020		ug/g		0.02	21-SEP-15
o,p-DDE			<0.020		ug/g		0.02	21-SEP-15
pp-DDE			<0.020		ug/g		0.02	21-SEP-15
op-DDT			<0.020		ug/g		0.02	21-SEP-15
pp-DDT			<0.020		ug/g		0.02	21-SEP-15
Dieldrin			<0.020		ug/g		0.02	21-SEP-15
Endosulfan I			<0.020		ug/g		0.02	21-SEP-15
Endosulfan II			<0.020		ug/g		0.02	21-SEP-15
Endrin			<0.020		ug/g		0.02	21-SEP-15
gamma-hexachlorocyclohexane			<0.010		ug/g		0.01	21-SEP-15
Heptachlor			<0.020		ug/g		0.02	21-SEP-15
Heptachlor Epoxide			<0.020		ug/g		0.02	21-SEP-15
Hexachlorobenzene			<0.010		ug/g		0.01	21-SEP-15
Hexachlorobutadiene			<0.010		ug/g		0.01	21-SEP-15
Hexachloroethane			<0.010		ug/g		0.01	21-SEP-15
Methoxychlor			<0.020		ug/g		0.02	21-SEP-15
Surrogate: 2-Fluorobiphenyl			91.9		%		50-140	21-SEP-15

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Client: SPL CONSULTANTS LIMITED (Collingwood)
14 Ronell Crescent, Unit 1
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Contact: NICOLE COLLINS

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PEST-OC-511-WT	Soil							
Batch R3270747								
WG2170866-1 MB								
Surrogate: d14-Terphenyl			93.1		%		50-140	21-SEP-15
WG2170866-5 MS		**WG2170866-3**						
Aldrin			94.6		%		50-140	21-SEP-15
a-chlordane			96.5		%		50-140	21-SEP-15
g-chlordane			101.8		%		50-140	21-SEP-15
op-DDD			92.8		%		50-140	21-SEP-15
pp-DDD			96.8		%		50-140	21-SEP-15
o,p-DDE			89.7		%		50-140	21-SEP-15
pp-DDE			94.7		%		50-140	21-SEP-15
op-DDT			92.1		%		50-140	21-SEP-15
pp-DDT			89.4		%		50-140	21-SEP-15
Dieldrin			94.1		%		50-140	21-SEP-15
Endosulfan I			80.8		%		50-140	21-SEP-15
Endosulfan II			97.3		%		50-140	21-SEP-15
Endrin			107.2		%		50-150	21-SEP-15
gamma-hexachlorocyclohexane			87.7		%		50-140	21-SEP-15
Heptachlor			82.4		%		50-140	21-SEP-15
Heptachlor Epoxide			97.7		%		50-140	21-SEP-15
Hexachlorobenzene			83.8		%		50-140	21-SEP-15
Hexachlorobutadiene			88.1		%		50-140	21-SEP-15
Hexachloroethane			86.0		%		50-140	21-SEP-15
Methoxychlor			93.8		%		50-140	21-SEP-15
PH-R511-WT	Soil							
Batch R3267065								
WG2171079-1 DUP		**L1672015-2**						
pH		7.96	7.95	J	pH units	0.01	0.3	16-SEP-15
WG2171755-2 LCS								
pH			7.05		pH units		6.7-7.3	16-SEP-15
Batch R3269545								
WG2171253-1 DUP		**L1672015-10**						
pH		7.67	7.70	J	pH units	0.03	0.3	18-SEP-15
WG2173681-1 LCS								
pH			6.97		pH units		6.7-7.3	18-SEP-15
SAR-R511-WT	Soil							

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Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
SAR-R511-WT	Soil							
Batch R3267169								
WG2171578-4 DUP		**WG2171578-3**						
Calcium (Ca)		20.1	18.4		mg/L	8.6	40	16-SEP-15
Sodium (Na)		<1.0	<1.0	RPD-NA	mg/L	N/A	40	16-SEP-15
Magnesium (Mg)		<1.0	<1.0	RPD-NA	mg/L	N/A	40	16-SEP-15
WG2171578-2 IRM		**WT SAR1**						
Calcium (Ca)			97.0		%		70-130	16-SEP-15
Sodium (Na)			98.5		%		70-130	16-SEP-15
Magnesium (Mg)			95.6		%		70-130	16-SEP-15
WG2171578-1 MB								
Calcium (Ca)			<1.0		mg/L		1	16-SEP-15
Sodium (Na)			<1.0		mg/L		1	16-SEP-15
Magnesium (Mg)			<1.0		mg/L		1	16-SEP-15
VOC-511-HS-WT	Soil							
Batch R3266043								
WG2169950-4 DUP		**WG2169950-3**						
1,1,1,2-Tetrachloroethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	17-SEP-15
1,1,2,2-Tetrachloroethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	17-SEP-15
1,1,1-Trichloroethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	17-SEP-15
1,1,2-Trichloroethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	17-SEP-15
1,1-Dichloroethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	17-SEP-15
1,1-Dichloroethylene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	17-SEP-15
1,2-Dibromoethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	17-SEP-15
1,2-Dichlorobenzene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	17-SEP-15
1,2-Dichloroethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	17-SEP-15
1,2-Dichloropropane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	17-SEP-15
1,3-Dichlorobenzene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	17-SEP-15
1,4-Dichlorobenzene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	17-SEP-15
Acetone		<0.50	<0.50	RPD-NA	ug/g	N/A	40	17-SEP-15
Benzene		<0.0068	<0.0068	RPD-NA	ug/g	N/A	40	17-SEP-15
Bromodichloromethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	17-SEP-15
Bromoform		<0.050	<0.050	RPD-NA	ug/g	N/A	40	17-SEP-15
Bromomethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	17-SEP-15
Carbon tetrachloride		<0.050	<0.050	RPD-NA	ug/g	N/A	40	17-SEP-15
Chlorobenzene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	17-SEP-15

Quality Control Report

Client: SPL CONSULTANTS LIMITED (Collingwood)
14 Ronell Crescent, Unit 1
Collingwood ON L9Y 4J7
Contact: NICOLE COLLINS

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
VOC-511-HS-WT	Soil							
Batch R3266043								
WG2169950-4 DUP		**WG2169950-3**						
Chloroform		<0.050	<0.050	RPD-NA	ug/g	N/A	40	17-SEP-15
cis-1,2-Dichloroethylene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	17-SEP-15
cis-1,3-Dichloropropene		<0.030	<0.030	RPD-NA	ug/g	N/A	40	17-SEP-15
Dibromochloromethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	17-SEP-15
Dichlorodifluoromethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	17-SEP-15
Ethylbenzene		<0.018	<0.018	RPD-NA	ug/g	N/A	40	17-SEP-15
n-Hexane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	17-SEP-15
Methylene Chloride		<0.050	<0.050	RPD-NA	ug/g	N/A	40	17-SEP-15
MTBE		<0.050	<0.050	RPD-NA	ug/g	N/A	40	17-SEP-15
m+p-Xylenes		<0.030	<0.030	RPD-NA	ug/g	N/A	40	17-SEP-15
Methyl Ethyl Ketone		<0.50	<0.50	RPD-NA	ug/g	N/A	40	17-SEP-15
Methyl Isobutyl Ketone		<0.50	<0.50	RPD-NA	ug/g	N/A	40	17-SEP-15
o-Xylene		<0.020	<0.020	RPD-NA	ug/g	N/A	40	17-SEP-15
Styrene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	17-SEP-15
Tetrachloroethylene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	17-SEP-15
Toluene		<0.080	<0.080	RPD-NA	ug/g	N/A	40	17-SEP-15
trans-1,2-Dichloroethylene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	17-SEP-15
trans-1,3-Dichloropropene		<0.030	<0.030	RPD-NA	ug/g	N/A	40	17-SEP-15
Trichloroethylene		0.032	0.033		ug/g	3.5	40	17-SEP-15
Trichlorofluoromethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	17-SEP-15
Vinyl chloride		<0.020	<0.020	RPD-NA	ug/g	N/A	40	17-SEP-15
WG2169950-2 LCS								
1,1,1,2-Tetrachloroethane			96.3		%		60-130	15-SEP-15
1,1,2,2-Tetrachloroethane			99.5		%		60-130	15-SEP-15
1,1,1-Trichloroethane			98.3		%		60-130	15-SEP-15
1,1,2-Trichloroethane			98.8		%		60-130	15-SEP-15
1,1-Dichloroethane			96.9		%		60-130	15-SEP-15
1,1-Dichloroethylene			91.0		%		60-130	15-SEP-15
1,2-Dibromoethane			97.4		%		70-130	15-SEP-15
1,2-Dichlorobenzene			100.6		%		70-130	15-SEP-15
1,2-Dichloroethane			98.3		%		60-130	15-SEP-15
1,2-Dichloropropane			99.5		%		70-130	15-SEP-15
1,3-Dichlorobenzene			98.9		%		70-130	15-SEP-15

Quality Control Report

Client: SPL CONSULTANTS LIMITED (Collingwood)
14 Ronell Crescent, Unit 1
Collingwood ON L9Y 4J7
Contact: NICOLE COLLINS

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
VOC-511-HS-WT	Soil							
Batch R3266043								
WG2169950-2 LCS								
1,4-Dichlorobenzene			101.9		%		70-130	15-SEP-15
Acetone			115.0		%		60-140	15-SEP-15
Benzene			98.7		%		70-130	15-SEP-15
Bromodichloromethane			96.1		%		50-140	15-SEP-15
Bromoform			96.6		%		70-130	15-SEP-15
Bromomethane			85.7		%		50-140	15-SEP-15
Carbon tetrachloride			96.2		%		70-130	15-SEP-15
Chlorobenzene			99.2		%		70-130	15-SEP-15
Chloroform			98.9		%		70-130	15-SEP-15
cis-1,2-Dichloroethylene			98.1		%		70-130	15-SEP-15
cis-1,3-Dichloropropene			97.1		%		70-130	15-SEP-15
Dibromochloromethane			100.9		%		60-130	15-SEP-15
Dichlorodifluoromethane			49.5	MES	%		50-140	15-SEP-15
Ethylbenzene			93.4		%		70-130	15-SEP-15
n-Hexane			100.2		%		70-130	15-SEP-15
Methylene Chloride			98.8		%		70-130	15-SEP-15
MTBE			95.8		%		70-130	15-SEP-15
m+p-Xylenes			95.4		%		70-130	15-SEP-15
Methyl Ethyl Ketone			110.7		%		60-140	15-SEP-15
Methyl Isobutyl Ketone			104.1		%		60-140	15-SEP-15
o-Xylene			93.7		%		70-130	15-SEP-15
Styrene			93.4		%		70-130	15-SEP-15
Tetrachloroethylene			95.6		%		60-130	15-SEP-15
Toluene			96.1		%		70-130	15-SEP-15
trans-1,2-Dichloroethylene			98.3		%		60-130	15-SEP-15
trans-1,3-Dichloropropene			93.2		%		70-130	15-SEP-15
Trichloroethylene			97.0		%		60-130	15-SEP-15
Trichlorofluoromethane			91.5		%		50-140	15-SEP-15
Vinyl chloride			77.3		%		60-140	15-SEP-15
WG2169950-1 MB								
1,1,1,2-Tetrachloroethane			<0.050		ug/g		0.05	15-SEP-15
1,1,2,2-Tetrachloroethane			<0.050		ug/g		0.05	15-SEP-15
1,1,1-Trichloroethane			<0.050		ug/g		0.05	15-SEP-15
1,1,2-Trichloroethane			<0.050		ug/g		0.05	15-SEP-15

Quality Control Report

Client: SPL CONSULTANTS LIMITED (Collingwood)
14 Ronell Crescent, Unit 1
Collingwood ON L9Y 4J7
Contact: NICOLE COLLINS

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
VOC-511-HS-WT	Soil							
Batch R3266043								
WG2169950-1 MB								
1,1-Dichloroethane			<0.050		ug/g		0.05	15-SEP-15
1,1-Dichloroethylene			<0.050		ug/g		0.05	15-SEP-15
1,2-Dibromoethane			<0.050		ug/g		0.05	15-SEP-15
1,2-Dichlorobenzene			<0.050		ug/g		0.05	15-SEP-15
1,2-Dichloroethane			<0.050		ug/g		0.05	15-SEP-15
1,2-Dichloropropane			<0.050		ug/g		0.05	15-SEP-15
1,3-Dichlorobenzene			<0.050		ug/g		0.05	15-SEP-15
1,4-Dichlorobenzene			<0.050		ug/g		0.05	15-SEP-15
Acetone			<0.50		ug/g		0.5	15-SEP-15
Benzene			<0.0068		ug/g		0.0068	15-SEP-15
Bromodichloromethane			<0.050		ug/g		0.05	15-SEP-15
Bromoform			<0.050		ug/g		0.05	15-SEP-15
Bromomethane			<0.050		ug/g		0.05	15-SEP-15
Carbon tetrachloride			<0.050		ug/g		0.05	15-SEP-15
Chlorobenzene			<0.050		ug/g		0.05	15-SEP-15
Chloroform			<0.050		ug/g		0.05	15-SEP-15
cis-1,2-Dichloroethylene			<0.050		ug/g		0.05	15-SEP-15
cis-1,3-Dichloropropene			<0.030		ug/g		0.03	15-SEP-15
Dibromochloromethane			<0.050		ug/g		0.05	15-SEP-15
Dichlorodifluoromethane			<0.050		ug/g		0.05	15-SEP-15
Ethylbenzene			<0.018		ug/g		0.018	15-SEP-15
n-Hexane			<0.050		ug/g		0.05	15-SEP-15
Methylene Chloride			<0.050		ug/g		0.05	15-SEP-15
MTBE			<0.050		ug/g		0.05	15-SEP-15
m+p-Xylenes			<0.030		ug/g		0.03	15-SEP-15
Methyl Ethyl Ketone			<0.50		ug/g		0.5	15-SEP-15
Methyl Isobutyl Ketone			<0.50		ug/g		0.5	15-SEP-15
o-Xylene			<0.020		ug/g		0.02	15-SEP-15
Styrene			<0.050		ug/g		0.05	15-SEP-15
Tetrachloroethylene			<0.050		ug/g		0.05	15-SEP-15
Toluene			<0.080		ug/g		0.08	15-SEP-15
trans-1,2-Dichloroethylene			<0.050		ug/g		0.05	15-SEP-15
trans-1,3-Dichloropropene			<0.030		ug/g		0.03	15-SEP-15

Quality Control Report

Client: SPL CONSULTANTS LIMITED (Collingwood)
14 Ronell Crescent, Unit 1
Collingwood ON L9Y 4J7
Contact: NICOLE COLLINS

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
VOC-511-HS-WT	Soil							
Batch	**R3266043**							
WG2169950-1	**MB**							
Trichloroethylene			<0.010		ug/g		0.01	15-SEP-15
Trichlorofluoromethane			<0.050		ug/g		0.05	15-SEP-15
Vinyl chloride			<0.020		ug/g		0.02	15-SEP-15
Surrogate: 1,4-Difluorobenzene			106.6		%		70-130	15-SEP-15
Surrogate: 4-Bromofluorobenzene			103.3		%		70-130	15-SEP-15
WG2169950-5	**MS**	**WG2169950-3**						
1,1,1,2-Tetrachloroethane			104.1		%		50-140	17-SEP-15
1,1,2,2-Tetrachloroethane			106.5		%		50-140	17-SEP-15
1,1,1-Trichloroethane			102.9		%		50-140	17-SEP-15
1,1,2-Trichloroethane			109.3		%		50-140	17-SEP-15
1,1-Dichloroethane			102.5		%		50-140	17-SEP-15
1,1-Dichloroethylene			94.4		%		50-140	17-SEP-15
1,2-Dibromoethane			105.1		%		50-140	17-SEP-15
1,2-Dichlorobenzene			98.2		%		50-140	17-SEP-15
1,2-Dichloroethane			101.9		%		50-140	17-SEP-15
1,2-Dichloropropane			102.7		%		50-140	17-SEP-15
1,3-Dichlorobenzene			92.9		%		50-140	17-SEP-15
1,4-Dichlorobenzene			95.5		%		50-140	17-SEP-15
Acetone			126.7		%		50-140	17-SEP-15
Benzene			103.2		%		50-140	17-SEP-15
Bromodichloromethane			104.0		%		50-140	17-SEP-15
Bromoform			101.9		%		50-140	17-SEP-15
Bromomethane			86.9		%		50-140	17-SEP-15
Carbon tetrachloride			99.5		%		50-140	17-SEP-15
Chlorobenzene			101.7		%		50-140	17-SEP-15
Chloroform			103.9		%		50-140	17-SEP-15
cis-1,2-Dichloroethylene			100.4		%		50-140	17-SEP-15
cis-1,3-Dichloropropene			89.1		%		50-140	17-SEP-15
Dibromochloromethane			108.5		%		50-140	17-SEP-15
Dichlorodifluoromethane			44.6	MES	%		50-140	17-SEP-15
Ethylbenzene			92.0		%		50-140	17-SEP-15
n-Hexane			103.2		%		50-140	17-SEP-15
Methylene Chloride			104.8		%		50-140	17-SEP-15
MTBE			97.3		%		50-140	17-SEP-15

Client: SPL CONSULTANTS LIMITED (Collingwood)
14 Ronell Crescent, Unit 1
Collingwood ON L9Y 4J7
Contact: NICOLE COLLINS

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
VOC-511-HS-WT	Soil							
Batch R3266043								
WG2169950-5 MS		**WG2169950-3**						
m+p-Xylenes			94.3		%		50-140	17-SEP-15
Methyl Ethyl Ketone			102.1		%		50-140	17-SEP-15
Methyl Isobutyl Ketone			95.3		%		50-140	17-SEP-15
o-Xylene			91.9		%		50-140	17-SEP-15
Styrene			87.5		%		50-140	17-SEP-15
Tetrachloroethylene			94.7		%		50-140	17-SEP-15
Toluene			95.5		%		50-140	17-SEP-15
trans-1,2-Dichloroethylene			102.6		%		50-140	17-SEP-15
trans-1,3-Dichloropropene			87.4		%		50-140	17-SEP-15
Trichloroethylene			98.2		%		50-140	17-SEP-15
Trichlorofluoromethane			95.4		%		50-140	17-SEP-15
Vinyl chloride			78.9		%		50-140	17-SEP-15
Batch R3266448								
WG2170539-4 DUP		**WG2170539-3**						
1,1,1,2-Tetrachloroethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	15-SEP-15
1,1,2,2-Tetrachloroethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	15-SEP-15
1,1,1-Trichloroethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	15-SEP-15
1,1,2-Trichloroethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	15-SEP-15
1,1-Dichloroethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	15-SEP-15
1,1-Dichloroethylene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	15-SEP-15
1,2-Dibromoethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	15-SEP-15
1,2-Dichlorobenzene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	15-SEP-15
1,2-Dichloroethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	15-SEP-15
1,2-Dichloropropane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	15-SEP-15
1,3-Dichlorobenzene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	15-SEP-15
1,4-Dichlorobenzene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	15-SEP-15
Acetone		<0.50	<0.50	RPD-NA	ug/g	N/A	40	15-SEP-15
Benzene		<0.020	<0.0068	RPD-NA	ug/g	N/A	40	15-SEP-15
Bromodichloromethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	15-SEP-15
Bromoform		<0.050	<0.050	RPD-NA	ug/g	N/A	40	15-SEP-15
Bromomethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	15-SEP-15
Carbon tetrachloride		<0.050	<0.050	RPD-NA	ug/g	N/A	40	15-SEP-15
Chlorobenzene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	15-SEP-15

Quality Control Report

Client: SPL CONSULTANTS LIMITED (Collingwood)
14 Ronell Crescent, Unit 1
Collingwood ON L9Y 4J7
Contact: NICOLE COLLINS

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
VOC-511-HS-WT	Soil							
Batch R3266448								
WG2170539-4 DUP		**WG2170539-3**						
Chloroform		<0.050	<0.050	RPD-NA	ug/g	N/A	40	15-SEP-15
cis-1,2-Dichloroethylene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	15-SEP-15
cis-1,3-Dichloropropene		<0.030	<0.030	RPD-NA	ug/g	N/A	40	15-SEP-15
Dibromochloromethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	15-SEP-15
Dichlorodifluoromethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	15-SEP-15
Ethylbenzene		<0.050	<0.018	RPD-NA	ug/g	N/A	40	15-SEP-15
n-Hexane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	15-SEP-15
Methylene Chloride		<0.050	<0.050	RPD-NA	ug/g	N/A	40	15-SEP-15
MTBE		<0.050	<0.050	RPD-NA	ug/g	N/A	40	15-SEP-15
m+p-Xylenes		<0.030	<0.030	RPD-NA	ug/g	N/A	40	15-SEP-15
Methyl Ethyl Ketone		<0.50	<0.50	RPD-NA	ug/g	N/A	40	15-SEP-15
Methyl Isobutyl Ketone		<0.50	<0.50	RPD-NA	ug/g	N/A	40	15-SEP-15
o-Xylene		<0.020	<0.020	RPD-NA	ug/g	N/A	40	15-SEP-15
Styrene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	15-SEP-15
Tetrachloroethylene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	15-SEP-15
Toluene		<0.20	<0.080	RPD-NA	ug/g	N/A	40	15-SEP-15
trans-1,2-Dichloroethylene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	15-SEP-15
trans-1,3-Dichloropropene		<0.030	<0.030	RPD-NA	ug/g	N/A	40	15-SEP-15
Trichloroethylene		<0.050	<0.010	RPD-NA	ug/g	N/A	40	15-SEP-15
Trichlorofluoromethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	15-SEP-15
Vinyl chloride		<0.020	<0.020	RPD-NA	ug/g	N/A	40	15-SEP-15
WG2170539-2 LCS								
1,1,1,2-Tetrachloroethane			100.3		%		60-130	15-SEP-15
1,1,2,2-Tetrachloroethane			105.7		%		60-130	15-SEP-15
1,1,1-Trichloroethane			103.5		%		60-130	15-SEP-15
1,1,2-Trichloroethane			104.0		%		60-130	15-SEP-15
1,1-Dichloroethane			101.2		%		60-130	15-SEP-15
1,1-Dichloroethylene			88.9		%		60-130	15-SEP-15
1,2-Dibromoethane			99.7		%		70-130	15-SEP-15
1,2-Dichlorobenzene			97.8		%		70-130	15-SEP-15
1,2-Dichloroethane			120.3		%		60-130	15-SEP-15
1,2-Dichloropropane			103.0		%		70-130	15-SEP-15
1,3-Dichlorobenzene			93.3		%		70-130	15-SEP-15

Quality Control Report

Client: SPL CONSULTANTS LIMITED (Collingwood)
14 Ronell Crescent, Unit 1
Collingwood ON L9Y 4J7
Contact: NICOLE COLLINS

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
VOC-511-HS-WT	Soil							
Batch	**R3266448**							
WG2170539-2	**LCS**							
1,4-Dichlorobenzene			98.3		%		70-130	15-SEP-15
Acetone			121.9		%		60-140	15-SEP-15
Benzene			97.9		%		70-130	15-SEP-15
Bromodichloromethane			106.5		%		50-140	15-SEP-15
Bromoform			107.1		%		70-130	15-SEP-15
Bromomethane			87.0		%		50-140	15-SEP-15
Carbon tetrachloride			100.0		%		70-130	15-SEP-15
Chlorobenzene			96.7		%		70-130	15-SEP-15
Chloroform			107.5		%		70-130	15-SEP-15
cis-1,2-Dichloroethylene			98.7		%		70-130	15-SEP-15
cis-1,3-Dichloropropene			115.7		%		70-130	15-SEP-15
Dibromochloromethane			106.3		%		60-130	15-SEP-15
Dichlorodifluoromethane			33.8	RRQC	%		50-140	15-SEP-15
Ethylbenzene			79.7		%		70-130	15-SEP-15
n-Hexane			89.0		%		70-130	15-SEP-15
Methylene Chloride			101.2		%		70-130	15-SEP-15
MTBE			89.0		%		70-130	15-SEP-15
m+p-Xylenes			85.4		%		70-130	15-SEP-15
Methyl Ethyl Ketone			108.7		%		60-140	15-SEP-15
Methyl Isobutyl Ketone			89.6		%		60-140	15-SEP-15
o-Xylene			83.4		%		70-130	15-SEP-15
Styrene			89.0		%		70-130	15-SEP-15
Tetrachloroethylene			90.0		%		60-130	15-SEP-15
Toluene			83.6		%		70-130	15-SEP-15
trans-1,2-Dichloroethylene			98.3		%		60-130	15-SEP-15
trans-1,3-Dichloropropene			95.5		%		70-130	15-SEP-15
Trichloroethylene			95.8		%		60-130	15-SEP-15
Trichlorofluoromethane			91.1		%		50-140	15-SEP-15
Vinyl chloride			66.9		%		60-140	15-SEP-15
COMMENTS: RRQC-Although recoveries failed to meet ALS DQO's samples are believed to be unaffected.								
WG2170539-1	**MB**							
1,1,1,2-Tetrachloroethane			<0.050		ug/g		0.05	15-SEP-15
1,1,2,2-Tetrachloroethane			<0.050		ug/g		0.05	15-SEP-15
1,1,1-Trichloroethane			<0.050		ug/g		0.05	15-SEP-15

Quality Control Report

Client: SPL CONSULTANTS LIMITED (Collingwood)
14 Ronell Crescent, Unit 1
Collingwood ON L9Y 4J7
Contact: NICOLE COLLINS

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
VOC-511-HS-WT	Soil							
Batch R3266448								
WG2170539-1 MB								
1,1,2-Trichloroethane			<0.050		ug/g		0.05	15-SEP-15
1,1-Dichloroethane			<0.050		ug/g		0.05	15-SEP-15
1,1-Dichloroethylene			<0.050		ug/g		0.05	15-SEP-15
1,2-Dibromoethane			<0.050		ug/g		0.05	15-SEP-15
1,2-Dichlorobenzene			<0.050		ug/g		0.05	15-SEP-15
1,2-Dichloroethane			<0.050		ug/g		0.05	15-SEP-15
1,2-Dichloropropane			<0.050		ug/g		0.05	15-SEP-15
1,3-Dichlorobenzene			<0.050		ug/g		0.05	15-SEP-15
1,4-Dichlorobenzene			<0.050		ug/g		0.05	15-SEP-15
Acetone			<0.50		ug/g		0.5	15-SEP-15
Benzene			<0.0068		ug/g		0.0068	15-SEP-15
Bromodichloromethane			<0.050		ug/g		0.05	15-SEP-15
Bromoform			<0.050		ug/g		0.05	15-SEP-15
Bromomethane			<0.050		ug/g		0.05	15-SEP-15
Carbon tetrachloride			<0.050		ug/g		0.05	15-SEP-15
Chlorobenzene			<0.050		ug/g		0.05	15-SEP-15
Chloroform			<0.050		ug/g		0.05	15-SEP-15
cis-1,2-Dichloroethylene			<0.050		ug/g		0.05	15-SEP-15
cis-1,3-Dichloropropene			<0.030		ug/g		0.03	15-SEP-15
Dibromochloromethane			<0.050		ug/g		0.05	15-SEP-15
Dichlorodifluoromethane			<0.050		ug/g		0.05	15-SEP-15
Ethylbenzene			<0.018		ug/g		0.018	15-SEP-15
n-Hexane			<0.050		ug/g		0.05	15-SEP-15
Methylene Chloride			<0.050		ug/g		0.05	15-SEP-15
MTBE			<0.050		ug/g		0.05	15-SEP-15
m+p-Xylenes			<0.030		ug/g		0.03	15-SEP-15
Methyl Ethyl Ketone			<0.50		ug/g		0.5	15-SEP-15
Methyl Isobutyl Ketone			<0.50		ug/g		0.5	15-SEP-15
o-Xylene			<0.020		ug/g		0.02	15-SEP-15
Styrene			<0.050		ug/g		0.05	15-SEP-15
Tetrachloroethylene			<0.050		ug/g		0.05	15-SEP-15
Toluene			<0.080		ug/g		0.08	15-SEP-15
trans-1,2-Dichloroethylene			<0.050		ug/g		0.05	15-SEP-15

Quality Control Report

Client: SPL CONSULTANTS LIMITED (Collingwood)
14 Ronell Crescent, Unit 1
Collingwood ON L9Y 4J7
Contact: NICOLE COLLINS

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
VOC-511-HS-WT	Soil							
Batch	**R3266448**							
WG2170539-1	**MB**							
trans-1,3-Dichloropropene			<0.030		ug/g		0.03	15-SEP-15
Trichloroethylene			<0.010		ug/g		0.01	15-SEP-15
Trichlorofluoromethane			<0.050		ug/g		0.05	15-SEP-15
Vinyl chloride			<0.020		ug/g		0.02	15-SEP-15
Surrogate: 1,4-Difluorobenzene			110.9		%		70-130	15-SEP-15
Surrogate: 4-Bromofluorobenzene			108.9		%		70-130	15-SEP-15
WG2170539-5	**MS**	**WG2170539-3**						
1,1,1,2-Tetrachloroethane			94.4		%		50-140	15-SEP-15
1,1,2,2-Tetrachloroethane			99.0		%		50-140	15-SEP-15
1,1,1-Trichloroethane			90.2		%		50-140	15-SEP-15
1,1,2-Trichloroethane			100.3		%		50-140	15-SEP-15
1,1-Dichloroethane			89.8		%		50-140	15-SEP-15
1,1-Dichloroethylene			81.6		%		50-140	15-SEP-15
1,2-Dibromoethane			97.9		%		50-140	15-SEP-15
1,2-Dichlorobenzene			92.6		%		50-140	15-SEP-15
1,2-Dichloroethane			100.6		%		50-140	15-SEP-15
1,2-Dichloropropane			93.6		%		50-140	15-SEP-15
1,3-Dichlorobenzene			87.9		%		50-140	15-SEP-15
1,4-Dichlorobenzene			88.2		%		50-140	15-SEP-15
Acetone			117.5		%		50-140	15-SEP-15
Benzene			89.6		%		50-140	15-SEP-15
Bromodichloromethane			91.8		%		50-140	15-SEP-15
Bromoform			96.8		%		50-140	15-SEP-15
Bromomethane			81.5		%		50-140	15-SEP-15
Carbon tetrachloride			86.0		%		50-140	15-SEP-15
Chlorobenzene			92.7		%		50-140	15-SEP-15
Chloroform			92.6		%		50-140	15-SEP-15
cis-1,2-Dichloroethylene			90.4		%		50-140	15-SEP-15
cis-1,3-Dichloropropene			102.2		%		50-140	15-SEP-15
Dibromochloromethane			100.1		%		50-140	15-SEP-15
Dichlorodifluoromethane			28.3	RRQC	%		50-140	15-SEP-15
Ethylbenzene			84.9		%		50-140	15-SEP-15
n-Hexane			84.4		%		50-140	15-SEP-15
Methylene Chloride			91.7		%		50-140	15-SEP-15

Quality Control Report

Client: SPL CONSULTANTS LIMITED (Collingwood)
14 Ronell Crescent, Unit 1
Collingwood ON L9Y 4J7
Contact: NICOLE COLLINS

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
VOC-511-HS-WT	Soil							
Batch R3266448								
WG2170539-5 MS		**WG2170539-3**						
MTBE			85.2		%		50-140	15-SEP-15
m+p-Xylenes			84.8		%		50-140	15-SEP-15
Methyl Ethyl Ketone			98.2		%		50-140	15-SEP-15
Methyl Isobutyl Ketone			81.8		%		50-140	15-SEP-15
o-Xylene			88.0		%		50-140	15-SEP-15
Styrene			91.1		%		50-140	15-SEP-15
Tetrachloroethylene			90.5		%		50-140	15-SEP-15
Toluene			86.7		%		50-140	15-SEP-15
trans-1,2-Dichloroethylene			90.4		%		50-140	15-SEP-15
trans-1,3-Dichloropropene			93.5		%		50-140	15-SEP-15
Trichloroethylene			87.6		%		50-140	15-SEP-15
Trichlorofluoromethane			82.1		%		50-140	15-SEP-15
Vinyl chloride			67.1		%		50-140	15-SEP-15

COMMENTS: RRQC-Although recoveries failed to meet ALS DQO's samples are believed to be unaffected.

Quality Control Report

Workorder: L1672015 Report Date: 22-SEP-15

Client: SPL CONSULTANTS LIMITED (Collingwood)
14 Ronell Crescent, Unit 1
Collingwood ON L9Y 4J7
Contact: NICOLE COLLINS

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
DUP-H	Duplicate results outside ALS DQO, due to sample heterogeneity.
J	Duplicate results and limits are expressed in terms of absolute difference.
MES	Data Quality Objective was marginally exceeded (by < 10% absolute) for < 10% of analytes in a Multi-Element Scan / Multi-Parameter Scan (considered acceptable as per OMOE & CCME).
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.
RRQC	Refer to report remarks for information regarding this QC result.

Hold Time Exceedances:

All test results reported with this submission were conducted within ALS recommended hold times.

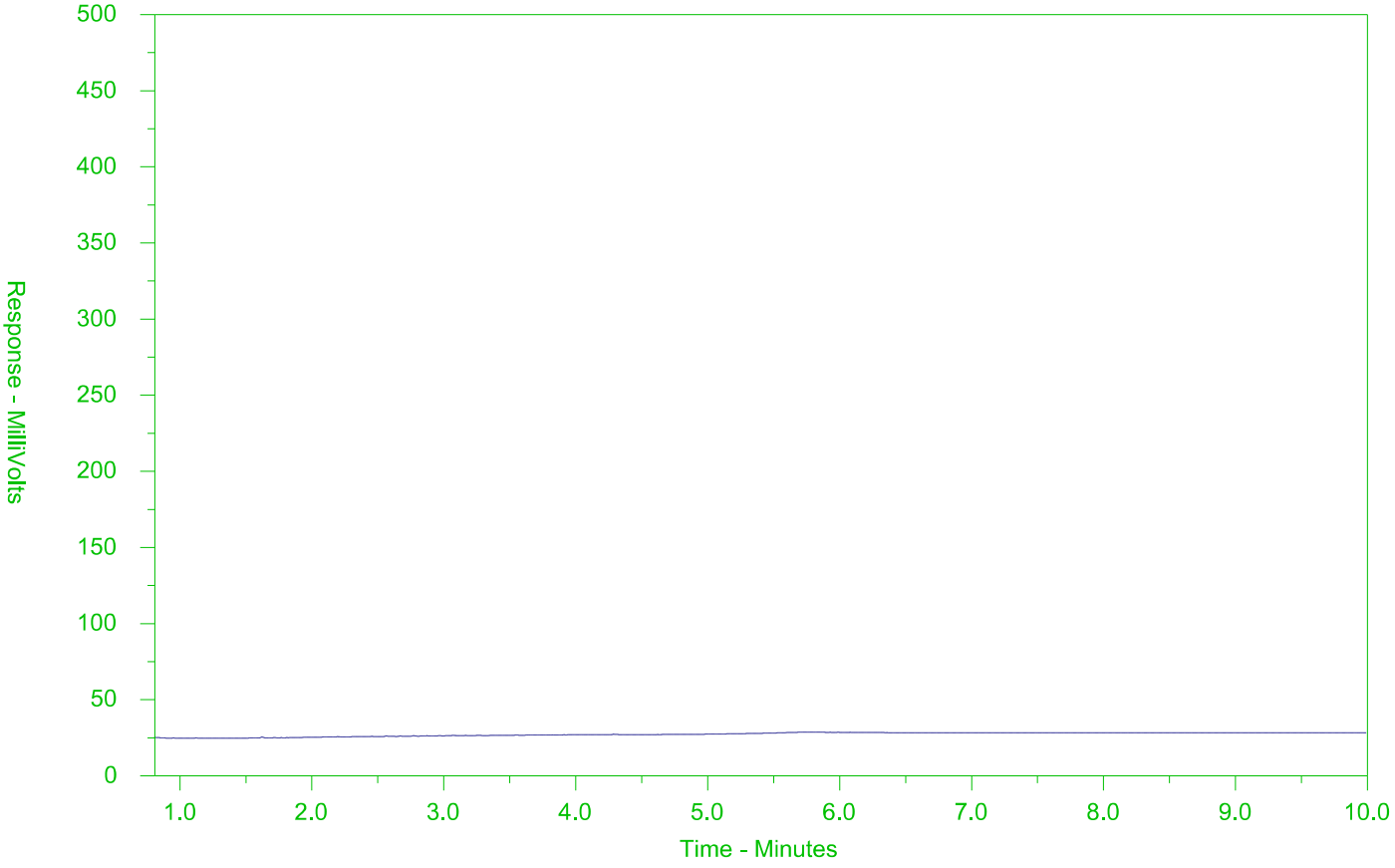
ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L1672015-3
Client Sample ID: BH15-01 SS5



← F2 →	← F3 →	← F4 →	
nC10	nC16	nC34	nC50
174°C	287°C	481°C	75°C
346°F	549°F	898°F	1067°F
← Gasoline →		← Motor Oils/ Lube Oils/ Grease →	
← Diesel/ Jet Fuels →			

The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

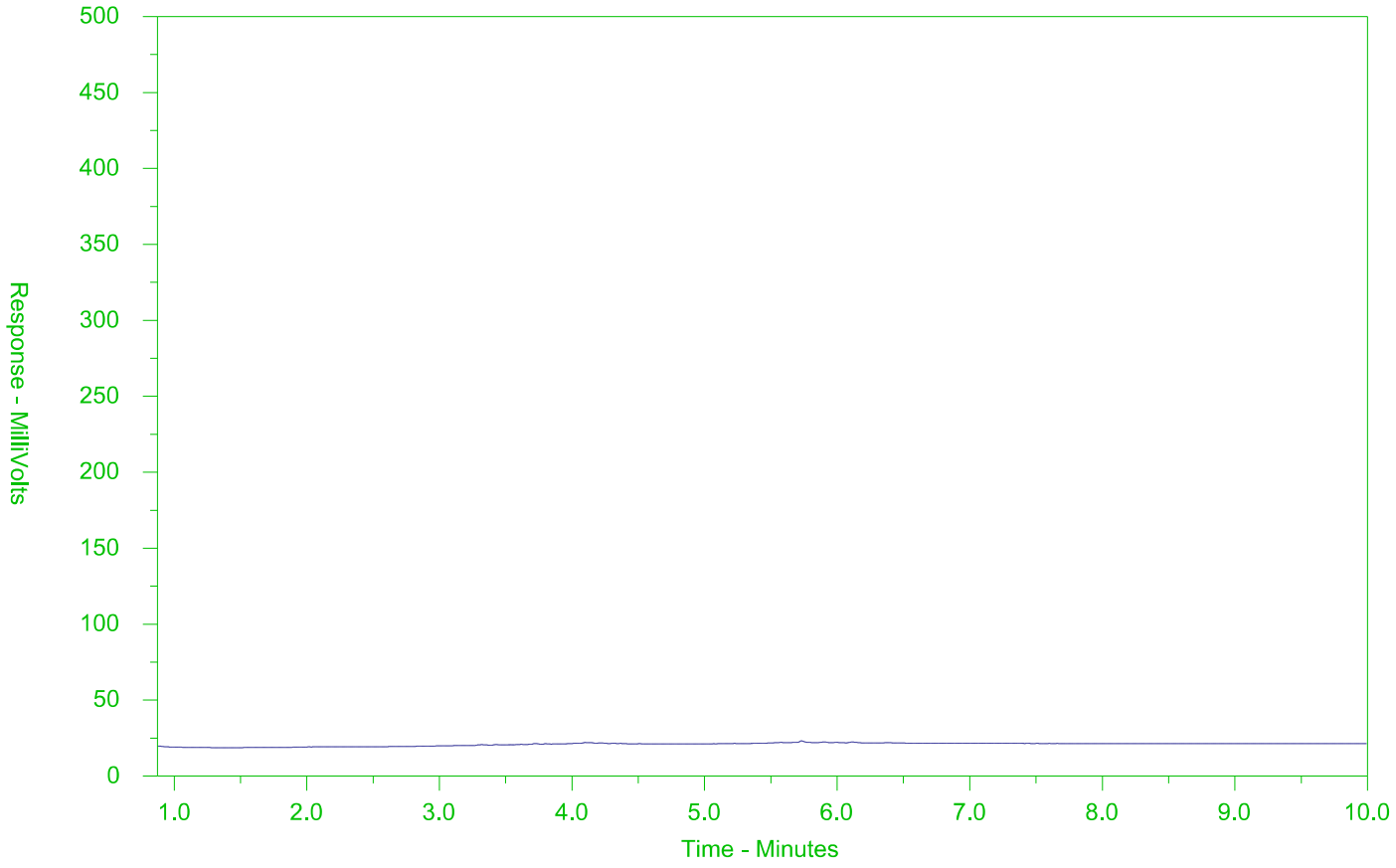
The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor and the scale at the left.

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F4 method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR Library can be found at www.alsglobal.com.

CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L1672015-8
Client Sample ID: BH15-03 SS8



← F2 →	← F3 →	← F4 →	
nC10	nC16	nC34	nC50
174°C	287°C	481°C	75°C
346°F	549°F	898°F	1067°F
← Gasoline →		← Motor Oils/ Lube Oils/ Grease →	
← Diesel/ Jet Fuels →			

The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

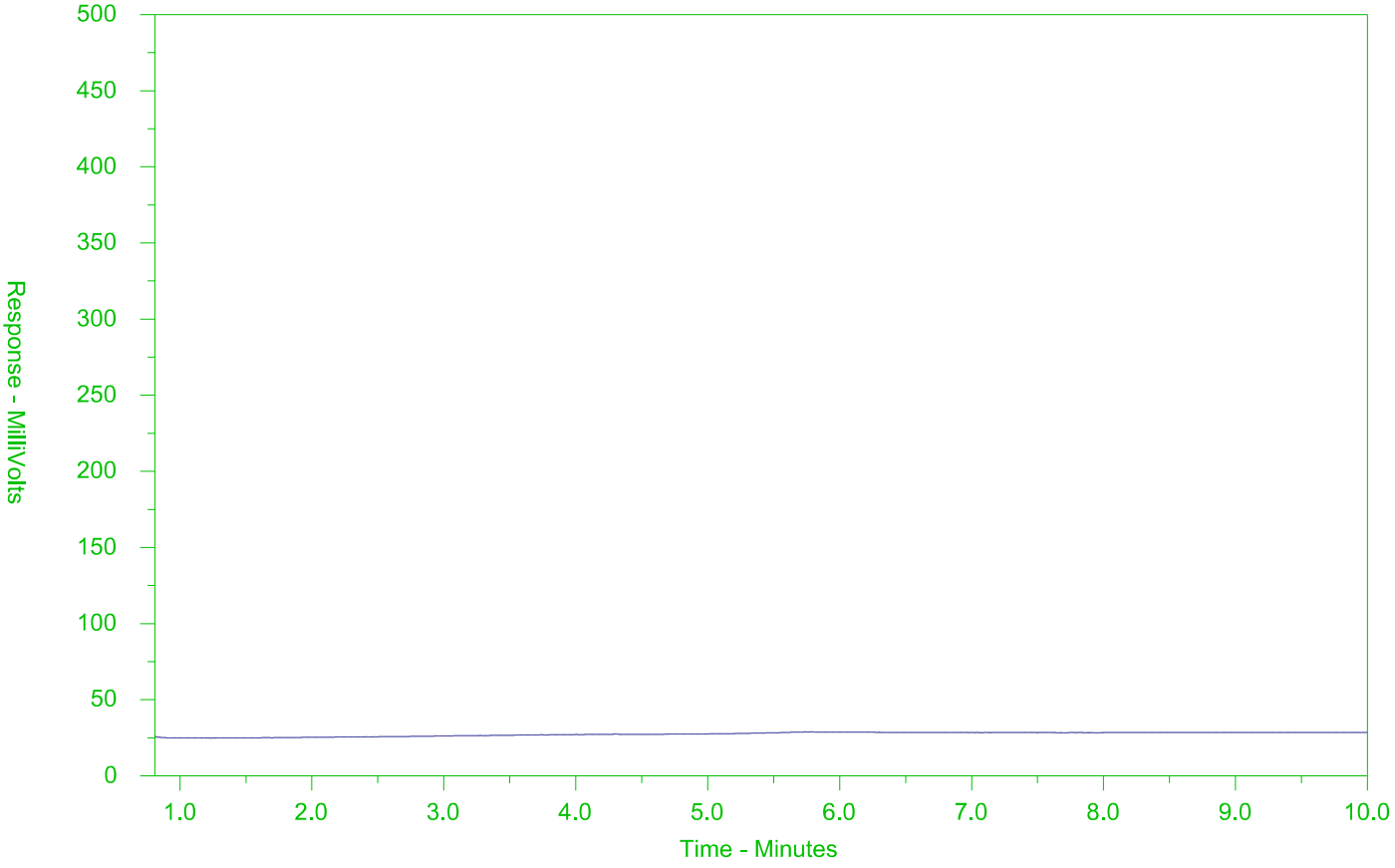
The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor and the scale at the left.

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F4 method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR Library can be found at www.alsglobal.com.

CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L1672015-17
Client Sample ID: BH15-06 SS4



← F2 →	← F3 →	← F4 →	
nC10	nC16	nC34	nC50
174°C	287°C	481°C	75°C
346°F	549°F	898°F	1067°F
← Gasoline →		← Motor Oils/ Lube Oils/ Grease →	
← Diesel/ Jet Fuels →			

The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

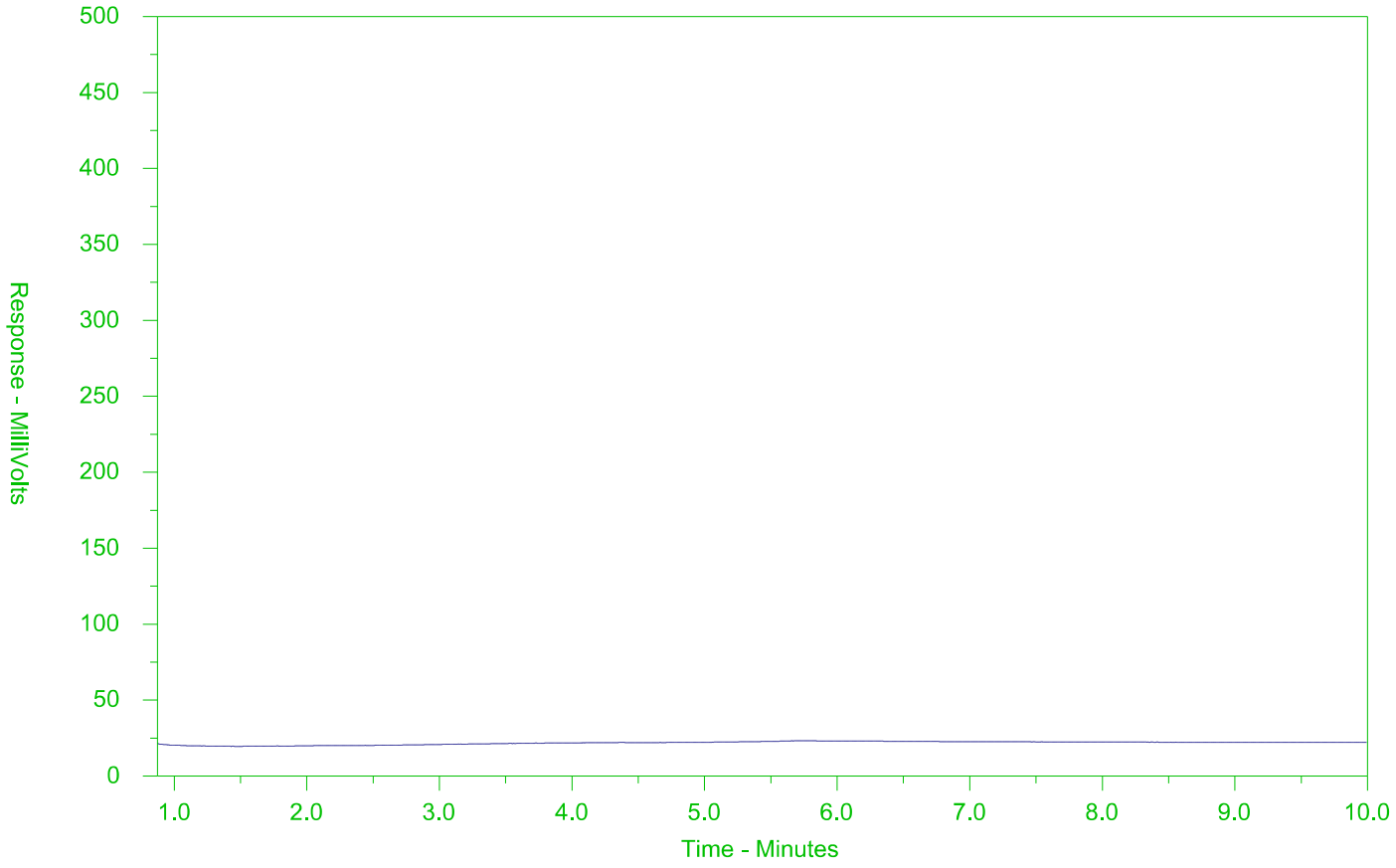
The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor and the scale at the left.

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F4 method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR Library can be found at www.alsglobal.com.

CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L1672015-20
Client Sample ID: BH15-07 SS5



← F2 →	← F3 →	← F4 →	
nC10	nC16	nC34	nC50
174°C	287°C	481°C	75°C
346°F	549°F	898°F	1067°F
← Gasoline →		← Motor Oils/ Lube Oils/ Grease →	
← Diesel/ Jet Fuels →			

The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

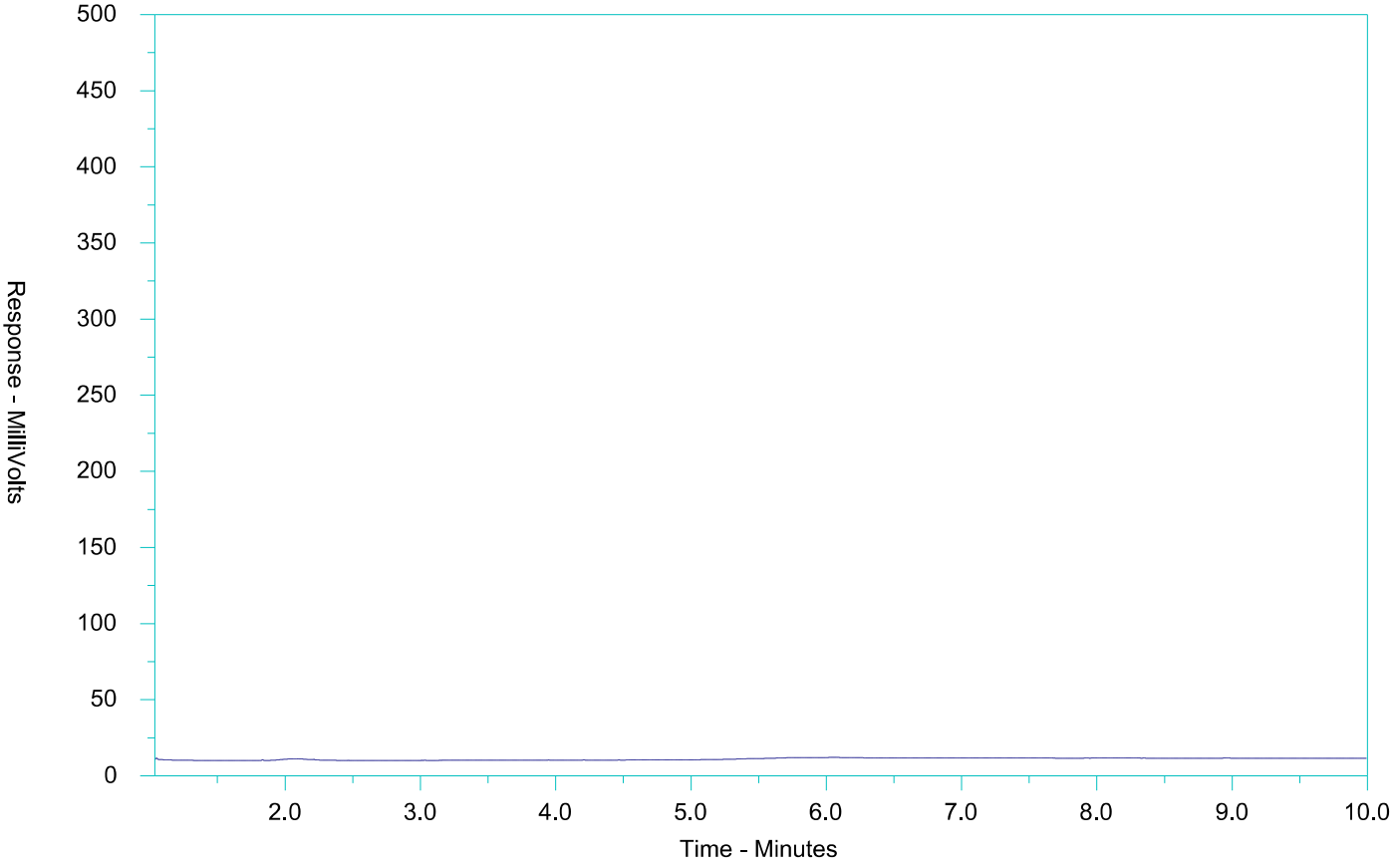
The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor and the scale at the left.

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F4 method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR Library can be found at www.alsglobal.com.

CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L1672015-27
Client Sample ID: BH15-09 SS6



← F2 →	← F3 →	← F4 →	
nC10	nC16	nC34	nC50
174°C	287°C	481°C	75°C
346°F	549°F	898°F	1067°F
← Gasoline →		← Motor Oils/ Lube Oils/ Grease →	
← Diesel/ Jet Fuels →			

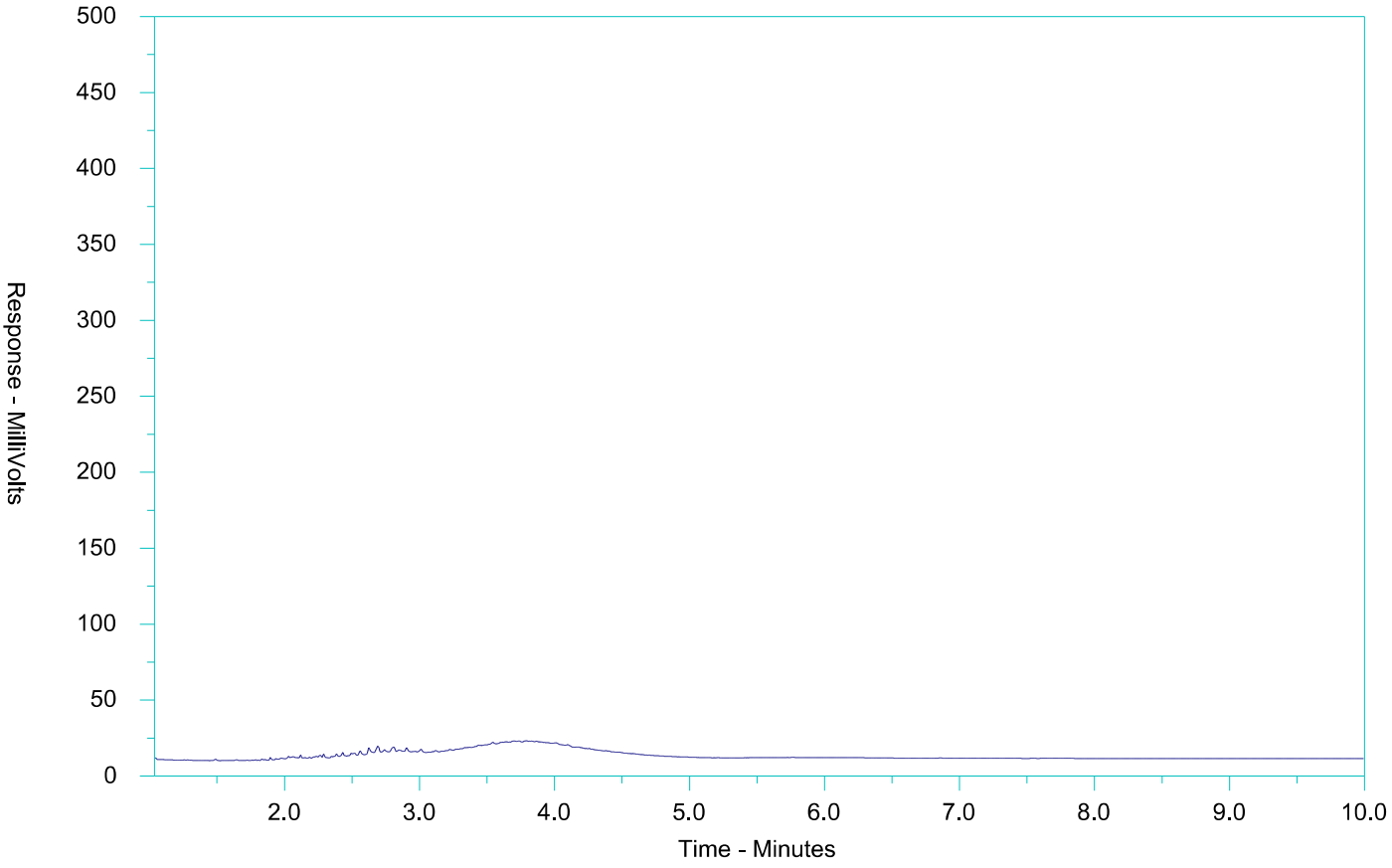
The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor and the scale at the left.

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F4 method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR Library can be found at www.alsglobal.com.

ALS Sample ID: L1672015-33
Client Sample ID: BH15-12 SS5



ALS www.alsglobal.com

Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

L1672015-COFC

COC Number: 14 - 465018

Page 1 of 4

Report To		Report Format / Distribution		Select Service Level Below (Rush Turnaround Time (TAT) is not available for all tests)
Company:	SPL Consultants Limited	Select Report Format:	☒ PDF ☒ EXCEL ☐ EDD (DIGITAL)	R ☒ Regular (Standard TAT if received by 3pm)
Contact:	Nicole Collins	Quality Control (QC) Report with Report	☒ Yes ☐ No	P ☐ Priority (2-4 business days if received by 3pm)
Address:	14 Ronell Cres. Unit 1 Collingwood, ON	☐ Criteria on Report - provide details below if box checked		E ☐ Emergency (1-2 business days if received by 3pm)
Phone:	(705) 445-0064	Select Distribution:	☒ EMAIL ☐ MAIL ☐ FAX	E2 ☐ Same day or weekend emergency if received by 10am – contact ALS for surcharge.
		Email 1 or Fax	ncollins@splconsultants.ca	Specify Date Required for E2,E or P:
		Email 2	gjarvis@splconsultants.ca	

Invoice To		Invoice Distribution	
	Same as Report To ☐ Yes ☒ No	Select Invoice Distribution:	☒ EMAIL ☐ MAIL ☐ FAX
	Copy of Invoice with Report ☐ Yes ☐ No	Email 1 or Fax	accounts@splconsultants.ca
Company:	SPL Consultants Limited	Email 2	
Contact:	Saren Jensen		

Project Information		Oil and Gas Required Fields (client use)	
ALS Quote #:		Approver ID:	Cost Center:
Job #:	10002397	GL Account:	Routing Code:
PO / AFE:		Activity Code:	
LSD:		Location:	
ALS Lab Work Order # (lab use only)		ALS Contact: Emerson Perez	Sampler: NC

Analysis Request — Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Metals	OC Pest	PHCs	VOCs	Number of Containers
1	BH15-01 SS1	09/09/15	AM	Soil		X			
2	BH15-01 SS2	↓	↓		X	X			
3	BH15-01 SS5	↓	↓				X	X	
4	BH15-02 SS1	09/08/15	PM			X			
5	BH15-02 SS2	↓	↓		X	X			
6	BH15-03 SS1	09/08/15	PM			X			
7	BH15-03 SS2	↓	↓		X	X			
8	BH15-03 SS8	↓	↓				X	X	
9	BH15-04 SS1	09/08/15	AM			X			
10	BH15-04 SS2	↓	↓		X	X			
11	BH15-05 SS1	09/08/15	AM			X			
12	BH15-05 SS2	↓	↓	↓	X				

Drinking Water (DW) Samples[1] (client use)	Special Instructions / Specify Criteria to add on report (client Use)
Are samples taken from a Regulated DW System? ☐ Yes ☒ No	Please compare to Table 9 for residential
Are samples for human drinking water use? ☐ Yes ☒ No	

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen	☐	SIF Observations	Yes ☐	No ☐
Ice packs	Yes ☒	No ☐	Custody seal intact	Yes ☒ No ☐
Cooling Initiated	☐			

INITIAL COOLER TEMPERATURES °C		FINAL COOLER TEMPERATURES °C			
8.1			4.9		

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by: Nicole Collins	Date: 09/10/15	Time: 1:00pm	Received by:	Date: 11-SEP-15	Time: 12:10	Received by:	Date: 11/9/15	Time: 18:05

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

PUROLATOR 330531533595

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LSD:		Location:	
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ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Metals	OC Pest	PHCs	VOCs									Number of Containers
13	BH15-05 SS3	09/08/15	AM	Soil		X											
14	BH15-06 SS1	09/04/15	AM			X											
15	BH15-06 SS2	↓	↓		X												
16	BH15-06 SS3					X											
17	BH15-06 SS4						X	X									
18	BH15-07 SS1	09/04/15	AM			X											
19	BH15-07 SS2	↓	↓		X	X											
20	BH15-07 SS5						X	X									
21	BH15-08 SS1	09/03/15	AM			X											
22	BH15-08 SS2	↓	↓		X												
23	BH15-08 ~~SS5~~ SS3					X											
24	BH15-09 SS1	09/03/15	AM	↓		X											

Drinking Water (DW) Samples[1] (client use)	Special Instructions / Specify Criteria to add on report (client Use)
Are samples taken from a Regulated DW System? Yes No	Please compere to Table 9 residential
Are samples for human drinking water use? Yes No	

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen		SIF Observations	Yes	No	
Ice packs	Yes No	Custody seal intact	Yes	No	
Cooling Initiated					

INITIAL COOLER TEMPERATURES °C		FINAL COOLER TEMPERATURES °C	
8.1		4.9	

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by:	Date:	Time:	Received by:	Date:	Time:	Received by:	Date:	Time:
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ALS Lab Work Order # (lab use only):		ALS Contact:	Sampler:

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25	BHIS-09 SS2	09/03/15	AM	Soil	X	X			
26	BHIS-09 SS3	↓	↓		X	X			
27	BHIS-09 SS6	↓	↓				X	X	
28	BHIS-10 SS1	09/03/15	PM			X			
29	BHIS-10 SS2	↓	↓		X	X			
30	BHIS-12 SS1	09/09/15	AM			X			
31	BHIS-12 SS2	↓	↓		X				
32	BHIS-12 SS3	↓	↓			X			
33	BHIS-12 SS5	↓	↓				X	X	
34	DUP 1					X			
35	DUP 2							X	
36	DUP 3			↓		X			

Drinking Water (DW) Samples[1] (client use)	Special Instructions / Specify Criteria to add on report (client Use)
Are samples taken from a Regulated DW System? Yes No	Please compare to Table 9 residential
Are samples for human drinking water use? Yes No	

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen		SIF Observations	Yes	No	
Ice packs	Yes X	No	Custody seal intact	Yes X	No
Cooling Initiated					

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		
8.1			4.1		

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by:	Date:	Time:	Received by:	Date:	Time:	Received by:	Date:	Time:
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Address:	14 Ronell Cres, Unit 7 Collingwood, ON	☐ Criteria on Report - provide details below if box checked		E ☐ Emergency (1-2 business days if received by 3pm)
Phone:	(705) 445-0064	Select Distribution:	☐ EMAIL ☐ MAIL ☐ FAX	E2 ☐ Same day or weekend emergency if received by 10am – contact ALS for surcharge.
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Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	OC Pest	Number of Containers
37	DUP 4			soil	X	
38	DUP 5			↓	X	

Drinking Water (DW) Samples[1] (client use)	Special Instructions / Specify Criteria to add on report (client Use)
Are samples taken from a Regulated DW System? ☐ Yes ☒ No	Please compare to Table 9 residential
Are samples for human drinking water use? ☐ Yes ☒ No	

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen	☐		SIF Observations	Yes	☐	No	☐
Ice packs	Yes ☒	No ☐	Custody seal intact	Yes	☐	No	☐
Cooling Initiated	☐						

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		
8.1			4.9		

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by:	Date:	Time:	Received by:	Date:	Time:	Received by:	Date:	Time:
Nicole Collins	09/10/15	1:00pm	[illegible]	11-SEP-15	12:10	[illegible]	11/9/15	15:05

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Water Balance Assessment

31 Marlwood Avenue

Town of Wasaga Beach

Prepared for:
Loft Planning Inc.

Prepared by:
Azimuth Environmental
Consulting, Inc.

Updated February 2020

AEC 15-273

AZIMUTH ENVIRONMENTAL CONSULTING, INC.

Environmental Assessments & Approvals

February 5th 2020 AEC 15-273

Loft Planning Inc.
P.O. Box 246 STN MAIN
Collingwood, Ontario
L9Y 3Z5

Attention: Kristine Loft, MCIP RPP

Re: **Water Balance Assessment**
31 Marlwood Avenue, Town of Wasaga Beach, Ontario

Dear Ms. Loft:

Azimuth Environmental Consulting, Inc. (Azimuth) is pleased to provide our Water Balance Assessment for the property located at 31 Marlwood Avenue within the Town of Wasaga Beach (the "Site"). This evaluation focused on the existing soil and ground water regime underlying the Site and the potential for the proposed development to impact the existing conditions. The Water Balance Assessment has been revised to reflect recent changes to the Site Plan.

Should you have any questions or wish to discuss the report in greater detail, please do not hesitate to contact the undersigned.

Yours truly,
AZIMUTH ENVIRONMENTAL CONSULTING, INC.

JMillington

Jennifer Millington, M.A.Sc., P.Geo.
Hydrogeologist

Mike Jones, M.Sc., P.Geo.
President

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1.0 INTRODUCTION

Azimuth Environmental Consulting, Inc. ("Azimuth") has been retained by Loft Planning Inc. to conduct a Water Balance for the proposed development located at 31 Marlwood Avenue within the Town of Wasaga Beach, Ontario (the "Site")(Figure 1).

The Site is approximately 55.0 hectares (ha) in size and currently contains the Marlwood Golf Course. The Site fronts onto Golf Course Road, and the current clubhouse is accessible off of Marlwood Crescent (Figure 2).

It is our understanding that a portion of the Site will be developed into 60 single detached residential homes in two phases. The proposed development will take a portion of the existing golf course land, with the remaining land to be redesigned to maintain the golf course use. The proposed residential lots will be serviced with municipal services. The purpose of this assessment is to characterize the existing hydrogeological conditions at the Site and the potential for the proposed development to impact the existing environmental conditions.

The first phase of development will include 9 detached residential units along the western boundary of the golf course between existing residential homes on Briton Court and Marlwood Avenue. The lots will have frontage on Golf Course Road. Phase 1 is approximately 0.85 ha in size.

The second phase of development will include 51 detached residential units in the southwest portion of the golf course. The lots are situated in an L-shape and will be accessible off of Golf Course Road. Phase 2 is approximately 7.43ha in size.

A Draft Plan (dated January 14th 2020) for both Phases of development are provided in Appendix B.

2.0 ENVIRONMENTAL SETTING

2.1 Soil

The soil map of Simcoe County (Soil Survey Report No. 29, Scale 1:63,360) shows the uppermost soil at the Site to be composed of Minesing marly clay or Tioga sandy loam (Hoffman *et al.*, 1962). Minesing marly clay is classified within hydrologic soil group "C". Group C represent soils which have low infiltration rates when thoroughly wet and consist chiefly of soils with a layer that impedes downward movement of water and soils with moderately fine to fine texture. Tioga sandy loam is classified within hydrologic soil group "A". Group A represents soils with a low runoff potential and high infiltration

rates even when thoroughly wet. They consist chiefly of deep, well to excessively drained sand or gravel. The proposed development is primarily located in the Minesing marly clay.

2.2 Physiography

The Ontario Geologic Survey (Chapman and Putnam, 1984) describes the area as being located within the Simcoe Lowlands physiographic region, specifically within the Nottawasaga Basin. The Simcoe Lowlands were at one time part of the floor of glacial Lake Algonquin and its surface beds are therefore deposits of deltaic and lacustrine origin.

2.3 Topography and Drainage

According to local topographic mapping the Site is found at an elevation of 185 to190 m above sea level (masl). In general, the Site is sloped toward Marl Lake, with local gradients toward the golf course ponds and forest area along Golf Course Road. A Provincially Significant Wetland (Jack's Lake Wetland) is located on the south west corner of Marl Lake, immediately adjacent to the golf course property. Marl Lake is drained by Marl Creek, which is part of the Lower Nottawasaga River subwatershed and drains into Georgian Bay. The Marl Lake outlet into Marl Creek is controlled by a man made outfall structure constructed in the 1990s. The outfall structure is constructed using a sheet pile barrier wall and removable members to allow for adjustment of water levels and maintenance of habitat within both the lake and its associated wetland.

The existing surface water catchment areas were delineated by R.J. Burnside & Associates (Appendix B).

In Phase 1, the Site topography generally drains east to south east towards the golf course and the existing pond feature within the golf course. There is currently no storm water infrastructure along Golf Course Road along the frontage of Phase 1. After development, runoff will therefore be directed into soak away pits and an infiltration trench within each lot. An emergency overland flow route will direct runoff toward the golf course via the public easement where it will travel 200m toward the existing golf course pond adjacent to Marl Lake. For Phase 1, the pre- and post-development drainage pathways are maintained and therefore can be considered one catchment for the water balance assessment.

In Phase 2, the existing Site topography is generally sloped toward two golf course ponds to the east, and to the forest to the south. The regional topography is sloped toward Marl Lake. According to information provided in Appendix B the proposed drainage patterns

will generally be maintained compared to pre-development conditions. A centralized storm water management pond will be used to collect runoff and will outlet into an open channel which will dissipate energy prior to entering the adjacent wetland.

The Marlwood Golf Course currently pumps water directly from Marl Lake for irrigation. This is facilitated through the use of a submersible pump that is suspended within the lake (~2 m below water surface) through the base of a small wooden shed that is constructed at the end of an approximately 20 m long wooden pier structure. From the lake, pumped water is transferred up to an irrigation head pond (dugout type) situated on the 9th hole of the golf course using a 203 mm∅ I.D. HDPE (partially) buried forcemain. From the irrigation head pond, water is utilized on an as-needed basis by the irrigation system.

2.4 Bedrock Geology

The Ontario Geologic Survey Earth Database shows that the uppermost bedrock unit at the subject property consists of limestone and shale of the Verulam Formation of the Simcoe Group (OGS, 2017). The Verulam Formation is Middle Ordovican in age. Bedrock is sufficiently deep (70m+) and does not influence the water balance assessment.

2.5 Quaternary Geology

The surficial material for the Site is consists of lacustrine deposits which may be composed of both silt and clay associated with basin or quiet water deposits, or sand, gravelly sand and gravel associated with near shore and beach deposits (OGS, 2017).

2.6 Hydrogeology

The Ontario Ministry of the Environment, Conservation, and Parks (MECP) Water Well Records were references for any recorded well information in the vicinity of the Subject Site (GIN, 2017; Table 1). Well records can be used to gain subsurface information which can provide insight into geological formations within the area.

Table 1: MOECC Water Well Database Summary[1]

Well ID	Elevation (masl)	Date Drilled	Static Water Level (mbgs)	Depth to Bedrock (m)	Total Depth (m)	Well Type	Primary Use
5729422	186	1992-06-12	9.2	-	41.2	Overburden	Domestic
5734995	186	2000-03-21	4.6	-	13.1	Overburden	Domestic
5726707	186	1990-06-06	9.1	-	41.5	Overburden	Domestic
5733732	197	1998-08-17	11.6	-	53.0	Overburden	Domestic
5731265	193	1994-11-24	10.1	-	44.5	Overburden	Domestic
5709060	191	1971-08-06	-	74.4	79.3	Bedrock	Abandoned
5709061	191	1971-08-13	-	-	54.9	Overburden	Test Hole
5733570	186	1998-06-24	8.5	-	41.4	Overburden	Domestic

Notes: [1] - values rounded for presentation purposes

The surrounding wells in the MECP database were drilled primarily for domestic use, with one well listed for test hole purposes and one well listed as abandoned. In general, wells were advanced primarily through a thick (11-25 m) surficial sand unit overlying a clay or silt layer which overlies a second, confined sand or gravel unit. Bedrock was encountered in one record at a depth of 74 mbgs. The static water table upon borehole completion was between 4.6 – 11.6 mbgs with an average depth of 8.9 mbgs.

A portion of the Site is considered a Significant Ground Water Recharge Area (SGRA) and a Highly Vulnerable Aquifer (HVA). The Site overlaps with a Wellhead Protection Area (WHPA) and is classified as WHPA-D. A portion of the Site is also located within the Nottawasaga Valley Conservation Authority (NVCA) Regulated Area.

The Oak Ridges Moraine Ground water Program (ORMGP, 2018) includes a water table layer which was created by contouring the static water levels from all wells where the well screen is less than 20 m deep. This layer is meant to represent an average water table since the values used in its creation were collected from all seasons over time. ORMGP (2018) suggests that the actual water table at any given time of the year may be up to 2-3m lower or higher than the values indicated on the water table layer. According to ORMGP (2018) the water table at the Site is found between 189 to 183 masl. The ground water flow is toward Marl Lake. Maps from the ORMGP (2018) are included in Appendix D.

3.0 MONITORING

3.1 Geotechnical Program

A preliminary geotechnical program was completed for the Site by SPL Consultants Limited in November 2015, and updated by WSP in January 2020. The geotechnical program included advancing twelve (12) boreholes (BH15-01 to BH15-12) at the Site within the Phase 1, Phase 2, and existing golf course lands. The boreholes were drilled to depths between 5.2 and 8.2 mbgs.

The SPL (2015) and WSP (2020) reports indicates the subsurface geology to be composed of topsoil overlying silty sand to sandy silt fill, overlying sand to silty sand and gravel. Marl was observed in six boreholes at various depths and extended up to 2.3mbgs.

3.2 Ground Water Elevations

Ground water measurements were collected at five installed monitoring wells (BH15-01, BH15-05, BH15-07, BH15-09, & BH15-12) on a monthly basis between October 2015

and August 2016. These wells overlapped with both the Phase 1 and Phase 2 lands. A summary of the water measurements are found in the below Table 2:

Table 2: Summary of Ground Water Measurements (WSP, 2020)

Borehole ID	High Ground Water Level		Low Ground Water Level		Range (m)
	mbgs	masl	mbgs	masl	
BH15-01	2.37	186.63	3.13	185.87	0.76
BH15-05	0.99	186.01	1.48	185.52	0.49
BH15-07	2.77	184.23	3.27	183.73	0.50
BH15-09	4.38	185.62	4.91	185.09	0.53
BH15-12	1.44	188.56	2.20	187.80	0.76

The high ground water level at the Site is therefore between 188.56 and 184.23 masl or 4.38 and 0.99 mbgs. The local ground water flow direction is toward Marl Lake. It should be noted that the water table elevation will fluctuate seasonally and will display the highest value in the spring months (March or June). The complete set of borehole logs and ground water measurements can be found in WSP (2020).

4.0 WATER BALANCE

In order to determine the potential changes to the natural ground water recharge conditions, a pre- and post-development water balance assessment has been completed using the Thornthwaite and Mather method (1957). This method evaluates evapotranspiration based on precipitation and temperature. Residual soil saturation is a function of topography and soil type. Monthly data are tabulated from daily average temperature and precipitation, and the water budget is a continuous calculation over the period of record. To clarify, the method and the approach used by many individuals in examining infiltration resets annual conditions (moisture deficit, snow storage, etc) over the winter months because of the general lack of infiltration during the frost period. However, we maintain those records and carry them forward from month to month during the entire period of record.

Values were determined on a monthly basis, compiled from daily Environment Canada meteorological data station located in Collingwood, Ontario between 1960 and 2010 (Collingwood Climate Data). The calculations are based on the average conditions during this period. The average precipitation was 888 millimeters (mm), rainfall was 656 mm, evapotranspiration was 495 mm, and the surplus was 393 mm per year.

4.1 Land Use

4.1.1 Pre-Development

Using an aerial image, the Site was classified according to land use/ vegetation type. Land within the pre-development area can be classified as forest, landscaped grass, and surface water (Table 3).

Table 3: Pre Development Area Classification

Land Use	Land Area (m^2)
Phase 1	
Forest	6,127
Landscaped Grass	2,373
Phase 1 TOTAL	**8,500**
Phase 2	
Forest	29,736
Landscaped Grass	42,799
Surface Water	1,765
Phase 2 TOTAL	**74,300**
Site TOTAL	**82,800**

Land within the pre-development scenario is considered 2% impervious. The impervious area is associated with the existing surface water "hazards" within the golf course.

4.1.2 Post-Development

To determine the post-development land use designations, the following assumptions have been made:

- The rooftop area was obtained from information reviewed within Appendix B and is assumed to be 50% of lot area. The total rooftop area in Phase 1 is 4,315 m^2 and the total rooftop area in Phase 2 is 16,524 m^2;
- The average driveway is 40 m^2;
- The internal road area within Phase 2 is 11,900 m^2. Phase 1 does not contain any internal roads other than driveways;
- The storm water pond in Phase 2 will be lined and considered 50% impervious. The pumping station within Phase 2 is also considered 50% impervious;
- About 15,200 m^2 of land will remain forest in the post-development scenario of Phase 2 (Block 55)
- All additional land within each lot and the storm water pond block is assumed to be landscaped grass;

Land within the post-development Site is summarized in the below Table 4:

Table 4: Post-Development Area Classification

Land Use	Land Area (m^2)
Phase 1	
Structures	4,315
Driveway	360
Landscaped Grass	3,825
Phase 1 TOTAL	**8,500**
Phase 2	
Structures	16,524
Driveway	2,040
Landscaped Grass	21,836
Forest	15,200
Roads	11,900
Storm Water Pond & Pumping Station - Impervious	6,800
Phase 2 TOTAL	**74,300**
Site TOTAL	**82,800**

Land within the post-development scenario is considered 51 % impervious. The impervious area is associated with the structures, driveways, storm water management pond, pump station, and internal road.

4.2 Infiltration

Infiltration is generated one of two ways: (1) directly from rainfall impact on pervious surfaces; and (2) indirectly when runoff from impervious surfaces is diverted into adjacent naturalized areas.

Infiltration factors for the Site were estimated based on the underlying soil, local topography, and ground cover as per Table 2 of the Ministry of Environment and Energy (MOEE) Hydrogeological Technical Information Requirements for Land Development Applications (1995).

The soil variable factor was determined by taking into account information obtained from the regional geologic mapping (Section 3.0) and the geotechnical program completed for the Site (Section 4.1). This information suggests that the dominant soil type in the area is sand, with some local marl deposits near Marl Lake. The soil is therefore considered a sandy loam for the purpose of the water balance assessment. The infiltration factors utilized in the water balance assessment are summarized in Table 5 below.

The topography factor was based on the pre- and post-development slope information provided on the Preliminary Grading Plans for each Phase included within the Burnside

(2017a & 2017b) reports. Based on the information reviewed, the pre- and post-development land can be classified as rolling land for both Phase 1 and Phase 2.

Table 5: Summary of Pervious Land Infiltration Factor (See Appendix E)

Scenario	Land Use	Infiltration Factor	Assumption
Pre-Development	Forest	0.80	Rolling land, sandy loam soil, woodland
	Landscaped Grass	0.65	Rolling land, sandy loam soil, grass
	Surface Water	0.0	Saturated soil does not promote infiltration
Post-Development	Forest	0.80	Rolling land, sandy loam soil, woodland
	Landscaped Grass	0.65	Rolling land, sandy loam soil, grass
	Stormwater Pond	0.0	The storm water pond will be lined and therefore no infiltration will occur.

4.2.1 Pre-Development

Pre-development infiltration was determined by multiplying the annual average surplus amount, the area of each land use, and the infiltration factor for each land use. The pre-development annual infiltration is therefore 22,815 m^3/year which includes 2,533m^3/year from Phase 1 and 20,282 m^3/year from Phase 2. (Appendix E).

4.2.2 Post-Development

Post-development infiltration (without mitigation) was determined by multiplying the annual average surplus amount, the area of each land use, and the infiltration factor for each land use. The post-development annual direct infiltration is therefore 11,334 m^3/year, which includes 977 m^3/year from Phase 1 and 10,357 m^3/year from Phase 2. There is therefore a decrease across the entire Site in infiltration of 11,481 m^3/year from pre- to post-development without mitigation which represents 50%. This represents a decrease of 1,555 m^3/year in Phase 1 (61%) and 9,925 m^3/year in Phase 2 (49%).

Additional infiltration will also be gained through low impact development (LID). According to the information provided by Burnside (Appendix B), soakaway pits will be used at the lot scale to collect and infiltrate runoff from rooftop surfaces. In Phase 1, the soakaway pits will infiltrate up to the 5mm event, and the remaining rooftop runoff (up to the 25mm event) will be infiltrated through an infiltration trench. In Phase 2, the soakaway pits will infiltrate up to the 12mm event from the rooftop area.

In order to correlate event based rainfall data, for which the LID's are designed (i.e. 20 mm rainfall event), to annual averages, as is what is utilized in water balances, an event based assessment has been completed for a climate station in Southern Ontario (Barrie). Rainfall events over the past 5 years of complete data (2013 – 2017) were broken down by event size, such that total volumes for each of these events could be calculated. It was determined that an event rainfall depth of 5mm or less represents 46% of annual rainfall, an event rainfall depth of 12mm or less represents 76% of annual rainfall, and an event rainfall depth of 25mm or less represents 93% of annual rainfall.

If the soakaway pit/infiltration trench combinations in Phase 1 are designed to capture up to the 25mm storm event over the 4,315 m^2 impervious area, an additional 2,632 m^3 of runoff will be incorporated as infiltration (93% x 656 mm x 4,315 m^2). Half of the remaining rooftop runoff that is not captured will be directed to the adjacent landscaped grass. The other half will be directed to the front lawn/driveway which would drain to the storm water infrastructure. This infiltration represents 52 m^3/year (7% x 656 mm x 4,315 m^2 x 0.65 x 80% x 50%). This value is also multiplied by the infiltration coefficient of the grass and includes a 20% loss factor for evapotranspiration.

If the soak away pits in Phase 2 are designed to capture up to the 12mm storm event over the 16,524 m^2 rooftop area, an additional 8,238 m^3 of runoff will be incorporated as infiltration (76% x 656 mm x 16,524 m^2). As in Phase 1, half of the remaining rooftop runoff that is not captured will be directed to the adjacent landscaped grass. This infiltration represents 676 m^3/year (54% x 656 mm x 16,524 m^2 x 0.65 x 80% x 50%).

The total post-development infiltration for the entire Site after incorporating mitigation measures is therefore 22,933 m^3, which is 100% of pre-development levels. This represents an increase of 45% from pre- to post-development in Phase 1 and a decrease of 5% from pre- to post-development in Phase 2.

4.3 Water Balance Summary

Using the climate model data and calculations mentioned above, the water balance was completed for pre-development, post-development, and post-development with mitigation (Appendix E).

The total infiltration at the Site is 22,815 m^3 in the pre-development scenario, which represents 2,533 m^3 from Phase 1 and 20,282 m^3 from Phase 2. The total infiltration is reduced by 50% when no mitigation measures are employed. This decrease is associated with the increase in impervious surfaces such as roads, driveways, and structures.

The decrease is eliminated when runoff from rooftops is incorporated into soak away pits, infiltration trenches, or is directed onto grassed surfaces in the post-development scenario. An additional 2,684 m^3/year is incorporated into Phase 1, and an additional 8,915 m^3/year is incorporated into Phase 2. The total Phase 1 infiltration after mitigation is 3,661 m^3, and the total Phase 2 infiltration after mitigation is 19,271 m^3. The total post-development infiltration after mitigation is 22,933 m^3, which represents 100% of the pre-development volume.

4.4 Sensitive Features: Jack's Lake Wetland

In the pre-development scenario, the existing conditions within Phase 1 contained approximately 2,533 m^3 of infiltration and 808 m^3 of runoff. The runoff drained via sheet flow east to south east towards the golf course and the existing pond feature within the golf course. In the post-development with mitigation scenario, Phase 1 contains approximately 3, 661 m^3 of infiltration and 637 m^3 of runoff. The infiltration will therefore increase, with a slight decrease in runoff. The runoff flow path for Phase 1 is also maintained, since the flow will be directed toward the golf course via the public easement where it will travel 200m toward the existing golf course pond.

In the pre-development scenario, the existing conditions within Phase 2 contained approximately 20,282 m^3 of infiltration and 9,478 m^3 of runoff. The runoff drained toward Master's Lane, the existing Golf Course ponds, Golf Course Road, or south toward residential homes along "The Boardwalk". According to Burnside (Appendix B) the proposed drainage patterns will generally be maintained compared to pre-development conditions. A centralized storm water management pond will be used to collect runoff and will outlet into an open channel which will dissipate energy prior to entering the adjacent wetland. In the post-development with mitigation scenario, Phase 2 contains approximately 19,271 m^3 of infiltration which represents 95% of pre-development levels. Phase 2 also contains 21,756 m^3 of runoff.

Based on the local topography, the Jack's Lake wetland feature likely receives some sheet flow runoff from the adjacent golf course land. Based on the information provided above, the total runoff will increase from pre- to post-development. Since the proposed drainage patterns will generally be maintained, the runoff contributions to the wetland feature should increase from pre- to post development.

The wetland is located around the vicinity of a large surface water feature, and therefore the primary contributing source of water within the wetland is Marl Lake. As identified above, the outlet of Marl Lake into Marl Creek is controlled through a man made outfall structure. When considering Phase 1 and Phase 2 together, there will be no decrease in the amount of infiltration into Marl Lake after development. When considering only

Phase 2, there will be a slight (5%) decrease after development. This isolated deficit is not considered significant. The slight decrease (5%) in infiltration at Phase 2 will be offset by the increase in infiltration from Phase 1, and the increase in runoff contributions into Marl Lake from both Phase 1 and Phase 2 within the proposed storm water pond. The pond will outlet via an open channel which will dissipate energy prior to entering the adjacent wetland. Based on this assessment, no significant changes in the water level of Jack's Lake Wetland are anticipated as a result of the proposed development.

5.0 SUMMARY AND CONCLUSIONS

Azimuth was retained by Loft Planning Inc. to conduct a Water Balance for the proposed development located at 31 Marlwood Avenue within the Town of Wasaga Beach, Ontario. The Site is approximately 55.0 hectares (ha) in size and currently contains the Marlwood Golf Course. The Site fronts onto Golf Course Road, and the current clubhouse is accessible off of Marlwood Crescent

It is our understanding that a portion of the Site will be developed into 60 single detached residential homes in two phases. The proposed development will take a portion of the existing golf course land, with the remaining land to be redesigned to maintain the golf course use. The proposed residential lots will be serviced with municipal services. The purpose of this assessment is to characterize the existing hydrogeological conditions at the Site and the potential for the proposed development to impact the existing environmental conditions.

The Site is found at an elevation of 185 to190 m above sea level (masl). In general, the Site is sloped toward Marl Lake, with local gradients toward the golf course ponds and forest area along Golf Course Road. A Provincially Significant Wetland (Jack's Lake Wetland) is located on the south west corner of Marl Lake, immediately adjacent to the golf course property. Marl Lake is drained by Marl Creek, which is part of the Lower Nottawasaga River subwatershed and drains into Georgian Bay. The Marl Lake outlet into Marl Creek is controlled by a man made outfall structure constructed in the 1990s.

A geotechnical evaluation was completed for the Site by SPL Consultants Limited in November 2015 and updated by WSP in 2020. The surficial material is composed of topsoil overlying silty sand to sandy silt fill, overlying sand to silty sand and gravel. Marl was observed in four boreholes and extended up to 2.3mbgs. Five monitoring wells were installed as part of the geotechnical program. The high ground water level at the Site is therefore between 188.56 and 184.23 masl or 4.38 and 0.99 mbgs. The local ground water flow direction is toward Marl Lake.

A pre- and post-development water balance assessment was completed to assess any impacts to the infiltration rate at the Site. The post-development with mitigation runoff contributions will increase, while the post-development with mitigation infiltration volume will not change.

When considering Phase 1 and Phase 2 together, there will be no decrease in the amount of infiltration into Marl Lake after development. When considering only Phase 2, there will be a slight (5%) decrease after development. This isolated deficit is not considered significant. The slight decrease (5%) in infiltration at Phase 2 will be offset by the increase in infiltration from Phase 1, and the increase in runoff contributions into Marl Lake from both Phase 1 and Phase 2 within the proposed storm water pond. The pond will outlet via an open channel which will dissipate energy prior to entering the adjacent wetland. Based on this assessment, no significant changes in the water level of Jack's Lake Wetland are anticipated as a result of the proposed development.

Based upon our assumptions above and the interpretation of the available data it is concluded that the present hydrogeological conditions of the Site and surrounding area will not experience a significant change due to the proposed development.

6.0 REFERENCES

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Thornthwaite, C.W., and Mather, J.R., 1957. Instructions and tables for computing potential evapotranspiration and the water balance. Climatology, v



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APPENDICES

Appendix A: Figures
Appendix B: Engineering Drawings & Draft Site Plans
Appendix C: MECP Well Records
Appendix D: ORMGP (2018) Maps
Appendix E: Water Balance Information

APPENDIX A

Figures



LEGEND:

Approx. Study Area

250m 0 750m

HORIZONTAL SCALE 1:25,000

AZIMUTH ENVIRONMENTAL CONSULTING, INC.

Study Area Location

Golf Course Rd.,
Wasaga Beach, ON

DATE ISSUED: *September 2015*	Figure No.
CREATED BY: *JLM*	
PROJECT NO.: *15-273*	1
REFERENCE: *MNRF*	

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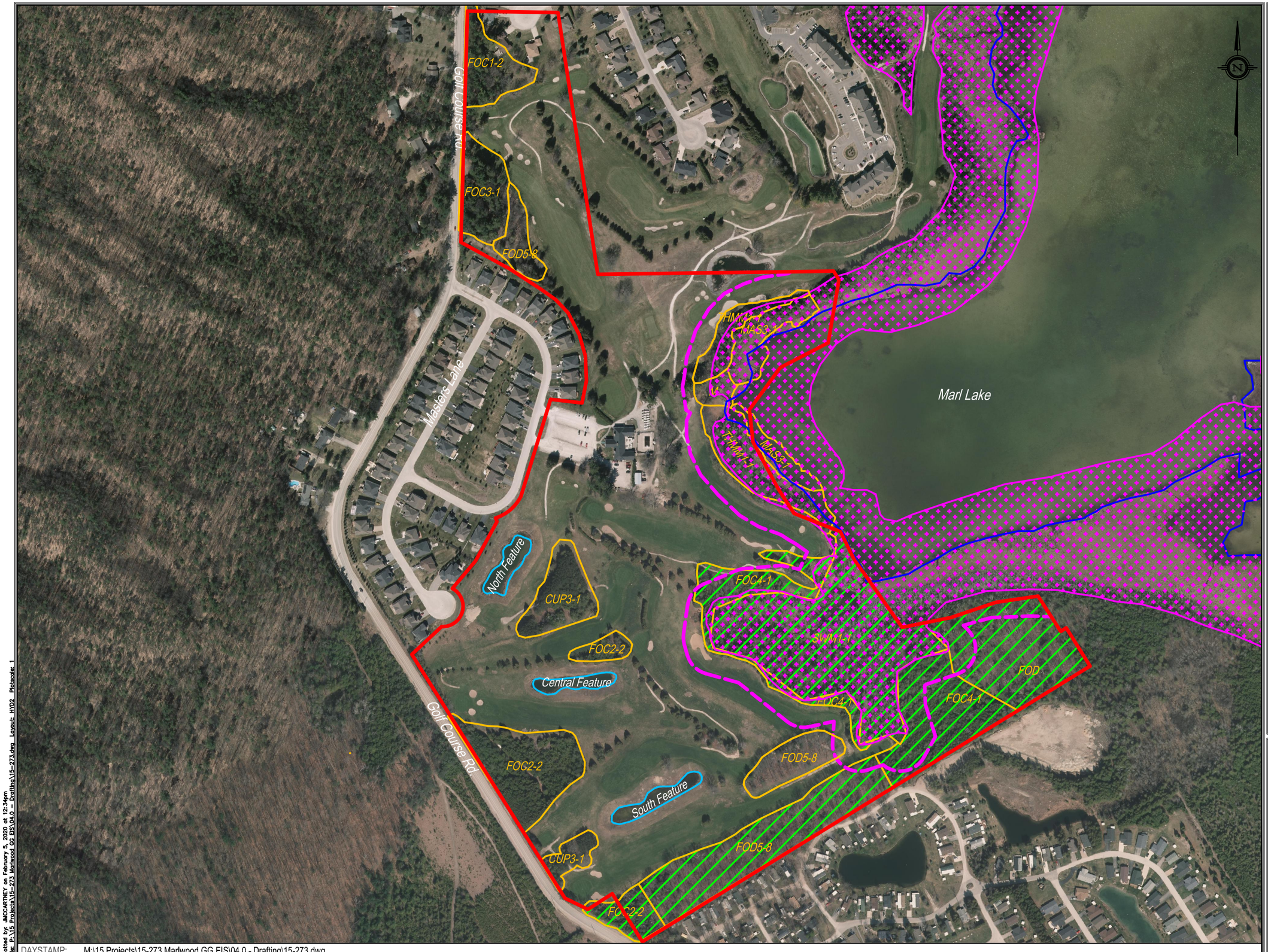


LEGEND:

- Approx. Study Area
- Lake
- Offline Water Hazard Feature
- Jack's Lake PSW (LIO)
- 30m Wetland Buffer
- Significant Woodland
- Vegetation Communities

CUP3-1	Red Pine Coniferous Plantation
FOC1-2	Dry-Fresh White Pine-Red Pine Coniferous Forest Type
FOC2-2	Dry-Fresh White Cedar Coniferous Forest
FOC3-1	Fresh-Moist Hemlock Coniferous Forest
FOC4-1	Fresh-Moist White Cedar Coniferous Forest Type
FOD	Deciduous Forest Type
FOD5-8	Dry-Fresh Sugar Maple-White Ash Deciduous Forest Type
MAS3-1	Cattail Organic Shallow Marsh
M	Maintained Lands
SWM1-1	White Cedar-Hardwood Organic Mixed Swamp
THMM1-1	Dry-Fresh Native Mixed Regeneration Thicket Type

60m 0 120m

HORIZONTAL SCALE 1:4,000

AZIMUTH ENVIRONMENTAL CONSULTING, INC.

Existing Conditions

Marlwood
Wasaga Beach, ON

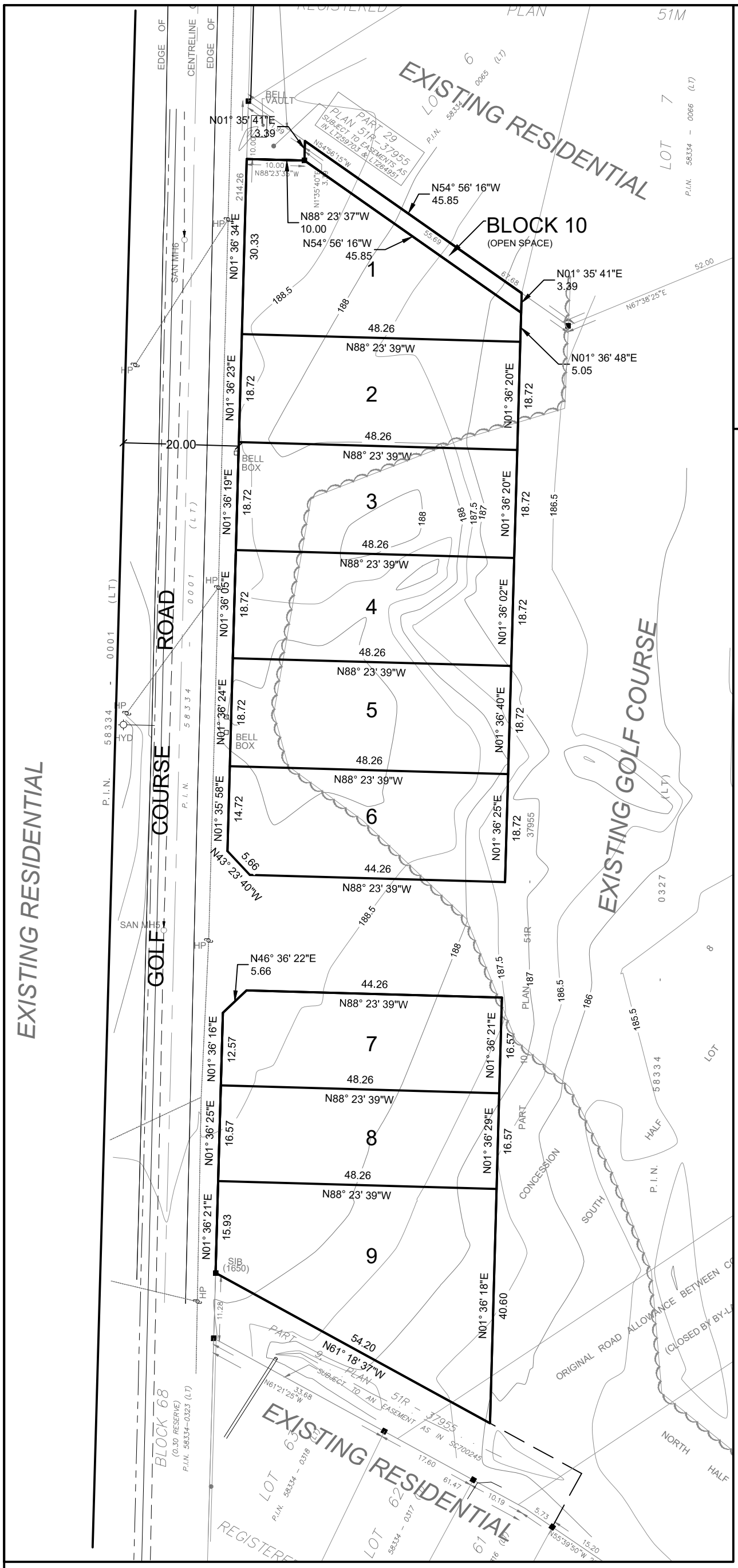
DATE ISSUED:	December 2019	Figure No.
CREATED BY:	JLM	2
PROJECT NO.:	15-273	
REFERENCE:	Simcoe County Mapping	

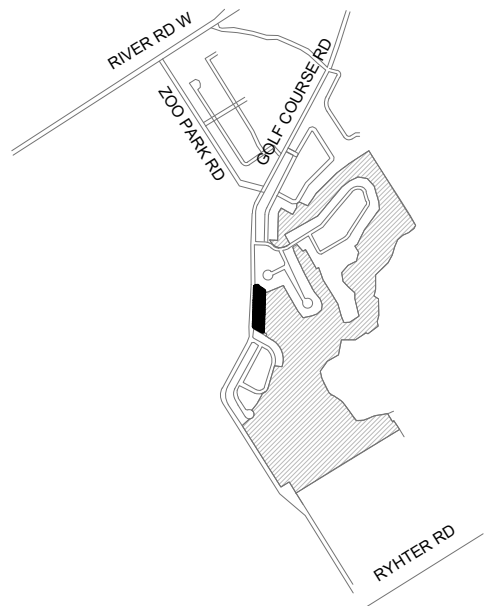
DAYSTAMP: M:\15 Projects\15-273 Marlwood GG EIS\04.0 - Drafting\15-273.dwg

Plotted by: JMCCARTNEY on February 5, 2020 at 12:34pm
File: P:\15 Projects\15-273 Marlwood GG EIS\04.0 - Drafting\15-273.dwg Layout: HY02 Plotscale: 1

APPENDIX B

Engineering Drawings & Draft Site Plans





KEY PLAN
N.T.S.

SUBJECT PROPERTY
ADDITIONAL LANDS OWNED BY APPLICANT

ADDITIONAL INFORMATION

As required under Section 51(17) of the Planning Act.

a), b), e), f), g) & j) – on plan
c) – on key plan
d) – see statistics
h) – piped water to be installed by developer
i) – sandy
k) – all municipal services to be made available
l) – DO WE HAVE TO INCLUDE THE BELL EASEMENT AND DRAINAGE BLOCK TO THE SOUTH IN THIS DRAFT PLAN

STATISTICS

PROPOSED LAND USE	LOT/BLOCK	AREA
SINGLE DETACHED RESIDENTIAL	1-9	0.84ha
OPEN SPACE	10	0.01ha

APPROVED SUBJECT TO CONDITIONS IN ACCORDANCE WITH SECTION 51(31) OF THE PLANNING ACT, RSO, CAP. P.13, AS AMENDED,

THIS _____ DAY OF _____,_____

DIRECTOR OF PLANNING, DEVELOPMENT AND TOURISM, COUNTY OF SIMCOE

OWNER'S CERTIFICATE

We authorize LOFT Planning Inc. to prepare and submit this Plan of Subdivision for approval.

A.S.O. _____

TPC MARLWOOD INC. date

SURVEYOR'S CERTIFICATE

I hereby certify that the boundaries of the lands being subdivided and their relationship to the adjacent lands are accurately and correctly shown.

RUDY MAK SURVEYING LTD. date

I-T-0003
DRAFT PLAN OF SUBDIVISION
Part of south half of Lot 26
Concession 7
Town of Wasaga Beach
County of Simcoe
(Geographic Township of Flos)

Date: January 14, 2020

STATISTICS

PROPOSED LAND USE	LOT/BLOCK	AREA
SINGLE DETACHED RESIDENTIAL	1-51	3.56ha
PROPOSED ROADS (544 LIN.M.)		1.19ha
OPEN SPACE & RESERVES	53, 55-62	2.00ha
STORMWATER MANAGEMENT	52	0.57ha
PUMPING STATION	54	0.11ha
TOTAL AREA		7.43ha

15m BUFFER

30m BUFFER

STAKED WETLAND BOUNDARY

BLOCK 54
Pumping Station
0.11ha

BLOCK 53
0.05ha

BLOCK 52
SWM Pond
0.57ha

BLOCK 55
Open Space
1.52ha

STREET 'A'

STREET 'B'

BLOCK 56
(OPEN SPACE)

BLOCK 57
(OPEN SPACE)

BLOCK 58
(OPEN SPACE)

BLOCK 59
(OPEN SPACE)

BLOCK 60
(OPEN SPACE)

BLOCK 61
(0.30m RESERVE)

BLOCK 62
(0.30m RESERVE)

BLOCK 63
(GOLF COURSE ROAD RIGHT-OF-WAY)

GOLF COURSE ROAD

PART 2, PLAN 51R - 37955

P.I.N. 58334-0254 (LT)

P.I.N. 58334-0322 (LT)

P.I.N. 58334-0001 (LT)

P.I.N. 58334-0044 (LT)

EXISTING RESIDENTIAL

EXISTING GOLF COURSE

MASTERS LANE
(BY REGISTERED PLAN 51M-743)

SITE BENCH MARK
TOP OF SPIGOT ON LE OF FIRE HYDRANT
ELEV. 190.18

BUSH

FENCE

SIB

SIBW

SIBW(T)

EDGE OF WATER

TOP OF BANK

EDGE OF ASPHALT

NORTH HALF LOT 26

SOUTH HALF LOT 26

LIMIT BETWEEN NORTH AND SOUTH HALVES OF LOT 26

KEY PLAN
SCALE: N.T.S.

SUBJECT PROPERTY
ADDITIONAL LANDS OWNED BY APPLICANT

RIVER RD W
ZOO PARK RD
GOLF COURSE RD
RYTHER RD

ADDITIONAL INFORMATION
As required under Section 51(17) of the Planning Act.
a), b), e), f), g) & j) – on plan
c) – on key plan
d) – see statistics
(h)(i) – piped water to be installed by developer
(h)(ii) – sandy
(h)(iii) – all municipal services to be made available
(k) – nil

APPROVED SUBJECT TO CONDITIONS IN ACCORDANCE WITH SECTION 51(31) OF THE PLANNING ACT, RSO, CAP. P.13, AS AMENDED,

THIS_____ DAY OF _____.

DIRECTOR OF PLANNING, DEVELOPMENT AND TOURISM, COUNTY OF SIMCOE

OWNER'S CERTIFICATE
We authorize LOFT Planning Inc. to prepare and submit this Plan of Subdivision for approval.

A.S.O.
TPC MARLWOOD INC. date

SURVEYOR'S CERTIFICATE
I hereby certify that the boundaries of the lands being subdivided and their relationship to the adjacent lands are accurately and correctly shown.

RUDY MAK SURVEYING LTD. date

LEGEND
PROPERTY LINE
LOT LINE

LOFT
LAND USE PLANNING | PROJECT MANAGEMENT
T 705.446.1168 | E Kristen@loftplanning.com

0 50 100 200 300 400
Metres

BURNSIDE

Client
TPC MARLWOOD INC.

Figure Title
MARLWOOD MASTER'S LANE EXTENSION
PRELIMINARY DRAFT PLAN

Drawn	Checked	Date	Figure No.
EDT	JO	20/01/14	1
Scale		Project No.	
1:750		300037815	

COPYRIGHT 2016, RUDY MAK SURVEYING LTD.

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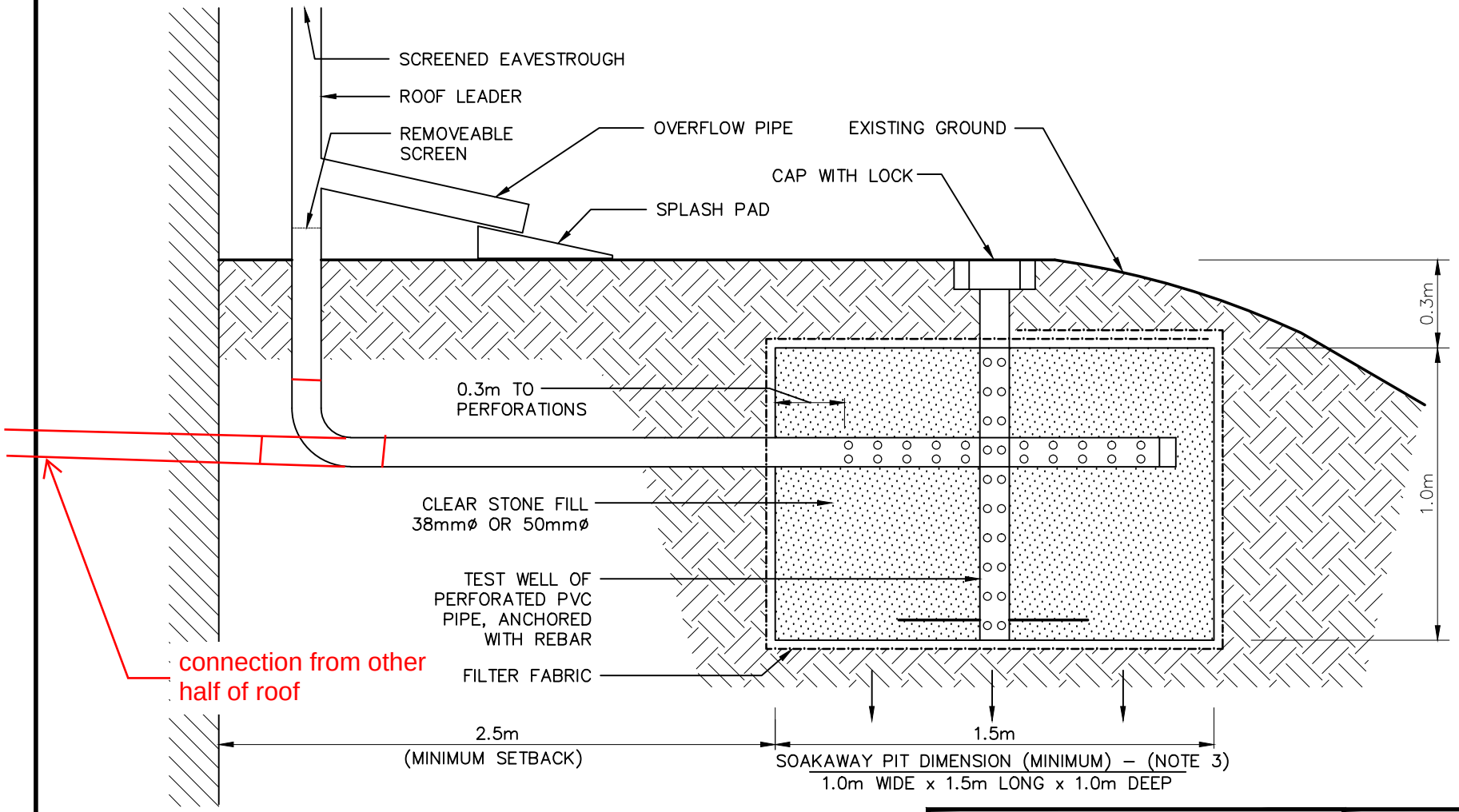

NOTE:

1. FILTER FABRIC TERRAFIX 270R OR EQUAL.
2. PROVIDE MINIMUM 0.5m CLEARANCE TO WATER TABLE FROM BOTTOM OF PIT.
3. SOAKAWAY PIT DIMENSIONS SHALL BE SIZED PER DESIGN ENGINEER RECOMMENDATION.
4. SOAKAWAY PIT TO BE INSPECTED BY DEVELOPER'S ENGINEER PRIOR TO BACKFILL.

TOWN OF WASAGA BEACH

ROOF LEADER
SOAKAWAY PIT DETAIL

DRAWN: TMM	SCALE: N.T.S.
DESIGN: MJP	PLOT: 1=1
CHECKED: MJP	DATE: MAR 2015

TOWN OF WASAGA BEACH • INCORPORATED 1974 •

STD.DWG.No.11

Soakaway Pit Sizing - 51 Lots

TPC Marlwood Inc.
31 Marlwood Ave, Wasaga Beach ON

Project #: 300037815
Date: 4-Dec-19
Designed: AH
Checked: JS

Runoff Depth to be Infiltrated: 12 mm
Design Infiltration Rate: 15 mm/hr
Maximum Drawdown Time: 48 hrs

Catchment ID	Roof Coverage (Full Roof)	Lot Area (m^2)	Area to be Infiltrated (Roof) (m^2)	Runoff to be Infiltrated (m)	Required Runoff Volume to be Infiltrated (m^3)	Drawdown Time (hrs)	Drawdown Rate (m^3/hr)	Design Infiltration Rate (m/hr)	Minimum Infiltration Gallery Footprint Area (m^2)	Length (m) *Minimum 1.5m	Width (m) *Minimum 1.0m	Infiltration Height (m) * Minimum 1.0m	Soakaway Pit Footprint Volume (m^3)	Void Ratio	Available Volume (m^3)
Typical Lot	50%	648	324	0.012	3.89	19	0.20	0.015	13.5	4.0	3.4	0.72	9.71	0.4	3.9

Soakaway Pit and Infiltration Trench Sizing - 9 Lots

TPC Marlwood Inc.
31 Marlwood Ave, Wasaga Beach ON

BURNSIDE
[THE DIFFERENCE IS OUR PEOPLE]

Project #: 300037815
Date: 14-Nov-19
Designed: AH
Checked: JS

Runoff Depth to be Infiltrated on Private Lots	5	mm
Runoff Depth to be Infiltrated within Proposed Easement	25	mm
Design Infiltration Rate:	15	mm/hr
Maximum Drawdown Time:	48	hrs

Catchment ID	Roof Coverage	Lot Area (m^2)	Area to be Infiltrated (Roof) (m^2)	Runoff to be Infiltrated (m)	Required Runoff Volume to be Infiltrated (m^3)	Drawdown Time (hrs)	Drawdown Rate (m^3/hr)	Design Infiltration Rate (m/hr)	Minimum Infiltration Gallery Footprint Area (m^2)	Length (m) *Minimum 1.5m	Width (m) *Minimum 1.0m	Infiltration Height (m) * Minimum 1.0m	Soakaway Pit Footprint Volume (m^3)	Void Ratio	Available Volume (m^3)
Lot 1 - Soakaway	50%	1115	558	0.005	2.8	19	0.15	0.015	9.7	4.0	2.4	0.72	6.97	0.4	2.8
Lot 2 - Soakaway	50%	900	450	0.005	2.3	19	0.12	0.015	7.8	3.5	2.2	0.72	5.63	0.4	2.3
Lot 3 - Soakaway	50%	905	453	0.005	2.3	19	0.12	0.015	7.9	3.5	2.2	0.72	5.66	0.4	2.3
Lot 4 - Soakaway	50%	905	453	0.005	2.3	19	0.12	0.015	7.9	3.5	2.2	0.72	5.66	0.4	2.3
Lot 5 - Soakaway	50%	905	453	0.005	2.3	19	0.12	0.015	7.9	3.5	2.2	0.72	5.66	0.4	2.3
Lot 6 - Soakaway	50%	900	450	0.005	2.3	19	0.12	0.015	7.8	3.5	2.2	0.72	5.63	0.4	2.3
Lot 7 - Soakaway	50%	800	400	0.005	2.0	19	0.10	0.015	6.9	3.5	2.0	0.72	5.00	0.4	2.0
Lot 8 - Soakaway	50%	800	400	0.005	2.0	19	0.10	0.015	6.9	3.5	2.0	0.72	5.00	0.4	2.0
Lot 9 - Soakaway	50%	1400	700	0.005	3.5	19	0.18	0.015	12.2	4.0	3.0	0.72	8.75	0.4	3.5
Remaining rooftop volume up to 25 mm - Infiltration Trench	50%	8630	4315	0.020	86.3	19	4.49	0.015	299.7	200.0	1.5	0.72	215.75	0.4	86.3

APPENDIX C

MECP Well Records

Groundwater Information Network
Réseau d'Information sur les Eaux Souterraines

Water Well

Identity : ca.on.waterWell.5729422
External identity : ca.on.waterWell.5729422
Source : Ontario Ministry of Environment
Online resource : http://www.ene.gov.on.ca/environment/en/subject/wells/index.htm
Length : 41.15m
Elevation : NaNm
Water level : 9.14m
Water yield : 36.37lpm
Water use : Domestic
Well status : Water Supply
Well type : Unknown
Screen components : From 39.9288 to 41.15m.

Well Log

Depth from (m)	Depth to (m)	GIN Lithology	Original Lithology	Porosity*	Hydraulic Conductivity*
0.00	12.50	**Sand**	SAND	[26,53]%	[2E-7,6E-3]m.s-1
12.50	24.99	**Sand**	SAND CLAY	[26,53]%	[2E-7,6E-3]m.s-1
		Clay		[34,57]%	[1E-11,4.7E-9]m.s-1
24.99	39.93	**Silt**	SILT	[34,61]%	[1E-9,2E-5]m.s-1
39.93	41.15	**Sand**	MEDIUM SAND	[26,53]%	[2E-7,6E-3]m.s-1
41.15	41.15	**Clay**	CLAY STONES	[34,57]%	[1E-11,4.7E-9]m.s-1
		Gravel		[24,44]%	[3E-4,3E-2]m.s-1

*Note: Porosity and hydraulic conductivity values are NOT measured but are derived from tables showing statistical averages for lithologies

Groundwater Information Network
Réseau d'Information sur les Eaux Souterraines

Water Well

Identity : ca.on.waterWell.5734995
External identity : ca.on.waterWell.5734995
Source : Ontario Ministry of Environment
Online resource : http://www.ene.gov.on.ca/environment/en/subject/wells/index.htm
Length : 13.11m
Elevation : NaNm
Water level : 4.57m
Water yield : 31.82lpm
Water use : Domestic
Well status : Water Supply
Well type : Unknown
Sealing components : From 0.00 to 4.57m.
Screen components : From 11.5824 to 12.80m.

Well Log

Depth from (m)	Depth to (m)	GIN Lithology	Original Lithology	Porosity*	Hydraulic Conductivity*
0.00	4.27	**Sand**	SAND	[26,53]%	[2E-7,6E-3]m.s-1
4.27	8.53	**Sand** **Silt** **Unknown material**	SAND SILT CEMENTED	[26,53]% [34,61]%	[2E-7,6E-3]m.s-1 [1E-9,2E-5]m.s-1
8.53	11.58	**Sand**	MEDIUM SAND	[26,53]%	[2E-7,6E-3]m.s-1
11.58	12.80	**Sand**	FINE SAND	[26,53]%	[2E-7,6E-3]m.s-1
12.80	13.11	**Sand** **Clay**	SAND CLAY	[26,53]% [34,57]%	[2E-7,6E-3]m.s-1 [1E-11,4.7E-9]m.s-1

*Note: Porosity and hydraulic conductivity values are NOT measured but are derived from tables showing statistical averages for lithologies

Groundwater Information Network
Réseau d'Information sur les Eaux Souterraines

Water Well

Identity : ca.on.waterWell.5726707
External identity : ca.on.waterWell.5726707
Source : Ontario Ministry of Environment
Online resource : http://www.ene.gov.on.ca/environment/en/subject/wells/index.htm
Length : 41.45m
Elevation : NaNm
Water level : 9.14m
Water yield : 45.46lpm
Water use : Domestic
Well status : Water Supply
Well type : Unknown
Sealing components : From 2.44 to 3.05m.
Screen components : From 40.5384 to 41.76m.

Well Log

Depth from (m)	Depth to (m)	GIN Lithology	Original Lithology	Porosity*	Hydraulic Conductivity*
0.00	12.80	**Sand**	SAND	[26,53]%	[2E-7,6E-3]m.s-1
12.80	23.47	**Sand**	SAND CLAY SANDY	[26,53]%	[2E-7,6E-3]m.s-1
		Clay		[34,57]%	[1E-11,4.7E-9]m.s-1
		Sand		[26,53]%	[2E-7,6E-3]m.s-1
23.47	31.09	**Clay**	CLAY HARD	[34,57]%	[1E-11,4.7E-9]m.s-1
		Unknown material			
31.09	39.01	**Sand**	FINE SAND	[26,53]%	[2E-7,6E-3]m.s-1
39.01	41.45	**Sand**	SAND CLEAN WATER-BEARING	[26,53]%	[2E-7,6E-3]m.s-1
		Unknown material			
		Unknown material			

*Note: Porosity and hydraulic conductivity values are NOT measured but are derived from tables showing statistical averages for lithologies

Groundwater Information Network
Réseau d'Information sur les Eaux Souterraines

Water Well

Identity : ca.on.waterWell.5733732
External identity : ca.on.waterWell.5733732
Source : Ontario Ministry of Environment
Online resource : http://www.ene.gov.on.ca/environment/en/subject/wells/index.htm
Length : 53.04m
Elevation : NaNm
Water level : 11.58m
Water yield : 54.55lpm
Water use : Domestic
Well status : Water Supply
Well type : Unknown
Sealing components : From 1.52 to 3.66m.
Screen components : From 52.1208 to 53.34m.

Well Log

Depth from (m)	Depth to (m)	GIN Lithology	Original Lithology	Porosity*	Hydraulic Conductivity*
0.00	7.01	**Sand**	SAND	[26,53]%	[2E-7,6E-3]m.s-1
7.01	12.50	**Sand**	SAND WOOD FRAGMENTS	[26,53]%	[2E-7,6E-3]m.s-1
		Organic material			
12.50	16.46	**Sand**	SAND CLAY LAYERED	[26,53]%	[2E-7,6E-3]m.s-1
		Clay		[34,57]%	[1E-11,4.7E-9]m.s-1
		Unknown material			
16.46	20.42	**Clay**	CLAY HARD	[34,57]%	[1E-11,4.7E-9]m.s-1
		Unknown material			
20.42	29.26	**Clay**	CLAY SOFT HARD	[34,57]%	[1E-11,4.7E-9]m.s-1
		Unknown material			
		Unknown material			
29.26	36.88	**Clay**	CLAY SAND GRAVEL	[34,57]%	[1E-11,4.7E-9]m.s-1
		Sand		[26,53]%	[2E-7,6E-3]m.s-1
		Gravel		[24,44]%	[3E-4,3E-2]m.s-1
36.88	42.06	**Clay**	CLAY HARD	[34,57]%	[1E-11,4.7E-9]m.s-1
		Unknown material			
42.06	44.81	**Sand**	SAND CLAY SANDY	[26,53]%	[2E-7,6E-3]m.s-1
		Clay		[34,57]%	[1E-11,4.7E-9]m.s-1
		Sand		[26,53]%	[2E-7,6E-3]m.s-1

Depth from (m)	Depth to (m)	GIN Lithology	Original Lithology	Porosity*	Hydraulic Conductivity*
44.81	51.82	**Clay**	CLAY HARD SOFT	[34,57]%	[1E-11,4.7E-9]m.s-1
		Unknown material			
		Unknown material			
51.82	53.04	**Sand**	SAND CLEAN WATER-BEARING	[26,53]%	[2E-7,6E-3]m.s-1
		Unknown material			
		Unknown material			

*Note: Porosity and hydraulic conductivity values are NOT measured but are derived from tables showing statistical averages for lithologies

Groundwater Information Network
Réseau d'Information sur les Eaux Souterraines

Water Well

Identity : ca.on.waterWell.5731265
External identity : ca.on.waterWell.5731265
Source : Ontario Ministry of Environment
Online resource : http://www.ene.gov.on.ca/environment/en/subject/wells/index.htm
Length : 44.50m
Elevation : NaNm
Water level : 10.06m
Water yield : 90.92lpm
Water use : Domestic
Well status : Water Supply
Well type : Unknown
Sealing components : From 1.83 to 3.35m.
Screen components : From 43.5864 to 44.50m.

Well Log

Depth from (m)	Depth to (m)	GIN Lithology	Original Lithology	Porosity*	Hydraulic Conductivity*
0.00	14.94	**Sand**	SAND	[26,53]%	[2E-7,6E-3]m.s-1
14.94	17.37	**Clay**	CLAY SOFT	[34,57]%	[1E-11,4.7E-9]m.s-1
		Unknown material			
17.37	27.43	**Clay**	CLAY SOFT	[34,57]%	[1E-11,4.7E-9]m.s-1
		Unknown material			
27.43	42.06	**Clay**	CLAY SAND GRAVEL	[34,57]%	[1E-11,4.7E-9]m.s-1
		Sand		[26,53]%	[2E-7,6E-3]m.s-1
		Gravel		[24,44]%	[3E-4,3E-2]m.s-1
42.06	44.50	**Sand**	SAND CLEAN WATER-BEARING	[26,53]%	[2E-7,6E-3]m.s-1
		Unknown material			
		Unknown material			

*Note: Porosity and hydraulic conductivity values are NOT measured but are derived from tables showing statistical averages for lithologies

Groundwater Information Network
Réseau d'Information sur les Eaux Souterraines

Water Well

Identity : ca.on.waterWell.5709060
External identity : ca.on.waterWell.5709060
Source : Ontario Ministry of Environment
Online resource : http://www.ene.gov.on.ca/environment/en/subject/wells/index.htm
Length : 79.25m
Elevation : 190.50m
Well status : Abandoned-Supply
Well type : Unknown

Well Log

Depth from (m)	Depth to (m)	GIN Lithology	Original Lithology	Porosity*	Hydraulic Conductivity*
0.00	11.58	**Sand**	MEDIUM SAND	[26,53]%	[2E-7,6E-3]m.s-1
11.58	25.91	**Clay**	CLAY	[34,57]%	[1E-11,4.7E-9]m.s-1
25.91	43.59	**Sand**	MEDIUM SAND	[26,53]%	[2E-7,6E-3]m.s-1
		Clay	CLAY	[34,57]%	[1E-11,4.7E-9]m.s-1
43.59	53.64	**Gravel**	GRAVEL	[24,44]%	[3E-4,3E-2]m.s-1
53.64	57.30	**Sand**	COARSE SAND	[26,53]%	[2E-7,6E-3]m.s-1
57.30	74.37	**Clay**	CLAY MEDIUM	[34,57]%	[1E-11,4.7E-9]m.s-1
		Sand	SAND	[26,53]%	[2E-7,6E-3]m.s-1
74.37	79.25	**Limestone**	LIMESTONE	[7,56]%	[1E-9,6E-6]m.s-1

*Note: Porosity and hydraulic conductivity values are NOT measured but are derived from tables showing statistical averages for lithologies

Groundwater Information Network
Réseau d'Information sur les Eaux Souterraines

Water Well

Identity : ca.on.waterWell.5709061
External identity : ca.on.waterWell.5709061
Source : Ontario Ministry of Environment
Online resource : http://www.ene.gov.on.ca/environment/en/subject/wells/index.htm
Length : 54.86m
Elevation : 190.50m
Well status : Test Hole
Well type : Unknown
Screen components : From 40.8432 to 46.94m.

Well Log

Depth from (m)	Depth to (m)	GIN Lithology	Original Lithology	Porosity*	Hydraulic Conductivity*
0.00	11.58	**Sand**	MEDIUM SAND	[26,53]%	[2E-7,6E-3]m.s-1
11.58	25.91	**Clay**	CLAY	[34,57]%	[1E-11,4.7E-9]m.s-1
25.91	43.59	**Sand**	MEDIUM SAND	[26,53]%	[2E-7,6E-3]m.s-1
		Clay	CLAY	[34,57]%	[1E-11,4.7E-9]m.s-1
43.59	51.82	**Gravel**	GRAVEL MEDIUM	[24,44]%	[3E-4,3E-2]m.s-1
		Sand	SAND	[26,53]%	[2E-7,6E-3]m.s-1
51.82	54.86	**Clay**	CLAY MEDIUM	[34,57]%	[1E-11,4.7E-9]m.s-1
		Sand	SAND	[26,53]%	[2E-7,6E-3]m.s-1

*Note: Porosity and hydraulic conductivity values are NOT measured but are derived from tables showing statistical averages for lithologies

Groundwater Information Network
Réseau d'Information sur les Eaux Souterraines

Water Well

Identity : ca.on.waterWell.5733570
External identity : ca.on.waterWell.5733570
Source : Ontario Ministry of Environment
Online resource : http://www.ene.gov.on.ca/environment/en/subject/wells/index.htm
Length : 41.15m
Elevation : NaNm
Water level : 8.53m
Water yield : 136.38lpm
Water use : Domestic
Well status : Water Supply
Well type : Unknown
Sealing components : From 2.44 to 3.66m.

Well Log

Depth from (m)	Depth to (m)	GIN Lithology	Original Lithology	Porosity*	Hydraulic Conductivity*
0.00	17.07	**Sand** **Gravel**	SAND STONES	[26,53]% [24,44]%	[2E-7,6E-3]m.s-1 [3E-4,3E-2]m.s-1
17.07	23.77	**Clay** **Unknown material**	CLAY SOFT	[34,57]%	[1E-11,4.7E-9]m.s-1
23.77	31.39	**Clay** **Gravel**	CLAY STONES	[34,57]% [24,44]%	[1E-11,4.7E-9]m.s-1 [3E-4,3E-2]m.s-1
31.39	37.80	**Clay** **Sand** **Unknown material**	CLAY SAND CEMENTED	[34,57]% [26,53]%	[1E-11,4.7E-9]m.s-1 [2E-7,6E-3]m.s-1
37.80	39.32	**Clay** **Unknown material** **Unknown material**	CLAY HARD LAYERED	[34,57]%	[1E-11,4.7E-9]m.s-1
39.32	41.15	**Sand** **Unknown material** **Unknown material**	SAND CLEAN WATER-BEARING	[26,53]%	[2E-7,6E-3]m.s-1

*Note: Porosity and hydraulic conductivity values are NOT measured but are derived from tables showing statistical averages for lithologies

APPENDIX D

ORMGP (2018) Maps

41 Marlwood Avenue Ground Water (masl)



Legend

- CAMC Boundary
- Oak Ridges Moraine Boundary
- Well
- Strahler Class 4 to 7 Streams

Water Table (mASL)

High : 530.229

Low : 45.0948

AZIMUTH ENVIRONMENTAL CONSULTING, INC.
Environmental Assessments & Approvals

229.3 0 114.66 229.3 Metres

1: 4,514

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Map Compiled by the Conservation Authorities Moraine Coalition
101 Exchange Avenue, Vaughan, Ontario, M3N 1S4

This map is for information purposes only and the Conservation Authorities Moraine Coalition takes no responsibility for, nor guarantees, the accuracy of all the information contained within the map.

SOURCE: CAMC, 2018; MNR, 2018;

PROJECTION: WGS_1984_Web_Mercator_Auxiliary Sphere

DATE PRINTED: November 23, 2018

41 Marlwood Avenue Ground Water (masl)



Legend

- CAMC Boundary
- Oak Ridges Moraine Boundary
- Well
- Strahler Class 4 to 7 Streams

Water Table (mASL)

High : 530.229

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AZIMUTH ENVIRONMENTAL CONSULTING, INC.
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SOURCE: CAMC, 2018; MNR, 2018;

PROJECTION: WGS_1984_Web_Mercator_Auxiliary Sphere

DATE PRINTED: November 23, 2018

APPENDIX E

Water Balance

Water Balance Summary Table - Pre-Development

Catchment Designation	Phase 1		Phase 2			Total
	Forest	Landscaped	Forest	Landscaped	Surface Water	
Area (m^2)	6,127	2,373	29,736	42,799	1,765	82,800
Pervious Area (m^2)	6,127	2,373	29,736	42,799	-	81,035
Impervious Area (m^2)	-	-	-	-	1,765	1,765
Infiltration Factors						
Topography Infiltration Factor	0.2	0.2	0.2	0.2	0	
Soil Infiltration Factor	0.4	0.4	0.4	0.4	0	
Land Cover Infiltration Factor	0.2	0.05	0.2	0.05	0	
Infiltration Factor	0.8	0.65	0.8	0.65	0	
Run-Off Coefficient	0.2	0.35	0.2	0.35	1	
Run-Off From Impervious Surfaces	0.8	0.8	0.8	0.8	0.8	
Inputs (Per Unit Area)						
Precipitation (mm/yr)	888	888	888	888	888	888
Rainfall (mm/yr)	656	656	656	656	656	656
Run-On (mm/yr)	0	0	0	0	0	0
Other Inputs (mm/yr)	0	0	0		0	0
Total Inputs (mm/yr)	**888**	**888**	**888**	**888**	**888**	888
Outputs (Per Unit Area)						
Precipitation Surplus (mm/yr)	393	393	393	393	710	
Net Surplus (mm/yr)	393	393	393	393	710	
Evapotranspiration (mm/yr)	495	495	495	495	178	
Infiltration (mm/yr)	314	255	314	255	0	
Supplemental Infiltration (mm/yr)	0	0	0	0	0	
Total Infiltration (mm/yr)	314	255	314	255	0	
Run-Off Pervious Areas (mm/yr)	79	138	79	138	0	
Run-Off Impervious Areas (mm/yr)	0	0	0	0	710	
Total Run-Off (mm/yr)	79	138	79	138	710	
Total Outputs (mm/yr)	**888**	**888**	**888**	**888**	**888**	
Difference (Inputs - Outputs)	**0**	**0**	**0**	**0**	**0**	
Inputs (Volumes)						
Precipitation (m^3/yr)	5,441	2,107	26,406	38,006	1,567	73,526
Run-On (m^3/yr)	0	0	0	0	0	0
Other Inputs (m^3/yr)	0	0	0	0	0	0
Total Inputs (m^3/yr)	**5,441**	**2,107**	**26,406**	**38,006**	**1,567**	**73,526**
Outputs (Volumes)						
Precipitation Surplus (m^3/yr)	2,408	933	11,686	16,820	1,254	33,101
Net Surplus (m^3/yr)	2,408	933	11,686	16,820	1,254	33,101
Evapotranspiration (m^3/yr)	3,033	1,175	14,719	21,186	313	40,426
Infiltration (m^3/yr)	1,926	606	9,349	10,933	0	22,815
Rooftop Infiltration (m^3/yr)	0	0	0	0	0	0
Total Infiltration (m^3/yr)	***1,926***	***606***	***9,349***	***10,933***	***0***	22,815
Run-Off Pervious Areas (m^3/yr)	482	326	2,337	5,887	0	9,032
Run-Off Impervious Areas (m^3/yr)	0	0	0	0	1,254	1,254
Total Run-Off (m^3/yr)	482	326	2,337	5,887	1,254	10,286
Total Outputs (m^3/yr)	**5,441**	**2,107**	**26,406**	**38,006**	**1,567**	**73,526**
Difference (Inputs - Outputs)	**0**	**0**	**0**	**0**	**0**	**0**

Water Balance Summary Table - Post-Development (no mitigation)

Catchment Designation	Phase 1			Phase 2						Total
	Structure	Driveway	Landscaped	Structure	Driveway	Roads	Impervious SWM Pond & Pumping Station	Forest	Landscaped	
Area (m^2)	4315	360	3825	16524	2040	11900	6800	15,200	21,836	82,800
Pervious Area (m^2)	0	0	3825	0	0	0	0	15,200	21,836	40,861
Impervious Area (m^2)	4315	360	0	16524	2040	11900	6800	0	0	41,939
Infiltration Factors										
Topography Infiltration Factor	0	0	0.2	0	0	0	0	0.2	0.2	
Soil Infiltration Factor	0	0	0.4	0	0	0	0	0.4	0.4	
Land Cover Infiltration Factor	0	0	0.05	0	0	0	0	0.2	0.05	
Infiltration Factor	0	0	0.65	0	0	0	0	0.8	0.65	
Run-Off Coefficient	1	1	0.35	1	1	1	1	0.2	0.35	
Run-Off From Impervious Surfaces	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.9	0.8	
Inputs (Per Unit Area)										
Precipitation (mm/yr)	888	888	888	888	888	888	888	888	888	
Rainfall (mm/yr)	656	656	656	656	656	656	656	656	656	
Run-On (mm/yr)	0	0	0	0	0	0	0	0	0	
Other Inputs (mm/yr)	0	0	0	0	0	0	0	0	0	
Total Inputs (mm/yr)	**888**	**888**	**888**	**888**	**888**			**888**	**888**	888
Outputs (Per Unit Area)										
Precipitation Surplus (mm/yr)	710	710	393	710	710	710	710	393	393	
Net Surplus (mm/yr)	710	710	393	710	710	710	710	393	393	
Evapotranspiration (mm/yr)	178	178	495	178	178	178	178	495	495	
Infiltration (mm/yr)	0	0	255	0	0	0	0	314	255	
Supplemental Infiltration (mm/yr)	0	0	0	0	0	0	0	0	0	
Total Infiltration (mm/yr)	0	0	255	0	0	0	0	314	255	
Run-Off Pervious Areas (mm/yr)	0	0	138	0	0	0	0	79	138	
Run-Off Impervious Areas (mm/yr)	710	710	0	710	710	710	710	0	0	
Total Run-Off (mm/yr)	710	710	138	710	710	710	710	79	138	
Total Outputs (mm/yr)	**888**	**888**	**888**	**888**	**888**	**888**	**888**	**888**	**888**	
Difference (Inputs - Outputs)	**0**	**0**	**0**	**0**	**0**	**888**	**888**	**0**	**0**	
Inputs (Volumes)										
Precipitation (m^3/yr)	3,832	320	3,397	14,673	1,812	10,567	6,038	13,498	19,390	73,526
Run-On (m^3/yr)	0	0	0	0	0	0	0	0	0	0
Other Inputs (m^3/yr)	0	0	0	0	0	0	0	0	0	0
Total Inputs (m^3/yr)	**3,832**	**320**	**3,397**	**14,673**	**1,812**	**10,567**	**6,038**		**19,390**	**73,526**
Outputs (Volumes)										
Precipitation Surplus (m^3/yr)	3,065	256	1,503	11,739	1,449	8,454	4,831	5,974	8,582	45,852
Net Surplus (m^3/yr)	3,065	256	1,503	11,739	1,449	8,454	4,831	5,974	8,582	45,852
Evapotranspiration (m^3/yr)	766	64	1,893	2,935	362	2,113	1,208	7,524	10,809	27,675
Infiltration (m^3/yr)	0	0	977	0	0	0	0	4,779	5,578	11,334
Rooftop Infiltration (m^3/yr)	0	0	0	0	0	0	0	0	0	0
Total Infiltration (m^3/yr)	***0***	***0***	***977***	***0***	***0***	***0***	***0***	***4,779***	***5,578***	11,334
Run-Off Pervious Areas (m^3/yr)	0	0	526	0	0	0	0	1,195	3,004	4,724
Run-Off Impervious Areas (m^3/yr)	3,065	256	0	11,739	1,449	8,454	4,831	0	0	29,793
Total Run-Off (m^3/yr)	3,065	256	526	11,739	1,449	8,454	4,831	1,195	3,004	34,518
Total Outputs (m^3/yr)	3,832	320	3,397	14,673	1,812	10,567	6,038	13,498	19,390	73,526
Difference (Inputs - Outputs)	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**13,498**	**0**	**0**

Water Balance Summary Table - Post-Development (with mitigation)

Catchment Designation	Phase 1			Phase 2						Total
	Structure	Driveway	Landscaped	Structure	Driveway	Roads	SWM Pond	Forest	Landscaped	
Area (m^2)	4315	360	3825	16524	2040	11900	6800	15,200	21,836	82,800
Pervious Area (m^2)	0	0	3825	0	0	0	0	15,200	21,836	40,861
Impervious Area (m^2)	4315	360	0	16524	2040	11900	6800	0	0	41,939
Infiltration Factors										
Topography Infiltration Factor	0	0	0.2	0	0	0	0	0.2	0.2	
Soil Infiltration Factor	0	0	0.4	0	0	0	0	0.4	0.4	
Land Cover Infiltration Factor	0	0	0.05	0	0	0	0	0.2	0.05	
Infiltration Factor	0	0	0.65	0	0	0	0	0.8	0.65	
Run-Off Coefficient	1	1	0.35	1	1	1	1	0.2	0.35	
Run-Off From Impervious Surfaces	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.9	0.8	
Inputs (Per Unit Area)										
Precipitation (mm/yr)	888	888	888	888	888	888	888	888	888	
Rainfall (mm/yr)	656	656	656	656	656	656	656	656	656	
Run-On (mm/yr)	0	0	0	0	0	0	0	0	0	
Other Inputs (mm/yr)	0	0	0	0	0	0	0	0	0	
Total Inputs (mm/yr)	**888**	**888**	**888**	**888**	**888**	**888**	**888**	**888**	**888**	
Outputs (Per Unit Area)										
Precipitation Surplus (mm/yr)	710	710	393	710	710	710	710	393	393	
Net Surplus (mm/yr)	710	710	393	710	710	710	710	393	393	
Evapotranspiration (mm/yr)	178	178	495	178	178	178	178	495	495	
Infiltration (mm/yr)	0	0	255	0	0	0	0	314	255	
Supplemental Infiltration (mm/yr)	622	0	0	539	0	0	0	0	0	
Total Infiltration (mm/yr)	622	0	255	539	0	0	0	314	255	
Run-Off Pervious Areas (mm/yr)	0	0	138	0	0	0	0	79	138	
Run-Off Impervious Areas (mm/yr)	88	710	0	171	710	710	710	0	0	
Total Run-Off (mm/yr)	88	710	138	171	710	710	710	79	138	
Total Outputs (mm/yr)	**888**	**888**	**888**	**888**	**888**	**888**	**888**	**888**	**888**	
Difference (Inputs - Outputs)	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	
Inputs (Volumes)										
Precipitation (m^3/yr)	3,832	320	3,397	14,673	1,812	10,567	6,038	13,498	19,390	73,526
Run-On (m^3/yr)	0	0	0	0	0	0	0	0	0	0
Other Inputs (m^3/yr)	0	0	0	0	0	0	0	0	0	0
Total Inputs (m^3/yr)	**3,832**	**320**	**3,397**	**14,673**	**1,812**	**10,567**	**6,038**		**19,390**	**73,526**
Outputs (Volumes)										
Precipitation Surplus (m^3/yr)	3,065	256	1,503	11,739	1,449	8,454	4,831	5,974	8,582	45,852
Net Surplus (m^3/yr)	3,065	256	1,503	11,739	1,449	8,454	4,831	5,974	8,582	45,852
Evapotranspiration (m^3/yr)	766	64	1,893	2,935	362	2,113	1,208	7,524	10,809	27,675
Infiltration (m^3/yr)	0	0	977	0	0	0	0	4,779	5,578	11,334
Supplemental Infiltration (m^3/yr)	2,684	0	0	8,915	0	0	0	0	0	11,599
Total Infiltration (m^3/yr)	***2,684***	***0***	***977***	***8,915***	***0***	***0***	***0***	***4,779***	***5,578***	22,933
Run-Off Pervious Areas (m^3/yr)	0	0	526	0	0	0	0	1,195	3,004	4,724
Run-Off Impervious Areas (m^3/yr)	381	256	0	2,824	1,449	8,454	4,831	0	0	18,195
Total Run-Off (m^3/yr)	381	256	526	2,824	1,449	8,454	4,831	1,195	3,004	22,919
Total Outputs (m^3/yr)	3,832	320	3,397	14,673	1,812	10,567	6,038	13,498	19,390	73,526
Difference (Inputs - Outputs)	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**13,498**	**0**	**0**

Overall Water Balance Summary Table

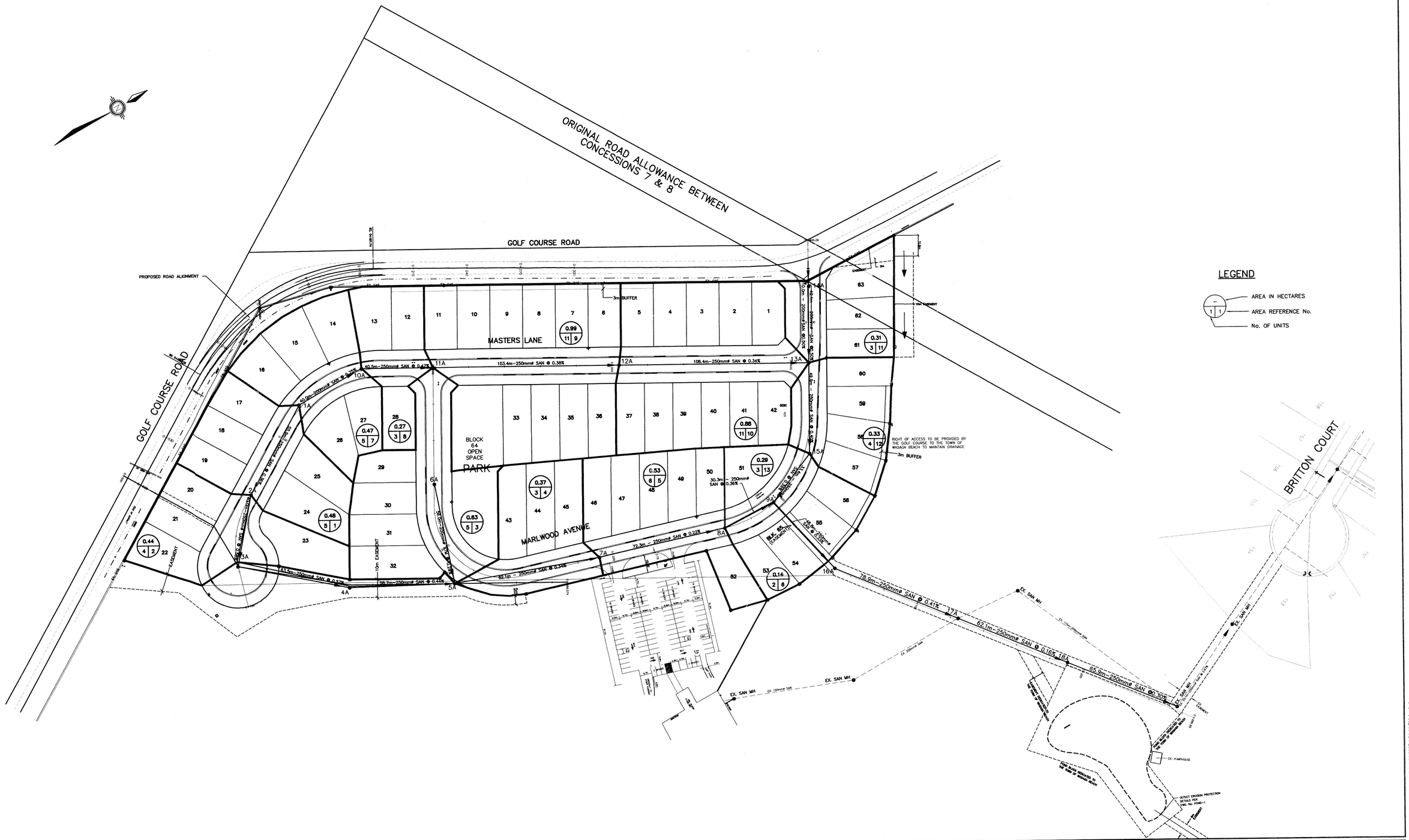
Characteristic	Site						
	Pre-Development	Post-Development	Change (Pre to Post)		Post-Development with Mitigation	Change (Pre to Post with Mitigation)	
Inputs (Volume)							
Precipitation (m^3/yr)	73,526	73,526	0	0%	73,526	0	0%
Run-On (m^3/yr)	0	0	0	0%	0	0	-
Other Inputs (m^3/yr)	0	0	0	0%	0	0	-
Total Inputs (m^3/yr)	73,526	73,526	0	0%	73,526	0	0%
Outputs (Volume)							
Precipitation Surplus (m^3/yr)	33,101	45,852	12,751	39%	45,852	12,751	39%
Net Surplus (m3/yr)	33,101	45,852	12,751	39%	45,852	12,751	39%
Evapotranspiration (m^3/yr)	40,426	27,675	-12,751	-32%	27,675	-12,751	-32%
Infiltration (m^3/yr)	22,815	11,334	-11,481	-50%	11,334	-11,481	-50%
Supplemental Infiltration (m^3/yr)	0	0	0	0%	11,599	11,599	-
Total Infiltration (m^3/yr)	***22,815***	***11,334***	***-11,481***	***-50%***	22,933	***118***	***0.52%***
Run-Off Pervious Areas (m^3/yr)	9,032	4,724	-4,308	-48%	4,724	-4,308	-48%
Run-Off Impervious Areas (m^3/yr)	1,254	29,793	28,540	0%	18,195	16,941	-
Total Run-Off (m^3/yr)	10,286	34,518	24,232	236%	22,919	12,633	123%
Total Outputs (m^3/yr)	**73,526**	**73,526**	**0**	0%	73,526	0	0%

BURNSIDE

[THE DIFFERENCE IS OUR PEOPLE]

Appendix C

As-Built Drawings
Golf Course Road
Existing Marlwood Subdivision



LEGEND

AREA IN HECTARES
AREA REFERENCE No.
No. OF UNITS

Notes

"ORIGINAL TENDER ISSUE DRAWINGS SEALED BY R. G. ROBINSON, P. ENG."

BENCHMARK:

ELEVATION – 191.842
SPIKE AND WASHER IN WEST FACE OF HYDRO POLE SOUTHEAST CORNER OF GOLF COURSE ROAD AND FAIRWAY CRESCENT.

NO.	REVISIONS	DATE	INITIAL
1	AS CONSTRUCTED	OCT 06	RP

Approved

Approved

MARLWOOD SUBDIVISION
BEAVER BAY DEVELOPMENTS INC.

SANITARY DRAINAGE PLAN

RG ROBINSON AND ASSOCIATES (BARRIE) LTD
CONSULTING ENGINEERS AND PLANNERS
10 High Street, Suite 200, Barrie, Ontario (705) 721-9222

SCALE: HORZ. 1:1000
VERT.

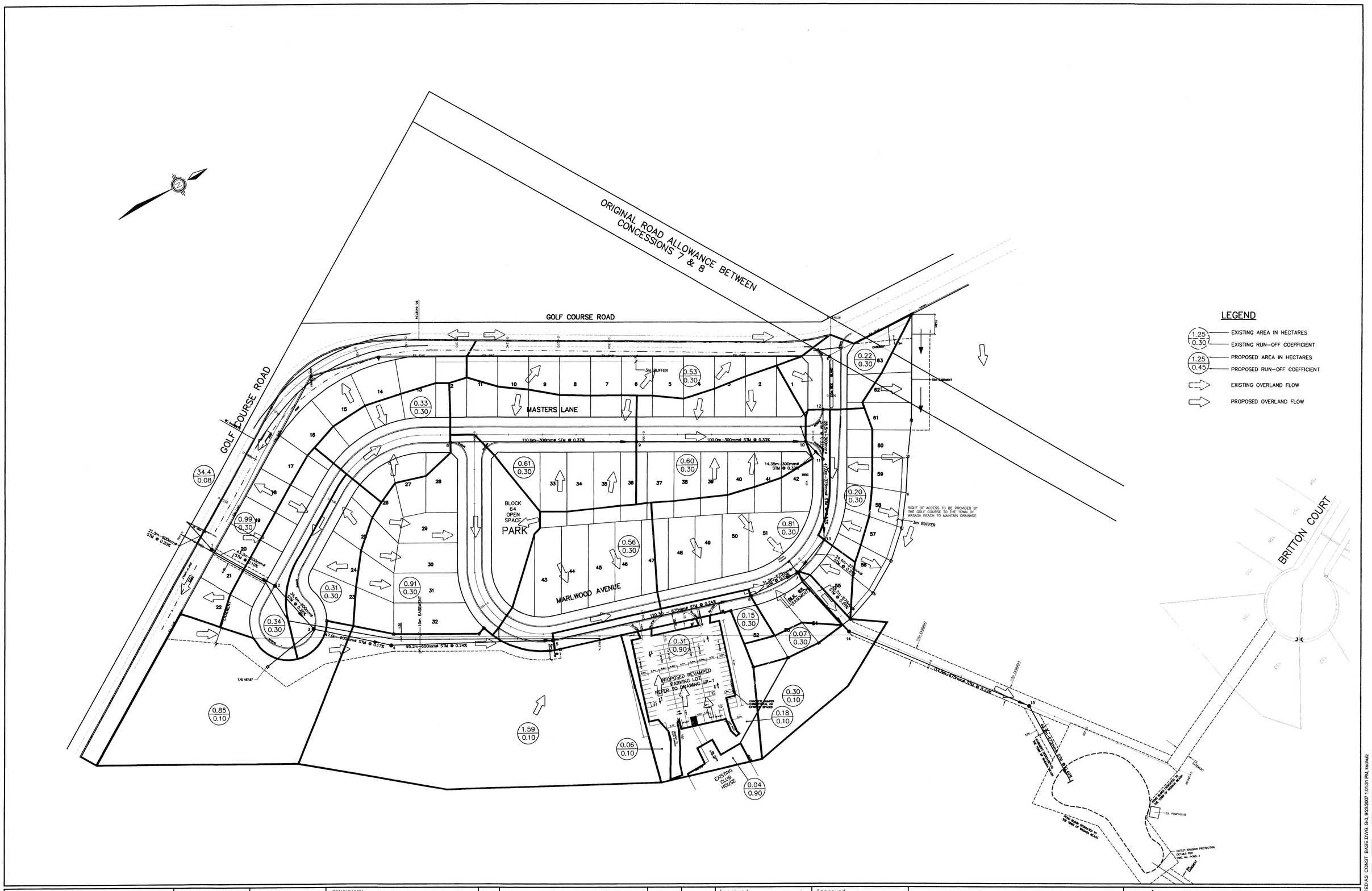
644-00142-20

DESIGN DD | CHECKED RGR

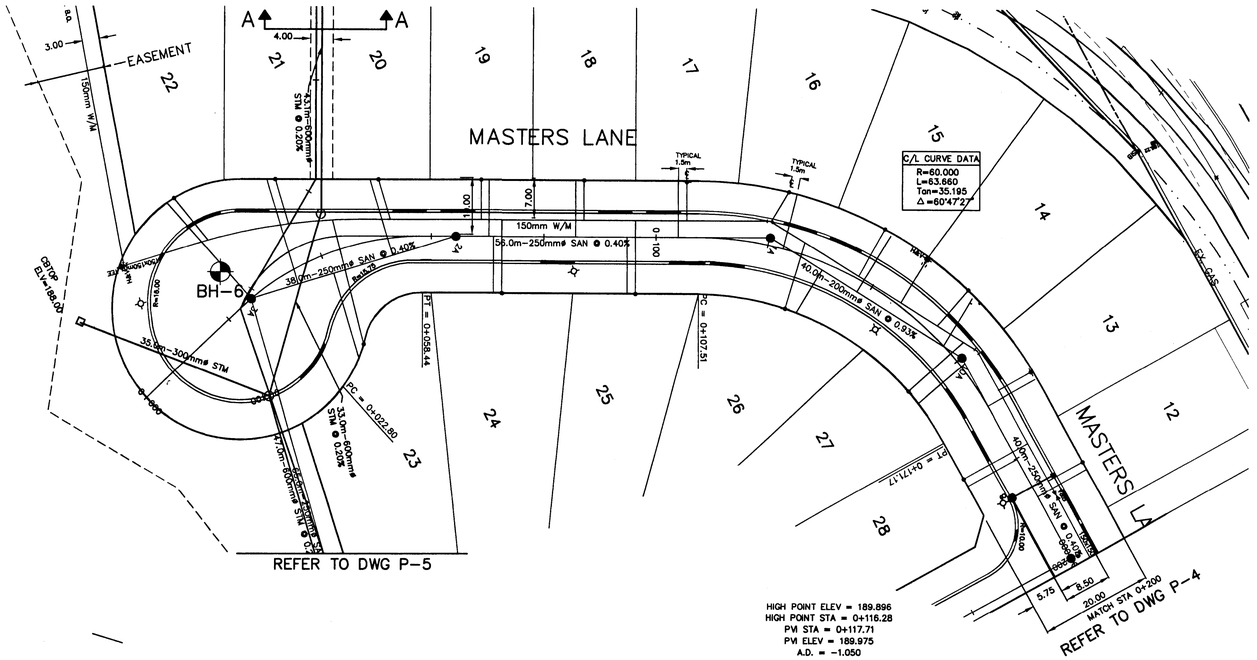
DRAWN KJ | DATE JAN/02

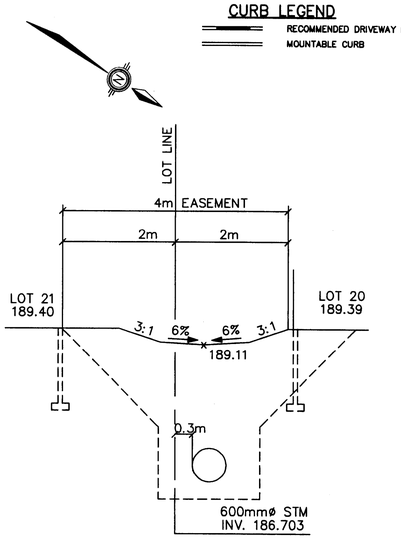
DWG. Nº G-2

I:\2006\06-644\PLOT\Marlwood\AS CONSTRUCTED\AS CONST BASE.DWG, G-2, 9/29/2007 10:11:11 PM, kschultz



Notes			BENCHMARK:					Approved	Approved	MARLWOOD SUBDIVISION BEAVER BAY DEVELOPMENTS INC.	RG ROBINSON AND ASSOCIATES (BARRIE) LTD CONSULTING ENGINEERS AND PLANNERS 10 High Street, Suite 200, Barrie, Ontario (705) 721-9222
		"ORIGINAL TENDER ISSUE DRAWINGS SEALED BY R. G. ROBINSON, P. ENG."	ELEVATION – 191.842 SPIKE AND WASHER IN WEST FACE OF HYDRO POLE SOUTHEAST CORNER OF GOLF COURSE ROAD AND FAIRWAY CRESCENT.							STORM DRAINAGE PLAN	SCALE: HORZ. 1:1000 VERT. 644-00142-20
				1	AS CONSTRUCTED	OCT 06	RP				DESIGN DD / CHECKED RGR
				NO.	REVISIONS	DATE	INITIAL				DRAWN KJ / DATE JAN/02 / DWG. № G-3





SECTION A-A
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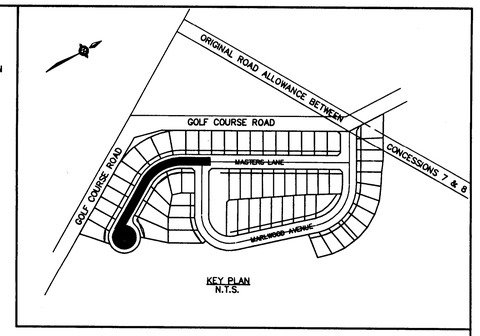
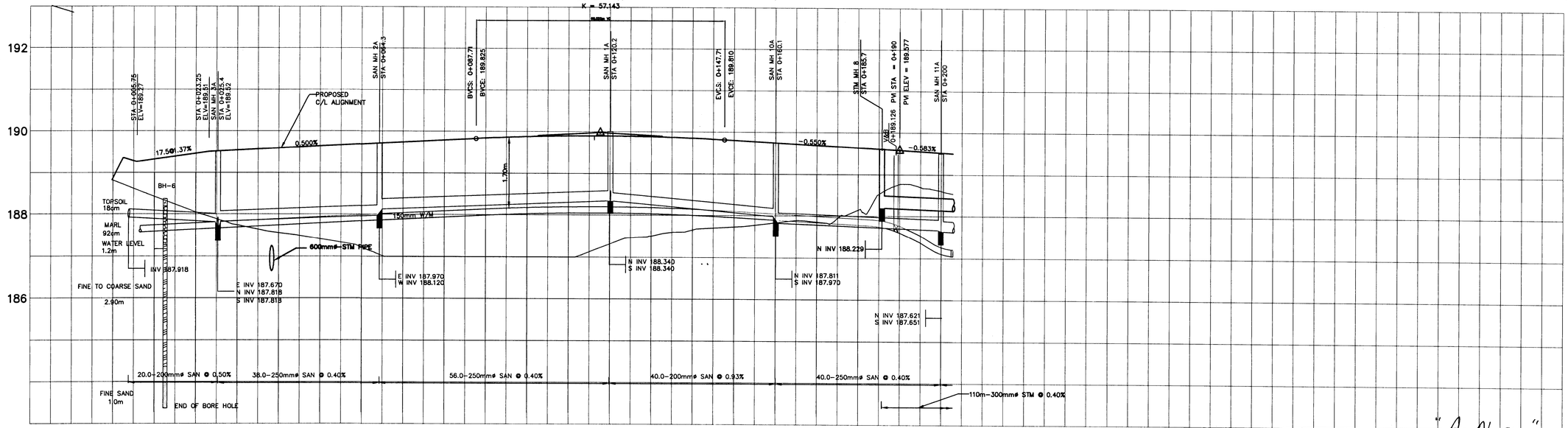


KEY PLAN
N.T.S.



FIN.C/L PROFILE		189.457	189.586	189.686	189.786	189.873	189.895	189.847	189.742	189.632	189.519
EXIST.C/L PROFILE	188.80	188.05	187.55	187.21	187.00	187.00	187.31	188.65	187.83	188.14	186.61
CHAINAGE	0+000	0+020	0+040	0+060	0+080	0+100	0+120	0+140	0+160	0+180	0+200

"AS NOTED"

ACCEPTED FOR CONSTRUCTION
Ainley & Associates Limited
Town Engineers
per ...
Date ... AUGUST 19/02

Notes

BENCHMARK:

ELEVATION - 191.842
SPIKE AND WASHER IN WEST FACE OF HYDRO POLE SOUTHEAST CORNER OF GOLF COURSE ROAD AND FAIRWAY CRESCENT.

R.G. ROBINSON
REGISTERED PROFESSIONAL ENGINEER
PROVINCE OF ONTARIO
JUNE 19/02

NO.	REVISIONS	DATE	INITIAL

Approved

Approved

MARLWOOD SUBDIVISION
BEAVER BAY DEVELOPMENTS INC.

PLAN AND PROFILE
MASTERS LANE
STA 0+000 TO STA 0+200

RG ROBINSON AND ASSOCIATES (BARRIE) LTD
CONSULTING ENGINEERS AND PLANNERS
10 High Street, Suite 200, Barrie, Ontario (705) 721-9222

SCALE: HORZ. 1:500 VERT. 1:50			644-00142-20
DESIGN DD	CHECKED RGR		
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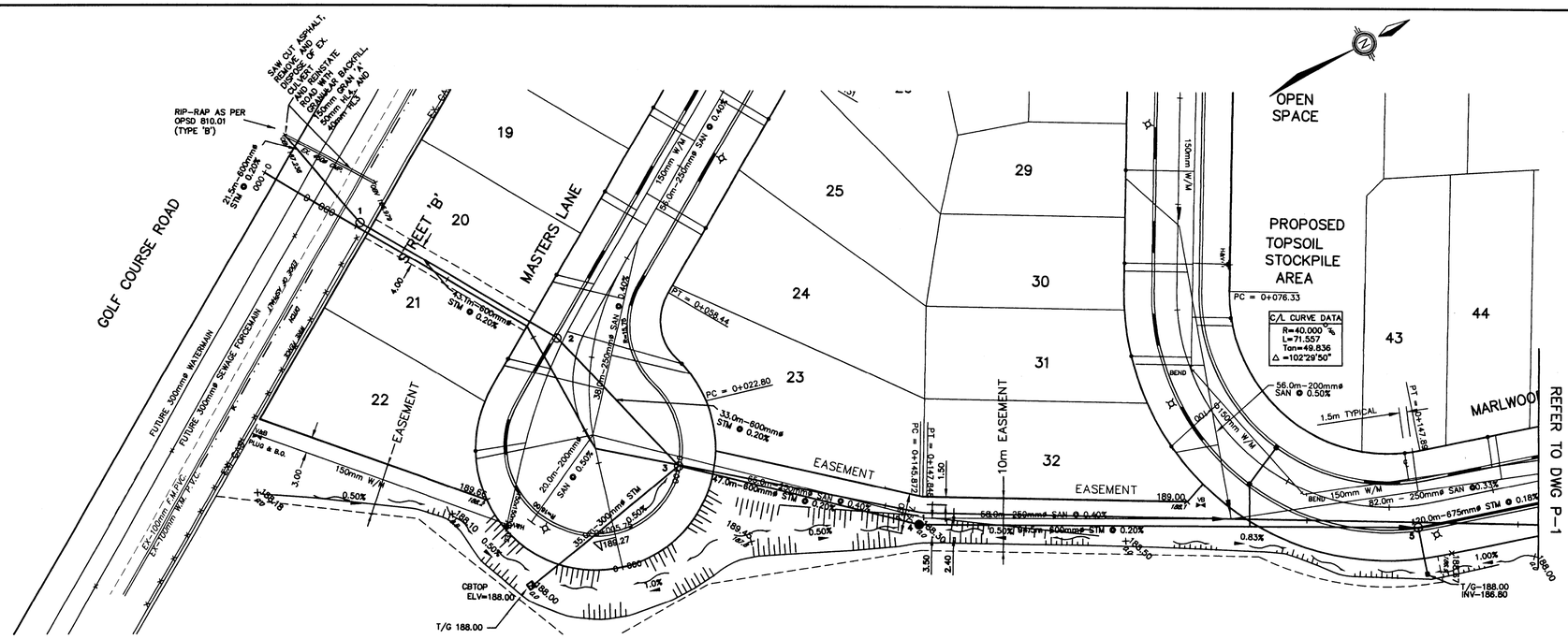

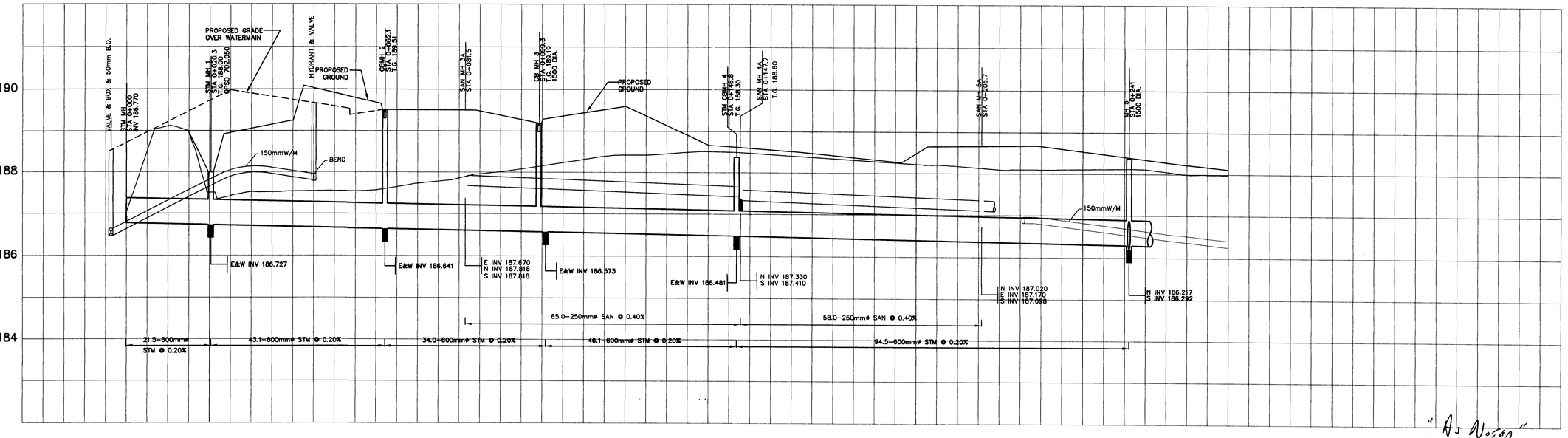

CHAINAGE	0+000	0+020	0+040	0+060	0+080	0+100	0+120	0+140	0+160	0+180	0+200	0+220	0+240	0+260
EXIST.C/L PROFILE	187.02	187.50	187.52	187.56	187.86	188.16	188.42	188.50	188.41	188.28	188.17	088.09	188.12	187.99
FIN.C/L PROFILE														

ACCEPTED FOR CONSTRUCTION
Ainley & Associates Limited
Town Engineers
per .....
Date August 19/02

Notes

BENCHMARK:

ELEVATION – 191.842
SPIKE AND WASHER IN WEST FACE OF HYDRO POLE SOUTHEAST CORNER OF GOLF COURSE ROAD AND FAIRWAY CRESCENT.

R.G. ROBINSON
REGISTERED PROFESSIONAL ENGINEER
PROVINCE OF ONTARIO

NO.	REVISIONS	DATE	INITIAL

Approved

Approved

MARLWOOD SUBDIVISION
BEAVER BAY DEVELOPMENTS INC.

PLAN AND PROFILE
GOLF COURSE ROAD TO MARLWOOD AVENUE
STA 0+000 TO STA 0+268.57

RG ROBINSON AND ASSOCIATES (BARRIE) LTD
CONSULTING ENGINEERS AND PLANNERS
10 High Street, Suite 200, Barrie, Ontario (705) 721-9222

SCALE: HORZ. 1:500 VERT. 1:50			644-00142-20
DESIGN DD	CHECKED RGR		
DRAWN KJ	DATE JAN/02		DWG. Nº P-5

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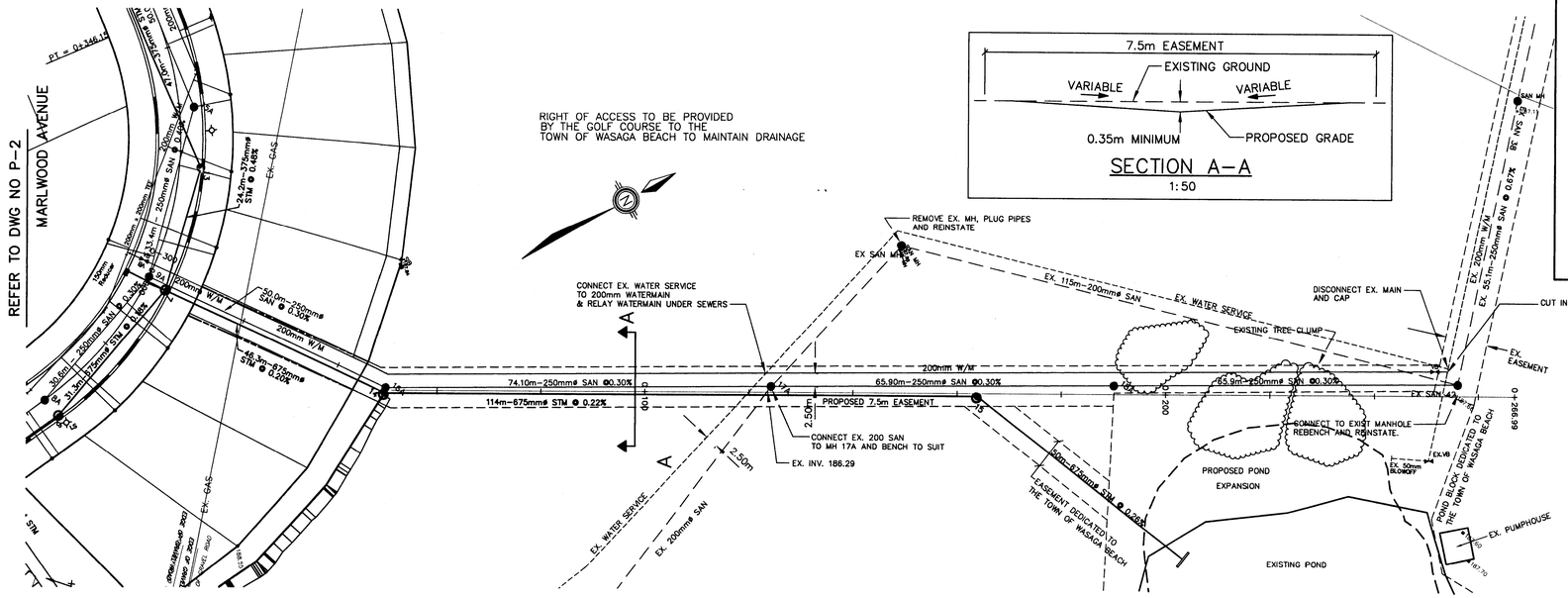

CHAINAGE	0+000	0+020	0+040	0+060	0+080	0+100	0+120	0+140	0+160	0+180	0+200	0+220	0+240	0+255.57
ORIG.C/L PROFILE	188.00	187.72	188.02	187.92	187.98	188.02	187.99	188.09	188.03	187.93	187.70	187.90	187.82	187.66
FIN.C/L PROFILE														

ACCEPTED FOR CONSTRUCTION
Alnley & Associates Limited
Town Engineers
per
Date 19/02

Notes

BENCHMARK:

ELEVATION - 191.842
SPIKE AND WASHER IN WEST FACE OF HYDRO POLE SOUTHEAST CORNER OF GOLF COURSE ROAD AND FAIRWAY CRESCENT.

REGISTERED PROFESSIONAL ENGINEER R.G. ROBINSON PROVINCE OF ONTARIO
June 19/02

NO.	REVISIONS	DATE	INITIAL

Approved

Approved

MARLWOOD SUBDIVISION
BEAVER BAY DEVELOPMENTS INC.

PLAN AND PROFILE
MARLWOOD AVENUE TO EXISTING
STA 0+000 TO 0+266.99

RG ROBINSON AND ASSOCIATES (BARRIE) LTD
CONSULTING ENGINEERS AND PLANNERS
10 High Street, Suite 200, Barrie, Ontario (705) 721-9222

SCALE: HORZ. 1:500
VERT. 1:50
644-00142-20
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DWG. Nº P-6

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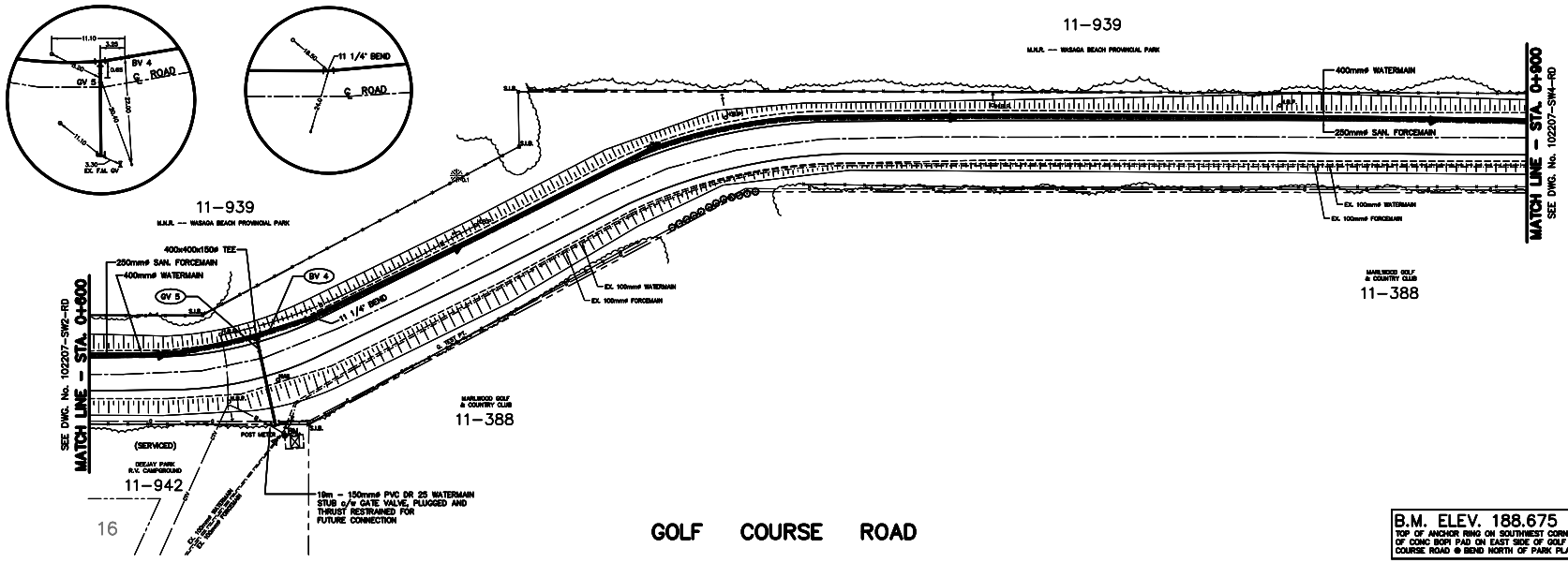
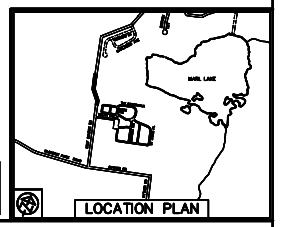
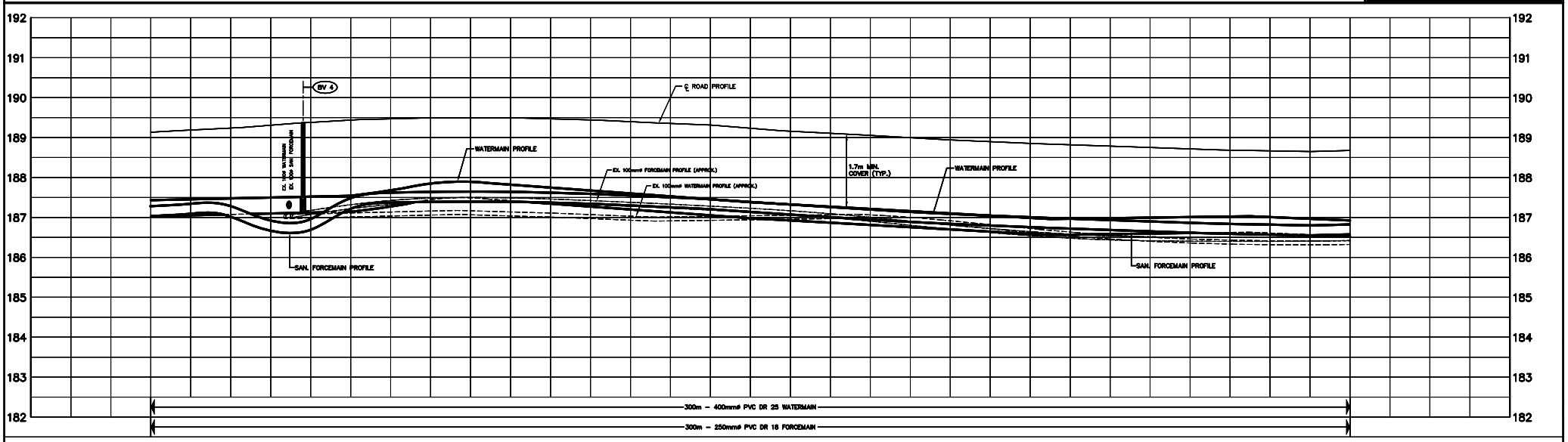




B.M. ELEV. 188.675
TOP OF ANCHOR RING ON SOUTHWEST CORNER OF CONC BOX PAD ON EAST SIDE OF GOLF COURSE ROAD @ BEND NORTH OF PARK PLACE



CHAINAGE PLOT 1=0.5: 0+600 | 0+625 | 0+650 | 0+675 | 0+700 | 0+725 | 0+750 | 0+775 | 0+800 | 0+825 | 0+850 | 0+875 | 0+900

LEGEND

- PROPERTY LINE
- BURIED BELL CABLE
- BURIED GAS MAIN
- EXISTING WATER MAIN AND VALVE
- EX. SANITARY SEWER & M.H.
- PROPOSED WATER MAIN AND VALVE
- PROPOSED SANITARY SEWER
- PROPOSED SANITARY FORCEMAIN
- MH PROPOSED SANITARY M.H.
- GV PROPOSED GATE VALVE
- FH PROPOSED FIRE HYDRANT, VALVE & HYDRANT LEAD
- BV PROPOSED BUTTERFLY VALVE

NOTE : 1) LOCATIONS OF UTILITIES ARE APPROXIMATE.

RECORD DRAWING

COMPILED BY:	J.S.	DATE:	OCT. 2004
CHECKED BY:	J.S.	DATE:	OCT. 2004
DRAWN BY:	L.G.B.	DATE:	OCT. 2004
CHECKED BY:	D.B.E.	DATE:	OCT. 2004

NO.	REVISIONS	DATE	INITIAL
	REVISED AS RECORD DRAWING	OCT. 2004	D.B.E.

RECORD DRAWING
NOTICE TO USERS

Information contained on this drawing may have changed since the completion of construction. Further, this drawing may contain information provided by others. While Aleksy & Associates Limited believes this information to be reliable and correct as of the completion of construction, no warranty is provided as to its accuracy and/or completeness. As such, Aleksy & Associates Limited shall not be responsible for any errors or omissions which may result from incorporation of the information herein.

SCALE:	HORZ. 1=250 VERT. 1=50
DESIGN:	D.B.E.
DRAWN:	P.C.S.
CHECKED:	B.K.G.
DATE:	MAR. 2004

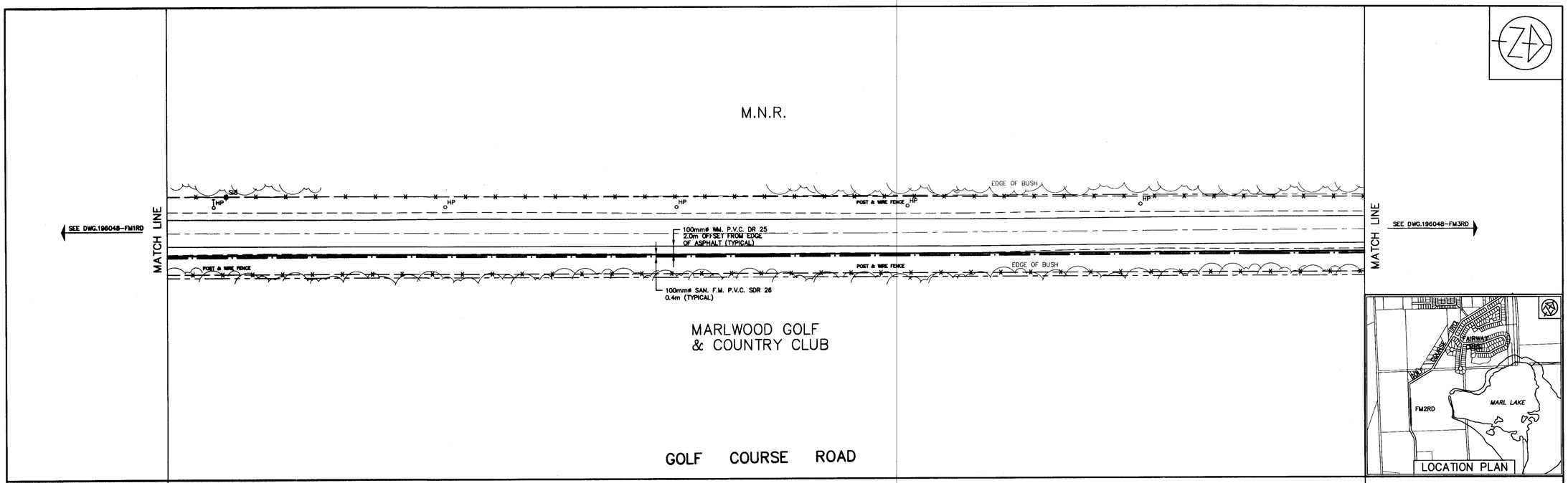
TOWN OF WASAGA BEACH

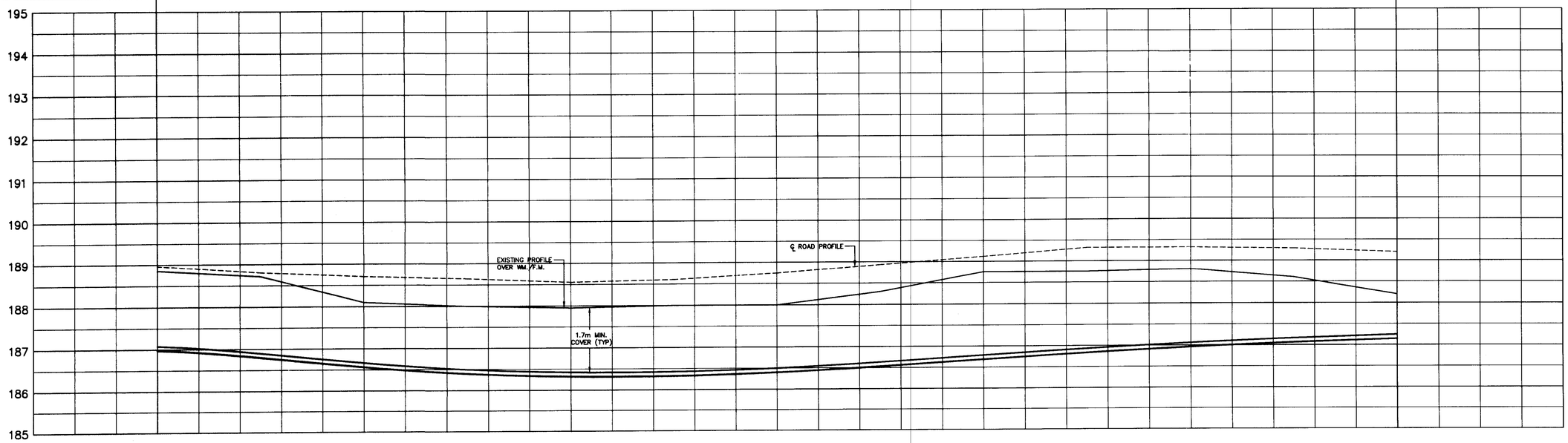
EAST END SERVICING

PLAN & PROFILE
GOLF COURSE ROAD
STA. 0+600 TO STA. 0+900

Aleksy CONSULTING ENGINEERS PLANNERS

CONTRACT No. 7A | DWG. 102207-SW3-RD





CHAINAGE	0+300	0+325	0+350	0+375	0+400	0+425	0+450	0+475	0+500	0+525	0+550	0+575	0+600
℄ ROAD	192.96	192.80	192.70	192.64	192.55	192.60	192.74	192.93	193.12	193.32	193.32	193.29	193.20
℄ WM./F.M.	188.85	188.71	188.10	188.00	187.95	188.00	188.00	188.30	188.75	188.75	188.80	188.60	188.20

LEGEND

- PROPERTY LINE
- BURIED BELL CABLE
- BURIED BELL CONDUIT
- BURIED GAS MAIN
- EXISTING WATER MAIN AND VALVE
- PROPOSED WATER MAIN AND VALVE
- EX. SANITARY SEWER & M.H.
- PROPOSED SANITARY FORCEMAIN
- GV. PROPOSED GATE VALVE

NOTES :

1) LOCATION OF UTILITIES ARE APPROXIMATE. CONTRACTOR TO OBTAIN UTILITY LOCATES AS REQUIRED PRIOR TO CONSTRUCTION.

PLOT: 1=5

RECORD DRAWING

COMPILED	BY: D.H.	DATE:	MAR. 1998
CHECKED	BY: R.H.M.	DATE:	MAR. 1998
DRAWN	BY: D.H.	DATE:	SEP. 1998
CHECKED	BY: R.H.M.	DATE:	SEP. 1998

NO.	REVISIONS	DATE	INITIAL
	REVISED RECORD DRAWING	SEP. 1998	R.H.M.

RECORD DRAWING

NOTICE TO USERS

This Record Drawing may include information provided by others. Ainley & Associates Limited believes this information to be reliable but has not verified its accuracy and/or completeness and, accordingly, shall not be responsible for any errors or omissions which may result from its incorporation herein.

TOWN OF WASAGA BEACH

PROPOSED R.V. PARK SERVICING

PLAN & PROFILE

GOLF COURSE RD. STA. 0+300 TO SAT. 0+600

Ainley & Associates Limited

Consulting Engineers and Planners

Collingwood – Barrie – Belleville – Ottawa

SCALE:	HORIZ: 1:500 VERT: 1:50		
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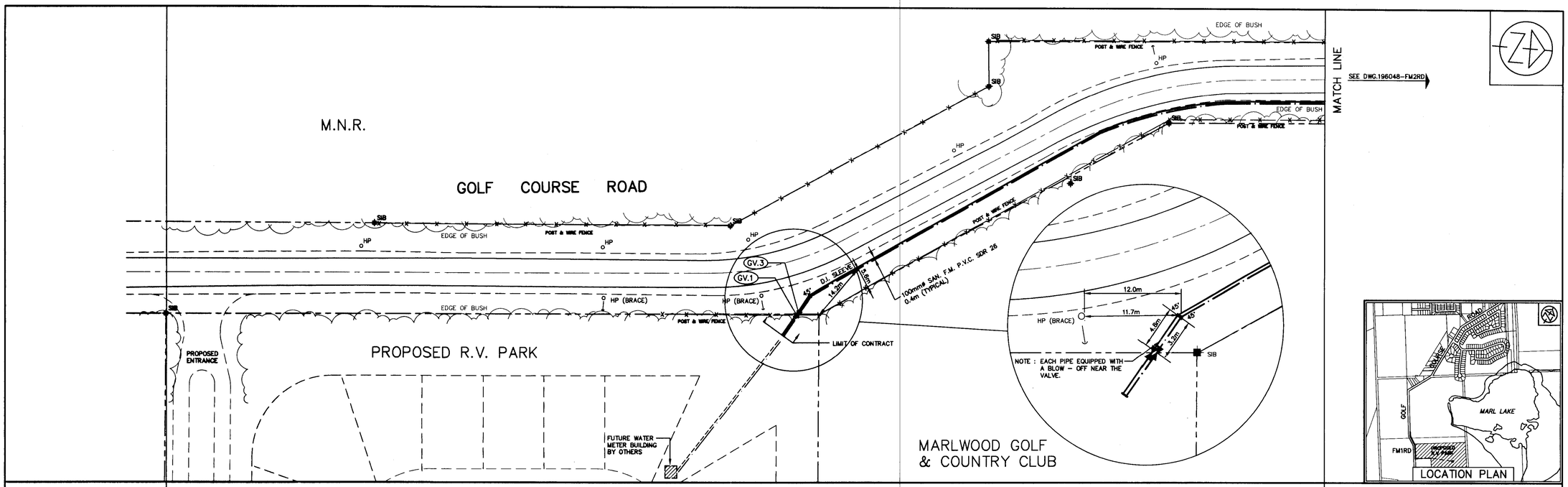
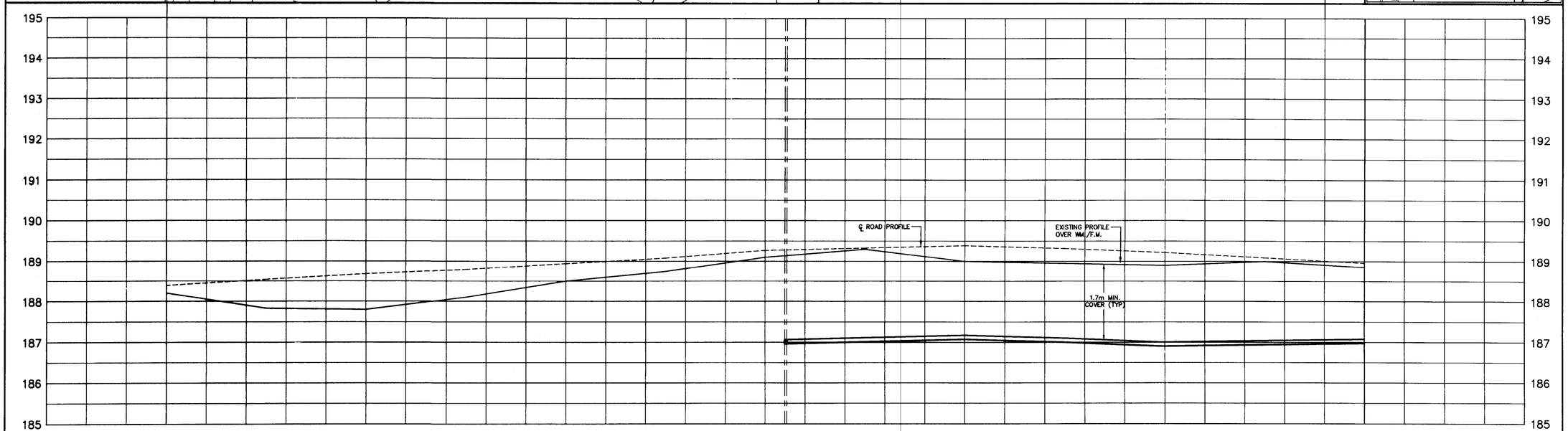
DRAWN:	D.P.	DATE:	JAN. 1997

DWG. 196048-FM2RD





CHAINAGE	℄ ROAD	℄ WM. F.M.
0+000	188.39	188.20
0+025	188.54	187.83
0+050	188.68	187.80
0+075	188.79	188.10
0+100	188.94	188.50
0+125	189.06	188.74
0+150	189.27	189.10
0+175	189.32	189.30
0+200	189.39	189.00
0+225	189.32	188.95
0+250	189.22	188.90
0+275	189.08	189.00
0+300	188.96	188.85

LEGEND

- PROPERTY LINE
- BURIED BELL CABLE
- BURIED BELL CONDUIT
- BURIED GAS MAIN
- EXISTING WATER MAIN AND VALVE
- PROPOSED WATER MAIN AND VALVE
- EX. SANITARY SEWER & M.H.
- PROPOSED SANITARY FORCEMAIN
- GV. PROPOSED GATE VALVE

PLOT: 1=5

NOTES :
1) LOCATION OF UTILITIES ARE APPROXIMATE. CONTRACTOR TO OBTAIN UTILITY LOCATES AS REQUIRED PRIOR TO CONSTRUCTION.

RECORD DRAWING

COMPILED BY: D.H.	DATE: MAR. 1998
CHECKED BY: R.H.M.	DATE: MAR. 1998
DRAWN BY: D.H.	DATE: SEP. 1998
CHECKED BY: R.H.M.	DATE: SEP. 1998

NO.	REVISIONS	DATE	INITIAL
	REVISED RECORD DRAWING	SEP. 1998	R.H.M.

RECORD DRAWING
NOTICE TO USERS

This Record Drawing may include information provided by others. Ainley & Associates Limited believes this information to be reliable but has not verified its accuracy and/or completeness and, accordingly, shall not be responsible for any errors or omissions which may result from its incorporation herein.

TOWN OF WASAGA BEACH
PROPOSED R.V. PARK SERVICING

PLAN & PROFILE
GOLF COURSE RD. STA. 0+000 TO SAT. 0+300

Ainley & Associates Limited
Consulting Engineers and Planners
Collingwood – Barrie – Belleville – Ottawa

SCALE: HORIZ: 1:500 VERT: 1:50			
DESIGN: R.H.M.	CHECKED: D.B.E.	DWG. 196048-FM1RD	
DRAWN: D.P.	DATE: APR. 1997		

BURNSIDE

[THE DIFFERENCE IS OUR PEOPLE]

Appendix D

Water Demand Calculations & Sanitary Pumping Station

BURNSIDE
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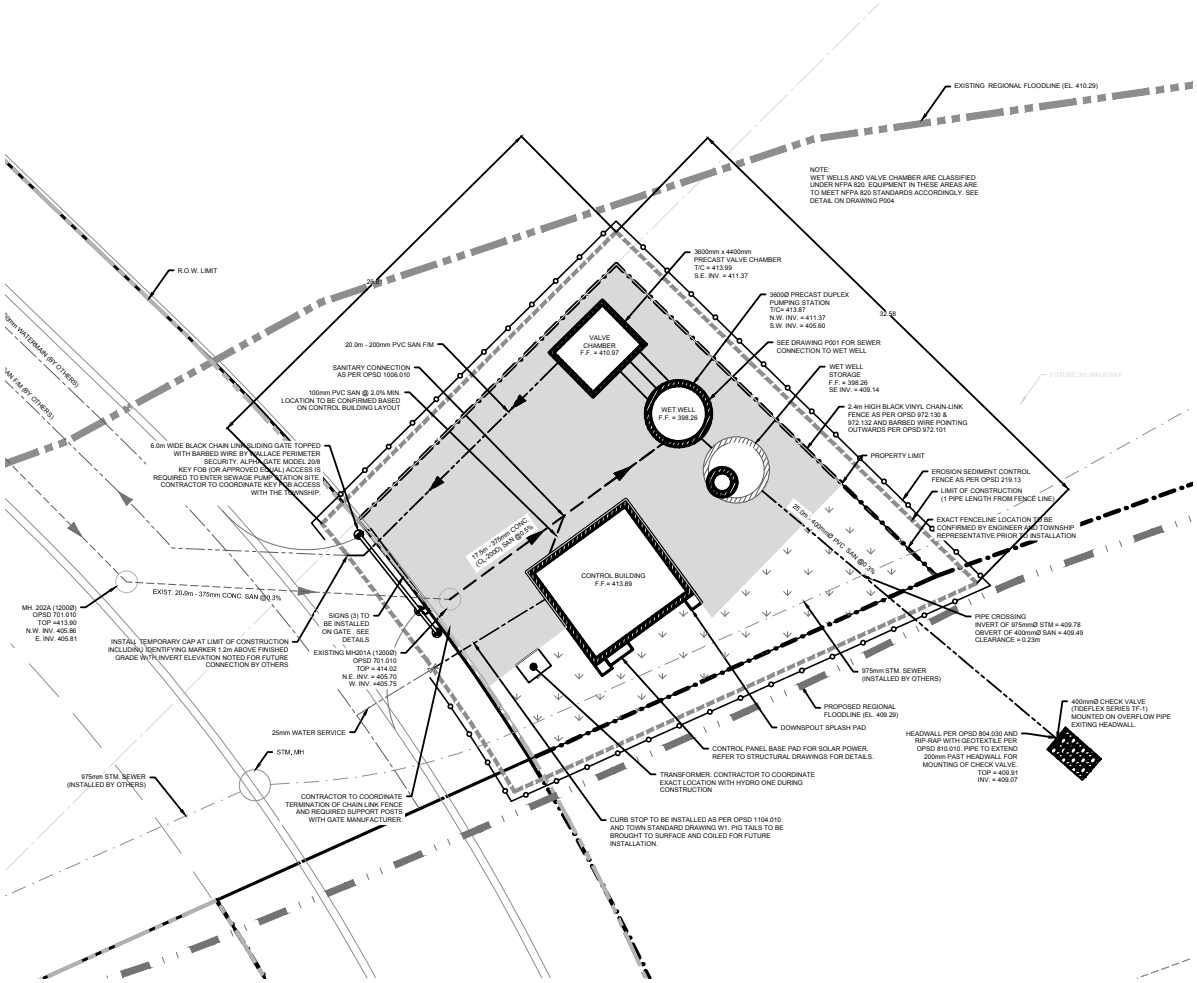
CALCULATION SHEET

Project: **Marlwood Development (East Portion)**
Water Demand Calculations

Prepared by:	C.Scobie
Checked by:	E. Tjeerdsma
Project No:	300037451
Date:	June 30, 2017
Updated:	November 29, 2019

Domestic Flow Calculations

Average Day Per Capita Flow =	350	L/c/d
Number of Proposed Units =	51	
Residential Density =	2.6	ppu
Population =	132.6	
Average Day Demand =	46,410	L/d
=	0.54	L/s
Peak Factor =	4	
Total Domestic Peak Demand =	**2.15**	**L/s**
	34	USGPM


EXISTING REGIONAL FLOODLINE (EL 410.29)
NOTE:
WET WELLS AND VALVE CHAMBER ARE CLASSIFIED UNDER NFPA 820. EQUIPMENT IN THESE AREAS ARE TO MEET NFPA 820 STANDARDS ACCORDINGLY. SEE DETAIL ON DRAWING P004
R.O.W. LIMIT
3600mm x 4400mm PRECAST VALVE CHAMBER T/C = 413.99 S.E. INV. = 411.37
3600Ø PRECAST DUPLEX PUMPING STATION T/C= 413.87 N.W. INV. = 411.37 S.W. INV. = 405.60
SEE DRAWING P001 FOR SEWER CONNECTION TO WET WELL
VALVE CHAMBER F.F. = 410.07
WET WELL F.F. = 398.26
WET WELL STORAGE F.F. = 398.26 SE INV. = 409.14
FUTURE 3m WALKWAY
2.4m HIGH BLACK VINYL CHAIN-LINK FENCE AS PER OPSD 972.130 & 972.132 AND BARBED WIRE POINTING OUTWARDS PER OPSD 972.101
PROPERTY LIMIT
EROSION SEDIMENT CONTROL FENCE AS PER OPSD 219.13
LIMIT OF CONSTRUCTION (1 PIPE LENGTH FROM FENCE LINE)
EXACT FENCELINE LOCATION TO BE CONFIRMED BY ENGINEER AND TOWNSHIP REPRESENTATIVE PRIOR TO INSTALLATION
20.0m - 200mm PVC SAN F/M
SANITARY CONNECTION AS PER OPSD 1006.010
100mm PVC SAN @ 2.0% MIN. LOCATION TO BE CONFIRMED BASED ON CONTROL BUILDING LAYOUT
6.0m WIDE BLACK CHAIN LINK SLIDING GATE TOPPED WITH BARBED WIRE BY WALLACE PERIMETER SECURITY. ALPHA GATE MODEL 20/8 KEY FOB (OR APPROVED EQUAL) ACCESS IS REQUIRED TO ENTER SEWAGE PUMPING STATION SITE. CONTRACTOR TO COORDINATE KEY FOB ACCESS WITH THE TOWNSHIP.
17.0m - 375mm CONC. (C-3000) SAN @0.3%
25.2m - 450mmØ PVC SAN @0.3%
CONTROL BUILDING F.F.= 413.89
EXIST. 20.2m - 375mm CONC. SAN @0.3%
MH. 202A (1200Ø) OPSD 701.010 TOP =413.90 N.W. INV. 405.86 E. INV. 405.81
SIGNS (3) TO BE INSTALLED ON GATE. SEE DETAILS
INSTALL TEMPORARY CAP AT LIMIT OF CONSTRUCTION INCLUDING IDENTIFYING MARKER 1.2m ABOVE FINISHED GRADE W/ FH, INVERT ELEVATION NOTED FOR FUTURE CONNECTION BY OTHERS
EXISTING MH201A (1200Ø) OPSD 701.010 TOP = 414.02 N.E. INV. = 405.70 W. INV. =405.75
PIPE CROSSING INVERT OF 975mmØ STM = 409.78 OBVERT OF 400mmØ SAN = 409.49 CLEARANCE = 0.23m
975mm STM. SEWER (INSTALLED BY OTHERS)
PROPOSED REGIONAL FLOODLINE (EL. 409.29)
DOWNSPOUT SPLASH PAD
400mmØ CHECK VALVE (TIDEFLEX SERIES TF-1) MOUNTED ON OVERFLOW PIPE EXITING HEADWALL.
HEADWALL PER OPSD 804.030 AND RIP-RAP WITH GEOTEXTILE PER OPSD 810.010. PIPE TO EXTEND 200mm PAST HEADWALL FOR MOUNTING OF CHECK VALVE. TOP = 409.91 INV. = 409.07
25mm WATER SERVICE
STM. MH
975mm STM. SEWER (INSTALLED BY OTHERS)
CONTROL PANEL BASE PAD FOR SOLAR POWER. REFER TO STRUCTURAL DRAWINGS FOR DETAILS.
TRANSFORMER. CONTRACTOR TO COORDINATE EXACT LOCATION WITH HYDRO ONE DURING CONSTRUCTION
CONTRACTOR TO COORDINATE TERMINATION OF CHAIN LINK FENCE AND REQUIRED SUPPORT POSTS WITH GATE MANUFACTURER.
CURB STOP TO BE INSTALLED AS PER OPSD 1104.010 AND TOWN STANDARD DRAWING W1. PIG TAILS TO BE BROUGHT TO SURFACE AND COILED FOR FUTURE INSTALLATION.

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Appendix E

Stormwater Management Calculations

BURNSIDE

Project: Marlwood
Project No.: 300037815
Modelled by: H. Knill
Date: 29-Nov-2019

SITE IMPERVIOUSNESS CALCULATIONS

PRE-DEVELOPMENT			
Catchment ID	**Area (ha)**	**Imperviousness (%)**	**Runoff Coefficient**
101	0.46	7	0.25
102	3.51	7	0.25
103	0.87	7	0.25
104	1.05	7	0.25
EX1	3.08	7	0.25
TOTAL	**8.97**	**7**	**0.25**

POST-DEVELOPMENT - CONTROLLED			
Catchment ID	**Area (ha)**	**Imperviousness (%)**	**Runoff Coefficient**
201	3.61	66	0.66
202	0.75	50	0.55
203	0.53	50	0.55
EX1	3.08	7	0.25
TOTAL	**7.97**	**40**	**0.48**

POST-DEVELOPMENT - UNCONTROLLED			
Catchment ID	**Area (ha)**	**Imperviousness (%)**	**Runoff Coefficient**
UN1	0.32	50	0.55
UN2	0.17	7	0.25
UN3	0.52	50	0.55
TOTAL	**1.01**	**43**	**0.50**

BURNSIDE

Project: Marlwood
Project No.: 300037815
Modelled by: H. Knill
Date: 29-Nov-2019

SWM POND REQUIRED PERMANENT POOL VOLUME - ENHANCED PROTECTION LEVEL

	Impervious Level (%)			
	35	**55**	**70**	**85**
Storage Volume (m^3/ha)	140	190	225	250

Pond Drainage Area Imperviousness = 40 %

Required Storage = 154 m^3/ha, less 40 m^3/ha (Extended Detention)

Pond Drainage Area = 7.97 ha

Required Storage = 906 m^3

Project:	Marlwood
Project No.:	300037815
Designed By:	H. Knill
Checked By:	J. Smith
Date:	29-Nov-2019

SWM POND SEDIMENT FOREBAY SIZING

Refer to MOE SWM Planning and Design Manual (2003) for equations shown

1) Settling Calculations

$$Dist = \sqrt{\frac{r Q_p}{V_s}}$$

Equation 4.5: Forebay Settling Length

r =	2	:1 (length:width)
Q_p =	0.008	m^3/s (quality event outflow)
V_s =	0.0003	m/s (recommended settling velocity)
Dist =	**7.3**	**m (min settling length)**

2) Dispersion Length

$$Dist = \frac{8Q}{dV_f}$$

Equation 4.6: Dispersion Length

Q =	1.783	m^3/s (5-year inflow)
d =	1	m (forebay depth)
V_f =	0.5	m/s (velocity of discharge jet at forebay berm)
Dist =	**28.5**	**m (min dispersion length)**

$$Width = \frac{Dist}{8}$$

Equation 4.7: Minimum Forebay Deep Zone Bottom Width

Width =	**3.6**	**m (min bottom width)**

Cross-sectional Area =	10.65	m^2	
Max velocity =	**Q / cross-sectional area**		
=	0.17	m/s	(0.15 m/s maximum)

3) Area Sizing

Forebay Permanent Pool

Elevation (m)	Area (m^2)	Volume (m^3)	Depth (m)
185.6	329	202	1

Entire Permanent Pool

Elevation (m)	Area (m^2)	Volume (m^3)	Depth (m)
185.6	1525	1011	1

Minimum Criteria (per MOE guidelines)

Forebay area =	**22**	**%**	**of total Permanent Pool area**
Maximum Forebay area =	33	%	of total Permanent Pool area

Preferred Criteria (per MOE guidelines)

Forebay volume =	**20**	**%**	**of total Permanent Pool volume**
Maximum Forebay volume =	20	%	of total Permanent Pool volume

Therefore, the minimum criteria per MOE guidelines are satisfied.

BURNSIDE

Project: Marlwood
Project No.: 300037815
Modelled by: H. Knill
Date: 29-Nov-2019

SWM POND STAGE STORAGE

	Elevation (m)	Area (m^2)	Average Area (m^2)	Height (m)	Volume (m^3)	Cumulative Volume (m^3)	Active Storage (m^3)	Depth (m)
	184.60	496				0		0.00
			1011	1.00	1011			
N.W.L.	**185.60**	**1525**				**1011**		**1.00**
			1883	0.50	942			
	186.10	2241				1952	942	1.50
			3162	1.45	4584			
	187.55	4082				6536	5526	2.95

Permanent Pool Volume Required = 906 m^3
Permanent Pool Volume Provided = 1011 m^3

BURNSIDE

Project: Marlwood
Project No.: 300037815
Modelled by: H. Knill
Date: 29-Nov-2019

EMERGENCY SPILLWAY SIZING CALCULATION

Manning's Equation:

$$Q = VA = \frac{AR^{2/3}S^{1/2}}{n}$$

Where: Q = Flow Rate (m^3/s)
V = Velocity (m/s)
A = Flow Area (m^2)
R = Hydraulic Radius (m)
S = Channel Slope (m/m)
n = Manning's Roughness Coefficient

Flow Depth =	0.29	m
Side Slope Ratio (H:V) =	3	:1
Bed Width =	7.00	m
Area =	2.28	m^2
Wetted Perimeter =	8.83	m
Slope =	1.00	%
Manning's n =	0.025	
Top Width =	8.74	m
Velocity =	1.62	m/s
Channel Discharge, Q =	**3.70**	**m^3/s**
Maximum 100-Year Inflow =	3.53	m^3/s

Therefore, the emergency spillway has sufficient capacity.

Project:	Marlwood
Project No.:	300037815
Designed By:	H. Knill
Checked By:	J. Smith
Date:	29-Nov-2019

EXTENDED DETENTION DRAWDOWN TIME & ORIFICE SIZING

Solve for Orifice Size/Drawdown Time:

$$A_o = \frac{0.66C_2h^{1.5} + 2C_3h^{0.5}}{2.75t}$$

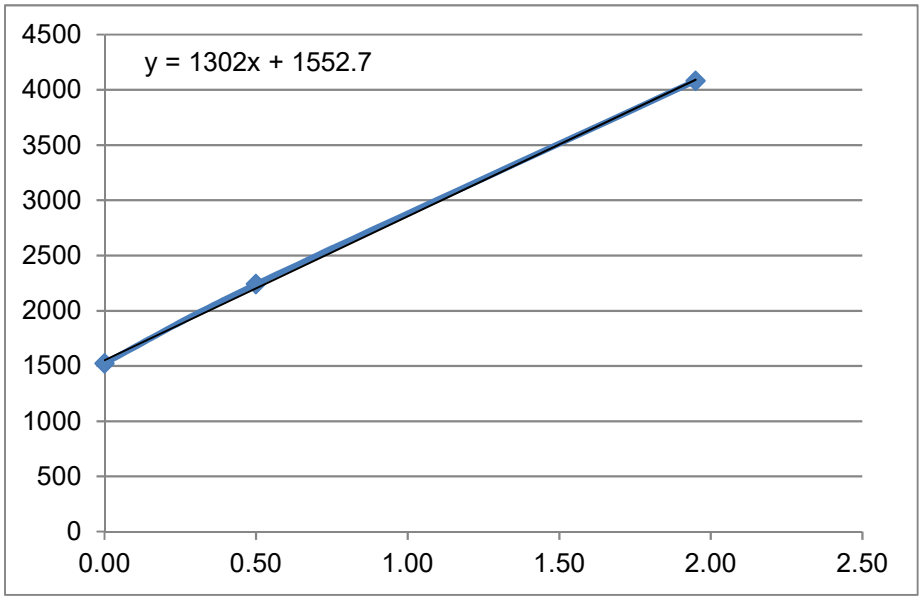
Falling Head Orifice Equation
(Eq. 4.11, MOE 2003)

Known:

t =	180000	seconds =	50	hours
h =	0.41	m		
C_2 =	1302	slope coefficient from area-depth linear regression		
C_3 =	1552.7	intercept from the area-depth linear regression		
A_o =	0.0045	m^2		
Dia =	**0.075**	**m**		

Area - Depth Linear Regression

Elevation (m)	Depth (m)	Area (m^2)
185.60	0.00	1525
186.10	0.50	2241
187.55	1.95	4082



Soakaway Pit Sizing - 51 Lots

TPC Marlwood Inc.
31 Marlwood Ave, Wasaga Beach ON

Project #: 300037815
Date: 14-Jan-20
Designed: AH
Checked: JS

Runoff Depth to be Infiltrated: 12 mm
Design Infiltration Rate: 15 mm/hr
Maximum Drawdown Time: 48 hrs

Catchment ID	Roof Coverage (Full Roof)	Lot Area (m^2)	Area to be Infiltrated (Roof) (m^2)	Runoff to be Infiltrated (m)	Required Runoff Volume to be Infiltrated (m^3)	Drawdown Time (hrs)	Drawdown Rate (m^3/hr)	Design Infiltration Rate (m/hr)	Minimum Infiltration Gallery Footprint Area (m^2)	Length (m) *Minimum 1.5m	Width (m) *Minimum 1.0m	Infiltration Height (m) * Minimum 1.0m	Soakaway Pit Footprint Volume (m^3)	Void Ratio	Available Volume (m^3)
Typical Lot	50%	648	324	0.012	3.89	19	0.20	0.015	13.5	4.0	3.4	0.72	9.71	0.4	3.9

Development Export Summary

Development :TPC Marlwood

Pre-Development Phosphorus Export

DEVELOPMENT : TPC Marlwood

Landuse	Area (ha)	P coeff (kg/ha)	Pload (kg/yr)
Natural Heritage			
Forest	2.90	0.06	0.17
Open Water	0.13	0.26	0.03
Turf/Sod	4.37	0.11	0.48
Natural Heritage Land use Class Total :	**7.40**		**0.68**
Development Total :	**7.40**		**0.68**

Cropland Site Sediment & Phosphorus Pre-Development Export

DEVELOPMENT : TPC Marlwood

COLOUR KEY : Site Specific Input | Constant / Lookup | Calculation

SubArea :

Slope Area (ha)	R (rainfall / runoff for Lake Simcoe)
Surface Slope Gradient (%)	K (soil errodability factor)
Length of Slope (m)	NN (determined by slope)
Cropt Type Factor)	LS (slope length gradient factor)
Tillage Type Factor	C (crop management factor)
	P (prevention + capture)
	Soil Loss (kg/year)
	Phosphorus export (kg/ha/yr)
	Phosphorus load (kg/yr)

PRE Developed Area (ha) :

Phosphorus export (kg/ha/yr) :

Phosphorus load (kg/yr) :

Updated : Sept 2014

Post-Development Phosphorus Export

DEVELOPMENT : TPC Marlwood

Landuse	Area (ha)	P coeff (kg/ha)	Pload (kg/yr)
Natural Heritage			
Forest	1.35	0.06	0.08
Wetland	0.75	0.05	0.04
Natural Heritage Land use Class Total :	**2.10**		**0.12**
Urban			
Residential	5.30	0.41	2.17
Urban Land use Class Total :	**5.30**		**2.17**
Development Total :	**7.40**		**2.29**

Updated : Sept 2014

Cropland Site Sediment & Phosphorus Post-Development Export

DEVELOPMENT : TPC Marlwood

COLOUR KEY : Site Specific Input | Constant / Lookup | Calculation

SubArea :

Slope Area (ha)
Surface Slope Gradient (%)
Length of Slope (m)

Cropt Type Factor)
Tillage Type Factor

R (rainfall / runoff for Lake Simcoe)
K (soil errodability factor)
NN (determined by slope)

LS (slope length gradient factor)
C (crop management factor)
P (prevention + capture)
Soil Loss (kg/year)
Phosphorus export (kg/ha/yr)
Phosphorus load (kg/yr)

PRE Developed Area (ha) :

Phosphorus export (kg/ha/yr) :

Phosphorus load (kg/yr) :

Updated : Sept 2014

Post Dev BMP

Area (ha)	Treated Area %	P coefficient	P coefficient	P Load Reduction (kg/yr)	Rationale
Best Management Practices (BMP) Applied (and Rationale)					
Residential					
4.88	100	0.41	63 %	1.26	
Wet Detention Ponds					
Residential					
1.77	100	0.41	60 %	0.44	
Soakaways - Infiltration Trenches					
Residential					
0.52	100	0.41	100 %	0.21	
Enhanced Grass/Water Quality Swales					

Updated : Sept 2014

Development Area P and BMP Summary

Total PreDevelopment Area (ha):	7.40
PreDevelopment Area excluding Wetlands (ha):	7.40
Total PostDevelopment Area (ha):	7.40
Total Area treated by BMP's (ha):	7.17
Treated Area total:	7.17
Total PreDevelopment Load (kg/yr):	0.68
Total PostDevelopment Load (kg/yr):	2.29
Total P Load Reduction with BMP's (kg/yr):	1.91
Minimum P Load Reduction Required:	1.61
Total PostDevelopment Load with BMP's (kg/yr)	0.38

Conclusion : No Net Increase in P Load.

Updated : Sept 2014

Post Dev Construction

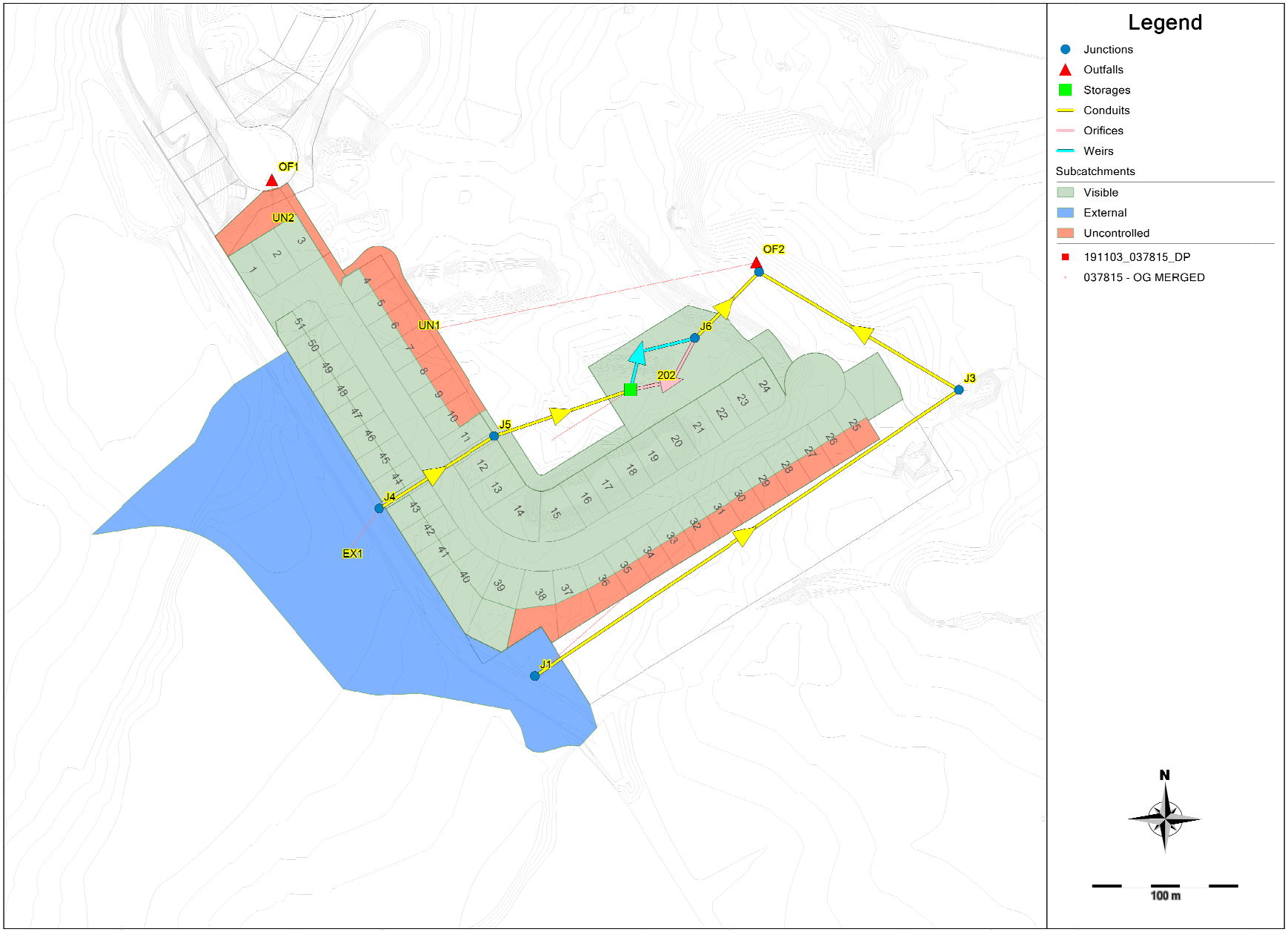
300037815 TPC Marlwood Inc.

Pre-Development
PCSWMM Model Layout


OF1
101
OF2
J3
104
102
J2
EX1
103
J1
Legend
Junctions
Outfalls
Conduits
Subcatchments
Visible
External
037815 - OG MERGED
N
100 m

300037815 TPC Marlwood Inc.

Post-Development
PCSWMM Model Layout


OF1
UN2
UN1
OF2
J6
202
J3
J5
J4
EX1
J1
Legend
Junctions
Outfalls
Storages
Conduits
Orifices
Weirs
Subcatchments
Visible
External
Uncontrolled
191103_037815_DP
037815 - OG MERGED
N
100 m

300037815 TPC Marlwood Inc.

Pre-Development PCSWMM Model
24-hr SCS Type II

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.011)

****
Element Count
****
Number of rain gages 14
Number of subcatchments ... 5
Number of nodes 5
Number of links 3
Number of pollutants 0
Number of land uses 0

****
Raingage Summary
****

Name	Data Source	Data Type	Recording Interval
100yr_24hr_SCS_TypeII	100yr_24hr_SCS_TypeII	INTENSITY	6 min.
100yr_4hr_Chicago	100yr_4hr_Chicago	INTENSITY	5 min.
10yr_24hr_SCS_TypeII	10yr_24hr_SCS_TypeII	INTENSITY	6 min.
10yr_4hr_Chicago	10yr_4hr_Chicago	INTENSITY	5 min.
25mm_4hr_Chicago	25mm_4hr_Chicago	INTENSITY	10 min.
25yr_24hr_SCS_TypeII	25yr_24hr_SCS_TypeII	INTENSITY	6 min.
25yr_4hr_Chicago	25yr_4hr_Chicago	INTENSITY	5 min.
2yr_24hr_SCS_TypeII	2yr_24hr_SCS_TypeII	INTENSITY	6 min.
2yr_4hr_Chicago	2yr_4hr_Chicago	INTENSITY	5 min.
50yr_24hr_SCS_TypeII	50yr_24hr_SCS_TypeII	INTENSITY	6 min.
50yr_4hr_Chicago	50yr_4hr_Chicago	INTENSITY	5 min.
5yr_24hr_SCS_TypeII	5yr_24hr_SCS_TypeII	INTENSITY	6 min.
5yr_4hr_Chicago	5yr_4hr_Chicago	INTENSITY	5 min.
Timmins_Storm_(0-25)	Timmins_Storm_(0-25)	INTENSITY	60 min.

****
Subcatchment Summary
****

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
101	0.46	59.22	7.00	0.5000	2yr_24hr_SCS_TypeII	OF1
102	3.52	395.00	7.00	4.0000	2yr_24hr_SCS_TypeII	OF2
103	0.87	229.97	7.00	7.4000	2yr_24hr_SCS_TypeII	J1

104	1.05	105.40	7.00	2.0000	2yr_24hr_SCS_TypeII	J2
EX1	3.08	205.15	7.00	5.0000	2yr_24hr_SCS_TypeII	102

****
Node Summary
****

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
J1	JUNCTION	188.00	0.60	0.0	
J2	JUNCTION	187.10	0.60	0.0	
J3	JUNCTION	186.25	0.60	0.0	
OF1	OUTFALL	184.00	0.00	0.0	
OF2	OUTFALL	185.44	0.61	0.0	

****
Link Summary
****

Name	From Node	To Node	Type	Length	%Slope	Roughness
C1	J1	J2	CONDUIT	244.6	0.3679	0.0400
C2	J2	J3	CONDUIT	107.7	0.7893	0.0400
C3	J3	OF2	CONDUIT	160.6	0.4981	0.0400

****
Cross Section Summary
****

Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow
C1	TRAPEZOIDAL	0.60	2.88	0.42	6.60	1	2.46
C2	TRAPEZOIDAL	0.60	2.88	0.42	6.60	1	3.61
C3	TRAPEZOIDAL	0.60	2.88	0.42	6.60	1	2.87

****
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
****

****

Analysis Options
****
Flow Units ..... CMS
Process Models:
  Rainfall/Runoff ..... YES
  RDII ..... NO
  Snowmelt ..... NO
  Groundwater ..... NO
  Flow Routing ..... YES
  Ponding Allowed ..... NO
  Water Quality ..... NO
Infiltration Method ..... GREEN_AMPT
Flow Routing Method ..... DYNWAVE
Starting Date 01/05/2017 00:00:00
Ending Date 01/06/2017 23:48:00
Antecedent Dry Days 0.0
Report Time Step 00:00:05
Wet Time Step 00:00:05
Dry Time Step 00:00:05
Routing Time Step ..... 5.00 sec
Variable Time Step ..... YES
Maximum Trials 8
Number of Threads 1
Head Tolerance ..... 0.001500 m

Runoff Quantity Continuity	Volume hectare-m	Depth mm
Total Precipitation	0.500	55.700
Evaporation Loss	0.000	0.000
Infiltration Loss	0.238	26.540
Surface Runoff	0.261	29.020
Final Storage	0.001	0.140
Continuity Error (%)	0.000	

Flow Routing Continuity	Volume hectare-m	Volume 10^6 ltr
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.261	2.605
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	0.260	2.605

Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.000	0.000
Continuity Error (%)	0.004	

****
Time-Step Critical Elements
****
None

****
Highest Flow Instability Indexes
****
All links are stable.

****
Routing Time Step Summary
****

Minimum Time Step	:	4.50 sec
Average Time Step	:	5.00 sec
Maximum Time Step	:	5.00 sec
Percent in Steady State	:	0.00
Average Iterations per Step	:	2.00
Percent Not Converging	:	0.00

****
Subcatchment Runoff Summary
****

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff CMS	Runoff Coeff
101	55.70	0.00	0.00	25.27	30.29	0.14	0.03	0.544
102	55.70	22.83	0.00	25.21	53.18	1.87	0.44	0.677
103	55.70	0.00	0.00	24.23	31.33	0.27	0.13	0.562
104	55.70	0.00	0.00	24.87	30.69	0.32	0.08	0.551
EX1	55.70	0.00	0.00	29.47	26.09	0.80	0.19	0.468

****
Node Depth Summary
****

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min	Reported Max Depth Meters
J1	JUNCTION	0.00	0.11	188.11	0 12:00	0.11
J2	JUNCTION	0.01	0.13	187.23	0 12:02	0.13
J3	JUNCTION	0.01	0.15	186.40	0 12:14	0.15
OF1	OUTFALL	0.00	0.00	184.00	0 00:00	0.00
OF2	OUTFALL	0.00	0.00	185.44	0 00:00	0.00

****
Node Inflow Summary
****

Node	Type	Maximum Lateral Inflow CMS	Maximum Total Inflow CMS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 ltr	Total Inflow Volume 10^6 ltr	Flow Balance Error Percent
J1	JUNCTION	0.128	0.128	0 11:54	0.274	0.274	-0.271
J2	JUNCTION	0.080	0.201	0 12:00	0.324	0.598	-0.014
J3	JUNCTION	0.000	0.212	0 12:05	0	0.598	0.193
OF1	OUTFALL	0.027	0.027	0 12:00	0.138	0.138	0.000
OF2	OUTFALL	0.440	0.469	0 12:00	1.87	2.47	0.000

****
Node Surcharge Summary
****

No nodes were surcharged.

****
Node Flooding Summary
****

No nodes were flooded.

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow CMS	Max Flow CMS	Total Volume 10^6 ltr
OF1	43.64	0.002	0.027	0.138
OF2	65.18	0.022	0.469	2.467
System	54.41	0.024	0.496	2.605

****
Link Flow Summary
****

Link	Type	Maximum |Flow| CMS	Time of Max Occurrence days hr:min	Maximum |Veloc| m/sec	Max/ Full Flow	Max/ Full Depth
C1	CONDUIT	0.121	0 12:00	0.32	0.05	0.20
C2	CONDUIT	0.212	0 12:05	0.51	0.06	0.21
C3	CONDUIT	0.134	0 12:14	0.39	0.05	0.18

****
Flow Classification Summary
****

Conduit	Adjusted /Actual Length	Fraction of Time in Flow Class: Dry	Up Dry	Down Dry	Sub Crit	Sup Crit	Up Crit	Down Crit	Norm Ltd	Inlet Ctrl
C1	1.00	0.07	0.00	0.00	0.93	0.00	0.00	0.00	0.90	0.00
C2	1.00	0.07	0.00	0.00	0.93	0.00	0.00	0.00	0.84	0.00
C3	1.00	0.08	0.00	0.00	0.00	0.00	0.00	0.92	0.00	0.00

****

Conduit Surcharge Summary
****

No conduits were surcharged.

Analysis begun on: Thu Nov 28 11:35:02 2019
Analysis ended on: Thu Nov 28 11:35:02 2019
Total elapsed time: < 1 sec

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.011)

****
Element Count
****
Number of rain gages 14
Number of subcatchments ... 5
Number of nodes 5
Number of links 3
Number of pollutants 0
Number of land uses 0

****
Raingage Summary
****

Name	Data Source	Data Type	Recording Interval
100yr_24hr_SCS_TypeII	100yr_24hr_SCS_TypeII	INTENSITY	6 min.
100yr_4hr_Chicago	100yr_4hr_Chicago	INTENSITY	5 min.
10yr_24hr_SCS_TypeII	10yr_24hr_SCS_TypeII	INTENSITY	6 min.
10yr_4hr_Chicago	10yr_4hr_Chicago	INTENSITY	5 min.
25mm_4hr_Chicago	25mm_4hr_Chicago	INTENSITY	10 min.
25yr_24hr_SCS_TypeII	25yr_24hr_SCS_TypeII	INTENSITY	6 min.
25yr_4hr_Chicago	25yr_4hr_Chicago	INTENSITY	5 min.
2yr_24hr_SCS_TypeII	2yr_24hr_SCS_TypeII	INTENSITY	6 min.
2yr_4hr_Chicago	2yr_4hr_Chicago	INTENSITY	5 min.
50yr_24hr_SCS_TypeII	50yr_24hr_SCS_TypeII	INTENSITY	6 min.
50yr_4hr_Chicago	50yr_4hr_Chicago	INTENSITY	5 min.
5yr_24hr_SCS_TypeII	5yr_24hr_SCS_TypeII	INTENSITY	6 min.
5yr_4hr_Chicago	5yr_4hr_Chicago	INTENSITY	5 min.
Timmins_Storm_(0-25)	Timmins_Storm_(0-25)	INTENSITY	60 min.

****
Subcatchment Summary
****

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
101	0.46	59.22	7.00	0.5000	5yr_24hr_SCS_TypeII	OF1
102	3.52	395.00	7.00	4.0000	5yr_24hr_SCS_TypeII	OF2
103	0.87	229.97	7.00	7.4000	5yr_24hr_SCS_TypeII	J1

104	1.05	105.40	7.00	2.0000	5yr_24hr_SCS_TypeII	J2
EX1	3.08	205.15	7.00	5.0000	5yr_24hr_SCS_TypeII	102

****
Node Summary
****

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
J1	JUNCTION	188.00	0.60	0.0	
J2	JUNCTION	187.10	0.60	0.0	
J3	JUNCTION	186.25	0.60	0.0	
OF1	OUTFALL	184.00	0.00	0.0	
OF2	OUTFALL	185.44	0.61	0.0	

****
Link Summary
****

Name	From Node	To Node	Type	Length	%Slope	Roughness
C1	J1	J2	CONDUIT	244.6	0.3679	0.0400
C2	J2	J3	CONDUIT	107.7	0.7893	0.0400
C3	J3	OF2	CONDUIT	160.6	0.4981	0.0400

****
Cross Section Summary
****

Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow
C1	TRAPEZOIDAL	0.60	2.88	0.42	6.60	1	2.46
C2	TRAPEZOIDAL	0.60	2.88	0.42	6.60	1	3.61
C3	TRAPEZOIDAL	0.60	2.88	0.42	6.60	1	2.87

****
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
****

****

Analysis Options
****
Flow Units ..... CMS
Process Models:
  Rainfall/Runoff ..... YES
  RDII ..... NO
  Snowmelt ..... NO
  Groundwater ..... NO
  Flow Routing ..... YES
  Ponding Allowed ..... NO
  Water Quality ..... NO
Infiltration Method ..... GREEN_AMPT
Flow Routing Method ..... DYNWAVE
Starting Date 01/05/2017 00:00:00
Ending Date 01/06/2017 23:48:00
Antecedent Dry Days 0.0
Report Time Step 00:00:05
Wet Time Step 00:00:05
Dry Time Step 00:00:05
Routing Time Step ..... 5.00 sec
Variable Time Step ..... YES
Maximum Trials 8
Number of Threads 1
Head Tolerance ..... 0.001500 m

**********	Volume	Depth
Runoff Quantity Continuity	hectare-m	mm
**********	---	---
Total Precipitation	0.663	73.900
Evaporation Loss	0.000	0.000
Infiltration Loss	0.283	31.488
Surface Runoff	0.379	42.272
Final Storage	0.001	0.140
Continuity Error (%)	0.000	

**********	Volume	Volume
Flow Routing Continuity	hectare-m	10^6 ltr
**********	---	---
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.379	3.795
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	0.379	3.794

Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.000	0.000
Continuity Error (%)	0.003	

****
Time-Step Critical Elements
****
None

****
Highest Flow Instability Indexes
****
All links are stable.

****
Routing Time Step Summary
****

Minimum Time Step	:	4.50 sec
Average Time Step	:	5.00 sec
Maximum Time Step	:	5.00 sec
Percent in Steady State	:	0.00
Average Iterations per Step	:	2.00
Percent Not Converging	:	0.00

****
Subcatchment Runoff Summary
****

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff CMS	Runoff Coeff
101	73.90	0.00	0.00	27.15	46.61	0.21	0.04	0.631
102	73.90	37.07	0.00	34.81	76.01	2.67	0.70	0.685
103	73.90	0.00	0.00	26.29	47.47	0.41	0.19	0.642
104	73.90	0.00	0.00	26.80	46.96	0.49	0.13	0.635
EX1	73.90	0.00	0.00	31.42	42.34	1.30	0.35	0.573

****
Node Depth Summary
****

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min	Reported Max Depth Meters
J1	JUNCTION	0.00	0.14	188.14	0 12:00	0.14
J2	JUNCTION	0.01	0.15	187.25	0 12:00	0.15
J3	JUNCTION	0.01	0.20	186.45	0 12:09	0.20
OF1	OUTFALL	0.00	0.00	184.00	0 00:00	0.00
OF2	OUTFALL	0.00	0.00	185.44	0 00:00	0.00

****
Node Inflow Summary
****

Node	Type	Maximum Lateral Inflow CMS	Maximum Total Inflow CMS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 ltr	Total Inflow Volume 10^6 ltr	Flow Balance Error Percent
J1	JUNCTION	0.185	0.185	0 11:54	0.415	0.415	-0.184
J2	JUNCTION	0.130	0.299	0 12:00	0.495	0.911	-0.013
J3	JUNCTION	0.000	0.287	0 12:00	0	0.911	0.133
OF1	OUTFALL	0.044	0.044	0 12:00	0.213	0.213	0.000
OF2	OUTFALL	0.700	0.827	0 12:00	2.67	3.58	0.000

****
Node Surcharge Summary
****

No nodes were surcharged.

****
Node Flooding Summary
****

No nodes were flooded.

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow CMS	Max Flow CMS	Total Volume 10^6 ltr
OF1	45.74	0.003	0.044	0.213
OF2	68.05	0.031	0.827	3.582
System	56.89	0.033	0.872	3.794

****
Link Flow Summary
****

Link	Type	Maximum |Flow| CMS	Time of Max Occurrence days hr:min	Maximum |Veloc| m/sec	Max/ Full Flow	Max/ Full Depth
C1	CONDUIT	0.169	0 12:00	0.36	0.07	0.24
C2	CONDUIT	0.287	0 12:00	0.56	0.08	0.28
C3	CONDUIT	0.219	0 12:09	0.46	0.08	0.23

****
Flow Classification Summary
****

Conduit	Adjusted /Actual Length	Fraction of Time in Flow Class: Dry	Up Dry	Down Dry	Sub Crit	Sup Crit	Up Crit	Down Crit	Norm Ltd	Inlet Ctrl
C1	1.00	0.05	0.00	0.00	0.95	0.00	0.00	0.00	0.90	0.00
C2	1.00	0.05	0.00	0.00	0.95	0.00	0.00	0.00	0.85	0.00
C3	1.00	0.06	0.00	0.00	0.00	0.00	0.00	0.94	0.00	0.00

****

Conduit Surcharge Summary
****

No conduits were surcharged.

Analysis begun on: Thu Nov 28 11:36:14 2019
Analysis ended on: Thu Nov 28 11:36:14 2019
Total elapsed time: < 1 sec

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.011)

****
Element Count
****
Number of rain gages 14
Number of subcatchments ... 5
Number of nodes 5
Number of links 3
Number of pollutants 0
Number of land uses 0

****
Raingage Summary
****

Name	Data Source	Data Type	Recording Interval
100yr_24hr_SCS_TypeII	100yr_24hr_SCS_TypeII	INTENSITY	6 min.
100yr_4hr_Chicago	100yr_4hr_Chicago	INTENSITY	5 min.
10yr_24hr_SCS_TypeII	10yr_24hr_SCS_TypeII	INTENSITY	6 min.
10yr_4hr_Chicago	10yr_4hr_Chicago	INTENSITY	5 min.
25mm_4hr_Chicago	25mm_4hr_Chicago	INTENSITY	10 min.
25yr_24hr_SCS_TypeII	25yr_24hr_SCS_TypeII	INTENSITY	6 min.
25yr_4hr_Chicago	25yr_4hr_Chicago	INTENSITY	5 min.
2yr_24hr_SCS_TypeII	2yr_24hr_SCS_TypeII	INTENSITY	6 min.
2yr_4hr_Chicago	2yr_4hr_Chicago	INTENSITY	5 min.
50yr_24hr_SCS_TypeII	50yr_24hr_SCS_TypeII	INTENSITY	6 min.
50yr_4hr_Chicago	50yr_4hr_Chicago	INTENSITY	5 min.
5yr_24hr_SCS_TypeII	5yr_24hr_SCS_TypeII	INTENSITY	6 min.
5yr_4hr_Chicago	5yr_4hr_Chicago	INTENSITY	5 min.
Timmins_Storm_(0-25)	Timmins_Storm_(0-25)	INTENSITY	60 min.

****
Subcatchment Summary
****

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
101	0.46	59.22	7.00	0.5000	10yr_24hr_SCS_TypeII	OF1
102	3.52	395.00	7.00	4.0000	10yr_24hr_SCS_TypeII	OF2
103	0.87	229.97	7.00	7.4000	10yr_24hr_SCS_TypeII	J1

104	1.05	105.40	7.00	2.0000	10yr_24hr_SCS_TypeII	J2
EX1	3.08	205.15	7.00	5.0000	10yr_24hr_SCS_TypeII	102

****
Node Summary
****

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
J1	JUNCTION	188.00	0.60	0.0	
J2	JUNCTION	187.10	0.60	0.0	
J3	JUNCTION	186.25	0.60	0.0	
OF1	OUTFALL	184.00	0.00	0.0	
OF2	OUTFALL	185.44	0.61	0.0	

****
Link Summary
****

Name	From Node	To Node	Type	Length	%Slope	Roughness
C1	J1	J2	CONDUIT	244.6	0.3679	0.0400
C2	J2	J3	CONDUIT	107.7	0.7893	0.0400
C3	J3	OF2	CONDUIT	160.6	0.4981	0.0400

****
Cross Section Summary
****

Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow
C1	TRAPEZOIDAL	0.60	2.88	0.42	6.60	1	2.46
C2	TRAPEZOIDAL	0.60	2.88	0.42	6.60	1	3.61
C3	TRAPEZOIDAL	0.60	2.88	0.42	6.60	1	2.87

****
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
****

****

Analysis Options
****
Flow Units ..... CMS
Process Models:
  Rainfall/Runoff ..... YES
  RDII ..... NO
  Snowmelt ..... NO
  Groundwater ..... NO
  Flow Routing ..... YES
  Ponding Allowed ..... NO
  Water Quality ..... NO
Infiltration Method ..... GREEN_AMPT
Flow Routing Method ..... DYNWAVE
Starting Date 01/05/2017 00:00:00
Ending Date 01/06/2017 23:48:00
Antecedent Dry Days 0.0
Report Time Step 00:00:05
Wet Time Step 00:00:05
Dry Time Step 00:00:05
Routing Time Step ..... 5.00 sec
Variable Time Step ..... YES
Maximum Trials 8
Number of Threads 1
Head Tolerance ..... 0.001500 m

Runoff Quantity Continuity	Volume hectare-m	Depth mm
Total Precipitation	0.771	85.900
Evaporation Loss	0.000	0.000
Infiltration Loss	0.372	41.481
Surface Runoff	0.397	44.279
Final Storage	0.001	0.140
Continuity Error (%)	0.000	

Flow Routing Continuity	Volume hectare-m	Volume 10^6 ltr
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.397	3.975
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	0.397	3.975

Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.000	0.000
Continuity Error (%)	0.003	

****
Time-Step Critical Elements
****
None

****
Highest Flow Instability Indexes
****
All links are stable.

****
Routing Time Step Summary
****

Minimum Time Step	:	4.50 sec
Average Time Step	:	5.00 sec
Maximum Time Step	:	5.00 sec
Percent in Steady State	:	0.00
Average Iterations per Step	:	2.00
Percent Not Converging	:	0.00

****
Subcatchment Runoff Summary
****

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff CMS	Runoff Coeff
101	85.90	0.00	0.00	40.18	45.58	0.21	0.05	0.531
102	85.90	36.26	0.00	40.36	81.66	2.87	0.82	0.668
103	85.90	0.00	0.00	38.83	46.93	0.41	0.22	0.546
104	85.90	0.00	0.00	39.65	46.11	0.49	0.14	0.537
EX1	85.90	0.00	0.00	44.34	41.42	1.27	0.37	0.482

****
Node Depth Summary
****

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min	Reported Max Depth Meters
J1	JUNCTION	0.00	0.15	188.15	0 12:00	0.15
J2	JUNCTION	0.01	0.18	187.28	0 12:00	0.18
J3	JUNCTION	0.01	0.21	186.46	0 12:09	0.21
OF1	OUTFALL	0.00	0.00	184.00	0 00:00	0.00
OF2	OUTFALL	0.00	0.00	185.44	0 00:00	0.00

****
Node Inflow Summary
****

Node	Type	Maximum Lateral Inflow CMS	Maximum Total Inflow CMS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 ltr	Total Inflow Volume 10^6 ltr	Flow Balance Error Percent
J1	JUNCTION	0.215	0.215	0 11:54	0.41	0.41	-0.288
J2	JUNCTION	0.144	0.341	0 12:00	0.486	0.897	-0.031
J3	JUNCTION	0.000	0.370	0 12:02	0	0.898	0.200
OF1	OUTFALL	0.049	0.049	0 12:00	0.208	0.208	0.000
OF2	OUTFALL	0.816	0.922	0 12:00	2.87	3.77	0.000

****
Node Surcharge Summary
****

No nodes were surcharged.

****
Node Flooding Summary
****

No nodes were flooded.

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow CMS	Max Flow CMS	Total Volume 10^6 ltr
OF1	45.87	0.003	0.049	0.208
OF2	68.30	0.032	0.922	3.767
System	57.08	0.035	0.970	3.974

****
Link Flow Summary
****

Link	Type	Maximum |Flow| CMS	Time of Max Occurrence days hr:min	Maximum |Veloc| m/sec	Max/ Full Flow	Max/ Full Depth
C1	CONDUIT	0.197	0 12:00	0.38	0.08	0.27
C2	CONDUIT	0.370	0 12:02	0.62	0.10	0.30
C3	CONDUIT	0.248	0 12:09	0.48	0.09	0.25

****
Flow Classification Summary
****

Conduit	Adjusted /Actual Length	Fraction of Time in Flow Class: Dry	Up Dry	Down Dry	Sub Crit	Sup Crit	Up Crit	Down Crit	Norm Ltd	Inlet Ctrl
C1	1.00	0.04	0.00	0.00	0.96	0.00	0.00	0.00	0.93	0.00
C2	1.00	0.05	0.00	0.00	0.95	0.00	0.00	0.00	0.87	0.00
C3	1.00	0.05	0.00	0.00	0.00	0.00	0.00	0.95	0.00	0.00

****

Conduit Surcharge Summary
****

No conduits were surcharged.

Analysis begun on: Thu Nov 28 11:38:17 2019
Analysis ended on: Thu Nov 28 11:38:17 2019
Total elapsed time: < 1 sec

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.011)

****
Element Count
****
Number of rain gages 14
Number of subcatchments ... 5
Number of nodes 5
Number of links 3
Number of pollutants 0
Number of land uses 0

****
Raingage Summary
****

Name	Data Source	Data Type	Recording Interval
100yr_24hr_SCS_TypeII	100yr_24hr_SCS_TypeII	INTENSITY	6 min.
100yr_4hr_Chicago	100yr_4hr_Chicago	INTENSITY	5 min.
10yr_24hr_SCS_TypeII	10yr_24hr_SCS_TypeII	INTENSITY	6 min.
10yr_4hr_Chicago	10yr_4hr_Chicago	INTENSITY	5 min.
25mm_4hr_Chicago	25mm_4hr_Chicago	INTENSITY	10 min.
25yr_24hr_SCS_TypeII	25yr_24hr_SCS_TypeII	INTENSITY	6 min.
25yr_4hr_Chicago	25yr_4hr_Chicago	INTENSITY	5 min.
2yr_24hr_SCS_TypeII	2yr_24hr_SCS_TypeII	INTENSITY	6 min.
2yr_4hr_Chicago	2yr_4hr_Chicago	INTENSITY	5 min.
50yr_24hr_SCS_TypeII	50yr_24hr_SCS_TypeII	INTENSITY	6 min.
50yr_4hr_Chicago	50yr_4hr_Chicago	INTENSITY	5 min.
5yr_24hr_SCS_TypeII	5yr_24hr_SCS_TypeII	INTENSITY	6 min.
5yr_4hr_Chicago	5yr_4hr_Chicago	INTENSITY	5 min.
Timmins_Storm_(0-25)	Timmins_Storm_(0-25)	INTENSITY	60 min.

****
Subcatchment Summary
****

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
101	0.46	59.22	7.00	0.5000	25yr_24hr_SCS_TypeII	OF1
102	3.52	395.00	7.00	4.0000	25yr_24hr_SCS_TypeII	OF2
103	0.87	229.97	7.00	7.4000	25yr_24hr_SCS_TypeII	J1

104	1.05	105.40	7.00	2.0000	25yr_24hr_SCS_TypeII J2
EX1	3.08	205.15	7.00	5.0000	25yr_24hr_SCS_TypeII 102

****
Node Summary
****

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
J1	JUNCTION	188.00	0.60	0.0	
J2	JUNCTION	187.10	0.60	0.0	
J3	JUNCTION	186.25	0.60	0.0	
OF1	OUTFALL	184.00	0.00	0.0	
OF2	OUTFALL	185.44	0.61	0.0	

****
Link Summary
****

Name	From Node	To Node	Type	Length	%Slope	Roughness
C1	J1	J2	CONDUIT	244.6	0.3679	0.0400
C2	J2	J3	CONDUIT	107.7	0.7893	0.0400
C3	J3	OF2	CONDUIT	160.6	0.4981	0.0400

****
Cross Section Summary
****

Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow
C1	TRAPEZOIDAL	0.60	2.88	0.42	6.60	1	2.46
C2	TRAPEZOIDAL	0.60	2.88	0.42	6.60	1	3.61
C3	TRAPEZOIDAL	0.60	2.88	0.42	6.60	1	2.87

****
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
****

****

Analysis Options
****
Flow Units ..... CMS
Process Models:
  Rainfall/Runoff ..... YES
  RDII ..... NO
  Snowmelt ..... NO
  Groundwater ..... NO
  Flow Routing ..... YES
  Ponding Allowed ..... NO
  Water Quality ..... NO
Infiltration Method ..... GREEN_AMPT
Flow Routing Method ..... DYNWAVE
Starting Date 01/05/2017 00:00:00
Ending Date 01/06/2017 23:48:00
Antecedent Dry Days 0.0
Report Time Step 00:00:05
Wet Time Step 00:00:05
Dry Time Step 00:00:05
Routing Time Step ..... 5.00 sec
Variable Time Step ..... YES
Maximum Trials 8
Number of Threads 1
Head Tolerance ..... 0.001500 m

**********	Volume	Depth
Runoff Quantity Continuity	hectare-m	mm
**********	---	---
Total Precipitation	0.908	101.200
Evaporation Loss	0.000	0.000
Infiltration Loss	0.435	48.473
Surface Runoff	0.472	52.587
Final Storage	0.001	0.140
Continuity Error (%)	0.000	

**********	Volume	Volume
Flow Routing Continuity	hectare-m	10^6 ltr
**********	---	---
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.472	4.721
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	0.472	4.720

Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.000	0.000
Continuity Error (%)	0.002	

****
Time-Step Critical Elements
****
None

****
Highest Flow Instability Indexes
****
All links are stable.

****
Routing Time Step Summary
****

Minimum Time Step	:	4.50 sec
Average Time Step	:	5.00 sec
Maximum Time Step	:	5.00 sec
Percent in Steady State	:	0.00
Average Iterations per Step	:	2.00
Percent Not Converging	:	0.00

****
Subcatchment Runoff Summary
****

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff CMS	Runoff Coeff
101	101.20	0.00	0.00	47.16	53.90	0.25	0.06	0.533
102	101.20	43.56	0.00	47.44	97.18	3.42	1.04	0.671
103	101.20	0.00	0.00	45.66	55.40	0.48	0.26	0.547
104	101.20	0.00	0.00	46.58	54.48	0.57	0.18	0.538
EX1	101.20	0.00	0.00	51.30	49.76	1.53	0.48	0.492

****
Node Depth Summary
****

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min	Reported Max Depth Meters
J1	JUNCTION	0.01	0.16	188.16	0 12:00	0.16
J2	JUNCTION	0.01	0.19	187.29	0 11:59	0.19
J3	JUNCTION	0.01	0.24	186.49	0 12:08	0.24
OF1	OUTFALL	0.00	0.00	184.00	0 00:00	0.00
OF2	OUTFALL	0.00	0.00	185.44	0 00:00	0.00

****
Node Inflow Summary
****

Node	Type	Maximum Lateral Inflow CMS	Maximum Total Inflow CMS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 ltr	Total Inflow Volume 10^6 ltr	Flow Balance Error Percent
J1	JUNCTION	0.262	0.262	0 11:54	0.484	0.484	-0.277
J2	JUNCTION	0.181	0.417	0 12:00	0.574	1.06	-0.039
J3	JUNCTION	0.000	0.448	0 12:00	0	1.06	0.197
OF1	OUTFALL	0.062	0.062	0 12:00	0.246	0.246	0.000
OF2	OUTFALL	1.040	1.214	0 12:00	3.42	4.47	0.000

****
Node Surcharge Summary
****

No nodes were surcharged.

****
Node Flooding Summary
****

No nodes were flooded.

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow CMS	Max Flow CMS	Total Volume 10^6 ltr
OF1	46.53	0.003	0.062	0.246
OF2	69.29	0.038	1.214	4.475
System	57.91	0.041	1.275	4.720

****
Link Flow Summary
****

Link	Type	Maximum |Flow| CMS	Time of Max Occurrence days hr:min	Maximum |Veloc| m/sec	Max/ Full Flow	Max/ Full Depth
C1	CONDUIT	0.236	0 12:00	0.39	0.10	0.30
C2	CONDUIT	0.448	0 12:00	0.66	0.12	0.34
C3	CONDUIT	0.314	0 12:08	0.52	0.11	0.28

****
Flow Classification Summary
****

Conduit	Adjusted /Actual Length	Fraction of Time in Flow Class: Dry	Up Dry	Down Dry	Sub Crit	Sup Crit	Up Crit	Down Crit	Norm Ltd	Inlet Ctrl
C1	1.00	0.04	0.00	0.00	0.96	0.00	0.00	0.00	0.93	0.00
C2	1.00	0.04	0.00	0.00	0.96	0.00	0.00	0.00	0.88	0.00
C3	1.00	0.05	0.00	0.00	0.00	0.00	0.00	0.95	0.00	0.00

****

Conduit Surcharge Summary
****

No conduits were surcharged.

Analysis begun on: Thu Nov 28 11:39:04 2019
Analysis ended on: Thu Nov 28 11:39:04 2019
Total elapsed time: < 1 sec

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.011)

****
Element Count
****
Number of rain gages 14
Number of subcatchments ... 5
Number of nodes 5
Number of links 3
Number of pollutants 0
Number of land uses 0

****
Raingage Summary
****

Name	Data Source	Data Type	Recording Interval
100yr_24hr_SCS_TypeII	100yr_24hr_SCS_TypeII	INTENSITY	6 min.
100yr_4hr_Chicago	100yr_4hr_Chicago	INTENSITY	5 min.
10yr_24hr_SCS_TypeII	10yr_24hr_SCS_TypeII	INTENSITY	6 min.
10yr_4hr_Chicago	10yr_4hr_Chicago	INTENSITY	5 min.
25mm_4hr_Chicago	25mm_4hr_Chicago	INTENSITY	10 min.
25yr_24hr_SCS_TypeII	25yr_24hr_SCS_TypeII	INTENSITY	6 min.
25yr_4hr_Chicago	25yr_4hr_Chicago	INTENSITY	5 min.
2yr_24hr_SCS_TypeII	2yr_24hr_SCS_TypeII	INTENSITY	6 min.
2yr_4hr_Chicago	2yr_4hr_Chicago	INTENSITY	5 min.
50yr_24hr_SCS_TypeII	50yr_24hr_SCS_TypeII	INTENSITY	6 min.
50yr_4hr_Chicago	50yr_4hr_Chicago	INTENSITY	5 min.
5yr_24hr_SCS_TypeII	5yr_24hr_SCS_TypeII	INTENSITY	6 min.
5yr_4hr_Chicago	5yr_4hr_Chicago	INTENSITY	5 min.
Timmins_Storm_(0-25)	Timmins_Storm_(0-25)	INTENSITY	60 min.

****
Subcatchment Summary
****

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
101	0.46	59.22	7.00	0.5000	50yr_24hr_SCS_TypeII	OF1
102	3.52	395.00	7.00	4.0000	50yr_24hr_SCS_TypeII	OF2
103	0.87	229.97	7.00	7.4000	50yr_24hr_SCS_TypeII	J1

104	1.05	105.40	7.00	2.0000	50yr_24hr_SCS_TypeII	J2
EX1	3.08	205.15	7.00	5.0000	50yr_24hr_SCS_TypeII	102

****
Node Summary
****

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
J1	JUNCTION	188.00	0.60	0.0	
J2	JUNCTION	187.10	0.60	0.0	
J3	JUNCTION	186.25	0.60	0.0	
OF1	OUTFALL	184.00	0.00	0.0	
OF2	OUTFALL	185.44	0.61	0.0	

****
Link Summary
****

Name	From Node	To Node	Type	Length	%Slope	Roughness
C1	J1	J2	CONDUIT	244.6	0.3679	0.0400
C2	J2	J3	CONDUIT	107.7	0.7893	0.0400
C3	J3	OF2	CONDUIT	160.6	0.4981	0.0400

****
Cross Section Summary
****

Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow
C1	TRAPEZOIDAL	0.60	2.88	0.42	6.60	1	2.46
C2	TRAPEZOIDAL	0.60	2.88	0.42	6.60	1	3.61
C3	TRAPEZOIDAL	0.60	2.88	0.42	6.60	1	2.87

****
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
****

****

Analysis Options
****
Flow Units ..... CMS
Process Models:
  Rainfall/Runoff ..... YES
  RDII ..... NO
  Snowmelt ..... NO
  Groundwater ..... NO
  Flow Routing ..... YES
  Ponding Allowed ..... NO
  Water Quality ..... NO
Infiltration Method ..... GREEN_AMPT
Flow Routing Method ..... DYNWAVE
Starting Date 01/05/2017 00:00:00
Ending Date 01/06/2017 23:48:00
Antecedent Dry Days 0.0
Report Time Step 00:00:05
Wet Time Step 00:00:05
Dry Time Step 00:00:05
Routing Time Step ..... 5.00 sec
Variable Time Step ..... YES
Maximum Trials 8
Number of Threads 1
Head Tolerance ..... 0.001500 m

**********	Volume	Depth
Runoff Quantity Continuity	hectare-m	mm
**********	---	---
Total Precipitation	1.009	112.400
Evaporation Loss	0.000	0.000
Infiltration Loss	0.450	50.122
Surface Runoff	0.558	62.138
Final Storage	0.001	0.140
Continuity Error (%)	0.000	

**********	Volume	Volume
Flow Routing Continuity	hectare-m	10^6 ltr
**********	---	---
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.558	5.578
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	0.558	5.578

Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.000	0.000
Continuity Error (%)	0.002	

****
Time-Step Critical Elements
****
None

****
Highest Flow Instability Indexes
****
All links are stable.

****
Routing Time Step Summary
****

Minimum Time Step	:	4.50 sec
Average Time Step	:	5.00 sec
Maximum Time Step	:	5.00 sec
Percent in Steady State	:	0.00
Average Iterations per Step	:	2.00
Percent Not Converging	:	0.00

****
Subcatchment Runoff Summary
****

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff CMS	Runoff Coeff
101	112.40	0.00	0.00	48.77	63.49	0.29	0.07	0.565
102	112.40	51.89	0.00	49.05	115.11	4.05	1.25	0.701
103	112.40	0.00	0.00	47.36	64.90	0.57	0.30	0.577
104	112.40	0.00	0.00	48.24	64.02	0.67	0.21	0.570
EX1	112.40	0.00	0.00	52.98	59.28	1.82	0.59	0.527

****
Node Depth Summary
****

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min	Reported Max Depth Meters
J1	JUNCTION	0.01	0.18	188.18	0 11:59	0.18
J2	JUNCTION	0.01	0.20	187.30	0 11:58	0.20
J3	JUNCTION	0.01	0.26	186.51	0 12:07	0.26
OF1	OUTFALL	0.00	0.00	184.00	0 00:00	0.00
OF2	OUTFALL	0.00	0.00	185.44	0 00:00	0.00

****
Node Inflow Summary
****

Node	Type	Maximum Lateral Inflow CMS	Maximum Total Inflow CMS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 ltr	Total Inflow Volume 10^6 ltr	Flow Balance Error Percent
J1	JUNCTION	0.299	0.299	0 11:54	0.567	0.567	-0.231
J2	JUNCTION	0.214	0.481	0 12:00	0.675	1.24	-0.039
J3	JUNCTION	0.000	0.482	0 11:59	0	1.24	0.171
OF1	OUTFALL	0.074	0.074	0 12:00	0.29	0.29	0.000
OF2	OUTFALL	1.246	1.504	0 12:00	4.05	5.29	0.000

****
Node Surcharge Summary
****

No nodes were surcharged.

****
Node Flooding Summary
****

No nodes were flooded.

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow CMS	Max Flow CMS	Total Volume 10^6 ltr
OF1	46.91	0.004	0.074	0.290
OF2	69.93	0.044	1.504	5.288
System	58.42	0.048	1.578	5.578

****
Link Flow Summary
****

Link	Type	Maximum |Flow| CMS	Time of Max Occurrence days hr:min	Maximum |Veloc| m/sec	Max/ Full Flow	Max/ Full Depth
C1	CONDUIT	0.267	0 11:59	0.40	0.11	0.31
C2	CONDUIT	0.482	0 11:59	0.67	0.13	0.37
C3	CONDUIT	0.373	0 12:07	0.56	0.13	0.31

****
Flow Classification Summary
****

Conduit	Adjusted /Actual Length	Fraction of Time in Flow Class: Dry	Up Dry	Down Dry	Sub Crit	Sup Crit	Up Crit	Down Crit	Norm Ltd	Inlet Ctrl
C1	1.00	0.03	0.00	0.00	0.97	0.00	0.00	0.00	0.93	0.00
C2	1.00	0.04	0.00	0.00	0.96	0.00	0.00	0.00	0.89	0.00
C3	1.00	0.04	0.00	0.00	0.00	0.00	0.00	0.96	0.00	0.00

****

Conduit Surcharge Summary
****

No conduits were surcharged.

Analysis begun on: Thu Nov 28 11:40:22 2019
Analysis ended on: Thu Nov 28 11:40:22 2019
Total elapsed time: < 1 sec

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.011)

****
Element Count
****
Number of rain gages 14
Number of subcatchments ... 5
Number of nodes 5
Number of links 3
Number of pollutants 0
Number of land uses 0

****
Raingage Summary
****

Name	Data Source	Data Type	Recording Interval
100yr_24hr_SCS_TypeII	100yr_24hr_SCS_TypeII	INTENSITY	6 min.
100yr_4hr_Chicago	100yr_4hr_Chicago	INTENSITY	5 min.
10yr_24hr_SCS_TypeII	10yr_24hr_SCS_TypeII	INTENSITY	6 min.
10yr_4hr_Chicago	10yr_4hr_Chicago	INTENSITY	5 min.
25mm_4hr_Chicago	25mm_4hr_Chicago	INTENSITY	10 min.
25yr_24hr_SCS_TypeII	25yr_24hr_SCS_TypeII	INTENSITY	6 min.
25yr_4hr_Chicago	25yr_4hr_Chicago	INTENSITY	5 min.
2yr_24hr_SCS_TypeII	2yr_24hr_SCS_TypeII	INTENSITY	6 min.
2yr_4hr_Chicago	2yr_4hr_Chicago	INTENSITY	5 min.
50yr_24hr_SCS_TypeII	50yr_24hr_SCS_TypeII	INTENSITY	6 min.
50yr_4hr_Chicago	50yr_4hr_Chicago	INTENSITY	5 min.
5yr_24hr_SCS_TypeII	5yr_24hr_SCS_TypeII	INTENSITY	6 min.
5yr_4hr_Chicago	5yr_4hr_Chicago	INTENSITY	5 min.
Timmins_Storm_(0-25)	Timmins_Storm_(0-25)	INTENSITY	60 min.

****
Subcatchment Summary
****

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
101	0.46	59.22	7.00	0.5000	100yr_24hr_SCS_TypeII	OF1
102	3.52	395.00	7.00	4.0000	100yr_24hr_SCS_TypeII	OF2
103	0.87	229.97	7.00	7.4000	100yr_24hr_SCS_TypeII	J1

104	1.05	105.40	7.00	2.0000	100yr_24hr_SCS_TypeII J2
EX1	3.08	205.15	7.00	5.0000	100yr_24hr_SCS_TypeII 102

****
Node Summary
****

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
J1	JUNCTION	188.00	0.60	0.0	
J2	JUNCTION	187.10	0.60	0.0	
J3	JUNCTION	186.25	0.60	0.0	
OF1	OUTFALL	184.00	0.00	0.0	
OF2	OUTFALL	185.44	0.61	0.0	

****
Link Summary
****

Name	From Node	To Node	Type	Length	%Slope	Roughness
C1	J1	J2	CONDUIT	244.6	0.3679	0.0400
C2	J2	J3	CONDUIT	107.7	0.7893	0.0400
C3	J3	OF2	CONDUIT	160.6	0.4981	0.0400

****
Cross Section Summary
****

Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow
C1	TRAPEZOIDAL	0.60	2.88	0.42	6.60	1	2.46
C2	TRAPEZOIDAL	0.60	2.88	0.42	6.60	1	3.61
C3	TRAPEZOIDAL	0.60	2.88	0.42	6.60	1	2.87

****
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
****

****

Analysis Options
****
Flow Units ..... CMS
Process Models:
  Rainfall/Runoff ..... YES
  RDII ..... NO
  Snowmelt ..... NO
  Groundwater ..... NO
  Flow Routing ..... YES
  Ponding Allowed ..... NO
  Water Quality ..... NO
Infiltration Method ..... GREEN_AMPT
Flow Routing Method ..... DYNWAVE
Starting Date 01/05/2017 00:00:00
Ending Date 01/06/2017 23:48:00
Antecedent Dry Days 0.0
Report Time Step 00:00:05
Wet Time Step 00:00:05
Dry Time Step 00:00:05
Routing Time Step ..... 5.00 sec
Variable Time Step ..... YES
Maximum Trials 8
Number of Threads 1
Head Tolerance ..... 0.001500 m

**********	Volume	Depth
Runoff Quantity Continuity	hectare-m	mm
**********	---	---
Total Precipitation	1.110	123.600
Evaporation Loss	0.000	0.000
Infiltration Loss	0.462	51.517
Surface Runoff	0.646	71.943
Final Storage	0.001	0.140
Continuity Error (%)	0.000	

**********	Volume	Volume
Flow Routing Continuity	hectare-m	10^6 ltr
**********	---	---
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.646	6.458
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	0.646	6.458

Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.000	0.000
Continuity Error (%)	0.001	

****
Time-Step Critical Elements
****
None

****
Highest Flow Instability Indexes
****
All links are stable.

****
Routing Time Step Summary
****

Minimum Time Step	:	4.50 sec
Average Time Step	:	5.00 sec
Maximum Time Step	:	5.00 sec
Percent in Steady State	:	0.00
Average Iterations per Step	:	2.00
Percent Not Converging	:	0.00

****
Subcatchment Runoff Summary
****

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff CMS	Runoff Coeff
101	123.60	0.00	0.00	50.14	73.32	0.33	0.09	0.593
102	123.60	60.44	0.00	50.38	133.52	4.69	1.46	0.726
103	123.60	0.00	0.00	48.85	74.61	0.65	0.33	0.604
104	123.60	0.00	0.00	49.66	73.80	0.78	0.25	0.597
EX1	123.60	0.00	0.00	54.42	69.04	2.12	0.70	0.559

Node Depth Summary

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min	Reported Max Depth Meters
J1	JUNCTION	0.01	0.19	188.19	0 11:58	0.19
J2	JUNCTION	0.01	0.21	187.31	0 12:00	0.21
J3	JUNCTION	0.01	0.28	186.53	0 12:06	0.28
OF1	OUTFALL	0.00	0.00	184.00	0 00:00	0.00
OF2	OUTFALL	0.00	0.00	185.44	0 00:00	0.00

Node Inflow Summary

Node	Type	Maximum Lateral Inflow CMS	Maximum Total Inflow CMS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 ltr	Total Inflow Volume 10^6 ltr	Flow Balance Error Percent
J1	JUNCTION	0.335	0.335	0 11:54	0.652	0.652	-0.216
J2	JUNCTION	0.247	0.544	0 12:00	0.778	1.43	-0.021
J3	JUNCTION	0.000	0.523	0 12:00	0	1.43	0.142
OF1	OUTFALL	0.087	0.087	0 12:00	0.334	0.334	0.000
OF2	OUTFALL	1.456	1.783	0 12:00	4.69	6.12	0.000

Node Surcharge Summary

No nodes were surcharged.

Node Flooding Summary

No nodes were flooded.

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow CMS	Max Flow CMS	Total Volume 10^6 ltr
OF1	47.24	0.004	0.087	0.334
OF2	70.53	0.050	1.783	6.123
System	58.89	0.055	1.869	6.458

****
Link Flow Summary
****

Link	Type	Maximum |Flow| CMS	Time of Max Occurrence days hr:min	Maximum |Veloc| m/sec	Max/ Full Flow	Max/ Full Depth
C1	CONDUIT	0.298	0 11:58	0.43	0.12	0.33
C2	CONDUIT	0.523	0 12:00	0.68	0.14	0.40
C3	CONDUIT	0.430	0 12:06	0.59	0.15	0.34

****
Flow Classification Summary
****

Conduit	Adjusted /Actual Length	Fraction of Time in Flow Class: Dry	Up Dry	Down Dry	Sub Crit	Sup Crit	Up Crit	Down Crit	Norm Ltd	Inlet Ctrl
C1	1.00	0.03	0.00	0.00	0.97	0.00	0.00	0.00	0.93	0.00
C2	1.00	0.03	0.00	0.00	0.97	0.00	0.00	0.00	0.89	0.00
C3	1.00	0.04	0.00	0.00	0.00	0.00	0.00	0.96	0.00	0.00

****

Conduit Surcharge Summary
****

No conduits were surcharged.

Analysis begun on: Thu Nov 28 11:40:52 2019
Analysis ended on: Thu Nov 28 11:40:53 2019
Total elapsed time: 00:00:01

300037815 TPC Marlwood Inc.

Post-Development PCSWMM Model
24-hr SCS Type II

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.011)

****
Element Count
****
Number of rain gages 14
Number of subcatchments ... 7
Number of nodes 9
Number of links 8
Number of pollutants 0
Number of land uses 0

****
Raingage Summary
****

Name	Data Source	Data Type	Recording Interval
100yr_24hr_SCS_TypeII	100yr_24hr_SCS_TypeII	INTENSITY	6 min.
100yr_4hr_Chicago	100yr_4hr_Chicago	INTENSITY	5 min.
10yr_24hr_SCS_TypeII	10yr_24hr_SCS_TypeII	INTENSITY	6 min.
10yr_4hr_Chicago	10yr_4hr_Chicago	INTENSITY	5 min.
25mm_4hr_Chicago	25mm_4hr_Chicago	INTENSITY	10 min.
25yr_24hr_SCS_TypeII	25yr_24hr_SCS_TypeII	INTENSITY	6 min.
25yr_4hr_Chicago	25yr_4hr_Chicago	INTENSITY	5 min.
2yr_24hr_SCS_TypeII	2yr_24hr_SCS_TypeII	INTENSITY	6 min.
2yr_4hr_Chicago	2yr_4hr_Chicago	INTENSITY	5 min.
50yr_24hr_SCS_TypeII	50yr_24hr_SCS_TypeII	INTENSITY	6 min.
50yr_4hr_Chicago	50yr_4hr_Chicago	INTENSITY	5 min.
5yr_24hr_SCS_TypeII	5yr_24hr_SCS_TypeII	INTENSITY	6 min.
5yr_4hr_Chicago	5yr_4hr_Chicago	INTENSITY	5 min.
Timmins_Storm_(0-25)	Timmins_Storm_(0-25)	INTENSITY	60 min.

****
Subcatchment Summary
****

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
201	3.61	2123.65	66.00	2.0000	2yr_24hr_SCS_TypeII	SU1
202	0.75	188.32	50.00	6.0000	2yr_24hr_SCS_TypeII	SU1
203	0.53	314.00	50.00	2.0000	2yr_24hr_SCS_TypeII	J4

EX1	3.08	205.16	7.00	5.0000	2yr_24hr_SCS_TypeII	J4
UN1	0.32	187.06	50.00	2.0000	2yr_24hr_SCS_TypeII	OF2
UN2	0.17	57.55	7.00	0.5000	2yr_24hr_SCS_TypeII	OF1
UN3	0.52	304.65	50.00	2.0000	2yr_24hr_SCS_TypeII	J1

****
Node Summary
****

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
J1	JUNCTION	188.00	0.60	0.0	
J3	JUNCTION	186.25	0.60	0.0	
J4	JUNCTION	187.44	0.50	0.0	
J5	JUNCTION	187.22	0.50	0.0	
J6	JUNCTION	185.60	2.00	0.0	
J7	JUNCTION	185.45	0.90	0.0	
OF1	OUTFALL	184.00	0.00	0.0	
OF2	OUTFALL	185.44	0.60	0.0	
SU1	STORAGE	184.60	2.95	0.0	

****
Link Summary
****

Name	From Node	To Node	Type	Length	%Slope	Roughness
C1	J1	J3	CONDUIT	352.3	0.4967	0.0400
C2	J3	J7	CONDUIT	159.6	0.5012	0.0400
C3	J4	J5	CONDUIT	89.9	0.2447	0.0250
C4	J5	SU1	CONDUIT	98.7	0.2534	0.0250
C5	J6	J7	CONDUIT	52.8	0.2843	0.0130
C6	J7	OF2	CONDUIT	1.0	1.0001	0.0400
OR1	SU1	J6	ORIFICE			
OR2	SU1	J6	WEIR			

****
Cross Section Summary
****

Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow
C1	TRAPEZOIDAL	0.60	2.88	0.42	6.60	1	2.86
C2	TRAPEZOIDAL	0.60	2.88	0.42	6.60	1	2.88

C3	TRAPEZOIDAL	0.50	1.25	0.30	4.00	1	1.11
C4	TRAPEZOIDAL	0.50	1.25	0.30	4.00	1	1.13
C5	CIRCULAR	0.90	0.64	0.23	0.90	1	0.97
C6	TRAPEZOIDAL	0.60	2.88	0.42	6.60	1	4.06

```
**********************************************************
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
**********************************************************

****************
Analysis Options
****************
Flow Units ............... CMS
Process Models:
  Rainfall/Runoff ........ YES
  RDII ................... NO
  Snowmelt ............... NO
  Groundwater ............ NO
  Flow Routing ........... YES
  Ponding Allowed ........ NO
  Water Quality .......... NO
Infiltration Method ...... GREEN_AMPT
Flow Routing Method ...... DYNWAVE
Starting Date ............ 01/05/2017 00:00:00
Ending Date .............. 01/07/2017 00:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:00:05
Wet Time Step ............ 00:00:05
Dry Time Step ............ 00:00:05
Routing Time Step ........ 5.00 sec
Variable Time Step ....... YES
Maximum Trials ........... 8
Number of Threads ........ 1
Head Tolerance ........... 0.001500 m

**************************        Volume         Depth
Runoff Quantity Continuity     hectare-m            mm
**************************     ---------       -------
Total Precipitation ......         0.500        55.700
Evaporation Loss .........         0.000         0.000
Infiltration Loss ........         0.154        17.175
```

Surface Runoff	0.339	37.707
Final Storage	0.007	0.818
Continuity Error (%)	0.000	

Flow Routing Continuity	Volume hectare-m	Volume 10^6 ltr
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.339	3.386
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	0.312	3.118
Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.101	1.010
Final Stored Volume	0.128	1.278
Continuity Error (%)	0.000	

Time-Step Critical Elements

Link C6 (15.97%)

Highest Flow Instability Indexes

All links are stable.

Routing Time Step Summary

Minimum Time Step	:	0.50 sec
Average Time Step	:	4.28 sec
Maximum Time Step	:	5.00 sec
Percent in Steady State	:	0.00
Average Iterations per Step	:	2.00
Percent Not Converging	:	0.00

Subcatchment Runoff Summary
****

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff CMS	Runoff Coeff
201	55.70	0.00	0.00	8.82	45.56	1.64	0.74	0.818
202	55.70	0.00	0.00	12.99	41.71	0.31	0.14	0.749
203	55.70	0.00	0.00	12.98	41.72	0.22	0.10	0.749
EX1	55.70	0.00	0.00	29.47	26.09	0.80	0.19	0.468
UN1	55.70	0.00	0.00	12.98	41.72	0.13	0.06	0.749
UN2	55.70	0.00	0.00	24.54	31.02	0.05	0.02	0.557
UN3	55.70	0.00	0.00	12.98	41.72	0.22	0.10	0.749

****
Node Depth Summary
****

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min	Reported Max Depth Meters
J1	JUNCTION	0.01	0.10	188.10	0 12:00	0.10
J3	JUNCTION	0.01	0.06	186.31	0 12:12	0.06
J4	JUNCTION	0.04	0.25	187.69	0 12:00	0.25
J5	JUNCTION	0.05	0.27	187.49	0 12:01	0.27
J6	JUNCTION	0.09	0.29	185.89	0 12:16	0.29
J7	JUNCTION	0.03	0.11	185.56	0 12:15	0.11
OF1	OUTFALL	0.00	0.00	184.00	0 00:00	0.00
OF2	OUTFALL	0.02	0.10	185.54	0 12:15	0.10
SU1	STORAGE	1.33	1.69	186.29	0 12:16	1.69

****
Node Inflow Summary
****

Node	Type	Maximum Lateral Inflow CMS	Maximum Total Inflow CMS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 ltr	Total Inflow Volume 10^6 ltr	Flow Balance Error Percent

J1	JUNCTION	0.101	0.101	0	11:54	0.216	0.216	-0.369
J3	JUNCTION	0.000	0.070	0	12:01	0	0.217	0.323
J4	JUNCTION	0.265	0.265	0	12:00	1.03	1.03	-0.089
J5	JUNCTION	0.000	0.257	0	12:00	0	1.03	0.078
J6	JUNCTION	0.000	0.257	0	12:16	0	2.72	0.014
J7	JUNCTION	0.000	0.306	0	12:14	0	2.94	0.123
OF1	OUTFALL	0.017	0.017	0	12:00	0.0518	0.0518	0.000
OF2	OUTFALL	0.062	0.314	0	12:14	0.133	3.07	0.000
SU1	STORAGE	0.881	1.032	0	11:54	1.96	4	0.003

****
Node Surcharge Summary
****

No nodes were surcharged.

****
Node Flooding Summary
****

No nodes were flooded.

****
Storage Volume Summary
****

Storage Unit	Average Volume 1000 m3	Avg Pcnt Full	Evap Pcnt Loss	Exfil Pcnt Loss	Maximum Volume 1000 m3	Max Pcnt Full	Time of Max Occurrence days hr:min	Maximum Outflow CMS
SU1	1.627	25	0	0	2.396	37	0 12:16	0.257

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow CMS	Max Flow CMS	Total Volume 10^6 ltr

OF1	42.18	0.003	0.017	0.052
OF2	94.41	0.057	0.314	3.066
System	68.29	0.060	0.323	3.118

****
Link Flow Summary
****

Link	Type	Maximum |Flow| CMS	Time of Max Occurrence days hr:min	Maximum |Veloc| m/sec	Max/ Full Flow	Max/ Full Depth
C1	CONDUIT	0.070	0 12:01	0.30	0.02	0.12
C2	CONDUIT	0.050	0 12:12	0.18	0.02	0.15
C3	CONDUIT	0.257	0 12:00	0.59	0.23	0.52
C4	CONDUIT	0.237	0 12:01	0.68	0.21	0.42
C5	CONDUIT	0.257	0 12:16	2.37	0.27	0.23
C6	CONDUIT	0.305	0 12:15	0.86	0.08	0.18
OR1	ORIFICE	0.008	0 12:16			1.00
OR2	WEIR	0.249	0 12:16			0.28

****
Flow Classification Summary
****

Conduit	Adjusted /Actual Length	Fraction of Time in Flow Class: Dry	Up Dry	Down Dry	Sub Crit	Sup Crit	Up Crit	Down Crit	Norm Ltd	Inlet Ctrl
C1	1.00	0.06	0.00	0.00	0.94	0.00	0.00	0.00	0.75	0.00
C2	1.00	0.06	0.00	0.00	0.94	0.00	0.00	0.00	0.93	0.00
C3	1.00	0.06	0.13	0.00	0.81	0.00	0.00	0.00	0.91	0.00
C4	1.00	0.06	0.00	0.00	0.00	0.00	0.00	0.94	0.00	0.00
C5	1.00	0.06	0.00	0.00	0.02	0.92	0.00	0.00	0.00	0.00
C6	1.00	0.06	0.00	0.00	0.94	0.00	0.00	0.00	0.01	0.00

****
Conduit Surcharge Summary
****

No conduits were surcharged.

Analysis begun on: Thu Nov 28 13:57:33 2019
Analysis ended on: Thu Nov 28 13:57:34 2019
Total elapsed time: 00:00:01

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.011)

****
Element Count
****
Number of rain gages 14
Number of subcatchments ... 7
Number of nodes 9
Number of links 8
Number of pollutants 0
Number of land uses 0

****
Raingage Summary
****

Name	Data Source	Data Type	Recording Interval
100yr_24hr_SCS_TypeII	100yr_24hr_SCS_TypeII	INTENSITY	6 min.
100yr_4hr_Chicago	100yr_4hr_Chicago	INTENSITY	5 min.
10yr_24hr_SCS_TypeII	10yr_24hr_SCS_TypeII	INTENSITY	6 min.
10yr_4hr_Chicago	10yr_4hr_Chicago	INTENSITY	5 min.
25mm_4hr_Chicago	25mm_4hr_Chicago	INTENSITY	10 min.
25yr_24hr_SCS_TypeII	25yr_24hr_SCS_TypeII	INTENSITY	6 min.
25yr_4hr_Chicago	25yr_4hr_Chicago	INTENSITY	5 min.
2yr_24hr_SCS_TypeII	2yr_24hr_SCS_TypeII	INTENSITY	6 min.
2yr_4hr_Chicago	2yr_4hr_Chicago	INTENSITY	5 min.
50yr_24hr_SCS_TypeII	50yr_24hr_SCS_TypeII	INTENSITY	6 min.
50yr_4hr_Chicago	50yr_4hr_Chicago	INTENSITY	5 min.
5yr_24hr_SCS_TypeII	5yr_24hr_SCS_TypeII	INTENSITY	6 min.
5yr_4hr_Chicago	5yr_4hr_Chicago	INTENSITY	5 min.
Timmins_Storm_(0-25)	Timmins_Storm_(0-25)	INTENSITY	60 min.

****
Subcatchment Summary
****

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
201	3.61	2123.65	66.00	2.0000	5yr_24hr_SCS_TypeII	SU1
202	0.75	188.32	50.00	6.0000	5yr_24hr_SCS_TypeII	SU1
203	0.53	314.00	50.00	2.0000	5yr_24hr_SCS_TypeII	J4

EX1	3.08	205.16	7.00	5.0000	5yr_24hr_SCS_TypeII	J4
UN1	0.32	187.06	50.00	2.0000	5yr_24hr_SCS_TypeII	OF2
UN2	0.17	57.55	7.00	0.5000	5yr_24hr_SCS_TypeII	OF1
UN3	0.52	304.65	50.00	2.0000	5yr_24hr_SCS_TypeII	J1

****
Node Summary
****

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
J1	JUNCTION	188.00	0.60	0.0	
J3	JUNCTION	186.25	0.60	0.0	
J4	JUNCTION	187.44	0.50	0.0	
J5	JUNCTION	187.22	0.50	0.0	
J6	JUNCTION	185.60	2.00	0.0	
J7	JUNCTION	185.45	0.90	0.0	
OF1	OUTFALL	184.00	0.00	0.0	
OF2	OUTFALL	185.44	0.60	0.0	
SU1	STORAGE	184.60	2.95	0.0	

****
Link Summary
****

Name	From Node	To Node	Type	Length	%Slope	Roughness
C1	J1	J3	CONDUIT	352.3	0.4967	0.0400
C2	J3	J7	CONDUIT	159.6	0.5012	0.0400
C3	J4	J5	CONDUIT	89.9	0.2447	0.0250
C4	J5	SU1	CONDUIT	98.7	0.2534	0.0250
C5	J6	J7	CONDUIT	52.8	0.2843	0.0130
C6	J7	OF2	CONDUIT	1.0	1.0001	0.0400
OR1	SU1	J6	ORIFICE			
OR2	SU1	J6	WEIR			

****
Cross Section Summary
****

Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow
C1	TRAPEZOIDAL	0.60	2.88	0.42	6.60	1	2.86
C2	TRAPEZOIDAL	0.60	2.88	0.42	6.60	1	2.88

C3	TRAPEZOIDAL	0.50	1.25	0.30	4.00	1	1.11
C4	TRAPEZOIDAL	0.50	1.25	0.30	4.00	1	1.13
C5	CIRCULAR	0.90	0.64	0.23	0.90	1	0.97
C6	TRAPEZOIDAL	0.60	2.88	0.42	6.60	1	4.06

****
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
****

****
Analysis Options
****
Flow Units ..... CMS
Process Models:
  Rainfall/Runoff ..... YES
  RDII ..... NO
  Snowmelt ..... NO
  Groundwater ..... NO
  Flow Routing ..... YES
  Ponding Allowed ..... NO
  Water Quality ..... NO
Infiltration Method ..... GREEN_AMPT
Flow Routing Method ..... DYNWAVE
Starting Date 01/05/2017 00:00:00
Ending Date 01/07/2017 00:00:00
Antecedent Dry Days 0.0
Report Time Step 00:00:05
Wet Time Step 00:00:05
Dry Time Step 00:00:05
Routing Time Step ..... 5.00 sec
Variable Time Step ..... YES
Maximum Trials 8
Number of Threads 1
Head Tolerance ..... 0.001500 m

**********	Volume	Depth
Runoff Quantity Continuity	hectare-m	mm
**********	---------	-------
Total Precipitation	0.663	73.900
Evaporation Loss	0.000	0.000
Infiltration Loss	0.166	18.445

Surface Runoff	0.491	54.637
Final Storage	0.007	0.818
Continuity Error (%)	0.000	

Flow Routing Continuity	Volume hectare-m	Volume 10^6 ltr
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.491	4.905
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	0.463	4.626
Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.101	1.010
Final Stored Volume	0.129	1.289
Continuity Error (%)	0.000	

Time-Step Critical Elements

Link C6 (24.51%)

Highest Flow Instability Indexes

Link C5 (2)

Routing Time Step Summary

Minimum Time Step	:	0.50 sec
Average Time Step	:	3.90 sec
Maximum Time Step	:	5.00 sec
Percent in Steady State	:	0.00
Average Iterations per Step	:	2.00
Percent Not Converging	:	0.00

Subcatchment Runoff Summary
****

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff CMS	Runoff Coeff
201	73.90	0.00	0.00	9.57	63.01	2.27	0.99	0.853
202	73.90	0.00	0.00	14.11	58.80	0.44	0.19	0.796
203	73.90	0.00	0.00	14.09	58.81	0.31	0.14	0.796
EX1	73.90	0.00	0.00	31.42	42.34	1.30	0.35	0.573
UN1	73.90	0.00	0.00	14.09	58.81	0.19	0.08	0.796
UN2	73.90	0.00	0.00	26.54	47.22	0.08	0.03	0.639
UN3	73.90	0.00	0.00	14.09	58.81	0.30	0.14	0.796

****
Node Depth Summary
****

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min	Reported Max Depth Meters
J1	JUNCTION	0.01	0.12	188.12	0 12:00	0.12
J3	JUNCTION	0.01	0.08	186.33	0 12:08	0.08
J4	JUNCTION	0.06	0.32	187.76	0 12:00	0.32
J5	JUNCTION	0.07	0.35	187.57	0 12:00	0.35
J6	JUNCTION	0.13	0.44	186.04	0 12:08	0.44
J7	JUNCTION	0.05	0.17	185.62	0 12:09	0.17
OF1	OUTFALL	0.00	0.00	184.00	0 00:00	0.00
OF2	OUTFALL	0.04	0.15	185.59	0 12:09	0.15
SU1	STORAGE	1.40	1.86	186.46	0 12:08	1.86

****
Node Inflow Summary
****

Node	Type	Maximum Lateral Inflow CMS	Maximum Total Inflow CMS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 ltr	Total Inflow Volume 10^6 ltr	Flow Balance Error Percent

J1	JUNCTION	0.137	0.137	0	11:54	0.305	0.305	-0.362
J3	JUNCTION	0.000	0.104	0	12:00	0	0.306	0.312
J4	JUNCTION	0.452	0.452	0	12:00	1.62	1.62	-0.082
J5	JUNCTION	0.000	0.443	0	12:00	0	1.62	0.071
J6	JUNCTION	0.000	0.513	0	12:08	0	4.06	0.028
J7	JUNCTION	0.000	0.625	0	12:08	0	4.36	0.068
OF1	OUTFALL	0.026	0.026	0	12:00	0.0789	0.0788	0.000
OF2	OUTFALL	0.084	0.605	0	12:09	0.187	4.55	0.000
SU1	STORAGE	1.183	1.492	0	11:54	2.72	5.35	0.003

****
Node Surcharge Summary
****

No nodes were surcharged.

****
Node Flooding Summary
****

No nodes were flooded.

****
Storage Volume Summary
****

Storage Unit	Average Volume 1000 m3	Avg Pcnt Full	Evap Pcnt Loss	Exfil Pcnt Loss	Maximum Volume 1000 m3	Max Pcnt Full	Time of Max Occurrence days hr:min	Maximum Outflow CMS
SU1	1.769	27	0	0	2.830	43	0 12:08	0.513

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow CMS	Max Flow CMS	Total Volume 10^6 ltr

OF1	56.30	0.004	0.026	0.079
OF2	96.04	0.114	0.605	4.548
System	76.17	0.118	0.621	4.626

****
Link Flow Summary
****

Link	Type	Maximum |Flow| CMS	Time of Max Occurrence days hr:min	Maximum |Veloc| m/sec	Max/ Full Flow	Max/ Full Depth
C1	CONDUIT	0.104	0 12:00	0.34	0.04	0.15
C2	CONDUIT	0.076	0 12:08	0.19	0.03	0.20
C3	CONDUIT	0.443	0 12:00	0.69	0.40	0.67
C4	CONDUIT	0.421	0 12:00	0.82	0.37	0.56
C5	CONDUIT	0.549	0 12:08	2.97	0.57	0.34
C6	CONDUIT	0.590	0 12:09	1.08	0.15	0.26
OR1	ORIFICE	0.008	0 12:08			1.00
OR2	WEIR	0.505	0 12:08			0.45

****
Flow Classification Summary
****

	Adjusted	Fraction of Time in Flow Class								
Conduit	/Actual Length	Dry	Up Dry	Down Dry	Sub Crit	Sup Crit	Up Crit	Down Crit	Norm Ltd	Inlet Ctrl
C1	1.00	0.04	0.00	0.00	0.96	0.00	0.00	0.00	0.75	0.00
C2	1.00	0.04	0.00	0.00	0.95	0.00	0.00	0.00	0.94	0.00
C3	1.00	0.04	0.12	0.00	0.84	0.00	0.00	0.00	0.93	0.00
C4	1.00	0.04	0.00	0.00	0.00	0.00	0.00	0.96	0.00	0.00
C5	1.00	0.04	0.00	0.00	0.02	0.94	0.00	0.00	0.00	0.00
C6	1.00	0.04	0.00	0.00	0.96	0.00	0.00	0.00	0.01	0.00

****
Conduit Surcharge Summary
****

No conduits were surcharged.

Analysis begun on: Thu Nov 28 14:01:26 2019
Analysis ended on: Thu Nov 28 14:01:27 2019
Total elapsed time: 00:00:01

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.011)

****
Element Count
****
Number of rain gages 14
Number of subcatchments ... 7
Number of nodes 9
Number of links 8
Number of pollutants 0
Number of land uses 0

****
Raingage Summary
****

Name	Data Source	Data Type	Recording Interval
100yr_24hr_SCS_TypeII	100yr_24hr_SCS_TypeII	INTENSITY	6 min.
100yr_4hr_Chicago	100yr_4hr_Chicago	INTENSITY	5 min.
10yr_24hr_SCS_TypeII	10yr_24hr_SCS_TypeII	INTENSITY	6 min.
10yr_4hr_Chicago	10yr_4hr_Chicago	INTENSITY	5 min.
25mm_4hr_Chicago	25mm_4hr_Chicago	INTENSITY	10 min.
25yr_24hr_SCS_TypeII	25yr_24hr_SCS_TypeII	INTENSITY	6 min.
25yr_4hr_Chicago	25yr_4hr_Chicago	INTENSITY	5 min.
2yr_24hr_SCS_TypeII	2yr_24hr_SCS_TypeII	INTENSITY	6 min.
2yr_4hr_Chicago	2yr_4hr_Chicago	INTENSITY	5 min.
50yr_24hr_SCS_TypeII	50yr_24hr_SCS_TypeII	INTENSITY	6 min.
50yr_4hr_Chicago	50yr_4hr_Chicago	INTENSITY	5 min.
5yr_24hr_SCS_TypeII	5yr_24hr_SCS_TypeII	INTENSITY	6 min.
5yr_4hr_Chicago	5yr_4hr_Chicago	INTENSITY	5 min.
Timmins_Storm_(0-25)	Timmins_Storm_(0-25)	INTENSITY	60 min.

****
Subcatchment Summary
****

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
201	3.61	2123.65	66.00	2.0000	10yr_24hr_SCS_TypeII	SU1
202	0.75	188.32	50.00	6.0000	10yr_24hr_SCS_TypeII	SU1
203	0.53	314.00	50.00	2.0000	10yr_24hr_SCS_TypeII	J4

EX1	3.08	205.16	7.00	5.0000	10yr_24hr_SCS_TypeII	J4
UN1	0.32	187.06	50.00	2.0000	10yr_24hr_SCS_TypeII	OF2
UN2	0.17	57.55	7.00	0.5000	10yr_24hr_SCS_TypeII	OF1
UN3	0.52	304.65	50.00	2.0000	10yr_24hr_SCS_TypeII	J1

****
Node Summary
****

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
J1	JUNCTION	188.00	0.60	0.0	
J3	JUNCTION	186.25	0.60	0.0	
J4	JUNCTION	187.44	0.50	0.0	
J5	JUNCTION	187.22	0.50	0.0	
J6	JUNCTION	185.60	2.00	0.0	
J7	JUNCTION	185.45	0.90	0.0	
OF1	OUTFALL	184.00	0.00	0.0	
OF2	OUTFALL	185.44	0.60	0.0	
SU1	STORAGE	184.60	2.95	0.0	

****
Link Summary
****

Name	From Node	To Node	Type	Length	%Slope	Roughness
C1	J1	J3	CONDUIT	352.3	0.4967	0.0400
C2	J3	J7	CONDUIT	159.6	0.5012	0.0400
C3	J4	J5	CONDUIT	89.9	0.2447	0.0250
C4	J5	SU1	CONDUIT	98.7	0.2534	0.0250
C5	J6	J7	CONDUIT	52.8	0.2843	0.0130
C6	J7	OF2	CONDUIT	1.0	1.0001	0.0400
OR1	SU1	J6	ORIFICE			
OR2	SU1	J6	WEIR			

****
Cross Section Summary
****

Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow
C1	TRAPEZOIDAL	0.60	2.88	0.42	6.60	1	2.86
C2	TRAPEZOIDAL	0.60	2.88	0.42	6.60	1	2.88

C3	TRAPEZOIDAL	0.50	1.25	0.30	4.00	1	1.11
C4	TRAPEZOIDAL	0.50	1.25	0.30	4.00	1	1.13
C5	CIRCULAR	0.90	0.64	0.23	0.90	1	0.97
C6	TRAPEZOIDAL	0.60	2.88	0.42	6.60	1	4.06

****
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
****

****
Analysis Options
****
Flow Units ..... CMS
Process Models:
  Rainfall/Runoff ..... YES
  RDII ..... NO
  Snowmelt ..... NO
  Groundwater ..... NO
  Flow Routing ..... YES
  Ponding Allowed ..... NO
  Water Quality ..... NO
Infiltration Method ..... GREEN_AMPT
Flow Routing Method ..... DYNWAVE
Starting Date 01/05/2017 00:00:00
Ending Date 01/07/2017 00:00:00
Antecedent Dry Days 0.0
Report Time Step 00:00:05
Wet Time Step 00:00:05
Dry Time Step 00:00:05
Routing Time Step ..... 5.00 sec
Variable Time Step ..... YES
Maximum Trials 8
Number of Threads 1
Head Tolerance ..... 0.001500 m

**********	Volume	Depth
Runoff Quantity Continuity	hectare-m	mm
**********	---------	-------
Total Precipitation	0.771	85.900
Evaporation Loss	0.000	0.000
Infiltration Loss	0.238	26.537

Surface Runoff	0.526	58.545
Final Storage	0.007	0.818
Continuity Error (%)	0.000	

Flow Routing Continuity	Volume hectare-m	Volume 10^6 ltr
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.526	5.256
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	0.498	4.977
Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.101	1.010
Final Stored Volume	0.129	1.290
Continuity Error (%)	-0.001	

Time-Step Critical Elements

Link C6 (25.86%)

Highest Flow Instability Indexes

Link C5 (2)

Routing Time Step Summary

Minimum Time Step	:	0.50 sec
Average Time Step	:	3.84 sec
Maximum Time Step	:	5.00 sec
Percent in Steady State	:	0.00
Average Iterations per Step	:	2.00
Percent Not Converging	:	0.00

Subcatchment Runoff Summary
****

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff CMS	Runoff Coeff
201	85.90	0.00	0.00	14.14	70.44	2.54	1.15	0.820
202	85.90	0.00	0.00	20.83	64.07	0.48	0.23	0.746
203	85.90	0.00	0.00	20.81	64.09	0.34	0.16	0.746
EX1	85.90	0.00	0.00	44.34	41.42	1.27	0.37	0.482
UN1	85.90	0.00	0.00	20.81	64.09	0.20	0.10	0.746
UN2	85.90	0.00	0.00	39.23	46.53	0.08	0.03	0.542
UN3	85.90	0.00	0.00	20.81	64.09	0.33	0.16	0.746

****
Node Depth Summary
****

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min	Reported Max Depth Meters
J1	JUNCTION	0.01	0.13	188.13	0 11:59	0.13
J3	JUNCTION	0.01	0.08	186.33	0 12:08	0.08
J4	JUNCTION	0.06	0.34	187.78	0 12:00	0.34
J5	JUNCTION	0.07	0.36	187.58	0 12:00	0.36
J6	JUNCTION	0.14	0.48	186.08	0 12:06	0.48
J7	JUNCTION	0.05	0.18	185.63	0 12:08	0.18
OF1	OUTFALL	0.00	0.00	184.00	0 00:00	0.00
OF2	OUTFALL	0.04	0.17	185.61	0 12:08	0.17
SU1	STORAGE	1.41	1.91	186.51	0 12:06	1.91

****
Node Inflow Summary
****

Node	Type	Maximum Lateral Inflow CMS	Maximum Total Inflow CMS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 ltr	Total Inflow Volume 10^6 ltr	Flow Balance Error Percent

J1	JUNCTION	0.159	0.159	0	11:54	0.332	0.332	-0.432
J3	JUNCTION	0.000	0.123	0	12:00	0	0.333	0.389
J4	JUNCTION	0.496	0.496	0	12:00	1.62	1.62	-0.089
J5	JUNCTION	0.000	0.485	0	12:00	0	1.62	0.079
J6	JUNCTION	0.000	0.601	0	12:06	0	4.37	0.030
J7	JUNCTION	0.000	0.736	0	12:07	0	4.7	0.059
OF1	OUTFALL	0.029	0.029	0	12:00	0.0777	0.0777	0.000
OF2	OUTFALL	0.098	0.708	0	12:07	0.204	4.9	0.000
SU1	STORAGE	1.377	1.698	0	11:54	3.03	5.65	0.002

****
Node Surcharge Summary
****

No nodes were surcharged.

****
Node Flooding Summary
****

No nodes were flooded.

****
Storage Volume Summary
****

Storage Unit	Average Volume 1000 m3	Avg Pcnt Full	Evap Pcnt Loss	Exfil Pcnt Loss	Maximum Volume 1000 m3	Max Pcnt Full	Time of Max Occurrence days hr:min	Maximum Outflow CMS
SU1	1.804	28	0	0	2.979	46	0 12:06	0.601

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow CMS	Max Flow CMS	Total Volume 10^6 ltr

OF1	58.11	0.004	0.029	0.078
OF2	96.60	0.129	0.708	4.899
System	77.36	0.134	0.727	4.977

****
Link Flow Summary
****

Link	Type	Maximum |Flow| CMS	Time of Max Occurrence days hr:min	Maximum |Veloc| m/sec	Max/ Full Flow	Max/ Full Depth
C1	CONDUIT	0.123	0 12:00	0.37	0.04	0.17
C2	CONDUIT	0.089	0 12:08	0.20	0.03	0.22
C3	CONDUIT	0.485	0 12:00	0.70	0.44	0.69
C4	CONDUIT	0.457	0 12:00	0.84	0.40	0.58
C5	CONDUIT	0.647	0 12:06	3.11	0.67	0.37
C6	CONDUIT	0.690	0 12:08	1.13	0.17	0.29
OR1	ORIFICE	0.008	0 12:06			1.00
OR2	WEIR	0.593	0 12:06			0.50

****
Flow Classification Summary
****

Conduit	Adjusted /Actual Length	Fraction of Time in Flow Class: Dry	Up Dry	Down Dry	Sub Crit	Sup Crit	Up Crit	Down Crit	Norm Ltd	Inlet Ctrl
C1	1.00	0.03	0.00	0.00	0.97	0.00	0.00	0.00	0.75	0.00
C2	1.00	0.04	0.00	0.00	0.96	0.00	0.00	0.00	0.95	0.00
C3	1.00	0.03	0.12	0.00	0.85	0.00	0.00	0.00	0.93	0.00
C4	1.00	0.03	0.00	0.00	0.00	0.00	0.00	0.97	0.00	0.00
C5	1.00	0.04	0.00	0.00	0.01	0.95	0.00	0.00	0.00	0.00
C6	1.00	0.04	0.00	0.00	0.96	0.00	0.00	0.00	0.01	0.00

****
Conduit Surcharge Summary
****

No conduits were surcharged.

Analysis begun on: Thu Nov 28 14:15:06 2019
Analysis ended on: Thu Nov 28 14:15:06 2019
Total elapsed time: < 1 sec

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.011)

****
Element Count
****
Number of rain gages 14
Number of subcatchments ... 7
Number of nodes 9
Number of links 8
Number of pollutants 0
Number of land uses 0

****
Raingage Summary
****

Name	Data Source	Data Type	Recording Interval
100yr_24hr_SCS_TypeII	100yr_24hr_SCS_TypeII	INTENSITY	6 min.
100yr_4hr_Chicago	100yr_4hr_Chicago	INTENSITY	5 min.
10yr_24hr_SCS_TypeII	10yr_24hr_SCS_TypeII	INTENSITY	6 min.
10yr_4hr_Chicago	10yr_4hr_Chicago	INTENSITY	5 min.
25mm_4hr_Chicago	25mm_4hr_Chicago	INTENSITY	10 min.
25yr_24hr_SCS_TypeII	25yr_24hr_SCS_TypeII	INTENSITY	6 min.
25yr_4hr_Chicago	25yr_4hr_Chicago	INTENSITY	5 min.
2yr_24hr_SCS_TypeII	2yr_24hr_SCS_TypeII	INTENSITY	6 min.
2yr_4hr_Chicago	2yr_4hr_Chicago	INTENSITY	5 min.
50yr_24hr_SCS_TypeII	50yr_24hr_SCS_TypeII	INTENSITY	6 min.
50yr_4hr_Chicago	50yr_4hr_Chicago	INTENSITY	5 min.
5yr_24hr_SCS_TypeII	5yr_24hr_SCS_TypeII	INTENSITY	6 min.
5yr_4hr_Chicago	5yr_4hr_Chicago	INTENSITY	5 min.
Timmins_Storm_(0-25)	Timmins_Storm_(0-25)	INTENSITY	60 min.

****
Subcatchment Summary
****

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
201	3.61	2123.65	66.00	2.0000	25yr_24hr_SCS_TypeII	SU1
202	0.75	188.32	50.00	6.0000	25yr_24hr_SCS_TypeII	SU1
203	0.53	314.00	50.00	2.0000	25yr_24hr_SCS_TypeII	J4

EX1	3.08	205.16	7.00	5.0000	25yr_24hr_SCS_TypeII	J4
UN1	0.32	187.06	50.00	2.0000	25yr_24hr_SCS_TypeII	OF2
UN2	0.17	57.55	7.00	0.5000	25yr_24hr_SCS_TypeII	OF1
UN3	0.52	304.65	50.00	2.0000	25yr_24hr_SCS_TypeII	J1

****
Node Summary
****

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
J1	JUNCTION	188.00	0.60	0.0	
J3	JUNCTION	186.25	0.60	0.0	
J4	JUNCTION	187.44	0.50	0.0	
J5	JUNCTION	187.22	0.50	0.0	
J6	JUNCTION	185.60	2.00	0.0	
J7	JUNCTION	185.45	0.90	0.0	
OF1	OUTFALL	184.00	0.00	0.0	
OF2	OUTFALL	185.44	0.60	0.0	
SU1	STORAGE	184.60	2.95	0.0	

****
Link Summary
****

Name	From Node	To Node	Type	Length	%Slope	Roughness
C1	J1	J3	CONDUIT	352.3	0.4967	0.0400
C2	J3	J7	CONDUIT	159.6	0.5012	0.0400
C3	J4	J5	CONDUIT	89.9	0.2447	0.0250
C4	J5	SU1	CONDUIT	98.7	0.2534	0.0250
C5	J6	J7	CONDUIT	52.8	0.2843	0.0130
C6	J7	OF2	CONDUIT	1.0	1.0001	0.0400
OR1	SU1	J6	ORIFICE			
OR2	SU1	J6	WEIR			

****
Cross Section Summary
****

Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow
C1	TRAPEZOIDAL	0.60	2.88	0.42	6.60	1	2.86
C2	TRAPEZOIDAL	0.60	2.88	0.42	6.60	1	2.88

C3	TRAPEZOIDAL	0.50	1.25	0.30	4.00	1	1.11
C4	TRAPEZOIDAL	0.50	1.25	0.30	4.00	1	1.13
C5	CIRCULAR	0.90	0.64	0.23	0.90	1	0.97
C6	TRAPEZOIDAL	0.60	2.88	0.42	6.60	1	4.06

****
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
****

****
Analysis Options
****
Flow Units ..... CMS
Process Models:
  Rainfall/Runoff ..... YES
  RDII ..... NO
  Snowmelt ..... NO
  Groundwater ..... NO
  Flow Routing ..... YES
  Ponding Allowed ..... NO
  Water Quality ..... NO
Infiltration Method ..... GREEN_AMPT
Flow Routing Method ..... DYNWAVE
Starting Date 01/05/2017 00:00:00
Ending Date 01/07/2017 00:00:00
Antecedent Dry Days 0.0
Report Time Step 00:00:05
Wet Time Step 00:00:05
Dry Time Step 00:00:05
Routing Time Step ..... 5.00 sec
Variable Time Step ..... YES
Maximum Trials 8
Number of Threads 1
Head Tolerance ..... 0.001500 m

**********	Volume	Depth
Runoff Quantity Continuity	hectare-m	mm
**********	---------	-------
Total Precipitation	0.909	101.200
Evaporation Loss	0.000	0.000
Infiltration Loss	0.278	30.919

Surface Runoff	0.624	69.463
Final Storage	0.007	0.818
Continuity Error (%)	0.000	

Flow Routing Continuity	Volume hectare-m	Volume 10^6 ltr
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.624	6.236
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	0.595	5.953
Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.101	1.010
Final Stored Volume	0.129	1.294
Continuity Error (%)	-0.001	

Time-Step Critical Elements

Link C6 (28.53%)

Highest Flow Instability Indexes

Link C5 (2)

Routing Time Step Summary

Minimum Time Step	:	0.50 sec
Average Time Step	:	3.72 sec
Maximum Time Step	:	5.00 sec
Percent in Steady State	:	0.00
Average Iterations per Step	:	2.00
Percent Not Converging	:	0.00

Subcatchment Runoff Summary
****

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff CMS	Runoff Coeff
201	101.20	0.00	0.00	16.63	83.25	3.01	1.36	0.823
202	101.20	0.00	0.00	24.50	75.70	0.57	0.27	0.748
203	101.20	0.00	0.00	24.48	75.72	0.40	0.19	0.748
EX1	101.20	0.00	0.00	51.30	49.76	1.53	0.48	0.492
UN1	101.20	0.00	0.00	24.48	75.72	0.24	0.12	0.748
UN2	101.20	0.00	0.00	46.11	54.95	0.09	0.04	0.543
UN3	101.20	0.00	0.00	24.48	75.72	0.39	0.19	0.748

****
Node Depth Summary
****

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min	Reported Max Depth Meters
J1	JUNCTION	0.02	0.15	188.15	0 11:58	0.15
J3	JUNCTION	0.02	0.10	186.35	0 12:07	0.10
J4	JUNCTION	0.07	0.38	187.82	0 12:00	0.38
J5	JUNCTION	0.08	0.40	187.62	0 12:00	0.40
J6	JUNCTION	0.16	0.56	186.16	0 12:05	0.56
J7	JUNCTION	0.06	0.21	185.66	0 12:06	0.21
OF1	OUTFALL	0.00	0.00	184.00	0 00:00	0.00
OF2	OUTFALL	0.05	0.19	185.63	0 12:06	0.19
SU1	STORAGE	1.44	2.02	186.62	0 12:05	2.02

****
Node Inflow Summary
****

Node	Type	Maximum Lateral Inflow CMS	Maximum Total Inflow CMS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 ltr	Total Inflow Volume 10^6 ltr	Flow Balance Error Percent

J1	JUNCTION	0.189	0.189	0	11:54	0.393	0.392	-0.449
J3	JUNCTION	0.000	0.151	0	12:00	0	0.394	0.404
J4	JUNCTION	0.629	0.629	0	12:00	1.94	1.94	-0.081
J5	JUNCTION	0.000	0.617	0	12:00	0	1.94	0.074
J6	JUNCTION	0.000	0.784	0	12:05	0	5.23	0.038
J7	JUNCTION	0.000	0.970	0	12:06	0	5.62	0.038
OF1	OUTFALL	0.036	0.036	0	12:00	0.0918	0.0917	0.000
OF2	OUTFALL	0.116	0.918	0	12:06	0.241	5.86	0.000
SU1	STORAGE	1.628	2.057	0	11:54	3.58	6.52	0.001

****
Node Surcharge Summary
****

No nodes were surcharged.

****
Node Flooding Summary
****

No nodes were flooded.

****
Storage Volume Summary
****

Storage Unit	Average Volume 1000 m3	Avg Pcnt Full	Evap Pcnt Loss	Exfil Pcnt Loss	Maximum Volume 1000 m3	Max Pcnt Full	Time of Max Occurrence days hr:min	Maximum Outflow CMS
SU1	1.877	29	0	0	3.285	50	0 12:05	0.784

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow CMS	Max Flow CMS	Total Volume 10^6 ltr

OF1	59.93	0.005	0.036	0.092
OF2	97.17	0.163	0.918	5.861
System	78.55	0.168	0.942	5.953

****
Link Flow Summary
****

Link	Type	Maximum |Flow| CMS	Time of Max Occurrence days hr:min	Maximum |Veloc| m/sec	Max/ Full Flow	Max/ Full Depth
C1	CONDUIT	0.151	0 12:00	0.39	0.05	0.19
C2	CONDUIT	0.112	0 12:07	0.21	0.04	0.26
C3	CONDUIT	0.617	0 12:00	0.75	0.56	0.78
C4	CONDUIT	0.587	0 12:00	0.91	0.52	0.65
C5	CONDUIT	0.859	0 12:06	3.38	0.89	0.43
C6	CONDUIT	0.895	0 12:06	1.23	0.22	0.34
OR1	ORIFICE	0.008	0 12:08			1.00
OR2	WEIR	0.776	0 12:05			0.61

****
Flow Classification Summary
****

Conduit	Adjusted /Actual Length	Fraction of Time in Flow Class: Dry	Up Dry	Down Dry	Sub Crit	Sup Crit	Up Crit	Down Crit	Norm Ltd	Inlet Ctrl
C1	1.00	0.03	0.00	0.00	0.97	0.00	0.00	0.00	0.75	0.00
C2	1.00	0.03	0.00	0.00	0.97	0.00	0.00	0.00	0.96	0.00
C3	1.00	0.03	0.12	0.00	0.86	0.00	0.00	0.00	0.94	0.00
C4	1.00	0.03	0.00	0.00	0.00	0.00	0.00	0.97	0.00	0.00
C5	1.00	0.03	0.00	0.00	0.01	0.96	0.00	0.00	0.00	0.00
C6	1.00	0.03	0.00	0.00	0.97	0.00	0.00	0.00	0.01	0.00

****
Conduit Surcharge Summary
****

No conduits were surcharged.

Analysis begun on: Thu Nov 28 14:18:15 2019
Analysis ended on: Thu Nov 28 14:18:15 2019
Total elapsed time: < 1 sec

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.011)

****
Element Count
****
Number of rain gages 14
Number of subcatchments ... 7
Number of nodes 9
Number of links 8
Number of pollutants 0
Number of land uses 0

****
Raingage Summary
****

Name	Data Source	Data Type	Recording Interval
100yr_24hr_SCS_TypeII	100yr_24hr_SCS_TypeII	INTENSITY	6 min.
100yr_4hr_Chicago	100yr_4hr_Chicago	INTENSITY	5 min.
10yr_24hr_SCS_TypeII	10yr_24hr_SCS_TypeII	INTENSITY	6 min.
10yr_4hr_Chicago	10yr_4hr_Chicago	INTENSITY	5 min.
25mm_4hr_Chicago	25mm_4hr_Chicago	INTENSITY	10 min.
25yr_24hr_SCS_TypeII	25yr_24hr_SCS_TypeII	INTENSITY	6 min.
25yr_4hr_Chicago	25yr_4hr_Chicago	INTENSITY	5 min.
2yr_24hr_SCS_TypeII	2yr_24hr_SCS_TypeII	INTENSITY	6 min.
2yr_4hr_Chicago	2yr_4hr_Chicago	INTENSITY	5 min.
50yr_24hr_SCS_TypeII	50yr_24hr_SCS_TypeII	INTENSITY	6 min.
50yr_4hr_Chicago	50yr_4hr_Chicago	INTENSITY	5 min.
5yr_24hr_SCS_TypeII	5yr_24hr_SCS_TypeII	INTENSITY	6 min.
5yr_4hr_Chicago	5yr_4hr_Chicago	INTENSITY	5 min.
Timmins_Storm_(0-25)	Timmins_Storm_(0-25)	INTENSITY	60 min.

****
Subcatchment Summary
****

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
201	3.61	2123.65	66.00	2.0000	50yr_24hr_SCS_TypeII	SU1
202	0.75	188.32	50.00	6.0000	50yr_24hr_SCS_TypeII	SU1
203	0.53	314.00	50.00	2.0000	50yr_24hr_SCS_TypeII	J4

EX1	3.08	205.16	7.00	5.0000	50yr_24hr_SCS_TypeII	J4
UN1	0.32	187.06	50.00	2.0000	50yr_24hr_SCS_TypeII	OF2
UN2	0.17	57.55	7.00	0.5000	50yr_24hr_SCS_TypeII	OF1
UN3	0.52	304.65	50.00	2.0000	50yr_24hr_SCS_TypeII	J1

****
Node Summary
****

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
J1	JUNCTION	188.00	0.60	0.0	
J3	JUNCTION	186.25	0.60	0.0	
J4	JUNCTION	187.44	0.50	0.0	
J5	JUNCTION	187.22	0.50	0.0	
J6	JUNCTION	185.60	2.00	0.0	
J7	JUNCTION	185.45	0.90	0.0	
OF1	OUTFALL	184.00	0.00	0.0	
OF2	OUTFALL	185.44	0.60	0.0	
SU1	STORAGE	184.60	2.95	0.0	

****
Link Summary
****

Name	From Node	To Node	Type	Length	%Slope	Roughness
C1	J1	J3	CONDUIT	352.3	0.4967	0.0400
C2	J3	J7	CONDUIT	159.6	0.5012	0.0400
C3	J4	J5	CONDUIT	89.9	0.2447	0.0250
C4	J5	SU1	CONDUIT	98.7	0.2534	0.0250
C5	J6	J7	CONDUIT	52.8	0.2843	0.0130
C6	J7	OF2	CONDUIT	1.0	1.0001	0.0400
OR1	SU1	J6	ORIFICE			
OR2	SU1	J6	WEIR			

****
Cross Section Summary
****

Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow
C1	TRAPEZOIDAL	0.60	2.88	0.42	6.60	1	2.86
C2	TRAPEZOIDAL	0.60	2.88	0.42	6.60	1	2.88

C3	TRAPEZOIDAL	0.50	1.25	0.30	4.00	1	1.11
C4	TRAPEZOIDAL	0.50	1.25	0.30	4.00	1	1.13
C5	CIRCULAR	0.90	0.64	0.23	0.90	1	0.97
C6	TRAPEZOIDAL	0.60	2.88	0.42	6.60	1	4.06

****
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
****

****
Analysis Options
****
Flow Units ..... CMS
Process Models:
  Rainfall/Runoff ..... YES
  RDII ..... NO
  Snowmelt ..... NO
  Groundwater ..... NO
  Flow Routing ..... YES
  Ponding Allowed ..... NO
  Water Quality ..... NO
Infiltration Method ..... GREEN_AMPT
Flow Routing Method ..... DYNWAVE
Starting Date 01/05/2017 00:00:00
Ending Date 01/07/2017 00:00:00
Antecedent Dry Days 0.0
Report Time Step 00:00:05
Wet Time Step 00:00:05
Dry Time Step 00:00:05
Routing Time Step ..... 5.00 sec
Variable Time Step ..... YES
Maximum Trials 8
Number of Threads 1
Head Tolerance ..... 0.001500 m

**********	Volume	Depth
Runoff Quantity Continuity	hectare-m	mm
**********	---------	-------
Total Precipitation	1.009	112.400
Evaporation Loss	0.000	0.000
Infiltration Loss	0.287	31.992

Surface Runoff	0.715	79.590
Final Storage	0.007	0.818
Continuity Error (%)	0.000	

Flow Routing Continuity	Volume hectare-m	Volume 10^6 ltr
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.715	7.146
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	0.686	6.860
Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.101	1.010
Final Stored Volume	0.130	1.296
Continuity Error (%)	-0.001	

Time-Step Critical Elements

Link C6 (30.57%)

Highest Flow Instability Indexes

Link C5 (3)
Link C6 (1)
Link OR2 (1)

Routing Time Step Summary

Minimum Time Step	:	0.50 sec
Average Time Step	:	3.62 sec
Maximum Time Step	:	5.00 sec
Percent in Steady State	:	0.00
Average Iterations per Step	:	2.00
Percent Not Converging	:	0.00

****
Subcatchment Runoff Summary
****

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff CMS	Runoff Coeff
201	112.40	0.00	0.00	17.25	93.83	3.39	1.51	0.835
202	112.40	0.00	0.00	25.41	85.99	0.65	0.30	0.765
203	112.40	0.00	0.00	25.39	86.01	0.46	0.22	0.765
EX1	112.40	0.00	0.00	52.98	59.28	1.82	0.59	0.527
UN1	112.40	0.00	0.00	25.39	86.01	0.27	0.13	0.765
UN2	112.40	0.00	0.00	47.80	64.46	0.11	0.04	0.573
UN3	112.40	0.00	0.00	25.39	86.01	0.45	0.21	0.765

****
Node Depth Summary
****

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min	Reported Max Depth Meters
J1	JUNCTION	0.02	0.16	188.16	0 11:57	0.16
J3	JUNCTION	0.02	0.11	186.36	0 12:06	0.11
J4	JUNCTION	0.07	0.41	187.85	0 12:00	0.41
J5	JUNCTION	0.09	0.43	187.65	0 12:00	0.43
J6	JUNCTION	0.18	0.62	186.22	0 12:02	0.62
J7	JUNCTION	0.06	0.23	185.68	0 12:06	0.23
OF1	OUTFALL	0.00	0.00	184.00	0 00:00	0.00
OF2	OUTFALL	0.05	0.22	185.66	0 12:06	0.22
SU1	STORAGE	1.47	2.10	186.70	0 12:04	2.10

****
Node Inflow Summary
****

	Maximum Lateral	Maximum Total	Time of Max	Lateral Inflow	Total Inflow	Flow Balance

Node	Type	Inflow CMS	Inflow CMS	Occurrence days	Occurrence hr:min	Volume 10^6 ltr	Volume 10^6 ltr	Error Percent
J1	JUNCTION	0.211	0.211	0	11:54	0.446	0.445	-0.439
J3	JUNCTION	0.000	0.173	0	12:00	0	0.447	0.391
J4	JUNCTION	0.751	0.751	0	12:00	2.28	2.28	-0.072
J5	JUNCTION	0.000	0.739	0	12:00	0	2.29	0.066
J6	JUNCTION	0.000	0.939	0	12:04	0	6.04	0.048
J7	JUNCTION	0.000	1.144	0	12:02	0	6.48	0.020
OF1	OUTFALL	0.042	0.042	0	12:00	0.108	0.108	0.000
OF2	OUTFALL	0.130	1.094	0	12:05	0.274	6.75	0.000
SU1	STORAGE	1.815	2.355	0	11:54	4.04	7.33	0.001

****
Node Surcharge Summary
****

No nodes were surcharged.

****
Node Flooding Summary
****

No nodes were flooded.

****
Storage Volume Summary
****

Storage Unit	Average Volume 1000 m3	Avg Pcnt Full	Evap Pcnt Loss	Exfil Pcnt Loss	Maximum Volume 1000 m3	Max Pcnt Full	Time of Max Occurrence days	Time of Max Occurrence hr:min	Maximum Outflow CMS
SU1	1.935	30	0	0	3.537	54	0	12:04	0.939

****
Outfall Loading Summary
****

	Flow	Avg	Max	Total

Outfall Node	Freq Pcnt	Flow CMS	Flow CMS	Volume 10^6 ltr
OF1	61.20	0.006	0.042	0.108
OF2	97.49	0.192	1.094	6.752
System	79.35	0.197	1.122	6.860

****
Link Flow Summary
****

Link	Type	Maximum |Flow| CMS	Time of Max Occurrence days hr:min	Maximum |Veloc| m/sec	Max/ Full Flow	Max/ Full Depth
C1	CONDUIT	0.173	0 12:00	0.41	0.06	0.21
C2	CONDUIT	0.130	0 12:06	0.22	0.05	0.28
C3	CONDUIT	0.739	0 12:00	0.79	0.67	0.84
C4	CONDUIT	0.709	0 12:00	0.97	0.63	0.71
C5	CONDUIT	1.025	0 12:02	3.59	1.06	0.47
C6	CONDUIT	1.067	0 12:06	1.29	0.26	0.37
OR1	ORIFICE	0.009	0 12:04			1.00
OR2	WEIR	0.931	0 12:04			0.69

****
Flow Classification Summary
****

Conduit	Adjusted /Actual Length	Fraction of Time in Flow Class: Dry	Up Dry	Down Dry	Sub Crit	Sup Crit	Up Crit	Down Crit	Norm Ltd	Inlet Ctrl
C1	1.00	0.02	0.00	0.00	0.98	0.00	0.00	0.00	0.75	0.00
C2	1.00	0.03	0.00	0.00	0.97	0.00	0.00	0.00	0.96	0.00
C3	1.00	0.02	0.11	0.00	0.86	0.00	0.00	0.00	0.94	0.00
C4	1.00	0.03	0.00	0.00	0.00	0.00	0.00	0.97	0.00	0.00
C5	1.00	0.03	0.00	0.00	0.01	0.96	0.00	0.00	0.00	0.00
C6	1.00	0.03	0.00	0.00	0.97	0.00	0.00	0.00	0.01	0.00

****

Conduit Surcharge Summary
****

Conduit	Hours Full: Both Ends	Hours Full: Upstream	Hours Full: Dnstream	Hours Above Full Normal Flow	Hours Capacity Limited
C5	0.01	0.01	0.01	0.05	0.01

Analysis begun on: Thu Nov 28 14:26:39 2019
Analysis ended on: Thu Nov 28 14:26:40 2019
Total elapsed time: 00:00:01

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.011)

****
Element Count
****
Number of rain gages 14
Number of subcatchments ... 7
Number of nodes 9
Number of links 8
Number of pollutants 0
Number of land uses 0

****
Raingage Summary
****

Name	Data Source	Data Type	Recording Interval
100yr_24hr_SCS_TypeII	100yr_24hr_SCS_TypeII	INTENSITY	6 min.
100yr_4hr_Chicago	100yr_4hr_Chicago	INTENSITY	5 min.
10yr_24hr_SCS_TypeII	10yr_24hr_SCS_TypeII	INTENSITY	6 min.
10yr_4hr_Chicago	10yr_4hr_Chicago	INTENSITY	5 min.
25mm_4hr_Chicago	25mm_4hr_Chicago	INTENSITY	10 min.
25yr_24hr_SCS_TypeII	25yr_24hr_SCS_TypeII	INTENSITY	6 min.
25yr_4hr_Chicago	25yr_4hr_Chicago	INTENSITY	5 min.
2yr_24hr_SCS_TypeII	2yr_24hr_SCS_TypeII	INTENSITY	6 min.
2yr_4hr_Chicago	2yr_4hr_Chicago	INTENSITY	5 min.
50yr_24hr_SCS_TypeII	50yr_24hr_SCS_TypeII	INTENSITY	6 min.
50yr_4hr_Chicago	50yr_4hr_Chicago	INTENSITY	5 min.
5yr_24hr_SCS_TypeII	5yr_24hr_SCS_TypeII	INTENSITY	6 min.
5yr_4hr_Chicago	5yr_4hr_Chicago	INTENSITY	5 min.
Timmins_Storm_(0-25)	Timmins_Storm_(0-25)	INTENSITY	60 min.

****
Subcatchment Summary
****

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
201	3.61	2123.65	66.00	2.0000	100yr_24hr_SCS_TypeII	SU1
202	0.75	188.32	50.00	6.0000	100yr_24hr_SCS_TypeII	SU1
203	0.53	314.00	50.00	2.0000	100yr_24hr_SCS_TypeII	J4

EX1	3.08	205.16	7.00	5.0000	100yr_24hr_SCS_TypeII	J4
UN1	0.32	187.06	50.00	2.0000	100yr_24hr_SCS_TypeII	OF2
UN2	0.17	57.55	7.00	0.5000	100yr_24hr_SCS_TypeII	OF1
UN3	0.52	304.65	50.00	2.0000	100yr_24hr_SCS_TypeII	J1

****
Node Summary
****

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
J1	JUNCTION	188.00	0.60	0.0	
J3	JUNCTION	186.25	0.60	0.0	
J4	JUNCTION	187.44	0.50	0.0	
J5	JUNCTION	187.22	0.50	0.0	
J6	JUNCTION	185.60	2.00	0.0	
J7	JUNCTION	185.45	0.90	0.0	
OF1	OUTFALL	184.00	0.00	0.0	
OF2	OUTFALL	185.44	0.60	0.0	
SU1	STORAGE	184.60	2.95	0.0	

****
Link Summary
****

Name	From Node	To Node	Type	Length	%Slope	Roughness
C1	J1	J3	CONDUIT	352.3	0.4967	0.0400
C2	J3	J7	CONDUIT	159.6	0.5012	0.0400
C3	J4	J5	CONDUIT	89.9	0.2447	0.0250
C4	J5	SU1	CONDUIT	98.7	0.2534	0.0250
C5	J6	J7	CONDUIT	52.8	0.2843	0.0130
C6	J7	OF2	CONDUIT	1.0	1.0001	0.0400
OR1	SU1	J6	ORIFICE			
OR2	SU1	J6	WEIR			

****
Cross Section Summary
****

Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow
C1	TRAPEZOIDAL	0.60	2.88	0.42	6.60	1	2.86
C2	TRAPEZOIDAL	0.60	2.88	0.42	6.60	1	2.88

C3	TRAPEZOIDAL	0.50	1.25	0.30	4.00	1	1.11
C4	TRAPEZOIDAL	0.50	1.25	0.30	4.00	1	1.13
C5	CIRCULAR	0.90	0.64	0.23	0.90	1	0.97
C6	TRAPEZOIDAL	0.60	2.88	0.42	6.60	1	4.06

****
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
****

****
Analysis Options
****
Flow Units ..... CMS
Process Models:
  Rainfall/Runoff ..... YES
  RDII ..... NO
  Snowmelt ..... NO
  Groundwater ..... NO
  Flow Routing ..... YES
  Ponding Allowed ..... NO
  Water Quality ..... NO
Infiltration Method ..... GREEN_AMPT
Flow Routing Method ..... DYNWAVE
Starting Date 01/05/2017 00:00:00
Ending Date 01/07/2017 00:00:00
Antecedent Dry Days 0.0
Report Time Step 00:00:05
Wet Time Step 00:00:05
Dry Time Step 00:00:05
Routing Time Step ..... 5.00 sec
Variable Time Step ..... YES
Maximum Trials 8
Number of Threads 1
Head Tolerance ..... 0.001500 m

**********	Volume	Depth
Runoff Quantity Continuity	hectare-m	mm
**********	---------	-------
Total Precipitation	1.110	123.600
Evaporation Loss	0.000	0.000
Infiltration Loss	0.296	32.918

Surface Runoff	0.807	89.865
Final Storage	0.007	0.818
Continuity Error (%)	-0.000	

Flow Routing Continuity	Volume hectare-m	Volume 10^6 ltr
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.807	8.068
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	0.778	7.780
Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.101	1.010
Final Stored Volume	0.130	1.299
Continuity Error (%)	-0.001	

Time-Step Critical Elements

Link C6 (32.32%)

Highest Flow Instability Indexes

Link C5 (3)
Link C6 (1)
Link OR2 (1)

Routing Time Step Summary

Minimum Time Step	:	0.50 sec
Average Time Step	:	3.55 sec
Maximum Time Step	:	5.00 sec
Percent in Steady State	:	0.00
Average Iterations per Step	:	2.00
Percent Not Converging	:	0.00

****
Subcatchment Runoff Summary
****

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff CMS	Runoff Coeff
201	123.60	0.00	0.00	17.79	104.49	3.77	1.67	0.845
202	123.60	0.00	0.00	26.21	96.39	0.73	0.33	0.780
203	123.60	0.00	0.00	26.18	96.42	0.51	0.24	0.780
EX1	123.60	0.00	0.00	54.42	69.04	2.12	0.70	0.559
UN1	123.60	0.00	0.00	26.18	96.42	0.31	0.14	0.780
UN2	123.60	0.00	0.00	49.26	74.20	0.12	0.05	0.600
UN3	123.60	0.00	0.00	26.18	96.42	0.50	0.23	0.780

****
Node Depth Summary
****

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min	Reported Max Depth Meters
J1	JUNCTION	0.02	0.17	188.17	0 11:56	0.17
J3	JUNCTION	0.02	0.11	186.36	0 12:05	0.11
J4	JUNCTION	0.08	0.44	187.88	0 12:00	0.44
J5	JUNCTION	0.10	0.46	187.68	0 12:00	0.46
J6	JUNCTION	0.19	0.69	186.29	0 12:04	0.69
J7	JUNCTION	0.07	0.25	185.70	0 12:05	0.25
OF1	OUTFALL	0.00	0.00	184.00	0 00:00	0.00
OF2	OUTFALL	0.06	0.24	185.68	0 12:05	0.24
SU1	STORAGE	1.49	2.18	186.78	0 12:04	2.18

****
Node Inflow Summary
****

	Maximum Lateral	Maximum Total	Time of Max	Lateral Inflow	Total Inflow	Flow Balance

Node	Type	Inflow CMS	Inflow CMS	Occurrence days	Occurrence hr:min	Volume 10^6 ltr	Volume 10^6 ltr	Error Percent
J1	JUNCTION	0.233	0.233	0	11:54	0.5	0.499	-0.428
J3	JUNCTION	0.000	0.194	0	12:00	0	0.502	0.372
J4	JUNCTION	0.873	0.873	0	12:00	2.64	2.64	-0.066
J5	JUNCTION	0.000	0.861	0	12:00	0	2.64	0.060
J6	JUNCTION	0.000	1.093	0	12:04	0	6.85	0.053
J7	JUNCTION	0.000	1.362	0	12:05	0	7.35	0.009
OF1	OUTFALL	0.048	0.048	0	12:00	0.124	0.124	0.000
OF2	OUTFALL	0.143	1.268	0	12:05	0.307	7.66	0.000
SU1	STORAGE	2.002	2.658	0	11:54	4.5	8.15	0.001

****
Node Surcharge Summary
****

No nodes were surcharged.

****
Node Flooding Summary
****

No nodes were flooded.

****
Storage Volume Summary
****

Storage Unit	Average Volume 1000 m3	Avg Pcnt Full	Evap Pcnt Loss	Exfil Pcnt Loss	Maximum Volume 1000 m3	Max Pcnt Full	Time of Max Occurrence days	Time of Max Occurrence hr:min	Maximum Outflow CMS
SU1	1.990	30	0	0	3.784	58	0	12:04	1.093

****
Outfall Loading Summary
****

	Flow	Avg	Max	Total

Outfall Node	Freq Pcnt	Flow CMS	Flow CMS	Volume 10^6 ltr
OF1	62.26	0.006	0.048	0.124
OF2	97.76	0.218	1.268	7.656
System	80.01	0.225	1.301	7.779

****
Link Flow Summary
****

Link	Type	Maximum |Flow| CMS	Time of Max Occurrence days hr:min	Maximum |Veloc| m/sec	Max/ Full Flow	Max/ Full Depth
C1	CONDUIT	0.194	0 12:00	0.43	0.07	0.22
C2	CONDUIT	0.148	0 12:05	0.23	0.05	0.31
C3	CONDUIT	0.861	0 12:00	0.83	0.78	0.90
C4	CONDUIT	0.833	0 12:00	1.01	0.74	0.76
C5	CONDUIT	1.214	0 12:04	3.78	1.26	0.52
C6	CONDUIT	1.238	0 12:05	1.35	0.30	0.41
OR1	ORIFICE	0.009	0 12:04			1.00
OR2	WEIR	1.084	0 12:04			0.77

****
Flow Classification Summary
****

Conduit	Adjusted /Actual Length	Fraction of Time in Flow Class: Dry	Up Dry	Down Dry	Sub Crit	Sup Crit	Up Crit	Down Crit	Norm Ltd	Inlet Ctrl
C1	1.00	0.02	0.00	0.00	0.98	0.00	0.00	0.00	0.75	0.00
C2	1.00	0.02	0.00	0.00	0.97	0.00	0.00	0.00	0.96	0.00
C3	1.00	0.02	0.11	0.00	0.87	0.00	0.00	0.00	0.95	0.00
C4	1.00	0.02	0.00	0.00	0.00	0.00	0.00	0.98	0.00	0.00
C5	1.00	0.02	0.00	0.00	0.01	0.97	0.00	0.00	0.00	0.00
C6	1.00	0.02	0.00	0.00	0.98	0.00	0.00	0.00	0.01	0.00

****

Conduit Surcharge Summary
****

Conduit	Hours Full: Both Ends	Hours Full: Upstream	Hours Full: Dnstream	Hours Above Full Normal Flow	Hours Capacity Limited
C5	0.01	0.01	0.01	0.31	0.01

Analysis begun on: Thu Nov 28 14:45:24 2019
Analysis ended on: Thu Nov 28 14:45:24 2019
Total elapsed time: < 1 sec

300037815 TPC Marlwood Inc.

Pre-Development PCSWMM Model
4-hr Chicago

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.011)

****
Element Count
****
Number of rain gages 14
Number of subcatchments ... 5
Number of nodes 5
Number of links 3
Number of pollutants 0
Number of land uses 0

****
Raingage Summary
****

Name	Data Source	Data Type	Recording Interval
100yr_24hr_SCS_TypeII	100yr_24hr_SCS_TypeII	INTENSITY	6 min.
100yr_4hr_Chicago	100yr_4hr_Chicago	INTENSITY	5 min.
10yr_24hr_SCS_TypeII	10yr_24hr_SCS_TypeII	INTENSITY	6 min.
10yr_4hr_Chicago	10yr_4hr_Chicago	INTENSITY	5 min.
25mm_4hr_Chicago	25mm_4hr_Chicago	INTENSITY	10 min.
25yr_24hr_SCS_TypeII	25yr_24hr_SCS_TypeII	INTENSITY	6 min.
25yr_4hr_Chicago	25yr_4hr_Chicago	INTENSITY	5 min.
2yr_24hr_SCS_TypeII	2yr_24hr_SCS_TypeII	INTENSITY	6 min.
2yr_4hr_Chicago	2yr_4hr_Chicago	INTENSITY	5 min.
50yr_24hr_SCS_TypeII	50yr_24hr_SCS_TypeII	INTENSITY	6 min.
50yr_4hr_Chicago	50yr_4hr_Chicago	INTENSITY	5 min.
5yr_24hr_SCS_TypeII	5yr_24hr_SCS_TypeII	INTENSITY	6 min.
5yr_4hr_Chicago	5yr_4hr_Chicago	INTENSITY	5 min.
Timmins_Storm_(0-25)	Timmins_Storm_(0-25)	INTENSITY	60 min.

****
Subcatchment Summary
****

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
101	0.46	59.22	7.00	0.5000	2yr_4hr_Chicago	OF1
102	3.52	395.00	7.00	4.0000	2yr_4hr_Chicago	OF2
103	0.87	229.97	7.00	7.4000	2yr_4hr_Chicago	J1

104	1.05	105.40	7.00	2.0000	2yr_4hr_Chicago	J2
EX1	3.08	205.15	7.00	5.0000	2yr_4hr_Chicago	102

****
Node Summary
****

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
J1	JUNCTION	188.00	0.60	0.0	
J2	JUNCTION	187.10	0.60	0.0	
J3	JUNCTION	186.25	0.60	0.0	
OF1	OUTFALL	184.00	0.00	0.0	
OF2	OUTFALL	185.44	0.61	0.0	

****
Link Summary
****

Name	From Node	To Node	Type	Length	%Slope	Roughness
C1	J1	J2	CONDUIT	244.6	0.3679	0.0400
C2	J2	J3	CONDUIT	107.7	0.7893	0.0400
C3	J3	OF2	CONDUIT	160.6	0.4981	0.0400

****
Cross Section Summary
****

Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow
C1	TRAPEZOIDAL	0.60	2.88	0.42	6.60	1	2.46
C2	TRAPEZOIDAL	0.60	2.88	0.42	6.60	1	3.61
C3	TRAPEZOIDAL	0.60	2.88	0.42	6.60	1	2.87

****
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
****

****

Analysis Options
****
Flow Units ..... CMS
Process Models:
  Rainfall/Runoff ..... YES
  RDII ..... NO
  Snowmelt ..... NO
  Groundwater ..... NO
  Flow Routing ..... YES
  Ponding Allowed ..... NO
  Water Quality ..... NO
Infiltration Method ..... GREEN_AMPT
Flow Routing Method ..... DYNWAVE
Starting Date 01/05/2017 00:00:00
Ending Date 01/06/2017 23:48:00
Antecedent Dry Days 0.0
Report Time Step 00:00:05
Wet Time Step 00:00:05
Dry Time Step 00:00:05
Routing Time Step ..... 5.00 sec
Variable Time Step ..... YES
Maximum Trials 8
Number of Threads 1
Head Tolerance ..... 0.001500 m

Runoff Quantity Continuity	Volume hectare-m	Depth mm
Total Precipitation	0.292	32.481
Evaporation Loss	0.000	0.000
Infiltration Loss	0.210	23.341
Surface Runoff	0.081	9.000
Final Storage	0.001	0.140
Continuity Error (%)	0.000	

Flow Routing Continuity	Volume hectare-m	Volume 10^6 ltr
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.081	0.808
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	0.081	0.808

Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.000	0.000
Continuity Error (%)	0.006	

****
Time-Step Critical Elements
****
None

****
Highest Flow Instability Indexes
****
All links are stable.

****
Routing Time Step Summary
****

Minimum Time Step	:	4.50 sec
Average Time Step	:	5.00 sec
Maximum Time Step	:	5.00 sec
Percent in Steady State	:	0.00
Average Iterations per Step	:	2.00
Percent Not Converging	:	0.00

****
Subcatchment Runoff Summary
****

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff CMS	Runoff Coeff
101	32.48	0.00	0.00	22.91	9.43	0.04	0.01	0.290
102	32.48	5.33	0.00	22.04	15.63	0.55	0.18	0.413
103	32.48	0.00	0.00	20.14	12.20	0.11	0.07	0.376
104	32.48	0.00	0.00	22.00	10.34	0.11	0.04	0.318
EX1	32.48	0.00	0.00	26.25	6.09	0.19	0.08	0.187

****
Node Depth Summary
****

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min	Reported Max Depth Meters
J1	JUNCTION	0.00	0.06	188.06	0 01:43	0.06
J2	JUNCTION	0.00	0.07	187.17	0 01:51	0.07
J3	JUNCTION	0.00	0.08	186.33	0 02:10	0.08
OF1	OUTFALL	0.00	0.00	184.00	0 00:00	0.00
OF2	OUTFALL	0.00	0.00	185.44	0 00:00	0.00

****
Node Inflow Summary
****

Node	Type	Maximum Lateral Inflow CMS	Maximum Total Inflow CMS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 ltr	Total Inflow Volume 10^6 ltr	Flow Balance Error Percent
J1	JUNCTION	0.075	0.075	0 01:35	0.107	0.107	-0.205
J2	JUNCTION	0.039	0.066	0 01:44	0.109	0.216	-0.051
J3	JUNCTION	0.000	0.073	0 01:58	0	0.216	0.209
OF1	OUTFALL	0.015	0.015	0 01:35	0.043	0.043	0.000
OF2	OUTFALL	0.179	0.179	0 01:35	0.549	0.765	0.000

****
Node Surcharge Summary
****

No nodes were surcharged.

****
Node Flooding Summary
****

No nodes were flooded.

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow CMS	Max Flow CMS	Total Volume 10^6 ltr
OF1	8.93	0.003	0.015	0.043
OF2	33.22	0.013	0.179	0.765
System	21.07	0.016	0.194	0.808

****
Link Flow Summary
****

Link	Type	Maximum |Flow| CMS	Time of Max Occurrence days hr:min	Maximum |Veloc| m/sec	Max/ Full Flow	Max/ Full Depth
C1	CONDUIT	0.044	0 01:44	0.23	0.02	0.11
C2	CONDUIT	0.073	0 01:58	0.35	0.02	0.11
C3	CONDUIT	0.043	0 02:10	0.25	0.02	0.09

****
Flow Classification Summary
****

Conduit	Adjusted /Actual Length	Fraction of Time in Flow Class: Dry	Up Dry	Down Dry	Sub Crit	Sup Crit	Up Crit	Down Crit	Norm Ltd	Inlet Ctrl
C1	1.00	0.02	0.20	0.00	0.77	0.00	0.00	0.00	0.96	0.00
C2	1.00	0.01	0.01	0.00	0.98	0.00	0.00	0.00	0.96	0.00
C3	1.00	0.02	0.00	0.00	0.00	0.00	0.00	0.98	0.00	0.00

****

Conduit Surcharge Summary
****

No conduits were surcharged.

Analysis begun on: Thu Nov 28 11:44:12 2019
Analysis ended on: Thu Nov 28 11:44:13 2019
Total elapsed time: 00:00:01

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.011)

****
Element Count
****
Number of rain gages 14
Number of subcatchments ... 5
Number of nodes 5
Number of links 3
Number of pollutants 0
Number of land uses 0

****
Raingage Summary
****

Name	Data Source	Data Type	Recording Interval
100yr_24hr_SCS_TypeII	100yr_24hr_SCS_TypeII	INTENSITY	6 min.
100yr_4hr_Chicago	100yr_4hr_Chicago	INTENSITY	5 min.
10yr_24hr_SCS_TypeII	10yr_24hr_SCS_TypeII	INTENSITY	6 min.
10yr_4hr_Chicago	10yr_4hr_Chicago	INTENSITY	5 min.
25mm_4hr_Chicago	25mm_4hr_Chicago	INTENSITY	10 min.
25yr_24hr_SCS_TypeII	25yr_24hr_SCS_TypeII	INTENSITY	6 min.
25yr_4hr_Chicago	25yr_4hr_Chicago	INTENSITY	5 min.
2yr_24hr_SCS_TypeII	2yr_24hr_SCS_TypeII	INTENSITY	6 min.
2yr_4hr_Chicago	2yr_4hr_Chicago	INTENSITY	5 min.
50yr_24hr_SCS_TypeII	50yr_24hr_SCS_TypeII	INTENSITY	6 min.
50yr_4hr_Chicago	50yr_4hr_Chicago	INTENSITY	5 min.
5yr_24hr_SCS_TypeII	5yr_24hr_SCS_TypeII	INTENSITY	6 min.
5yr_4hr_Chicago	5yr_4hr_Chicago	INTENSITY	5 min.
Timmins_Storm_(0-25)	Timmins_Storm_(0-25)	INTENSITY	60 min.

****
Subcatchment Summary
****

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
101	0.46	59.22	7.00	0.5000	5yr_4hr_Chicago	OF1
102	3.52	395.00	7.00	4.0000	5yr_4hr_Chicago	OF2
103	0.87	229.97	7.00	7.4000	5yr_4hr_Chicago	J1

104	1.05	105.40	7.00	2.0000	5yr_4hr_Chicago	J2
EX1	3.08	205.15	7.00	5.0000	5yr_4hr_Chicago	102

****
Node Summary
****

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
J1	JUNCTION	188.00	0.60	0.0	
J2	JUNCTION	187.10	0.60	0.0	
J3	JUNCTION	186.25	0.60	0.0	
OF1	OUTFALL	184.00	0.00	0.0	
OF2	OUTFALL	185.44	0.61	0.0	

****
Link Summary
****

Name	From Node	To Node	Type	Length	%Slope	Roughness
C1	J1	J2	CONDUIT	244.6	0.3679	0.0400
C2	J2	J3	CONDUIT	107.7	0.7893	0.0400
C3	J3	OF2	CONDUIT	160.6	0.4981	0.0400

****
Cross Section Summary
****

Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow
C1	TRAPEZOIDAL	0.60	2.88	0.42	6.60	1	2.46
C2	TRAPEZOIDAL	0.60	2.88	0.42	6.60	1	3.61
C3	TRAPEZOIDAL	0.60	2.88	0.42	6.60	1	2.87

****
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
****

****

Analysis Options
****
Flow Units ..... CMS
Process Models:
  Rainfall/Runoff ..... YES
  RDII ..... NO
  Snowmelt ..... NO
  Groundwater ..... NO
  Flow Routing ..... YES
  Ponding Allowed ..... NO
  Water Quality ..... NO
Infiltration Method ..... GREEN_AMPT
Flow Routing Method ..... DYNWAVE
Starting Date 01/05/2017 00:00:00
Ending Date 01/06/2017 23:48:00
Antecedent Dry Days 0.0
Report Time Step 00:00:05
Wet Time Step 00:00:05
Dry Time Step 00:00:05
Routing Time Step ..... 5.00 sec
Variable Time Step ..... YES
Maximum Trials 8
Number of Threads 1
Head Tolerance ..... 0.001500 m

Runoff Quantity Continuity	Volume hectare-m	Depth mm
Total Precipitation	0.387	43.106
Evaporation Loss	0.000	0.000
Infiltration Loss	0.224	24.911
Surface Runoff	0.162	18.055
Final Storage	0.001	0.140
Continuity Error (%)	0.000	

Flow Routing Continuity	Volume hectare-m	Volume 10^6 ltr
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.162	1.621
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	0.162	1.621

Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.000	0.000
Continuity Error (%)	0.002	

****
Time-Step Critical Elements
****
None

****
Highest Flow Instability Indexes
****
All links are stable.

****
Routing Time Step Summary
****

Minimum Time Step	:	4.50 sec
Average Time Step	:	5.00 sec
Maximum Time Step	:	5.00 sec
Percent in Steady State	:	0.00
Average Iterations per Step	:	2.00
Percent Not Converging	:	0.00

****
Subcatchment Runoff Summary
****

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff CMS	Runoff Coeff
101	43.11	0.00	0.00	24.63	18.33	0.08	0.02	0.425
102	43.11	13.15	0.00	23.66	32.46	1.14	0.34	0.577
103	43.11	0.00	0.00	21.18	21.79	0.19	0.15	0.505
104	43.11	0.00	0.00	23.44	19.52	0.21	0.07	0.453
EX1	43.11	0.00	0.00	27.94	15.03	0.46	0.14	0.349

****
Node Depth Summary
****

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min	Reported Max Depth Meters
J1	JUNCTION	0.00	0.10	188.10	0 01:40	0.10
J2	JUNCTION	0.00	0.11	187.21	0 01:47	0.11
J3	JUNCTION	0.01	0.12	186.37	0 02:01	0.12
OF1	OUTFALL	0.00	0.00	184.00	0 00:00	0.00
OF2	OUTFALL	0.00	0.00	185.44	0 00:00	0.00

****
Node Inflow Summary
****

Node	Type	Maximum Lateral Inflow CMS	Maximum Total Inflow CMS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 ltr	Total Inflow Volume 10^6 ltr	Flow Balance Error Percent
J1	JUNCTION	0.151	0.151	0 01:35	0.19	0.19	-0.301
J2	JUNCTION	0.069	0.140	0 01:42	0.206	0.397	-0.039
J3	JUNCTION	0.000	0.150	0 01:52	0	0.397	0.213
OF1	OUTFALL	0.025	0.025	0 01:35	0.0836	0.0836	0.000
OF2	OUTFALL	0.338	0.338	0 01:35	1.14	1.54	0.000

****
Node Surcharge Summary
****

No nodes were surcharged.

****
Node Flooding Summary
****

No nodes were flooded.

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow CMS	Max Flow CMS	Total Volume 10^6 ltr
OF1	10.25	0.005	0.025	0.084
OF2	34.29	0.026	0.338	1.537
System	22.27	0.031	0.363	1.621

****
Link Flow Summary
****

Link	Type	Maximum |Flow| CMS	Time of Max Occurrence days hr:min	Maximum |Veloc| m/sec	Max/ Full Flow	Max/ Full Depth
C1	CONDUIT	0.095	0 01:42	0.30	0.04	0.17
C2	CONDUIT	0.150	0 01:52	0.45	0.04	0.17
C3	CONDUIT	0.091	0 02:01	0.33	0.03	0.14

****
Flow Classification Summary
****

Conduit	Adjusted /Actual Length	Fraction of Time in Flow Class: Dry	Up Dry	Down Dry	Sub Crit	Sup Crit	Up Crit	Down Crit	Norm Ltd	Inlet Ctrl
C1	1.00	0.01	0.20	0.00	0.78	0.00	0.00	0.00	0.97	0.00
C2	1.00	0.01	0.00	0.00	0.99	0.00	0.00	0.00	0.96	0.00
C3	1.00	0.02	0.00	0.00	0.00	0.00	0.00	0.98	0.00	0.00

****

Conduit Surcharge Summary
****

No conduits were surcharged.

Analysis begun on: Thu Nov 28 11:45:06 2019
Analysis ended on: Thu Nov 28 11:45:07 2019
Total elapsed time: 00:00:01

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.011)

****
Element Count
****
Number of rain gages 14
Number of subcatchments ... 5
Number of nodes 5
Number of links 3
Number of pollutants 0
Number of land uses 0

****
Raingage Summary
****

Name	Data Source	Data Type	Recording Interval
100yr_24hr_SCS_TypeII	100yr_24hr_SCS_TypeII	INTENSITY	6 min.
100yr_4hr_Chicago	100yr_4hr_Chicago	INTENSITY	5 min.
10yr_24hr_SCS_TypeII	10yr_24hr_SCS_TypeII	INTENSITY	6 min.
10yr_4hr_Chicago	10yr_4hr_Chicago	INTENSITY	5 min.
25mm_4hr_Chicago	25mm_4hr_Chicago	INTENSITY	10 min.
25yr_24hr_SCS_TypeII	25yr_24hr_SCS_TypeII	INTENSITY	6 min.
25yr_4hr_Chicago	25yr_4hr_Chicago	INTENSITY	5 min.
2yr_24hr_SCS_TypeII	2yr_24hr_SCS_TypeII	INTENSITY	6 min.
2yr_4hr_Chicago	2yr_4hr_Chicago	INTENSITY	5 min.
50yr_24hr_SCS_TypeII	50yr_24hr_SCS_TypeII	INTENSITY	6 min.
50yr_4hr_Chicago	50yr_4hr_Chicago	INTENSITY	5 min.
5yr_24hr_SCS_TypeII	5yr_24hr_SCS_TypeII	INTENSITY	6 min.
5yr_4hr_Chicago	5yr_4hr_Chicago	INTENSITY	5 min.
Timmins_Storm_(0-25)	Timmins_Storm_(0-25)	INTENSITY	60 min.

****
Subcatchment Summary
****

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
101	0.46	59.22	7.00	0.5000	10yr_4hr_Chicago	OF1
102	3.52	395.00	7.00	4.0000	10yr_4hr_Chicago	OF2
103	0.87	229.97	7.00	7.4000	10yr_4hr_Chicago	J1

104	1.05	105.40	7.00	2.0000	10yr_4hr_Chicago	J2
EX1	3.08	205.15	7.00	5.0000	10yr_4hr_Chicago	102

****
Node Summary
****

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
J1	JUNCTION	188.00	0.60	0.0	
J2	JUNCTION	187.10	0.60	0.0	
J3	JUNCTION	186.25	0.60	0.0	
OF1	OUTFALL	184.00	0.00	0.0	
OF2	OUTFALL	185.44	0.61	0.0	

****
Link Summary
****

Name	From Node	To Node	Type	Length	%Slope	Roughness
C1	J1	J2	CONDUIT	244.6	0.3679	0.0400
C2	J2	J3	CONDUIT	107.7	0.7893	0.0400
C3	J3	OF2	CONDUIT	160.6	0.4981	0.0400

****
Cross Section Summary
****

Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow
C1	TRAPEZOIDAL	0.60	2.88	0.42	6.60	1	2.46
C2	TRAPEZOIDAL	0.60	2.88	0.42	6.60	1	3.61
C3	TRAPEZOIDAL	0.60	2.88	0.42	6.60	1	2.87

****
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
****

****

Analysis Options
****
Flow Units ..... CMS
Process Models:
  Rainfall/Runoff ..... YES
  RDII ..... NO
  Snowmelt ..... NO
  Groundwater ..... NO
  Flow Routing ..... YES
  Ponding Allowed ..... NO
  Water Quality ..... NO
Infiltration Method ..... GREEN_AMPT
Flow Routing Method ..... DYNWAVE
Starting Date 01/05/2017 00:00:00
Ending Date 01/06/2017 23:48:00
Antecedent Dry Days 0.0
Report Time Step 00:00:05
Wet Time Step 00:00:05
Dry Time Step 00:00:05
Routing Time Step ..... 5.00 sec
Variable Time Step ..... YES
Maximum Trials 8
Number of Threads 1
Head Tolerance ..... 0.001500 m

Runoff Quantity Continuity	Volume hectare-m	Depth mm
Total Precipitation	0.450	50.088
Evaporation Loss	0.000	0.000
Infiltration Loss	0.230	25.586
Surface Runoff	0.219	24.362
Final Storage	0.001	0.140
Continuity Error (%)	0.000	

Flow Routing Continuity	Volume hectare-m	Volume 10^6 ltr
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.219	2.187
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	0.219	2.187

Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.000	0.000
Continuity Error (%)	0.002	

****
Time-Step Critical Elements
****
None

****
Highest Flow Instability Indexes
****
All links are stable.

****
Routing Time Step Summary
****

Minimum Time Step	:	4.50 sec
Average Time Step	:	5.00 sec
Maximum Time Step	:	5.00 sec
Percent in Steady State	:	0.00
Average Iterations per Step	:	2.00
Percent Not Converging	:	0.00

****
Subcatchment Runoff Summary
****

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff CMS	Runoff Coeff
101	50.09	0.00	0.00	25.40	24.55	0.11	0.03	0.490
102	50.09	18.65	0.00	24.36	44.24	1.56	0.47	0.644
103	50.09	0.00	0.00	21.66	28.29	0.25	0.21	0.565
104	50.09	0.00	0.00	24.10	25.85	0.27	0.09	0.516
EX1	50.09	0.00	0.00	28.64	21.31	0.66	0.20	0.425

****
Node Depth Summary
****

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min	Reported Max Depth Meters
J1	JUNCTION	0.00	0.12	188.12	0 01:39	0.12
J2	JUNCTION	0.00	0.14	187.24	0 01:45	0.14
J3	JUNCTION	0.01	0.15	186.40	0 01:58	0.15
OF1	OUTFALL	0.00	0.00	184.00	0 00:00	0.00
OF2	OUTFALL	0.00	0.00	185.44	0 00:00	0.00

****
Node Inflow Summary
****

Node	Type	Maximum Lateral Inflow CMS	Maximum Total Inflow CMS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 ltr	Total Inflow Volume 10^6 ltr	Flow Balance Error Percent
J1	JUNCTION	0.209	0.209	0 01:35	0.247	0.247	-0.358
J2	JUNCTION	0.093	0.200	0 01:40	0.272	0.521	-0.030
J3	JUNCTION	0.000	0.210	0 01:49	0	0.521	0.224
OF1	OUTFALL	0.032	0.032	0 01:35	0.112	0.112	0.000
OF2	OUTFALL	0.469	0.469	0 01:35	1.56	2.07	0.000

****
Node Surcharge Summary
****

No nodes were surcharged.

****
Node Flooding Summary
****

No nodes were flooded.

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow CMS	Max Flow CMS	Total Volume 10^6 ltr
OF1	10.83	0.006	0.032	0.112
OF2	34.72	0.035	0.469	2.075
System	22.77	0.041	0.502	2.187

****
Link Flow Summary
****

Link	Type	Maximum |Flow| CMS	Time of Max Occurrence days hr:min	Maximum |Veloc| m/sec	Max/ Full Flow	Max/ Full Depth
C1	CONDUIT	0.135	0 01:40	0.34	0.05	0.20
C2	CONDUIT	0.210	0 01:49	0.51	0.06	0.21
C3	CONDUIT	0.129	0 01:58	0.38	0.04	0.17

****
Flow Classification Summary
****

Conduit	Adjusted /Actual Length	Fraction of Time in Flow Class: Dry	Up Dry	Down Dry	Sub Crit	Sup Crit	Up Crit	Down Crit	Norm Ltd	Inlet Ctrl
C1	1.00	0.01	0.20	0.00	0.79	0.00	0.00	0.00	0.98	0.00
C2	1.00	0.01	0.00	0.00	0.99	0.00	0.00	0.00	0.96	0.00
C3	1.00	0.01	0.00	0.00	0.00	0.00	0.00	0.99	0.00	0.00

****

Conduit Surcharge Summary
****

No conduits were surcharged.

Analysis begun on: Thu Nov 28 11:45:56 2019
Analysis ended on: Thu Nov 28 11:45:57 2019
Total elapsed time: 00:00:01

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.011)

****
Element Count
****
Number of rain gages 14
Number of subcatchments ... 5
Number of nodes 5
Number of links 3
Number of pollutants 0
Number of land uses 0

****
Raingage Summary
****

Name	Data Source	Data Type	Recording Interval
100yr_24hr_SCS_TypeII	100yr_24hr_SCS_TypeII	INTENSITY	6 min.
100yr_4hr_Chicago	100yr_4hr_Chicago	INTENSITY	5 min.
10yr_24hr_SCS_TypeII	10yr_24hr_SCS_TypeII	INTENSITY	6 min.
10yr_4hr_Chicago	10yr_4hr_Chicago	INTENSITY	5 min.
25mm_4hr_Chicago	25mm_4hr_Chicago	INTENSITY	10 min.
25yr_24hr_SCS_TypeII	25yr_24hr_SCS_TypeII	INTENSITY	6 min.
25yr_4hr_Chicago	25yr_4hr_Chicago	INTENSITY	5 min.
2yr_24hr_SCS_TypeII	2yr_24hr_SCS_TypeII	INTENSITY	6 min.
2yr_4hr_Chicago	2yr_4hr_Chicago	INTENSITY	5 min.
50yr_24hr_SCS_TypeII	50yr_24hr_SCS_TypeII	INTENSITY	6 min.
50yr_4hr_Chicago	50yr_4hr_Chicago	INTENSITY	5 min.
5yr_24hr_SCS_TypeII	5yr_24hr_SCS_TypeII	INTENSITY	6 min.
5yr_4hr_Chicago	5yr_4hr_Chicago	INTENSITY	5 min.
Timmins_Storm_(0-25)	Timmins_Storm_(0-25)	INTENSITY	60 min.

****
Subcatchment Summary
****

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
101	0.46	59.22	7.00	0.5000	25yr_4hr_Chicago	OF1
102	3.52	395.00	7.00	4.0000	25yr_4hr_Chicago	OF2
103	0.87	229.97	7.00	7.4000	25yr_4hr_Chicago	J1

104	1.05	105.40	7.00	2.0000	25yr_4hr_Chicago	J2
EX1	3.08	205.15	7.00	5.0000	25yr_4hr_Chicago	102

****
Node Summary
****

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
J1	JUNCTION	188.00	0.60	0.0	
J2	JUNCTION	187.10	0.60	0.0	
J3	JUNCTION	186.25	0.60	0.0	
OF1	OUTFALL	184.00	0.00	0.0	
OF2	OUTFALL	185.44	0.61	0.0	

****
Link Summary
****

Name	From Node	To Node	Type	Length	%Slope	Roughness
C1	J1	J2	CONDUIT	244.6	0.3679	0.0400
C2	J2	J3	CONDUIT	107.7	0.7893	0.0400
C3	J3	OF2	CONDUIT	160.6	0.4981	0.0400

****
Cross Section Summary
****

Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow
C1	TRAPEZOIDAL	0.60	2.88	0.42	6.60	1	2.46
C2	TRAPEZOIDAL	0.60	2.88	0.42	6.60	1	3.61
C3	TRAPEZOIDAL	0.60	2.88	0.42	6.60	1	2.87

****
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
****

****

Analysis Options
****
Flow Units ..... CMS
Process Models:
  Rainfall/Runoff ..... YES
  RDII ..... NO
  Snowmelt ..... NO
  Groundwater ..... NO
  Flow Routing ..... YES
  Ponding Allowed ..... NO
  Water Quality ..... NO
Infiltration Method ..... GREEN_AMPT
Flow Routing Method ..... DYNWAVE
Starting Date 01/05/2017 00:00:00
Ending Date 01/06/2017 23:48:00
Antecedent Dry Days 0.0
Report Time Step 00:00:05
Wet Time Step 00:00:05
Dry Time Step 00:00:05
Routing Time Step ..... 5.00 sec
Variable Time Step ..... YES
Maximum Trials 8
Number of Threads 1
Head Tolerance ..... 0.001500 m

Runoff Quantity Continuity	Volume hectare-m	Depth mm
Total Precipitation	0.530	59.043
Evaporation Loss	0.000	0.000
Infiltration Loss	0.236	26.244
Surface Runoff	0.293	32.660
Final Storage	0.001	0.140
Continuity Error (%)	0.000	

Flow Routing Continuity	Volume hectare-m	Volume 10^6 ltr
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.293	2.932
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	0.293	2.932

Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.000	0.000
Continuity Error (%)	0.000	

****
Time-Step Critical Elements
****
None

****
Highest Flow Instability Indexes
****
All links are stable.

****
Routing Time Step Summary
****

Minimum Time Step	:	4.50 sec
Average Time Step	:	5.00 sec
Maximum Time Step	:	5.00 sec
Percent in Steady State	:	0.00
Average Iterations per Step	:	2.00
Percent Not Converging	:	0.00

****
Subcatchment Runoff Summary
****

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff CMS	Runoff Coeff
101	59.04	0.00	0.00	26.15	32.75	0.15	0.04	0.555
102	59.04	25.90	0.00	25.03	59.77	2.10	0.66	0.704
103	59.04	0.00	0.00	22.14	36.76	0.32	0.29	0.623
104	59.04	0.00	0.00	24.75	34.15	0.36	0.13	0.578
EX1	59.04	0.00	0.00	29.32	29.59	0.91	0.30	0.501

****
Node Depth Summary
****

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min	Reported Max Depth Meters
J1	JUNCTION	0.00	0.15	188.15	0 01:38	0.15
J2	JUNCTION	0.00	0.17	187.27	0 01:43	0.17
J3	JUNCTION	0.01	0.18	186.43	0 01:54	0.18
OF1	OUTFALL	0.00	0.00	184.00	0 00:00	0.00
OF2	OUTFALL	0.00	0.00	185.44	0 00:00	0.00

****
Node Inflow Summary
****

Node	Type	Maximum Lateral Inflow CMS	Maximum Total Inflow CMS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 ltr	Total Inflow Volume 10^6 ltr	Flow Balance Error Percent
J1	JUNCTION	0.287	0.287	0 01:35	0.321	0.321	-0.431
J2	JUNCTION	0.129	0.287	0 01:39	0.36	0.683	-0.020
J3	JUNCTION	0.000	0.296	0 01:47	0	0.683	0.237
OF1	OUTFALL	0.044	0.044	0 01:35	0.149	0.149	0.000
OF2	OUTFALL	0.662	0.663	0 01:35	2.1	2.78	0.000

****
Node Surcharge Summary
****

No nodes were surcharged.

****
Node Flooding Summary
****

No nodes were flooded.

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow CMS	Max Flow CMS	Total Volume 10^6 ltr
OF1	11.38	0.008	0.044	0.149
OF2	35.10	0.046	0.663	2.782
System	23.24	0.054	0.706	2.932

****
Link Flow Summary
****

Link	Type	Maximum |Flow| CMS	Time of Max Occurrence days hr:min	Maximum |Veloc| m/sec	Max/ Full Flow	Max/ Full Depth
C1	CONDUIT	0.192	0 01:39	0.38	0.08	0.25
C2	CONDUIT	0.296	0 01:47	0.57	0.08	0.25
C3	CONDUIT	0.184	0 01:54	0.43	0.06	0.21

****
Flow Classification Summary
****

Conduit	Adjusted /Actual Length	Fraction of Time in Flow Class: Dry	Up Dry	Down Dry	Sub Crit	Sup Crit	Up Crit	Down Crit	Norm Ltd	Inlet Ctrl
C1	1.00	0.01	0.20	0.00	0.79	0.00	0.00	0.00	0.98	0.00
C2	1.00	0.01	0.00	0.00	0.99	0.00	0.00	0.00	0.96	0.00
C3	1.00	0.01	0.00	0.00	0.00	0.00	0.00	0.99	0.00	0.00

****

Conduit Surcharge Summary
****

No conduits were surcharged.

Analysis begun on: Thu Nov 28 11:46:43 2019
Analysis ended on: Thu Nov 28 11:46:44 2019
Total elapsed time: 00:00:01

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.011)

****
Element Count
****
Number of rain gages 14
Number of subcatchments ... 5
Number of nodes 5
Number of links 3
Number of pollutants 0
Number of land uses 0

****
Raingage Summary
****

Name	Data Source	Data Type	Recording Interval
100yr_24hr_SCS_TypeII	100yr_24hr_SCS_TypeII	INTENSITY	6 min.
100yr_4hr_Chicago	100yr_4hr_Chicago	INTENSITY	5 min.
10yr_24hr_SCS_TypeII	10yr_24hr_SCS_TypeII	INTENSITY	6 min.
10yr_4hr_Chicago	10yr_4hr_Chicago	INTENSITY	5 min.
25mm_4hr_Chicago	25mm_4hr_Chicago	INTENSITY	10 min.
25yr_24hr_SCS_TypeII	25yr_24hr_SCS_TypeII	INTENSITY	6 min.
25yr_4hr_Chicago	25yr_4hr_Chicago	INTENSITY	5 min.
2yr_24hr_SCS_TypeII	2yr_24hr_SCS_TypeII	INTENSITY	6 min.
2yr_4hr_Chicago	2yr_4hr_Chicago	INTENSITY	5 min.
50yr_24hr_SCS_TypeII	50yr_24hr_SCS_TypeII	INTENSITY	6 min.
50yr_4hr_Chicago	50yr_4hr_Chicago	INTENSITY	5 min.
5yr_24hr_SCS_TypeII	5yr_24hr_SCS_TypeII	INTENSITY	6 min.
5yr_4hr_Chicago	5yr_4hr_Chicago	INTENSITY	5 min.
Timmins_Storm_(0-25)	Timmins_Storm_(0-25)	INTENSITY	60 min.

****
Subcatchment Summary
****

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
101	0.46	59.22	7.00	0.5000	50yr_4hr_Chicago	OF1
102	3.52	395.00	7.00	4.0000	50yr_4hr_Chicago	OF2
103	0.87	229.97	7.00	7.4000	50yr_4hr_Chicago	J1

104	1.05	105.40	7.00	2.0000	50yr_4hr_Chicago	J2
EX1	3.08	205.15	7.00	5.0000	50yr_4hr_Chicago	102

****
Node Summary
****

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
J1	JUNCTION	188.00	0.60	0.0	
J2	JUNCTION	187.10	0.60	0.0	
J3	JUNCTION	186.25	0.60	0.0	
OF1	OUTFALL	184.00	0.00	0.0	
OF2	OUTFALL	185.44	0.61	0.0	

****
Link Summary
****

Name	From Node	To Node	Type	Length	%Slope	Roughness
C1	J1	J2	CONDUIT	244.6	0.3679	0.0400
C2	J2	J3	CONDUIT	107.7	0.7893	0.0400
C3	J3	OF2	CONDUIT	160.6	0.4981	0.0400

****
Cross Section Summary
****

Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow
C1	TRAPEZOIDAL	0.60	2.88	0.42	6.60	1	2.46
C2	TRAPEZOIDAL	0.60	2.88	0.42	6.60	1	3.61
C3	TRAPEZOIDAL	0.60	2.88	0.42	6.60	1	2.87

****
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
****

****

Analysis Options
****
Flow Units ..... CMS
Process Models:
  Rainfall/Runoff ..... YES
  RDII ..... NO
  Snowmelt ..... NO
  Groundwater ..... NO
  Flow Routing ..... YES
  Ponding Allowed ..... NO
  Water Quality ..... NO
Infiltration Method ..... GREEN_AMPT
Flow Routing Method ..... DYNWAVE
Starting Date 01/05/2017 00:00:00
Ending Date 01/06/2017 23:48:00
Antecedent Dry Days 0.0
Report Time Step 00:00:05
Wet Time Step 00:00:05
Dry Time Step 00:00:05
Routing Time Step ..... 5.00 sec
Variable Time Step ..... YES
Maximum Trials 8
Number of Threads 1
Head Tolerance ..... 0.001500 m

Runoff Quantity Continuity	Volume hectare-m	Depth mm
Total Precipitation	0.589	65.570
Evaporation Loss	0.000	0.000
Infiltration Loss	0.239	26.625
Surface Runoff	0.348	38.805
Final Storage	0.001	0.140
Continuity Error (%)	-0.001	

Flow Routing Continuity	Volume hectare-m	Volume 10^6 ltr
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.348	3.483
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	0.348	3.483

Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.000	0.000
Continuity Error (%)	0.000	

****
Time-Step Critical Elements
****
None

****
Highest Flow Instability Indexes
****
All links are stable.

****
Routing Time Step Summary
****

Minimum Time Step	:	4.50 sec
Average Time Step	:	5.00 sec
Maximum Time Step	:	5.00 sec
Percent in Steady State	:	0.00
Average Iterations per Step	:	2.00
Percent Not Converging	:	0.00

****
Subcatchment Runoff Summary
****

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff CMS	Runoff Coeff
101	65.57	0.00	0.00	26.58	38.85	0.18	0.05	0.592
102	65.57	31.27	0.00	25.42	71.28	2.51	0.82	0.736
103	65.57	0.00	0.00	22.42	43.01	0.38	0.35	0.656
104	65.57	0.00	0.00	25.14	40.29	0.42	0.16	0.614
EX1	65.57	0.00	0.00	29.71	35.72	1.10	0.38	0.545

****
Node Depth Summary
****

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min	Reported Max Depth Meters
J1	JUNCTION	0.00	0.17	188.17	0 01:38	0.17
J2	JUNCTION	0.00	0.19	187.29	0 01:42	0.19
J3	JUNCTION	0.01	0.20	186.45	0 01:52	0.20
OF1	OUTFALL	0.00	0.00	184.00	0 00:00	0.00
OF2	OUTFALL	0.00	0.00	185.44	0 00:00	0.00

****
Node Inflow Summary
****

Node	Type	Maximum Lateral Inflow CMS	Maximum Total Inflow CMS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 ltr	Total Inflow Volume 10^6 ltr	Flow Balance Error Percent
J1	JUNCTION	0.346	0.346	0 01:35	0.376	0.376	-0.467
J2	JUNCTION	0.157	0.354	0 01:39	0.425	0.802	-0.012
J3	JUNCTION	0.000	0.363	0 01:46	0	0.802	0.245
OF1	OUTFALL	0.053	0.053	0 01:35	0.177	0.177	0.000
OF2	OUTFALL	0.818	0.820	0 01:35	2.51	3.31	0.000

****
Node Surcharge Summary
****

No nodes were surcharged.

****
Node Flooding Summary
****

No nodes were flooded.

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow CMS	Max Flow CMS	Total Volume 10^6 ltr
OF1	11.70	0.009	0.053	0.177
OF2	35.33	0.054	0.820	3.306
System	23.51	0.063	0.873	3.483

****
Link Flow Summary
****

Link	Type	Maximum |Flow| CMS	Time of Max Occurrence days hr:min	Maximum |Veloc| m/sec	Max/ Full Flow	Max/ Full Depth
C1	CONDUIT	0.237	0 01:39	0.41	0.10	0.28
C2	CONDUIT	0.363	0 01:46	0.62	0.10	0.28
C3	CONDUIT	0.228	0 01:52	0.47	0.08	0.24

****
Flow Classification Summary
****

Conduit	Adjusted /Actual Length	Fraction of Time in Flow Class: Dry	Up Dry	Down Dry	Sub Crit	Sup Crit	Up Crit	Down Crit	Norm Ltd	Inlet Ctrl
C1	1.00	0.01	0.20	0.00	0.79	0.00	0.00	0.00	0.98	0.00
C2	1.00	0.01	0.00	0.00	0.99	0.00	0.00	0.00	0.96	0.00
C3	1.00	0.01	0.00	0.00	0.00	0.00	0.00	0.99	0.00	0.00

****

Conduit Surcharge Summary
****

No conduits were surcharged.

Analysis begun on: Thu Nov 28 11:47:46 2019
Analysis ended on: Thu Nov 28 11:47:46 2019
Total elapsed time: < 1 sec

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.011)

****
Element Count
****
Number of rain gages 14
Number of subcatchments ... 5
Number of nodes 5
Number of links 3
Number of pollutants 0
Number of land uses 0

****
Raingage Summary
****

Name	Data Source	Data Type	Recording Interval
100yr_24hr_SCS_TypeII	100yr_24hr_SCS_TypeII	INTENSITY	6 min.
100yr_4hr_Chicago	100yr_4hr_Chicago	INTENSITY	5 min.
10yr_24hr_SCS_TypeII	10yr_24hr_SCS_TypeII	INTENSITY	6 min.
10yr_4hr_Chicago	10yr_4hr_Chicago	INTENSITY	5 min.
25mm_4hr_Chicago	25mm_4hr_Chicago	INTENSITY	10 min.
25yr_24hr_SCS_TypeII	25yr_24hr_SCS_TypeII	INTENSITY	6 min.
25yr_4hr_Chicago	25yr_4hr_Chicago	INTENSITY	5 min.
2yr_24hr_SCS_TypeII	2yr_24hr_SCS_TypeII	INTENSITY	6 min.
2yr_4hr_Chicago	2yr_4hr_Chicago	INTENSITY	5 min.
50yr_24hr_SCS_TypeII	50yr_24hr_SCS_TypeII	INTENSITY	6 min.
50yr_4hr_Chicago	50yr_4hr_Chicago	INTENSITY	5 min.
5yr_24hr_SCS_TypeII	5yr_24hr_SCS_TypeII	INTENSITY	6 min.
5yr_4hr_Chicago	5yr_4hr_Chicago	INTENSITY	5 min.
Timmins_Storm_(0-25)	Timmins_Storm_(0-25)	INTENSITY	60 min.

****
Subcatchment Summary
****

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
101	0.46	59.22	7.00	0.5000	100yr_4hr_Chicago	OF1
102	3.52	395.00	7.00	4.0000	100yr_4hr_Chicago	OF2
103	0.87	229.97	7.00	7.4000	100yr_4hr_Chicago	J1

104	1.05	105.40	7.00	2.0000	100yr_4hr_Chicago	J2
EX1	3.08	205.15	7.00	5.0000	100yr_4hr_Chicago	102

****
Node Summary
****

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
J1	JUNCTION	188.00	0.60	0.0	
J2	JUNCTION	187.10	0.60	0.0	
J3	JUNCTION	186.25	0.60	0.0	
OF1	OUTFALL	184.00	0.00	0.0	
OF2	OUTFALL	185.44	0.61	0.0	

****
Link Summary
****

Name	From Node	To Node	Type	Length	%Slope	Roughness
C1	J1	J2	CONDUIT	244.6	0.3679	0.0400
C2	J2	J3	CONDUIT	107.7	0.7893	0.0400
C3	J3	OF2	CONDUIT	160.6	0.4981	0.0400

****
Cross Section Summary
****

Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow
C1	TRAPEZOIDAL	0.60	2.88	0.42	6.60	1	2.46
C2	TRAPEZOIDAL	0.60	2.88	0.42	6.60	1	3.61
C3	TRAPEZOIDAL	0.60	2.88	0.42	6.60	1	2.87

****
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
****

****

Analysis Options
****
Flow Units ..... CMS
Process Models:
  Rainfall/Runoff ..... YES
  RDII ..... NO
  Snowmelt ..... NO
  Groundwater ..... NO
  Flow Routing ..... YES
  Ponding Allowed ..... NO
  Water Quality ..... NO
Infiltration Method ..... GREEN_AMPT
Flow Routing Method ..... DYNWAVE
Starting Date 01/05/2017 00:00:00
Ending Date 01/06/2017 23:48:00
Antecedent Dry Days 0.0
Report Time Step 00:00:05
Wet Time Step 00:00:05
Dry Time Step 00:00:05
Routing Time Step ..... 5.00 sec
Variable Time Step ..... YES
Maximum Trials 8
Number of Threads 1
Head Tolerance ..... 0.001500 m

Runoff Quantity Continuity	Volume hectare-m	Depth mm
Total Precipitation	0.647	72.096
Evaporation Loss	0.000	0.000
Infiltration Loss	0.242	26.948
Surface Runoff	0.404	45.008
Final Storage	0.001	0.140
Continuity Error (%)	-0.001	

Flow Routing Continuity	Volume hectare-m	Volume 10^6 ltr
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.404	4.040
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	0.404	4.040

Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.000	0.000
Continuity Error (%)	0.000	

****
Time-Step Critical Elements
****
None

****
Highest Flow Instability Indexes
****
All links are stable.

****
Routing Time Step Summary
****

Minimum Time Step	:	4.50 sec
Average Time Step	:	5.00 sec
Maximum Time Step	:	5.00 sec
Percent in Steady State	:	0.00
Average Iterations per Step	:	2.00
Percent Not Converging	:	0.00

****
Subcatchment Runoff Summary
****

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff CMS	Runoff Coeff
101	72.10	0.00	0.00	26.95	45.01	0.21	0.06	0.624
102	72.10	36.69	0.00	25.75	82.90	2.91	0.99	0.762
103	72.10	0.00	0.00	22.66	49.30	0.43	0.40	0.684
104	72.10	0.00	0.00	25.47	46.49	0.49	0.19	0.645
EX1	72.10	0.00	0.00	30.04	41.91	1.29	0.46	0.581

****
Node Depth Summary
****

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min	Reported Max Depth Meters
J1	JUNCTION	0.00	0.19	188.19	0 01:37	0.19
J2	JUNCTION	0.00	0.21	187.31	0 01:41	0.21
J3	JUNCTION	0.01	0.22	186.47	0 01:51	0.22
OF1	OUTFALL	0.00	0.00	184.00	0 00:00	0.00
OF2	OUTFALL	0.00	0.00	185.44	0 00:00	0.00

****
Node Inflow Summary
****

Node	Type	Maximum Lateral Inflow CMS	Maximum Total Inflow CMS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 ltr	Total Inflow Volume 10^6 ltr	Flow Balance Error Percent
J1	JUNCTION	0.404	0.404	0 01:35	0.431	0.431	-0.492
J2	JUNCTION	0.187	0.425	0 01:38	0.49	0.923	-0.008
J3	JUNCTION	0.000	0.434	0 01:45	0	0.923	0.251
OF1	OUTFALL	0.063	0.063	0 01:35	0.205	0.205	0.000
OF2	OUTFALL	0.986	0.989	0 01:35	2.91	3.83	0.000

****
Node Surcharge Summary
****

No nodes were surcharged.

****
Node Flooding Summary
****

No nodes were flooded.

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow CMS	Max Flow CMS	Total Volume 10^6 ltr
OF1	11.97	0.010	0.063	0.205
OF2	35.51	0.063	0.989	3.835
System	23.74	0.073	1.052	4.040

****
Link Flow Summary
****

Link	Type	Maximum |Flow| CMS	Time of Max Occurrence days hr:min	Maximum |Veloc| m/sec	Max/ Full Flow	Max/ Full Depth
C1	CONDUIT	0.284	0 01:38	0.44	0.12	0.31
C2	CONDUIT	0.434	0 01:45	0.65	0.12	0.32
C3	CONDUIT	0.274	0 01:51	0.50	0.10	0.26

****
Flow Classification Summary
****

Conduit	Adjusted /Actual Length	Fraction of Time in Flow Class: Dry	Up Dry	Down Dry	Sub Crit	Sup Crit	Up Crit	Down Crit	Norm Ltd	Inlet Ctrl
C1	1.00	0.01	0.20	0.00	0.79	0.00	0.00	0.00	0.98	0.00
C2	1.00	0.01	0.00	0.00	0.99	0.00	0.00	0.00	0.96	0.00
C3	1.00	0.01	0.00	0.00	0.00	0.00	0.00	0.99	0.00	0.00

****

Conduit Surcharge Summary
****

No conduits were surcharged.

Analysis begun on: Thu Nov 28 13:13:14 2019
Analysis ended on: Thu Nov 28 13:13:14 2019
Total elapsed time: < 1 sec

300037815 TPC Marlwood Inc.

Post-Development PCSWMM Model
4-hr Chicago

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.011)

****
Element Count
****
Number of rain gages 14
Number of subcatchments ... 7
Number of nodes 9
Number of links 8
Number of pollutants 0
Number of land uses 0

****
Raingage Summary
****

Name	Data Source	Data Type	Recording Interval
100yr_24hr_SCS_TypeII	100yr_24hr_SCS_TypeII	INTENSITY	6 min.
100yr_4hr_Chicago	100yr_4hr_Chicago	INTENSITY	5 min.
10yr_24hr_SCS_TypeII	10yr_24hr_SCS_TypeII	INTENSITY	6 min.
10yr_4hr_Chicago	10yr_4hr_Chicago	INTENSITY	5 min.
25mm_4hr_Chicago	25mm_4hr_Chicago	INTENSITY	10 min.
25yr_24hr_SCS_TypeII	25yr_24hr_SCS_TypeII	INTENSITY	6 min.
25yr_4hr_Chicago	25yr_4hr_Chicago	INTENSITY	5 min.
2yr_24hr_SCS_TypeII	2yr_24hr_SCS_TypeII	INTENSITY	6 min.
2yr_4hr_Chicago	2yr_4hr_Chicago	INTENSITY	5 min.
50yr_24hr_SCS_TypeII	50yr_24hr_SCS_TypeII	INTENSITY	6 min.
50yr_4hr_Chicago	50yr_4hr_Chicago	INTENSITY	5 min.
5yr_24hr_SCS_TypeII	5yr_24hr_SCS_TypeII	INTENSITY	6 min.
5yr_4hr_Chicago	5yr_4hr_Chicago	INTENSITY	5 min.
Timmins_Storm_(0-25)	Timmins_Storm_(0-25)	INTENSITY	60 min.

****
Subcatchment Summary
****

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
201	3.61	2123.65	66.00	2.0000	2yr_4hr_Chicago	SU1
202	0.75	188.32	50.00	6.0000	2yr_4hr_Chicago	SU1
203	0.53	314.00	50.00	2.0000	2yr_4hr_Chicago	J4

EX1	3.08	205.16	7.00	5.0000	2yr_4hr_Chicago	J4
UN1	0.32	187.06	50.00	2.0000	2yr_4hr_Chicago	OF2
UN2	0.17	57.55	7.00	0.5000	2yr_4hr_Chicago	OF1
UN3	0.52	304.65	50.00	2.0000	2yr_4hr_Chicago	J1

****
Node Summary
****

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
J1	JUNCTION	188.00	0.60	0.0	
J3	JUNCTION	186.25	0.60	0.0	
J4	JUNCTION	187.44	0.50	0.0	
J5	JUNCTION	187.22	0.50	0.0	
J6	JUNCTION	185.60	2.00	0.0	
J7	JUNCTION	185.45	0.90	0.0	
OF1	OUTFALL	184.00	0.00	0.0	
OF2	OUTFALL	185.44	0.60	0.0	
SU1	STORAGE	184.60	2.95	0.0	

****
Link Summary
****

Name	From Node	To Node	Type	Length	%Slope	Roughness
C1	J1	J3	CONDUIT	352.3	0.4967	0.0400
C2	J3	J7	CONDUIT	159.6	0.5012	0.0400
C3	J4	J5	CONDUIT	89.9	0.2447	0.0250
C4	J5	SU1	CONDUIT	98.7	0.2534	0.0250
C5	J6	J7	CONDUIT	52.8	0.2843	0.0130
C6	J7	OF2	CONDUIT	1.0	1.0001	0.0400
OR1	SU1	J6	ORIFICE			
OR2	SU1	J6	WEIR			

****
Cross Section Summary
****

Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow
C1	TRAPEZOIDAL	0.60	2.88	0.42	6.60	1	2.86
C2	TRAPEZOIDAL	0.60	2.88	0.42	6.60	1	2.88

C3	TRAPEZOIDAL	0.50	1.25	0.30	4.00	1	1.11
C4	TRAPEZOIDAL	0.50	1.25	0.30	4.00	1	1.13
C5	CIRCULAR	0.90	0.64	0.23	0.90	1	0.97
C6	TRAPEZOIDAL	0.60	2.88	0.42	6.60	1	4.06

```
**********************************************************
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
**********************************************************

****************
Analysis Options
****************
Flow Units ............... CMS
Process Models:
  Rainfall/Runoff ........ YES
  RDII ................... NO
  Snowmelt ............... NO
  Groundwater ............ NO
  Flow Routing ........... YES
  Ponding Allowed ........ NO
  Water Quality .......... NO
Infiltration Method ...... GREEN_AMPT
Flow Routing Method ...... DYNWAVE
Starting Date ............ 01/05/2017 00:00:00
Ending Date .............. 01/07/2017 00:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:00:05
Wet Time Step ............ 00:00:05
Dry Time Step ............ 00:00:05
Routing Time Step ........ 5.00 sec
Variable Time Step ....... YES
Maximum Trials ........... 8
Number of Threads ........ 1
Head Tolerance ........... 0.001500 m

**************************        Volume         Depth
Runoff Quantity Continuity     hectare-m            mm
**************************     ---------       -------
Total Precipitation ......         0.292        32.481
Evaporation Loss .........         0.000         0.000
Infiltration Loss ........         0.133        14.832
```

Surface Runoff	0.151	16.832
Final Storage	0.007	0.818
Continuity Error (%)	-0.001	

Flow Routing Continuity	Volume hectare-m	Volume 10^6 ltr
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.151	1.511
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	0.142	1.419
Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.101	1.010
Final Stored Volume	0.110	1.102
Continuity Error (%)	0.000	

Time-Step Critical Elements

None

Highest Flow Instability Indexes

All links are stable.

Routing Time Step Summary

Minimum Time Step	:	4.50 sec
Average Time Step	:	5.00 sec
Maximum Time Step	:	5.00 sec
Percent in Steady State	:	0.00
Average Iterations per Step	:	2.00
Percent Not Converging	:	0.00

Subcatchment Runoff Summary
****

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff CMS	Runoff Coeff
201	32.48	0.00	0.00	7.24	23.93	0.86	1.00	0.737
202	32.48	0.00	0.00	10.73	20.75	0.16	0.16	0.639
203	32.48	0.00	0.00	10.68	20.80	0.11	0.12	0.640
EX1	32.48	0.00	0.00	26.25	6.09	0.19	0.08	0.187
UN1	32.48	0.00	0.00	10.68	20.80	0.07	0.07	0.640
UN2	32.48	0.00	0.00	21.11	11.23	0.02	0.01	0.346
UN3	32.48	0.00	0.00	10.68	20.80	0.11	0.12	0.640

****
Node Depth Summary
****

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min	Reported Max Depth Meters
J1	JUNCTION	0.00	0.08	188.08	0 01:40	0.08
J3	JUNCTION	0.00	0.04	186.29	0 02:01	0.04
J4	JUNCTION	0.00	0.24	187.68	0 01:35	0.24
J5	JUNCTION	0.01	0.20	187.42	0 01:37	0.20
J6	JUNCTION	0.05	0.15	185.75	0 02:46	0.15
J7	JUNCTION	0.02	0.05	185.50	0 02:31	0.05
OF1	OUTFALL	0.00	0.00	184.00	0 00:00	0.00
OF2	OUTFALL	0.01	0.04	185.48	0 02:31	0.04
SU1	STORAGE	1.23	1.51	186.11	0 02:45	1.51

****
Node Inflow Summary
****

Node	Type	Maximum Lateral Inflow CMS	Maximum Total Inflow CMS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 ltr	Total Inflow Volume 10^6 ltr	Flow Balance Error Percent

J1	JUNCTION	0.120	0.120	0	01:35	0.108	0.108	-0.504
J3	JUNCTION	0.000	0.037	0	01:46	0	0.108	0.432
J4	JUNCTION	0.201	0.201	0	01:35	0.298	0.298	-0.372
J5	JUNCTION	0.000	0.195	0	01:35	0	0.299	0.364
J6	JUNCTION	0.000	0.059	0	02:45	0	1.23	0.018
J7	JUNCTION	0.000	0.070	0	02:30	0	1.34	0.148
OF1	OUTFALL	0.008	0.008	0	01:35	0.0187	0.0187	0.000
OF2	OUTFALL	0.073	0.076	0	01:35	0.0661	1.4	0.000
SU1	STORAGE	1.167	1.246	0	01:35	1.02	2.33	0.001

****
Node Surcharge Summary
****

No nodes were surcharged.

****
Node Flooding Summary
****

No nodes were flooded.

****
Storage Volume Summary
****

Storage Unit	Average Volume 1000 m3	Avg Pcnt Full	Evap Pcnt Loss	Exfil Pcnt Loss	Maximum Volume 1000 m3	Max Pcnt Full	Time of Max Occurrence days hr:min	Maximum Outflow CMS
SU1	1.404	21	0	0	1.969	30	0 02:45	0.059

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow CMS	Max Flow CMS	Total Volume 10^6 ltr

OF1	7.49	0.001	0.008	0.019
OF2	98.58	0.008	0.076	1.401
System	53.04	0.010	0.084	1.419

****
Link Flow Summary
****

Link	Type	Maximum |Flow| CMS	Time of Max Occurrence days hr:min	Maximum |Veloc| m/sec	Max/ Full Flow	Max/ Full Depth
C1	CONDUIT	0.037	0 01:46	0.23	0.01	0.08
C2	CONDUIT	0.027	0 02:01	0.20	0.01	0.07
C3	CONDUIT	0.195	0 01:35	0.60	0.18	0.41
C4	CONDUIT	0.111	0 01:37	0.52	0.10	0.29
C5	CONDUIT	0.059	0 02:46	1.47	0.06	0.11
C6	CONDUIT	0.070	0 02:31	0.50	0.02	0.08
OR1	ORIFICE	0.007	0 01:50			1.00
OR2	WEIR	0.052	0 02:45			0.10

****
Flow Classification Summary
****

Conduit	Adjusted /Actual Length	Fraction of Time in Flow Class: Dry	Up Dry	Down Dry	Sub Crit	Sup Crit	Up Crit	Down Crit	Norm Ltd	Inlet Ctrl
C1	1.00	0.01	0.04	0.00	0.95	0.00	0.00	0.00	0.96	0.00
C2	1.00	0.02	0.00	0.00	0.98	0.00	0.00	0.00	0.98	0.00
C3	1.00	0.15	0.41	0.00	0.44	0.00	0.00	0.00	0.76	0.00
C4	1.00	0.15	0.00	0.00	0.00	0.00	0.00	0.85	0.00	0.00
C5	1.00	0.02	0.00	0.00	0.01	0.98	0.00	0.00	0.00	0.00
C6	1.00	0.02	0.00	0.00	0.98	0.00	0.00	0.00	0.00	0.00

****
Conduit Surcharge Summary
****

No conduits were surcharged.

Analysis begun on: Thu Nov 28 14:55:42 2019
Analysis ended on: Thu Nov 28 14:55:43 2019
Total elapsed time: 00:00:01

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.011)

****
Element Count
****
Number of rain gages 14
Number of subcatchments ... 7
Number of nodes 9
Number of links 8
Number of pollutants 0
Number of land uses 0

****
Raingage Summary
****

Name	Data Source	Data Type	Recording Interval
100yr_24hr_SCS_TypeII	100yr_24hr_SCS_TypeII	INTENSITY	6 min.
100yr_4hr_Chicago	100yr_4hr_Chicago	INTENSITY	5 min.
10yr_24hr_SCS_TypeII	10yr_24hr_SCS_TypeII	INTENSITY	6 min.
10yr_4hr_Chicago	10yr_4hr_Chicago	INTENSITY	5 min.
25mm_4hr_Chicago	25mm_4hr_Chicago	INTENSITY	10 min.
25yr_24hr_SCS_TypeII	25yr_24hr_SCS_TypeII	INTENSITY	6 min.
25yr_4hr_Chicago	25yr_4hr_Chicago	INTENSITY	5 min.
2yr_24hr_SCS_TypeII	2yr_24hr_SCS_TypeII	INTENSITY	6 min.
2yr_4hr_Chicago	2yr_4hr_Chicago	INTENSITY	5 min.
50yr_24hr_SCS_TypeII	50yr_24hr_SCS_TypeII	INTENSITY	6 min.
50yr_4hr_Chicago	50yr_4hr_Chicago	INTENSITY	5 min.
5yr_24hr_SCS_TypeII	5yr_24hr_SCS_TypeII	INTENSITY	6 min.
5yr_4hr_Chicago	5yr_4hr_Chicago	INTENSITY	5 min.
Timmins_Storm_(0-25)	Timmins_Storm_(0-25)	INTENSITY	60 min.

****
Subcatchment Summary
****

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
201	3.61	2123.65	66.00	2.0000	5yr_4hr_Chicago	SU1
202	0.75	188.32	50.00	6.0000	5yr_4hr_Chicago	SU1
203	0.53	314.00	50.00	2.0000	5yr_4hr_Chicago	J4

EX1	3.08	205.16	7.00	5.0000	5yr_4hr_Chicago	J4
UN1	0.32	187.06	50.00	2.0000	5yr_4hr_Chicago	OF2
UN2	0.17	57.55	7.00	0.5000	5yr_4hr_Chicago	OF1
UN3	0.52	304.65	50.00	2.0000	5yr_4hr_Chicago	J1

****
Node Summary
****

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
J1	JUNCTION	188.00	0.60	0.0	
J3	JUNCTION	186.25	0.60	0.0	
J4	JUNCTION	187.44	0.50	0.0	
J5	JUNCTION	187.22	0.50	0.0	
J6	JUNCTION	185.60	2.00	0.0	
J7	JUNCTION	185.45	0.90	0.0	
OF1	OUTFALL	184.00	0.00	0.0	
OF2	OUTFALL	185.44	0.60	0.0	
SU1	STORAGE	184.60	2.95	0.0	

****
Link Summary
****

Name	From Node	To Node	Type	Length	%Slope	Roughness
C1	J1	J3	CONDUIT	352.3	0.4967	0.0400
C2	J3	J7	CONDUIT	159.6	0.5012	0.0400
C3	J4	J5	CONDUIT	89.9	0.2447	0.0250
C4	J5	SU1	CONDUIT	98.7	0.2534	0.0250
C5	J6	J7	CONDUIT	52.8	0.2843	0.0130
C6	J7	OF2	CONDUIT	1.0	1.0001	0.0400
OR1	SU1	J6	ORIFICE			
OR2	SU1	J6	WEIR			

****
Cross Section Summary
****

Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow
C1	TRAPEZOIDAL	0.60	2.88	0.42	6.60	1	2.86
C2	TRAPEZOIDAL	0.60	2.88	0.42	6.60	1	2.88

C3	TRAPEZOIDAL	0.50	1.25	0.30	4.00	1	1.11
C4	TRAPEZOIDAL	0.50	1.25	0.30	4.00	1	1.13
C5	CIRCULAR	0.90	0.64	0.23	0.90	1	0.97
C6	TRAPEZOIDAL	0.60	2.88	0.42	6.60	1	4.06

```
**********************************************************
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
**********************************************************

****************
Analysis Options
****************
Flow Units ............... CMS
Process Models:
  Rainfall/Runoff ........ YES
  RDII ................... NO
  Snowmelt ............... NO
  Groundwater ............ NO
  Flow Routing ........... YES
  Ponding Allowed ........ NO
  Water Quality .......... NO
Infiltration Method ...... GREEN_AMPT
Flow Routing Method ...... DYNWAVE
Starting Date ............ 01/05/2017 00:00:00
Ending Date .............. 01/07/2017 00:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:00:05
Wet Time Step ............ 00:00:05
Dry Time Step ............ 00:00:05
Routing Time Step ........ 5.00 sec
Variable Time Step ....... YES
Maximum Trials ........... 8
Number of Threads ........ 1
Head Tolerance ........... 0.001500 m

**************************        Volume         Depth
Runoff Quantity Continuity     hectare-m            mm
**************************     ---------       -------
Total Precipitation ......         0.387        43.106
Evaporation Loss .........         0.000         0.000
Infiltration Loss ........         0.141        15.693
```

Surface Runoff	0.239	26.596
Final Storage	0.007	0.818
Continuity Error (%)	-0.001	

Flow Routing Continuity	Volume hectare-m	Volume 10^6 ltr
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.239	2.388
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	0.229	2.293
Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.101	1.010
Final Stored Volume	0.110	1.105
Continuity Error (%)	0.000	

Time-Step Critical Elements

None

Highest Flow Instability Indexes

All links are stable.

Routing Time Step Summary

Minimum Time Step	:	4.50 sec
Average Time Step	:	5.00 sec
Maximum Time Step	:	5.00 sec
Percent in Steady State	:	0.00
Average Iterations per Step	:	2.00
Percent Not Converging	:	0.00

Subcatchment Runoff Summary
****

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff CMS	Runoff Coeff
201	43.11	0.00	0.00	7.58	34.21	1.24	1.45	0.794
202	43.11	0.00	0.00	11.26	30.85	0.23	0.25	0.716
203	43.11	0.00	0.00	11.20	30.91	0.16	0.19	0.717
EX1	43.11	0.00	0.00	27.94	15.03	0.46	0.14	0.349
UN1	43.11	0.00	0.00	11.20	30.91	0.10	0.11	0.717
UN2	43.11	0.00	0.00	22.34	20.63	0.03	0.01	0.479
UN3	43.11	0.00	0.00	11.20	30.91	0.16	0.18	0.717

****
Node Depth Summary
****

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min	Reported Max Depth Meters
J1	JUNCTION	0.00	0.10	188.10	0 01:39	0.10
J3	JUNCTION	0.00	0.06	186.31	0 01:56	0.06
J4	JUNCTION	0.01	0.29	187.73	0 01:35	0.29
J5	JUNCTION	0.01	0.25	187.47	0 01:37	0.25
J6	JUNCTION	0.06	0.24	185.84	0 02:15	0.24
J7	JUNCTION	0.02	0.09	185.54	0 02:06	0.09
OF1	OUTFALL	0.00	0.00	184.00	0 00:00	0.00
OF2	OUTFALL	0.01	0.07	185.51	0 02:06	0.07
SU1	STORAGE	1.24	1.61	186.21	0 02:15	1.61

****
Node Inflow Summary
****

Node	Type	Maximum Lateral Inflow CMS	Maximum Total Inflow CMS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 ltr	Total Inflow Volume 10^6 ltr	Flow Balance Error Percent

J1	JUNCTION	0.182	0.182	0	01:35	0.16	0.16	-0.589
J3	JUNCTION	0.000	0.063	0	01:43	0	0.161	0.475
J4	JUNCTION	0.332	0.332	0	01:35	0.627	0.627	-0.254
J5	JUNCTION	0.000	0.314	0	01:35	0	0.629	0.246
J6	JUNCTION	0.000	0.165	0	02:15	0	2	0.010
J7	JUNCTION	0.000	0.197	0	02:05	0	2.16	0.100
OF1	OUTFALL	0.015	0.015	0	01:35	0.0344	0.0344	0.000
OF2	OUTFALL	0.112	0.205	0	02:05	0.0983	2.26	0.000
SU1	STORAGE	1.696	1.831	0	01:35	1.47	3.11	0.001

****
Node Surcharge Summary
****

No nodes were surcharged.

****
Node Flooding Summary
****

No nodes were flooded.

****
Storage Volume Summary
****

Storage Unit	Average Volume 1000 m3	Avg Pcnt Full	Evap Pcnt Loss	Exfil Pcnt Loss	Maximum Volume 1000 m3	Max Pcnt Full	Time of Max Occurrence days hr:min	Maximum Outflow CMS
SU1	1.425	22	0	0	2.217	34	0 02:15	0.165

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow CMS	Max Flow CMS	Total Volume 10^6 ltr

OF1	8.35	0.002	0.015	0.034
OF2	98.88	0.013	0.205	2.259
System	53.61	0.016	0.211	2.293

****
Link Flow Summary
****

Link	Type	Maximum |Flow| CMS	Time of Max Occurrence days hr:min	Maximum |Veloc| m/sec	Max/ Full Flow	Max/ Full Depth
C1	CONDUIT	0.063	0 01:43	0.29	0.02	0.11
C2	CONDUIT	0.044	0 01:56	0.19	0.02	0.12
C3	CONDUIT	0.314	0 01:35	0.69	0.28	0.52
C4	CONDUIT	0.198	0 01:37	0.64	0.18	0.39
C5	CONDUIT	0.165	0 02:15	2.06	0.17	0.18
C6	CONDUIT	0.197	0 02:06	0.74	0.05	0.14
OR1	ORIFICE	0.007	0 02:13			1.00
OR2	WEIR	0.157	0 02:15			0.20

****
Flow Classification Summary
****

	Adjusted	Fraction of Time in Flow Class								
Conduit	/Actual Length	Dry	Up Dry	Down Dry	Sub Crit	Sup Crit	Up Crit	Down Crit	Norm Ltd	Inlet Ctrl
C1	1.00	0.01	0.04	0.00	0.95	0.00	0.00	0.00	0.96	0.00
C2	1.00	0.01	0.00	0.00	0.98	0.00	0.00	0.00	0.98	0.00
C3	1.00	0.14	0.42	0.00	0.44	0.00	0.00	0.00	0.78	0.00
C4	1.00	0.14	0.00	0.00	0.00	0.00	0.00	0.86	0.00	0.00
C5	1.00	0.01	0.00	0.00	0.01	0.98	0.00	0.00	0.00	0.00
C6	1.00	0.01	0.00	0.00	0.99	0.00	0.00	0.00	0.00	0.00

****
Conduit Surcharge Summary
****

No conduits were surcharged.

Analysis begun on: Thu Nov 28 14:58:03 2019
Analysis ended on: Thu Nov 28 14:58:04 2019
Total elapsed time: 00:00:01

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.011)

****
Element Count
****
Number of rain gages 14
Number of subcatchments ... 7
Number of nodes 9
Number of links 8
Number of pollutants 0
Number of land uses 0

****
Raingage Summary
****

Name	Data Source	Data Type	Recording Interval
100yr_24hr_SCS_TypeII	100yr_24hr_SCS_TypeII	INTENSITY	6 min.
100yr_4hr_Chicago	100yr_4hr_Chicago	INTENSITY	5 min.
10yr_24hr_SCS_TypeII	10yr_24hr_SCS_TypeII	INTENSITY	6 min.
10yr_4hr_Chicago	10yr_4hr_Chicago	INTENSITY	5 min.
25mm_4hr_Chicago	25mm_4hr_Chicago	INTENSITY	10 min.
25yr_24hr_SCS_TypeII	25yr_24hr_SCS_TypeII	INTENSITY	6 min.
25yr_4hr_Chicago	25yr_4hr_Chicago	INTENSITY	5 min.
2yr_24hr_SCS_TypeII	2yr_24hr_SCS_TypeII	INTENSITY	6 min.
2yr_4hr_Chicago	2yr_4hr_Chicago	INTENSITY	5 min.
50yr_24hr_SCS_TypeII	50yr_24hr_SCS_TypeII	INTENSITY	6 min.
50yr_4hr_Chicago	50yr_4hr_Chicago	INTENSITY	5 min.
5yr_24hr_SCS_TypeII	5yr_24hr_SCS_TypeII	INTENSITY	6 min.
5yr_4hr_Chicago	5yr_4hr_Chicago	INTENSITY	5 min.
Timmins_Storm_(0-25)	Timmins_Storm_(0-25)	INTENSITY	60 min.

****
Subcatchment Summary
****

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
201	3.61	2123.65	66.00	2.0000	10yr_4hr_Chicago	SU1
202	0.75	188.32	50.00	6.0000	10yr_4hr_Chicago	SU1
203	0.53	314.00	50.00	2.0000	10yr_4hr_Chicago	J4

EX1	3.08	205.16	7.00	5.0000	10yr_4hr_Chicago	J4
UN1	0.32	187.06	50.00	2.0000	10yr_4hr_Chicago	OF2
UN2	0.17	57.55	7.00	0.5000	10yr_4hr_Chicago	OF1
UN3	0.52	304.65	50.00	2.0000	10yr_4hr_Chicago	J1

****
Node Summary
****

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
J1	JUNCTION	188.00	0.60	0.0	
J3	JUNCTION	186.25	0.60	0.0	
J4	JUNCTION	187.44	0.50	0.0	
J5	JUNCTION	187.22	0.50	0.0	
J6	JUNCTION	185.60	2.00	0.0	
J7	JUNCTION	185.45	0.90	0.0	
OF1	OUTFALL	184.00	0.00	0.0	
OF2	OUTFALL	185.44	0.60	0.0	
SU1	STORAGE	184.60	2.95	0.0	

****
Link Summary
****

Name	From Node	To Node	Type	Length	%Slope	Roughness
C1	J1	J3	CONDUIT	352.3	0.4967	0.0400
C2	J3	J7	CONDUIT	159.6	0.5012	0.0400
C3	J4	J5	CONDUIT	89.9	0.2447	0.0250
C4	J5	SU1	CONDUIT	98.7	0.2534	0.0250
C5	J6	J7	CONDUIT	52.8	0.2843	0.0130
C6	J7	OF2	CONDUIT	1.0	1.0001	0.0400
OR1	SU1	J6	ORIFICE			
OR2	SU1	J6	WEIR			

****
Cross Section Summary
****

Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow
C1	TRAPEZOIDAL	0.60	2.88	0.42	6.60	1	2.86
C2	TRAPEZOIDAL	0.60	2.88	0.42	6.60	1	2.88

C3	TRAPEZOIDAL	0.50	1.25	0.30	4.00	1	1.11
C4	TRAPEZOIDAL	0.50	1.25	0.30	4.00	1	1.13
C5	CIRCULAR	0.90	0.64	0.23	0.90	1	0.97
C6	TRAPEZOIDAL	0.60	2.88	0.42	6.60	1	4.06

```
**********************************************************
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
**********************************************************

****************
Analysis Options
****************
Flow Units ............... CMS
Process Models:
  Rainfall/Runoff ........ YES
  RDII ................... NO
  Snowmelt ............... NO
  Groundwater ............ NO
  Flow Routing ........... YES
  Ponding Allowed ........ NO
  Water Quality .......... NO
Infiltration Method ...... GREEN_AMPT
Flow Routing Method ...... DYNWAVE
Starting Date ............ 01/05/2017 00:00:00
Ending Date .............. 01/07/2017 00:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:00:05
Wet Time Step ............ 00:00:05
Dry Time Step ............ 00:00:05
Routing Time Step ........ 5.00 sec
Variable Time Step ....... YES
Maximum Trials ........... 8
Number of Threads ........ 1
Head Tolerance ........... 0.001500 m

**************************        Volume         Depth
Runoff Quantity Continuity     hectare-m            mm
**************************     ---------       -------
Total Precipitation ......         0.450        50.088
Evaporation Loss .........         0.000         0.000
Infiltration Loss ........         0.144        16.057
```

Surface Runoff	0.298	33.214
Final Storage	0.007	0.818
Continuity Error (%)	-0.001	

Flow Routing Continuity	Volume hectare-m	Volume 10^6 ltr
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.298	2.982
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	0.289	2.887
Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.101	1.010
Final Stored Volume	0.111	1.106
Continuity Error (%)	-0.001	

Time-Step Critical Elements

Link C6 (18.28%)

Highest Flow Instability Indexes

All links are stable.

Routing Time Step Summary

Minimum Time Step	:	0.50 sec
Average Time Step	:	4.18 sec
Maximum Time Step	:	5.00 sec
Percent in Steady State	:	0.00
Average Iterations per Step	:	2.00
Percent Not Converging	:	0.00

Subcatchment Runoff Summary
****

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff CMS	Runoff Coeff
201	50.09	0.00	0.00	7.72	41.05	1.48	1.74	0.820
202	50.09	0.00	0.00	11.50	37.59	0.28	0.31	0.750
203	50.09	0.00	0.00	11.43	37.66	0.20	0.23	0.752
EX1	50.09	0.00	0.00	28.64	21.31	0.66	0.20	0.425
UN1	50.09	0.00	0.00	11.43	37.66	0.12	0.14	0.752
UN2	50.09	0.00	0.00	22.91	27.03	0.05	0.02	0.540
UN3	50.09	0.00	0.00	11.43	37.66	0.20	0.22	0.752

****
Node Depth Summary
****

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min	Reported Max Depth Meters
J1	JUNCTION	0.01	0.12	188.12	0 01:38	0.12
J3	JUNCTION	0.01	0.07	186.32	0 01:54	0.07
J4	JUNCTION	0.03	0.33	187.77	0 01:35	0.33
J5	JUNCTION	0.04	0.29	187.51	0 01:36	0.29
J6	JUNCTION	0.10	0.29	185.89	0 02:06	0.29
J7	JUNCTION	0.03	0.11	185.56	0 02:00	0.11
OF1	OUTFALL	0.00	0.00	184.00	0 00:00	0.00
OF2	OUTFALL	0.02	0.10	185.54	0 02:00	0.10
SU1	STORAGE	1.31	1.68	186.28	0 02:05	1.68

****
Node Inflow Summary
****

Node	Type	Maximum Lateral Inflow CMS	Maximum Total Inflow CMS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 ltr	Total Inflow Volume 10^6 ltr	Flow Balance Error Percent

J1	JUNCTION	0.224	0.224	0	01:35	0.195	0.195	-0.659
J3	JUNCTION	0.000	0.082	0	01:42	0	0.196	0.538
J4	JUNCTION	0.435	0.435	0	01:35	0.857	0.857	-0.239
J5	JUNCTION	0.000	0.412	0	01:35	0	0.859	0.221
J6	JUNCTION	0.000	0.250	0	02:05	0	2.53	0.007
J7	JUNCTION	0.000	0.298	0	01:59	0	2.72	0.083
OF1	OUTFALL	0.020	0.020	0	01:35	0.0451	0.0451	0.000
OF2	OUTFALL	0.137	0.309	0	02:00	0.12	2.84	0.000
SU1	STORAGE	2.042	2.231	0	01:35	1.77	3.63	0.003

****
Node Surcharge Summary
****

No nodes were surcharged.

****
Node Flooding Summary
****

No nodes were flooded.

****
Storage Volume Summary
****

Storage Unit	Average Volume 1000 m3	Avg Pcnt Full	Evap Pcnt Loss	Exfil Pcnt Loss	Maximum Volume 1000 m3	Max Pcnt Full	Time of Max Occurrence days hr:min	Maximum Outflow CMS
SU1	1.583	24	0	0	2.383	36	0 02:05	0.250

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow CMS	Max Flow CMS	Total Volume 10^6 ltr

OF1	23.75	0.005	0.020	0.045
OF2	99.18	0.058	0.309	2.842
System	61.46	0.063	0.317	2.887

****
Link Flow Summary
****

Link	Type	Maximum |Flow| CMS	Time of Max Occurrence days hr:min	Maximum |Veloc| m/sec	Max/ Full Flow	Max/ Full Depth
C1	CONDUIT	0.082	0 01:42	0.32	0.03	0.13
C2	CONDUIT	0.058	0 01:54	0.20	0.02	0.15
C3	CONDUIT	0.412	0 01:35	0.75	0.37	0.59
C4	CONDUIT	0.272	0 01:37	0.71	0.24	0.45
C5	CONDUIT	0.250	0 02:06	2.35	0.26	0.22
C6	CONDUIT	0.298	0 02:00	0.86	0.07	0.17
OR1	ORIFICE	0.008	0 02:05			1.00
OR2	WEIR	0.242	0 02:05			0.27

****
Flow Classification Summary
****

	Adjusted	Fraction of Time in Flow Class								
Conduit	/Actual Length	Dry	Up Dry	Down Dry	Sub Crit	Sup Crit	Up Crit	Down Crit	Norm Ltd	Inlet Ctrl
C1	1.00	0.01	0.03	0.00	0.96	0.00	0.00	0.00	0.96	0.00
C2	1.00	0.01	0.00	0.00	0.99	0.00	0.00	0.00	0.99	0.00
C3	1.00	0.11	0.35	0.00	0.54	0.00	0.00	0.00	0.78	0.00
C4	1.00	0.12	0.00	0.00	0.00	0.00	0.00	0.88	0.00	0.00
C5	1.00	0.01	0.00	0.00	0.00	0.99	0.00	0.00	0.00	0.00
C6	1.00	0.01	0.00	0.00	0.99	0.00	0.00	0.00	0.00	0.00

****
Conduit Surcharge Summary
****

No conduits were surcharged.

Analysis begun on: Thu Nov 28 15:05:22 2019
Analysis ended on: Thu Nov 28 15:05:22 2019
Total elapsed time: < 1 sec

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.011)

****
Element Count
****
Number of rain gages 14
Number of subcatchments ... 7
Number of nodes 9
Number of links 8
Number of pollutants 0
Number of land uses 0

****
Raingage Summary
****

Name	Data Source	Data Type	Recording Interval
100yr_24hr_SCS_TypeII	100yr_24hr_SCS_TypeII	INTENSITY	6 min.
100yr_4hr_Chicago	100yr_4hr_Chicago	INTENSITY	5 min.
10yr_24hr_SCS_TypeII	10yr_24hr_SCS_TypeII	INTENSITY	6 min.
10yr_4hr_Chicago	10yr_4hr_Chicago	INTENSITY	5 min.
25mm_4hr_Chicago	25mm_4hr_Chicago	INTENSITY	10 min.
25yr_24hr_SCS_TypeII	25yr_24hr_SCS_TypeII	INTENSITY	6 min.
25yr_4hr_Chicago	25yr_4hr_Chicago	INTENSITY	5 min.
2yr_24hr_SCS_TypeII	2yr_24hr_SCS_TypeII	INTENSITY	6 min.
2yr_4hr_Chicago	2yr_4hr_Chicago	INTENSITY	5 min.
50yr_24hr_SCS_TypeII	50yr_24hr_SCS_TypeII	INTENSITY	6 min.
50yr_4hr_Chicago	50yr_4hr_Chicago	INTENSITY	5 min.
5yr_24hr_SCS_TypeII	5yr_24hr_SCS_TypeII	INTENSITY	6 min.
5yr_4hr_Chicago	5yr_4hr_Chicago	INTENSITY	5 min.
Timmins_Storm_(0-25)	Timmins_Storm_(0-25)	INTENSITY	60 min.

****
Subcatchment Summary
****

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
201	3.61	2123.65	66.00	2.0000	25yr_4hr_Chicago	SU1
202	0.75	188.32	50.00	6.0000	25yr_4hr_Chicago	SU1
203	0.53	314.00	50.00	2.0000	25yr_4hr_Chicago	J4

EX1	3.08	205.16	7.00	5.0000	25yr_4hr_Chicago	J4
UN1	0.32	187.06	50.00	2.0000	25yr_4hr_Chicago	OF2
UN2	0.17	57.55	7.00	0.5000	25yr_4hr_Chicago	OF1
UN3	0.52	304.65	50.00	2.0000	25yr_4hr_Chicago	J1

****
Node Summary
****

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
J1	JUNCTION	188.00	0.60	0.0	
J3	JUNCTION	186.25	0.60	0.0	
J4	JUNCTION	187.44	0.50	0.0	
J5	JUNCTION	187.22	0.50	0.0	
J6	JUNCTION	185.60	2.00	0.0	
J7	JUNCTION	185.45	0.90	0.0	
OF1	OUTFALL	184.00	0.00	0.0	
OF2	OUTFALL	185.44	0.60	0.0	
SU1	STORAGE	184.60	2.95	0.0	

****
Link Summary
****

Name	From Node	To Node	Type	Length	%Slope	Roughness
C1	J1	J3	CONDUIT	352.3	0.4967	0.0400
C2	J3	J7	CONDUIT	159.6	0.5012	0.0400
C3	J4	J5	CONDUIT	89.9	0.2447	0.0250
C4	J5	SU1	CONDUIT	98.7	0.2534	0.0250
C5	J6	J7	CONDUIT	52.8	0.2843	0.0130
C6	J7	OF2	CONDUIT	1.0	1.0001	0.0400
OR1	SU1	J6	ORIFICE			
OR2	SU1	J6	WEIR			

****
Cross Section Summary
****

Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow
C1	TRAPEZOIDAL	0.60	2.88	0.42	6.60	1	2.86
C2	TRAPEZOIDAL	0.60	2.88	0.42	6.60	1	2.88

C3	TRAPEZOIDAL	0.50	1.25	0.30	4.00	1	1.11
C4	TRAPEZOIDAL	0.50	1.25	0.30	4.00	1	1.13
C5	CIRCULAR	0.90	0.64	0.23	0.90	1	0.97
C6	TRAPEZOIDAL	0.60	2.88	0.42	6.60	1	4.06

****
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
****

****
Analysis Options
****
Flow Units ..... CMS
Process Models:
  Rainfall/Runoff ..... YES
  RDII ..... NO
  Snowmelt ..... NO
  Groundwater ..... NO
  Flow Routing ..... YES
  Ponding Allowed ..... NO
  Water Quality ..... NO
Infiltration Method ..... GREEN_AMPT
Flow Routing Method ..... DYNWAVE
Starting Date 01/05/2017 00:00:00
Ending Date 01/07/2017 00:00:00
Antecedent Dry Days 0.0
Report Time Step 00:00:05
Wet Time Step 00:00:05
Dry Time Step 00:00:05
Routing Time Step ..... 5.00 sec
Variable Time Step ..... YES
Maximum Trials 8
Number of Threads 1
Head Tolerance ..... 0.001500 m

**********	Volume	Depth
Runoff Quantity Continuity	hectare-m	mm
**********	---------	-------
Total Precipitation	0.530	59.043
Evaporation Loss	0.000	0.000
Infiltration Loss	0.147	16.411

Surface Runoff	0.375	41.815
Final Storage	0.007	0.818
Continuity Error (%)	-0.002	

Flow Routing Continuity	Volume hectare-m	Volume 10^6 ltr
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.375	3.755
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	0.366	3.659
Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.101	1.010
Final Stored Volume	0.111	1.107
Continuity Error (%)	-0.003	

Time-Step Critical Elements

Link C6 (24.81%)

Highest Flow Instability Indexes

Link C5 (1)

Routing Time Step Summary

Minimum Time Step	:	0.50 sec
Average Time Step	:	3.88 sec
Maximum Time Step	:	5.00 sec
Percent in Steady State	:	0.00
Average Iterations per Step	:	2.00
Percent Not Converging	:	0.00

Subcatchment Runoff Summary
****

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff CMS	Runoff Coeff
201	59.04	0.00	0.00	7.86	49.86	1.80	2.09	0.844
202	59.04	0.00	0.00	11.73	46.31	0.35	0.38	0.784
203	59.04	0.00	0.00	11.65	46.39	0.25	0.29	0.786
EX1	59.04	0.00	0.00	29.32	29.59	0.91	0.30	0.501
UN1	59.04	0.00	0.00	11.65	46.39	0.15	0.17	0.786
UN2	59.04	0.00	0.00	23.49	35.41	0.06	0.03	0.600
UN3	59.04	0.00	0.00	11.65	46.39	0.24	0.28	0.786

****
Node Depth Summary
****

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min	Reported Max Depth Meters
J1	JUNCTION	0.01	0.14	188.14	0 01:37	0.14
J3	JUNCTION	0.01	0.08	186.33	0 01:51	0.08
J4	JUNCTION	0.05	0.38	187.82	0 01:35	0.38
J5	JUNCTION	0.06	0.33	187.55	0 01:36	0.33
J6	JUNCTION	0.12	0.37	185.97	0 01:57	0.37
J7	JUNCTION	0.04	0.14	185.59	0 01:55	0.14
OF1	OUTFALL	0.00	0.00	184.00	0 00:00	0.00
OF2	OUTFALL	0.03	0.13	185.57	0 01:55	0.13
SU1	STORAGE	1.35	1.77	186.37	0 01:59	1.77

****
Node Inflow Summary
****

Node	Type	Maximum Lateral Inflow CMS	Maximum Total Inflow CMS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 ltr	Total Inflow Volume 10^6 ltr	Flow Balance Error Percent

J1	JUNCTION	0.277	0.277	0	01:35	0.24	0.24	-0.722
J3	JUNCTION	0.000	0.110	0	01:41	0	0.242	0.593
J4	JUNCTION	0.584	0.584	0	01:35	1.16	1.16	-0.229
J5	JUNCTION	0.000	0.554	0	01:35	0	1.16	0.205
J6	JUNCTION	0.000	0.374	0	01:59	0	3.21	0.018
J7	JUNCTION	0.000	0.466	0	01:57	0	3.45	0.056
OF1	OUTFALL	0.028	0.028	0	01:35	0.0592	0.0591	0.000
OF2	OUTFALL	0.170	0.460	0	01:55	0.148	3.6	0.000
SU1	STORAGE	2.476	2.755	0	01:35	2.15	4.32	0.004

****
Node Surcharge Summary
****

No nodes were surcharged.

****
Node Flooding Summary
****

No nodes were flooded.

****
Storage Volume Summary
****

Storage Unit	Average Volume 1000 m3	Avg Pcnt Full	Evap Pcnt Loss	Exfil Pcnt Loss	Maximum Volume 1000 m3	Max Pcnt Full	Time of Max Occurrence days hr:min	Maximum Outflow CMS
SU1	1.673	26	0	0	2.602	40	0 01:59	0.374

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow CMS	Max Flow CMS	Total Volume 10^6 ltr

OF1	29.41	0.006	0.028	0.059
OF2	99.34	0.093	0.460	3.599
System	64.37	0.099	0.472	3.658

****
Link Flow Summary
****

Link	Type	Maximum |Flow| CMS	Time of Max Occurrence days hr:min	Maximum |Veloc| m/sec	Max/ Full Flow	Max/ Full Depth
C1	CONDUIT	0.110	0 01:41	0.35	0.04	0.16
C2	CONDUIT	0.077	0 01:51	0.21	0.03	0.18
C3	CONDUIT	0.554	0 01:35	0.81	0.50	0.68
C4	CONDUIT	0.385	0 01:37	0.80	0.34	0.53
C5	CONDUIT	0.397	0 01:57	2.71	0.41	0.28
C6	CONDUIT	0.445	0 01:55	0.98	0.11	0.22
OR1	ORIFICE	0.008	0 01:56			1.00
OR2	WEIR	0.366	0 01:59			0.36

****
Flow Classification Summary
****

Conduit	Adjusted /Actual Length	Fraction of Time in Flow Class: Dry	Up Dry	Down Dry	Sub Crit	Sup Crit	Up Crit	Down Crit	Norm Ltd	Inlet Ctrl
C1	1.00	0.01	0.03	0.00	0.97	0.00	0.00	0.00	0.96	0.00
C2	1.00	0.01	0.00	0.00	0.99	0.00	0.00	0.00	0.99	0.00
C3	1.00	0.11	0.32	0.00	0.57	0.00	0.00	0.00	0.78	0.00
C4	1.00	0.11	0.00	0.00	0.00	0.00	0.00	0.89	0.00	0.00
C5	1.00	0.01	0.00	0.00	0.00	0.99	0.00	0.00	0.00	0.00
C6	1.00	0.01	0.00	0.00	0.99	0.00	0.00	0.00	0.00	0.00

****
Conduit Surcharge Summary
****

No conduits were surcharged.

Analysis begun on: Thu Nov 28 15:08:31 2019
Analysis ended on: Thu Nov 28 15:08:32 2019
Total elapsed time: 00:00:01

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.011)

****
Element Count
****
Number of rain gages 14
Number of subcatchments ... 7
Number of nodes 9
Number of links 8
Number of pollutants 0
Number of land uses 0

****
Raingage Summary
****

Name	Data Source	Data Type	Recording Interval
100yr_24hr_SCS_TypeII	100yr_24hr_SCS_TypeII	INTENSITY	6 min.
100yr_4hr_Chicago	100yr_4hr_Chicago	INTENSITY	5 min.
10yr_24hr_SCS_TypeII	10yr_24hr_SCS_TypeII	INTENSITY	6 min.
10yr_4hr_Chicago	10yr_4hr_Chicago	INTENSITY	5 min.
25mm_4hr_Chicago	25mm_4hr_Chicago	INTENSITY	10 min.
25yr_24hr_SCS_TypeII	25yr_24hr_SCS_TypeII	INTENSITY	6 min.
25yr_4hr_Chicago	25yr_4hr_Chicago	INTENSITY	5 min.
2yr_24hr_SCS_TypeII	2yr_24hr_SCS_TypeII	INTENSITY	6 min.
2yr_4hr_Chicago	2yr_4hr_Chicago	INTENSITY	5 min.
50yr_24hr_SCS_TypeII	50yr_24hr_SCS_TypeII	INTENSITY	6 min.
50yr_4hr_Chicago	50yr_4hr_Chicago	INTENSITY	5 min.
5yr_24hr_SCS_TypeII	5yr_24hr_SCS_TypeII	INTENSITY	6 min.
5yr_4hr_Chicago	5yr_4hr_Chicago	INTENSITY	5 min.
Timmins_Storm_(0-25)	Timmins_Storm_(0-25)	INTENSITY	60 min.

****
Subcatchment Summary
****

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
201	3.61	2123.65	66.00	2.0000	50yr_4hr_Chicago	SU1
202	0.75	188.32	50.00	6.0000	50yr_4hr_Chicago	SU1
203	0.53	314.00	50.00	2.0000	50yr_4hr_Chicago	J4

EX1	3.08	205.16	7.00	5.0000	50yr_4hr_Chicago	J4
UN1	0.32	187.06	50.00	2.0000	50yr_4hr_Chicago	OF2
UN2	0.17	57.55	7.00	0.5000	50yr_4hr_Chicago	OF1
UN3	0.52	304.65	50.00	2.0000	50yr_4hr_Chicago	J1

****
Node Summary
****

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
J1	JUNCTION	188.00	0.60	0.0	
J3	JUNCTION	186.25	0.60	0.0	
J4	JUNCTION	187.44	0.50	0.0	
J5	JUNCTION	187.22	0.50	0.0	
J6	JUNCTION	185.60	2.00	0.0	
J7	JUNCTION	185.45	0.90	0.0	
OF1	OUTFALL	184.00	0.00	0.0	
OF2	OUTFALL	185.44	0.60	0.0	
SU1	STORAGE	184.60	2.95	0.0	

****
Link Summary
****

Name	From Node	To Node	Type	Length	%Slope	Roughness
C1	J1	J3	CONDUIT	352.3	0.4967	0.0400
C2	J3	J7	CONDUIT	159.6	0.5012	0.0400
C3	J4	J5	CONDUIT	89.9	0.2447	0.0250
C4	J5	SU1	CONDUIT	98.7	0.2534	0.0250
C5	J6	J7	CONDUIT	52.8	0.2843	0.0130
C6	J7	OF2	CONDUIT	1.0	1.0001	0.0400
OR1	SU1	J6	ORIFICE			
OR2	SU1	J6	WEIR			

****
Cross Section Summary
****

Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow
C1	TRAPEZOIDAL	0.60	2.88	0.42	6.60	1	2.86
C2	TRAPEZOIDAL	0.60	2.88	0.42	6.60	1	2.88

C3	TRAPEZOIDAL	0.50	1.25	0.30	4.00	1	1.11
C4	TRAPEZOIDAL	0.50	1.25	0.30	4.00	1	1.13
C5	CIRCULAR	0.90	0.64	0.23	0.90	1	0.97
C6	TRAPEZOIDAL	0.60	2.88	0.42	6.60	1	4.06

```
**********************************************************
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
**********************************************************

****************
Analysis Options
****************
Flow Units ............... CMS
Process Models:
  Rainfall/Runoff ........ YES
  RDII ................... NO
  Snowmelt ............... NO
  Groundwater ............ NO
  Flow Routing ........... YES
  Ponding Allowed ........ NO
  Water Quality .......... NO
Infiltration Method ...... GREEN_AMPT
Flow Routing Method ...... DYNWAVE
Starting Date ............ 01/05/2017 00:00:00
Ending Date .............. 01/07/2017 00:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:00:05
Wet Time Step ............ 00:00:05
Dry Time Step ............ 00:00:05
Routing Time Step ........ 5.00 sec
Variable Time Step ....... YES
Maximum Trials ........... 8
Number of Threads ........ 1
Head Tolerance ........... 0.001500 m

**************************        Volume         Depth
Runoff Quantity Continuity     hectare-m            mm
**************************     ---------       -------
Total Precipitation ......         0.589        65.570
Evaporation Loss .........         0.000         0.000
Infiltration Loss ........         0.149        16.618
```

Surface Runoff	0.432	48.135
Final Storage	0.007	0.818
Continuity Error (%)	-0.002	

Flow Routing Continuity	Volume hectare-m	Volume 10^6 ltr
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.432	4.321
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	0.422	4.225
Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.101	1.010
Final Stored Volume	0.111	1.107
Continuity Error (%)	-0.003	

Time-Step Critical Elements

Link C6 (27.71%)

Highest Flow Instability Indexes

Link C5 (2)

Routing Time Step Summary

Minimum Time Step	:	0.50 sec
Average Time Step	:	3.75 sec
Maximum Time Step	:	5.00 sec
Percent in Steady State	:	0.00
Average Iterations per Step	:	2.00
Percent Not Converging	:	0.00

Subcatchment Runoff Summary
****

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff CMS	Runoff Coeff
201	65.57	0.00	0.00	7.95	56.30	2.03	2.35	0.859
202	65.57	0.00	0.00	11.87	52.70	0.40	0.43	0.804
203	65.57	0.00	0.00	11.78	52.79	0.28	0.32	0.805
EX1	65.57	0.00	0.00	29.71	35.72	1.10	0.38	0.545
UN1	65.57	0.00	0.00	11.78	52.79	0.17	0.19	0.805
UN2	65.57	0.00	0.00	23.84	41.59	0.07	0.03	0.634
UN3	65.57	0.00	0.00	11.78	52.79	0.27	0.31	0.805

****
Node Depth Summary
****

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min	Reported Max Depth Meters
J1	JUNCTION	0.01	0.16	188.16	0 01:37	0.16
J3	JUNCTION	0.01	0.09	186.34	0 01:50	0.09
J4	JUNCTION	0.05	0.41	187.85	0 01:35	0.41
J5	JUNCTION	0.07	0.37	187.59	0 01:36	0.37
J6	JUNCTION	0.14	0.42	186.02	0 01:55	0.42
J7	JUNCTION	0.05	0.16	185.61	0 01:53	0.16
OF1	OUTFALL	0.00	0.00	184.00	0 00:00	0.00
OF2	OUTFALL	0.04	0.15	185.59	0 01:53	0.15
SU1	STORAGE	1.37	1.83	186.43	0 01:56	1.83

****
Node Inflow Summary
****

Node	Type	Maximum Lateral Inflow CMS	Maximum Total Inflow CMS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 ltr	Total Inflow Volume 10^6 ltr	Flow Balance Error Percent

J1	JUNCTION	0.314	0.314	0	01:35	0.274	0.273	-0.754
J3	JUNCTION	0.000	0.131	0	01:40	0	0.275	0.632
J4	JUNCTION	0.701	0.701	0	01:35	1.38	1.38	-0.224
J5	JUNCTION	0.000	0.665	0	01:35	0	1.38	0.196
J6	JUNCTION	0.000	0.474	0	01:56	0	3.72	0.025
J7	JUNCTION	0.000	0.593	0	01:53	0	3.99	0.042
OF1	OUTFALL	0.035	0.035	0	01:35	0.0695	0.0694	0.000
OF2	OUTFALL	0.193	0.579	0	01:53	0.168	4.16	0.000
SU1	STORAGE	2.785	3.142	0	01:35	2.43	4.82	0.004

****
Node Surcharge Summary
****

No nodes were surcharged.

****
Node Flooding Summary
****

No nodes were flooded.

****
Storage Volume Summary
****

Storage Unit	Average Volume 1000 m3	Avg Pcnt Full	Evap Pcnt Loss	Exfil Pcnt Loss	Maximum Volume 1000 m3	Max Pcnt Full	Time of Max Occurrence days hr:min	Maximum Outflow CMS
SU1	1.725	26	0	0	2.766	42	0 01:56	0.474

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow CMS	Max Flow CMS	Total Volume 10^6 ltr

OF1	31.95	0.007	0.035	0.069
OF2	99.42	0.116	0.579	4.155
System	65.69	0.123	0.594	4.225

****
Link Flow Summary
****

Link	Type	Maximum |Flow| CMS	Time of Max Occurrence days hr:min	Maximum |Veloc| m/sec	Max/ Full Flow	Max/ Full Depth
C1	CONDUIT	0.131	0 01:40	0.37	0.05	0.18
C2	CONDUIT	0.092	0 01:50	0.22	0.03	0.21
C3	CONDUIT	0.665	0 01:35	0.85	0.60	0.74
C4	CONDUIT	0.479	0 01:36	0.86	0.42	0.59
C5	CONDUIT	0.509	0 01:56	2.90	0.53	0.32
C6	CONDUIT	0.561	0 01:53	1.06	0.14	0.26
OR1	ORIFICE	0.008	0 01:57			1.00
OR2	WEIR	0.466	0 01:56			0.42

****
Flow Classification Summary
****

	Adjusted	Fraction of Time in Flow Class								
Conduit	/Actual Length	Dry	Up Dry	Down Dry	Sub Crit	Sup Crit	Up Crit	Down Crit	Norm Ltd	Inlet Ctrl
C1	1.00	0.01	0.02	0.00	0.97	0.00	0.00	0.00	0.96	0.00
C2	1.00	0.01	0.00	0.00	0.99	0.00	0.00	0.00	0.99	0.00
C3	1.00	0.10	0.31	0.00	0.58	0.00	0.00	0.00	0.79	0.00
C4	1.00	0.10	0.00	0.00	0.00	0.00	0.00	0.90	0.00	0.00
C5	1.00	0.01	0.00	0.00	0.00	0.99	0.00	0.00	0.00	0.00
C6	1.00	0.01	0.00	0.00	0.99	0.00	0.00	0.00	0.00	0.00

****
Conduit Surcharge Summary
****

No conduits were surcharged.

Analysis begun on: Thu Nov 28 15:10:26 2019
Analysis ended on: Thu Nov 28 15:10:27 2019
Total elapsed time: 00:00:01

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.011)

****
Element Count
****
Number of rain gages 14
Number of subcatchments ... 7
Number of nodes 9
Number of links 8
Number of pollutants 0
Number of land uses 0

****
Raingage Summary
****

Name	Data Source	Data Type	Recording Interval
100yr_24hr_SCS_TypeII	100yr_24hr_SCS_TypeII	INTENSITY	6 min.
100yr_4hr_Chicago	100yr_4hr_Chicago	INTENSITY	5 min.
10yr_24hr_SCS_TypeII	10yr_24hr_SCS_TypeII	INTENSITY	6 min.
10yr_4hr_Chicago	10yr_4hr_Chicago	INTENSITY	5 min.
25mm_4hr_Chicago	25mm_4hr_Chicago	INTENSITY	10 min.
25yr_24hr_SCS_TypeII	25yr_24hr_SCS_TypeII	INTENSITY	6 min.
25yr_4hr_Chicago	25yr_4hr_Chicago	INTENSITY	5 min.
2yr_24hr_SCS_TypeII	2yr_24hr_SCS_TypeII	INTENSITY	6 min.
2yr_4hr_Chicago	2yr_4hr_Chicago	INTENSITY	5 min.
50yr_24hr_SCS_TypeII	50yr_24hr_SCS_TypeII	INTENSITY	6 min.
50yr_4hr_Chicago	50yr_4hr_Chicago	INTENSITY	5 min.
5yr_24hr_SCS_TypeII	5yr_24hr_SCS_TypeII	INTENSITY	6 min.
5yr_4hr_Chicago	5yr_4hr_Chicago	INTENSITY	5 min.
Timmins_Storm_(0-25)	Timmins_Storm_(0-25)	INTENSITY	60 min.

****
Subcatchment Summary
****

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
201	3.61	2123.65	66.00	2.0000	100yr_4hr_Chicago	SU1
202	0.75	188.32	50.00	6.0000	100yr_4hr_Chicago	SU1
203	0.53	314.00	50.00	2.0000	100yr_4hr_Chicago	J4

EX1	3.08	205.16	7.00	5.0000	100yr_4hr_Chicago	J4
UN1	0.32	187.06	50.00	2.0000	100yr_4hr_Chicago	OF2
UN2	0.17	57.55	7.00	0.5000	100yr_4hr_Chicago	OF1
UN3	0.52	304.65	50.00	2.0000	100yr_4hr_Chicago	J1

****
Node Summary
****

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
J1	JUNCTION	188.00	0.60	0.0	
J3	JUNCTION	186.25	0.60	0.0	
J4	JUNCTION	187.44	0.50	0.0	
J5	JUNCTION	187.22	0.50	0.0	
J6	JUNCTION	185.60	2.00	0.0	
J7	JUNCTION	185.45	0.90	0.0	
OF1	OUTFALL	184.00	0.00	0.0	
OF2	OUTFALL	185.44	0.60	0.0	
SU1	STORAGE	184.60	2.95	0.0	

****
Link Summary
****

Name	From Node	To Node	Type	Length	%Slope	Roughness
C1	J1	J3	CONDUIT	352.3	0.4967	0.0400
C2	J3	J7	CONDUIT	159.6	0.5012	0.0400
C3	J4	J5	CONDUIT	89.9	0.2447	0.0250
C4	J5	SU1	CONDUIT	98.7	0.2534	0.0250
C5	J6	J7	CONDUIT	52.8	0.2843	0.0130
C6	J7	OF2	CONDUIT	1.0	1.0001	0.0400
OR1	SU1	J6	ORIFICE			
OR2	SU1	J6	WEIR			

****
Cross Section Summary
****

Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow
C1	TRAPEZOIDAL	0.60	2.88	0.42	6.60	1	2.86
C2	TRAPEZOIDAL	0.60	2.88	0.42	6.60	1	2.88

C3	TRAPEZOIDAL	0.50	1.25	0.30	4.00	1	1.11
C4	TRAPEZOIDAL	0.50	1.25	0.30	4.00	1	1.13
C5	CIRCULAR	0.90	0.64	0.23	0.90	1	0.97
C6	TRAPEZOIDAL	0.60	2.88	0.42	6.60	1	4.06

```
**********************************************************
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
**********************************************************

****************
Analysis Options
****************
Flow Units ............... CMS
Process Models:
  Rainfall/Runoff ........ YES
  RDII ................... NO
  Snowmelt ............... NO
  Groundwater ............ NO
  Flow Routing ........... YES
  Ponding Allowed ........ NO
  Water Quality .......... NO
Infiltration Method ...... GREEN_AMPT
Flow Routing Method ...... DYNWAVE
Starting Date ............ 01/05/2017 00:00:00
Ending Date .............. 01/07/2017 00:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:00:05
Wet Time Step ............ 00:00:05
Dry Time Step ............ 00:00:05
Routing Time Step ........ 5.00 sec
Variable Time Step ....... YES
Maximum Trials ........... 8
Number of Threads ........ 1
Head Tolerance ........... 0.001500 m

**************************        Volume         Depth
Runoff Quantity Continuity     hectare-m            mm
**************************     ---------       -------
Total Precipitation ......         0.647        72.096
Evaporation Loss .........         0.000         0.000
Infiltration Loss ........         0.151        16.793
```

Surface Runoff	0.489	54.487
Final Storage	0.007	0.818
Continuity Error (%)	-0.002	

Flow Routing Continuity	Volume hectare-m	Volume 10^6 ltr
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.489	4.892
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	0.480	4.795
Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.101	1.010
Final Stored Volume	0.111	1.108
Continuity Error (%)	-0.003	

Time-Step Critical Elements

Link C6 (29.98%)

Highest Flow Instability Indexes

Link C5 (2)

Routing Time Step Summary

Minimum Time Step	:	0.50 sec
Average Time Step	:	3.65 sec
Maximum Time Step	:	5.00 sec
Percent in Steady State	:	0.00
Average Iterations per Step	:	2.00
Percent Not Converging	:	0.00

Subcatchment Runoff Summary
****

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff CMS	Runoff Coeff
201	72.10	0.00	0.00	8.02	62.76	2.27	2.60	0.870
202	72.10	0.00	0.00	11.99	59.11	0.45	0.49	0.820
203	72.10	0.00	0.00	11.89	59.21	0.32	0.36	0.821
EX1	72.10	0.00	0.00	30.04	41.91	1.29	0.46	0.581
UN1	72.10	0.00	0.00	11.89	59.21	0.19	0.22	0.821
UN2	72.10	0.00	0.00	24.13	47.83	0.08	0.04	0.663
UN3	72.10	0.00	0.00	11.89	59.21	0.31	0.35	0.821

****
Node Depth Summary
****

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min	Reported Max Depth Meters
J1	JUNCTION	0.01	0.17	188.17	0 01:36	0.17
J3	JUNCTION	0.01	0.09	186.34	0 01:49	0.09
J4	JUNCTION	0.06	0.44	187.88	0 01:35	0.44
J5	JUNCTION	0.07	0.40	187.62	0 01:36	0.40
J6	JUNCTION	0.15	0.47	186.07	0 01:54	0.47
J7	JUNCTION	0.05	0.18	185.63	0 01:52	0.18
OF1	OUTFALL	0.00	0.00	184.00	0 00:00	0.00
OF2	OUTFALL	0.04	0.16	185.60	0 01:52	0.16
SU1	STORAGE	1.39	1.89	186.49	0 01:54	1.89

****
Node Inflow Summary
****

Node	Type	Maximum Lateral Inflow CMS	Maximum Total Inflow CMS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 ltr	Total Inflow Volume 10^6 ltr	Flow Balance Error Percent

J1	JUNCTION	0.351	0.351	0	01:35	0.307	0.307	-0.780
J3	JUNCTION	0.000	0.152	0	01:40	0	0.309	0.660
J4	JUNCTION	0.825	0.825	0	01:35	1.61	1.61	-0.220
J5	JUNCTION	0.000	0.783	0	01:35	0	1.61	0.190
J6	JUNCTION	0.000	0.576	0	01:55	0	4.22	0.029
J7	JUNCTION	0.000	0.722	0	01:51	0	4.53	0.032
OF1	OUTFALL	0.042	0.042	0	01:35	0.0799	0.0798	0.000
OF2	OUTFALL	0.216	0.698	0	01:51	0.189	4.72	0.000
SU1	STORAGE	3.090	3.533	0	01:35	2.71	5.33	0.004

****
Node Surcharge Summary
****

No nodes were surcharged.

****
Node Flooding Summary
****

No nodes were flooded.

****
Storage Volume Summary
****

Storage Unit	Average Volume 1000 m3	Avg Pcnt Full	Evap Pcnt Loss	Exfil Pcnt Loss	Maximum Volume 1000 m3	Max Pcnt Full	Time of Max Occurrence days hr:min	Maximum Outflow CMS
SU1	1.772	27	0	0	2.936	45	0 01:54	0.576

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow CMS	Max Flow CMS	Total Volume 10^6 ltr

OF1	33.94	0.008	0.042	0.080
OF2	99.48	0.138	0.698	4.715
System	66.71	0.146	0.717	4.795

****
Link Flow Summary
****

Link	Type	Maximum |Flow| CMS	Time of Max Occurrence days hr:min	Maximum |Veloc| m/sec	Max/ Full Flow	Max/ Full Depth
C1	CONDUIT	0.152	0 01:40	0.40	0.05	0.19
C2	CONDUIT	0.107	0 01:49	0.23	0.04	0.23
C3	CONDUIT	0.783	0 01:35	0.88	0.71	0.80
C4	CONDUIT	0.580	0 01:36	0.91	0.51	0.65
C5	CONDUIT	0.621	0 01:55	3.07	0.64	0.36
C6	CONDUIT	0.677	0 01:52	1.13	0.17	0.29
OR1	ORIFICE	0.008	0 01:55			1.00
OR2	WEIR	0.568	0 01:55			0.48

****
Flow Classification Summary
****

	Adjusted	Fraction of Time in Flow Class								
Conduit	/Actual Length	Dry	Up Dry	Down Dry	Sub Crit	Sup Crit	Up Crit	Down Crit	Norm Ltd	Inlet Ctrl
C1	1.00	0.01	0.02	0.00	0.97	0.00	0.00	0.00	0.96	0.00
C2	1.00	0.01	0.00	0.00	0.99	0.00	0.00	0.00	0.99	0.00
C3	1.00	0.10	0.31	0.00	0.60	0.00	0.00	0.00	0.79	0.00
C4	1.00	0.10	0.00	0.00	0.00	0.00	0.00	0.90	0.00	0.00
C5	1.00	0.01	0.00	0.00	0.00	0.99	0.00	0.00	0.00	0.00
C6	1.00	0.01	0.00	0.00	0.99	0.00	0.00	0.00	0.00	0.00

****
Conduit Surcharge Summary
****

No conduits were surcharged.

Analysis begun on: Thu Nov 28 15:14:14 2019
Analysis ended on: Thu Nov 28 15:14:15 2019
Total elapsed time: 00:00:01

300037815 TPC Marlwood Inc.

Pre-Development PCSWMM Model
25mm Storm

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.011)

****
Element Count
****
Number of rain gages 14
Number of subcatchments ... 5
Number of nodes 5
Number of links 3
Number of pollutants 0
Number of land uses 0

****
Raingage Summary
****

Name	Data Source	Data Type	Recording Interval
100yr_24hr_SCS_TypeII	100yr_24hr_SCS_TypeII	INTENSITY	6 min.
100yr_4hr_Chicago	100yr_4hr_Chicago	INTENSITY	5 min.
10yr_24hr_SCS_TypeII	10yr_24hr_SCS_TypeII	INTENSITY	6 min.
10yr_4hr_Chicago	10yr_4hr_Chicago	INTENSITY	5 min.
25mm_4hr_Chicago	25mm_4hr_Chicago	INTENSITY	10 min.
25yr_24hr_SCS_TypeII	25yr_24hr_SCS_TypeII	INTENSITY	6 min.
25yr_4hr_Chicago	25yr_4hr_Chicago	INTENSITY	5 min.
2yr_24hr_SCS_TypeII	2yr_24hr_SCS_TypeII	INTENSITY	6 min.
2yr_4hr_Chicago	2yr_4hr_Chicago	INTENSITY	5 min.
50yr_24hr_SCS_TypeII	50yr_24hr_SCS_TypeII	INTENSITY	6 min.
50yr_4hr_Chicago	50yr_4hr_Chicago	INTENSITY	5 min.
5yr_24hr_SCS_TypeII	5yr_24hr_SCS_TypeII	INTENSITY	6 min.
5yr_4hr_Chicago	5yr_4hr_Chicago	INTENSITY	5 min.
Timmins_Storm_(0-25)	Timmins_Storm_(0-25)	INTENSITY	60 min.

****
Subcatchment Summary
****

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
101	0.46	59.22	7.00	0.5000	25mm_4hr_Chicago	OF1
102	3.52	395.00	7.00	4.0000	25mm_4hr_Chicago	OF2
103	0.87	229.97	7.00	7.4000	25mm_4hr_Chicago	J1

104	1.05	105.40	7.00	2.0000	25mm_4hr_Chicago	J2
EX1	3.08	205.15	7.00	5.0000	25mm_4hr_Chicago	102

****
Node Summary
****

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
J1	JUNCTION	188.00	0.60	0.0	
J2	JUNCTION	187.10	0.60	0.0	
J3	JUNCTION	186.25	0.60	0.0	
OF1	OUTFALL	184.00	0.00	0.0	
OF2	OUTFALL	185.44	0.61	0.0	

****
Link Summary
****

Name	From Node	To Node	Type	Length	%Slope	Roughness
C1	J1	J2	CONDUIT	244.6	0.3679	0.0400
C2	J2	J3	CONDUIT	107.7	0.7893	0.0400
C3	J3	OF2	CONDUIT	160.6	0.4981	0.0400

****
Cross Section Summary
****

Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow
C1	TRAPEZOIDAL	0.60	2.88	0.42	6.60	1	2.46
C2	TRAPEZOIDAL	0.60	2.88	0.42	6.60	1	3.61
C3	TRAPEZOIDAL	0.60	2.88	0.42	6.60	1	2.87

****
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
****

****

Analysis Options
****
Flow Units ..... CMS
Process Models:
  Rainfall/Runoff ..... YES
  RDII ..... NO
  Snowmelt ..... NO
  Groundwater ..... NO
  Flow Routing ..... YES
  Ponding Allowed ..... NO
  Water Quality ..... NO
Infiltration Method ..... GREEN_AMPT
Flow Routing Method ..... DYNWAVE
Starting Date 01/05/2017 00:00:00
Ending Date 01/06/2017 23:48:00
Antecedent Dry Days 0.0
Report Time Step 00:00:05
Wet Time Step 00:00:05
Dry Time Step 00:00:05
Routing Time Step ..... 5.00 sec
Variable Time Step ..... YES
Maximum Trials 8
Number of Threads 1
Head Tolerance ..... 0.001500 m

Runoff Quantity Continuity	Volume hectare-m	Depth mm
Total Precipitation	0.225	25.023
Evaporation Loss	0.000	0.000
Infiltration Loss	0.193	21.542
Surface Runoff	0.030	3.341
Final Storage	0.001	0.140
Continuity Error (%)	0.000	

Flow Routing Continuity	Volume hectare-m	Volume 10^6 ltr
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.030	0.300
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	0.030	0.300

Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.000	0.000
Continuity Error (%)	0.016	

****
Time-Step Critical Elements
****
None

****
Highest Flow Instability Indexes
****
All links are stable.

****
Routing Time Step Summary
****

Minimum Time Step	:	4.50 sec
Average Time Step	:	5.00 sec
Maximum Time Step	:	5.00 sec
Percent in Steady State	:	0.00
Average Iterations per Step	:	2.00
Percent Not Converging	:	0.00

****
Subcatchment Runoff Summary
****

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff CMS	Runoff Coeff
101	25.02	0.00	0.00	21.30	3.58	0.02	0.00	0.143
102	25.02	1.41	0.00	20.73	5.56	0.20	0.04	0.210
103	25.02	0.00	0.00	19.66	5.22	0.05	0.01	0.209
104	25.02	0.00	0.00	20.86	4.02	0.04	0.01	0.161
EX1	25.02	0.00	0.00	23.27	1.61	0.05	0.02	0.064

****
Node Depth Summary
****

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min	Reported Max Depth Meters
J1	JUNCTION	0.00	0.03	188.03	0 02:02	0.03
J2	JUNCTION	0.00	0.03	187.13	0 02:07	0.03
J3	JUNCTION	0.00	0.04	186.29	0 02:39	0.04
OF1	OUTFALL	0.00	0.00	184.00	0 00:00	0.00
OF2	OUTFALL	0.00	0.00	185.44	0 00:00	0.00

****
Node Inflow Summary
****

Node	Type	Maximum Lateral Inflow CMS	Maximum Total Inflow CMS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 ltr	Total Inflow Volume 10^6 ltr	Flow Balance Error Percent
J1	JUNCTION	0.014	0.014	0 01:50	0.0456	0.0456	-0.054
J2	JUNCTION	0.010	0.017	0 02:00	0.0424	0.088	-0.060
J3	JUNCTION	0.000	0.021	0 02:16	0	0.0881	0.229
OF1	OUTFALL	0.004	0.004	0 01:40	0.0163	0.0163	0.000
OF2	OUTFALL	0.041	0.041	0 01:40	0.196	0.283	0.000

****
Node Surcharge Summary
****

No nodes were surcharged.

****
Node Flooding Summary
****

No nodes were flooded.

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow CMS	Max Flow CMS	Total Volume 10^6 ltr
OF1	7.62	0.001	0.004	0.016
OF2	32.37	0.005	0.041	0.283
System	19.99	0.006	0.045	0.300

****
Link Flow Summary
****

Link	Type	Maximum |Flow| CMS	Time of Max Occurrence days hr:min	Maximum |Veloc| m/sec	Max/ Full Flow	Max/ Full Depth
C1	CONDUIT	0.011	0 02:02	0.12	0.00	0.05
C2	CONDUIT	0.021	0 02:16	0.22	0.01	0.05
C3	CONDUIT	0.013	0 02:39	0.16	0.00	0.04

****
Flow Classification Summary
****

Conduit	Adjusted /Actual Length	Fraction of Time in Flow Class: Dry	Up Dry	Down Dry	Sub Crit	Sup Crit	Up Crit	Down Crit	Norm Ltd	Inlet Ctrl
C1	1.00	0.03	0.20	0.00	0.77	0.00	0.00	0.00	0.96	0.00
C2	1.00	0.02	0.01	0.00	0.97	0.00	0.00	0.00	0.95	0.00
C3	1.00	0.02	0.00	0.00	0.00	0.00	0.00	0.98	0.00	0.00

****

Conduit Surcharge Summary
****

No conduits were surcharged.

Analysis begun on: Thu Nov 28 13:14:10 2019
Analysis ended on: Thu Nov 28 13:14:10 2019
Total elapsed time: < 1 sec

300037815 TPC Marlwood Inc.

Post-Development PCSWMM Model
25mm Storm

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.011)

****
Element Count
****
Number of rain gages 14
Number of subcatchments ... 7
Number of nodes 9
Number of links 8
Number of pollutants 0
Number of land uses 0

****
Raingage Summary
****

Name	Data Source	Data Type	Recording Interval
100yr_24hr_SCS_TypeII	100yr_24hr_SCS_TypeII	INTENSITY	6 min.
100yr_4hr_Chicago	100yr_4hr_Chicago	INTENSITY	5 min.
10yr_24hr_SCS_TypeII	10yr_24hr_SCS_TypeII	INTENSITY	6 min.
10yr_4hr_Chicago	10yr_4hr_Chicago	INTENSITY	5 min.
25mm_4hr_Chicago	25mm_4hr_Chicago	INTENSITY	10 min.
25yr_24hr_SCS_TypeII	25yr_24hr_SCS_TypeII	INTENSITY	6 min.
25yr_4hr_Chicago	25yr_4hr_Chicago	INTENSITY	5 min.
2yr_24hr_SCS_TypeII	2yr_24hr_SCS_TypeII	INTENSITY	6 min.
2yr_4hr_Chicago	2yr_4hr_Chicago	INTENSITY	5 min.
50yr_24hr_SCS_TypeII	50yr_24hr_SCS_TypeII	INTENSITY	6 min.
50yr_4hr_Chicago	50yr_4hr_Chicago	INTENSITY	5 min.
5yr_24hr_SCS_TypeII	5yr_24hr_SCS_TypeII	INTENSITY	6 min.
5yr_4hr_Chicago	5yr_4hr_Chicago	INTENSITY	5 min.
Timmins_Storm_(0-25)	Timmins_Storm_(0-25)	INTENSITY	60 min.

****
Subcatchment Summary
****

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
201	3.61	2123.65	66.00	2.0000	25mm_4hr_Chicago	SU1
202	0.75	188.32	50.00	6.0000	25mm_4hr_Chicago	SU1
203	0.53	314.00	50.00	2.0000	25mm_4hr_Chicago	J4

EX1	3.08	205.16	7.00	5.0000	25mm_4hr_Chicago	J4
UN1	0.32	187.06	50.00	2.0000	25mm_4hr_Chicago	OF2
UN2	0.17	57.55	7.00	0.5000	25mm_4hr_Chicago	OF1
UN3	0.52	304.65	50.00	2.0000	25mm_4hr_Chicago	J1

****
Node Summary
****

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
J1	JUNCTION	188.00	0.60	0.0	
J3	JUNCTION	186.25	0.60	0.0	
J4	JUNCTION	187.44	0.50	0.0	
J5	JUNCTION	187.22	0.50	0.0	
J6	JUNCTION	185.60	2.00	0.0	
J7	JUNCTION	185.45	0.90	0.0	
OF1	OUTFALL	184.00	0.00	0.0	
OF2	OUTFALL	185.44	0.60	0.0	
SU1	STORAGE	184.60	2.95	0.0	

****
Link Summary
****

Name	From Node	To Node	Type	Length	%Slope	Roughness
C1	J1	J3	CONDUIT	352.3	0.4967	0.0400
C2	J3	J7	CONDUIT	159.6	0.5012	0.0400
C3	J4	J5	CONDUIT	89.9	0.2447	0.0250
C4	J5	SU1	CONDUIT	98.7	0.2534	0.0250
C5	J6	J7	CONDUIT	52.8	0.2843	0.0130
C6	J7	OF2	CONDUIT	1.0	1.0001	0.0400
OR1	SU1	J6	ORIFICE			
OR2	SU1	J6	WEIR			

****
Cross Section Summary
****

Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow
C1	TRAPEZOIDAL	0.60	2.88	0.42	6.60	1	2.86
C2	TRAPEZOIDAL	0.60	2.88	0.42	6.60	1	2.88

C3	TRAPEZOIDAL	0.50	1.25	0.30	4.00	1	1.11
C4	TRAPEZOIDAL	0.50	1.25	0.30	4.00	1	1.13
C5	CIRCULAR	0.90	0.64	0.23	0.90	1	0.97
C6	TRAPEZOIDAL	0.60	2.88	0.42	6.60	1	4.06

```
**********************************************************
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
**********************************************************

****************
Analysis Options
****************
Flow Units ............... CMS
Process Models:
  Rainfall/Runoff ........ YES
  RDII ................... NO
  Snowmelt ............... NO
  Groundwater ............ NO
  Flow Routing ........... YES
  Ponding Allowed ........ NO
  Water Quality .......... NO
Infiltration Method ...... GREEN_AMPT
Flow Routing Method ...... DYNWAVE
Starting Date ............ 01/05/2017 00:00:00
Ending Date .............. 01/07/2017 00:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:00:05
Wet Time Step ............ 00:00:05
Dry Time Step ............ 00:00:05
Routing Time Step ........ 5.00 sec
Variable Time Step ....... YES
Maximum Trials ........... 8
Number of Threads ........ 1
Head Tolerance ........... 0.001500 m

**************************        Volume         Depth
Runoff Quantity Continuity     hectare-m            mm
**************************     ---------       -------
Total Precipitation ......         0.225        25.023
Evaporation Loss .........         0.000         0.000
Infiltration Loss ........         0.123        13.663
```

Surface Runoff	0.095	10.543
Final Storage	0.007	0.818
Continuity Error (%)	0.000	

Flow Routing Continuity	Volume hectare-m	Volume 10^6 ltr
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.095	0.946
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	0.086	0.864
Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.101	1.010
Final Stored Volume	0.109	1.092
Continuity Error (%)	0.000	

Time-Step Critical Elements

None

Highest Flow Instability Indexes

All links are stable.

Routing Time Step Summary

Minimum Time Step	:	4.50 sec
Average Time Step	:	5.00 sec
Maximum Time Step	:	5.00 sec
Percent in Steady State	:	0.00
Average Iterations per Step	:	2.00
Percent Not Converging	:	0.00

Subcatchment Runoff Summary
****

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff CMS	Runoff Coeff
201	25.02	0.00	0.00	7.06	16.65	0.60	0.30	0.665
202	25.02	0.00	0.00	10.47	13.55	0.10	0.05	0.541
203	25.02	0.00	0.00	10.42	13.60	0.07	0.03	0.543
EX1	25.02	0.00	0.00	23.27	1.61	0.05	0.02	0.064
UN1	25.02	0.00	0.00	10.42	13.60	0.04	0.02	0.543
UN2	25.02	0.00	0.00	20.36	4.53	0.01	0.00	0.181
UN3	25.02	0.00	0.00	10.42	13.60	0.07	0.03	0.543

****
Node Depth Summary
****

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min	Reported Max Depth Meters
J1	JUNCTION	0.00	0.05	188.05	0 01:50	0.05
J3	JUNCTION	0.00	0.03	186.28	0 02:19	0.03
J4	JUNCTION	0.00	0.12	187.56	0 01:35	0.12
J5	JUNCTION	0.00	0.13	187.35	0 01:41	0.13
J6	JUNCTION	0.05	0.06	185.66	0 04:16	0.06
J7	JUNCTION	0.01	0.03	185.48	0 02:23	0.03
OF1	OUTFALL	0.00	0.00	184.00	0 00:00	0.00
OF2	OUTFALL	0.01	0.02	185.46	0 02:23	0.02
SU1	STORAGE	1.20	1.41	186.01	0 04:15	1.41

****
Node Inflow Summary
****

Node	Type	Maximum Lateral Inflow CMS	Maximum Total Inflow CMS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 ltr	Total Inflow Volume 10^6 ltr	Flow Balance Error Percent

J1	JUNCTION	0.033	0.033	0	01:40	0.0704	0.0704	-0.293
J3	JUNCTION	0.000	0.016	0	01:59	0	0.0706	0.342
J4	JUNCTION	0.059	0.059	0	01:40	0.122	0.122	-0.307
J5	JUNCTION	0.000	0.060	0	01:38	0	0.123	0.297
J6	JUNCTION	0.000	0.008	0	04:15	0	0.745	0.024
J7	JUNCTION	0.000	0.019	0	02:20	0	0.815	0.212
OF1	OUTFALL	0.002	0.002	0	01:40	0.00756	0.00756	0.000
OF2	OUTFALL	0.020	0.022	0	01:40	0.0432	0.857	0.000
SU1	STORAGE	0.346	0.388	0	01:40	0.703	1.84	0.001

****
Node Surcharge Summary
****

No nodes were surcharged.

****
Node Flooding Summary
****

No nodes were flooded.

****
Storage Volume Summary
****

Storage Unit	Average Volume 1000 m3	Avg Pcnt Full	Evap Pcnt Loss	Exfil Pcnt Loss	Maximum Volume 1000 m3	Max Pcnt Full	Time of Max Occurrence days hr:min	Maximum Outflow CMS
SU1	1.355	21	0	0	1.763	27	0 04:15	0.008

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow CMS	Max Flow CMS	Total Volume 10^6 ltr

OF1	6.91	0.001	0.002	0.008
OF2	98.08	0.005	0.022	0.857
System	52.49	0.006	0.024	0.864

****
Link Flow Summary
****

Link	Type	Maximum |Flow| CMS	Time of Max Occurrence days hr:min	Maximum |Veloc| m/sec	Max/ Full Flow	Max/ Full Depth
C1	CONDUIT	0.016	0 01:59	0.17	0.01	0.05
C2	CONDUIT	0.012	0 02:19	0.15	0.00	0.04
C3	CONDUIT	0.060	0 01:38	0.40	0.05	0.23
C4	CONDUIT	0.045	0 01:41	0.39	0.04	0.18
C5	CONDUIT	0.008	0 04:16	0.72	0.01	0.05
C6	CONDUIT	0.018	0 02:23	0.28	0.00	0.04
OR1	ORIFICE	0.007	0 04:14			1.00
OR2	WEIR	0.000	0 04:15			0.00

****
Flow Classification Summary
****

Conduit	Adjusted /Actual Length	Fraction of Time in Flow Class: Dry	Up Dry	Down Dry	Sub Crit	Sup Crit	Up Crit	Down Crit	Norm Ltd	Inlet Ctrl
C1	1.00	0.02	0.04	0.00	0.94	0.00	0.00	0.00	0.95	0.00
C2	1.00	0.02	0.00	0.00	0.98	0.00	0.00	0.00	0.98	0.00
C3	1.00	0.16	0.41	0.00	0.43	0.00	0.00	0.00	0.76	0.00
C4	1.00	0.16	0.00	0.00	0.00	0.00	0.00	0.84	0.00	0.00
C5	1.00	0.02	0.00	0.00	0.01	0.97	0.00	0.00	0.00	0.00
C6	1.00	0.02	0.00	0.00	0.98	0.00	0.00	0.00	0.00	0.00

****
Conduit Surcharge Summary
****

No conduits were surcharged.

Analysis begun on: Thu Nov 28 15:16:14 2019
Analysis ended on: Thu Nov 28 15:16:15 2019
Total elapsed time: 00:00:01

300037815 TPC Marlwood Inc.

Pre-Development PCSWMM Model
Timmins Regional Storm

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.011)

****
Element Count
****
Number of rain gages 14
Number of subcatchments ... 5
Number of nodes 5
Number of links 3
Number of pollutants 0
Number of land uses 0

****
Raingage Summary
****

Name	Data Source	Data Type	Recording Interval
100yr_24hr_SCS_TypeII	100yr_24hr_SCS_TypeII	INTENSITY	6 min.
100yr_4hr_Chicago	100yr_4hr_Chicago	INTENSITY	5 min.
10yr_24hr_SCS_TypeII	10yr_24hr_SCS_TypeII	INTENSITY	6 min.
10yr_4hr_Chicago	10yr_4hr_Chicago	INTENSITY	5 min.
25mm_4hr_Chicago	25mm_4hr_Chicago	INTENSITY	10 min.
25yr_24hr_SCS_TypeII	25yr_24hr_SCS_TypeII	INTENSITY	6 min.
25yr_4hr_Chicago	25yr_4hr_Chicago	INTENSITY	5 min.
2yr_24hr_SCS_TypeII	2yr_24hr_SCS_TypeII	INTENSITY	6 min.
2yr_4hr_Chicago	2yr_4hr_Chicago	INTENSITY	5 min.
50yr_24hr_SCS_TypeII	50yr_24hr_SCS_TypeII	INTENSITY	6 min.
50yr_4hr_Chicago	50yr_4hr_Chicago	INTENSITY	5 min.
5yr_24hr_SCS_TypeII	5yr_24hr_SCS_TypeII	INTENSITY	6 min.
5yr_4hr_Chicago	5yr_4hr_Chicago	INTENSITY	5 min.
Timmins_Storm_(0-25)	Timmins_Storm_(0-25)	INTENSITY	60 min.

****
Subcatchment Summary
****

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
101	0.46	59.22	7.00	0.5000	Timmins_Storm_(0-25)	OF1
102	3.52	395.00	7.00	4.0000	Timmins_Storm_(0-25)	OF2
103	0.87	229.97	7.00	7.4000	Timmins_Storm_(0-25)	J1

104	1.05	105.40	7.00	2.0000	Timmins_Storm_(0-25)	J2
EX1	3.08	205.15	7.00	5.0000	Timmins_Storm_(0-25)	102

****
Node Summary
****

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
J1	JUNCTION	188.00	0.60	0.0	
J2	JUNCTION	187.10	0.60	0.0	
J3	JUNCTION	186.25	0.60	0.0	
OF1	OUTFALL	184.00	0.00	0.0	
OF2	OUTFALL	185.44	0.61	0.0	

****
Link Summary
****

Name	From Node	To Node	Type	Length	%Slope	Roughness
C1	J1	J2	CONDUIT	244.6	0.3679	0.0400
C2	J2	J3	CONDUIT	107.7	0.7893	0.0400
C3	J3	OF2	CONDUIT	160.6	0.4981	0.0400

****
Cross Section Summary
****

Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow
C1	TRAPEZOIDAL	0.60	2.88	0.42	6.60	1	2.46
C2	TRAPEZOIDAL	0.60	2.88	0.42	6.60	1	3.61
C3	TRAPEZOIDAL	0.60	2.88	0.42	6.60	1	2.87

****
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
****

****

Analysis Options
****
Flow Units ..... CMS
Process Models:
  Rainfall/Runoff ..... YES
  RDII ..... NO
  Snowmelt ..... NO
  Groundwater ..... NO
  Flow Routing ..... YES
  Ponding Allowed ..... NO
  Water Quality ..... NO
Infiltration Method ..... GREEN_AMPT
Flow Routing Method ..... DYNWAVE
Starting Date 01/05/2017 00:00:00
Ending Date 01/06/2017 23:48:00
Antecedent Dry Days 0.0
Report Time Step 00:00:05
Wet Time Step 00:00:05
Dry Time Step 00:00:05
Routing Time Step ..... 5.00 sec
Variable Time Step ..... YES
Maximum Trials 8
Number of Threads 1
Head Tolerance ..... 0.001500 m

**********	Volume	Depth
Runoff Quantity Continuity	hectare-m	mm
**********	---	---
Total Precipitation	1.733	193.000
Evaporation Loss	0.000	0.000
Infiltration Loss	0.400	44.545
Surface Runoff	1.331	148.315
Final Storage	0.001	0.140
Continuity Error (%)	0.000	

**********	Volume	Volume
Flow Routing Continuity	hectare-m	10^6 ltr
**********	---	---
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	1.331	13.314
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	1.331	13.314

Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.000	0.000
Continuity Error (%)	0.001	

****
Time-Step Critical Elements
****
None

****
Highest Flow Instability Indexes
****
All links are stable.

****
Routing Time Step Summary
****

Minimum Time Step	:	4.50 sec
Average Time Step	:	5.00 sec
Maximum Time Step	:	5.00 sec
Percent in Steady State	:	0.00
Average Iterations per Step	:	2.00
Percent Not Converging	:	0.00

****
Subcatchment Runoff Summary
****

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff CMS	Runoff Coeff
101	193.00	0.00	0.00	44.40	148.46	0.68	0.05	0.769
102	193.00	127.00	0.00	43.27	276.59	9.72	0.74	0.864
103	193.00	0.00	0.00	40.21	152.65	1.33	0.10	0.791
104	193.00	0.00	0.00	43.02	149.84	1.58	0.12	0.776
EX1	193.00	0.00	0.00	47.77	145.09	4.46	0.35	0.752

****
Node Depth Summary
****

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min	Reported Max Depth Meters
J1	JUNCTION	0.01	0.10	188.10	0 07:00	0.10
J2	JUNCTION	0.02	0.13	187.23	0 07:00	0.13
J3	JUNCTION	0.03	0.20	186.45	0 07:02	0.20
OF1	OUTFALL	0.00	0.00	184.00	0 00:00	0.00
OF2	OUTFALL	0.00	0.00	185.44	0 00:00	0.00

****
Node Inflow Summary
****

Node	Type	Maximum Lateral Inflow CMS	Maximum Total Inflow CMS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 ltr	Total Inflow Volume 10^6 ltr	Flow Balance Error Percent
J1	JUNCTION	0.103	0.103	0 07:00	1.33	1.33	-0.027
J2	JUNCTION	0.118	0.220	0 07:00	1.58	2.91	-0.003
J3	JUNCTION	0.000	0.219	0 07:00	0	2.91	0.022
OF1	OUTFALL	0.048	0.048	0 07:00	0.677	0.677	0.000
OF2	OUTFALL	0.737	0.952	0 07:00	9.72	12.6	0.000

****
Node Surcharge Summary
****

No nodes were surcharged.

****
Node Flooding Summary
****

No nodes were flooded.

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow CMS	Max Flow CMS	Total Volume 10^6 ltr
OF1	30.67	0.013	0.048	0.677
OF2	53.38	0.138	0.952	12.637
System	42.03	0.150	1.001	13.314

****
Link Flow Summary
****

Link	Type	Maximum |Flow| CMS	Time of Max Occurrence days hr:min	Maximum |Veloc| m/sec	Max/ Full Flow	Max/ Full Depth
C1	CONDUIT	0.102	0 07:00	0.28	0.04	0.19
C2	CONDUIT	0.219	0 07:00	0.39	0.06	0.27
C3	CONDUIT	0.216	0 07:02	0.46	0.08	0.23

****
Flow Classification Summary
****

Conduit	Adjusted /Actual Length	Fraction of Time in Flow Class: Dry	Up Dry	Down Dry	Sub Crit	Sup Crit	Up Crit	Down Crit	Norm Ltd	Inlet Ctrl
C1	1.00	0.00	0.03	0.00	0.97	0.00	0.00	0.00	0.99	0.00
C2	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.97	0.00
C3	1.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00

****

Conduit Surcharge Summary
****

No conduits were surcharged.

Analysis begun on: Thu Nov 28 13:14:44 2019
Analysis ended on: Thu Nov 28 13:14:45 2019
Total elapsed time: 00:00:01

300037815 TPC Marlwood Inc.

Post-Development PCSWMM Model
Timmins Regional Storm

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.011)

****
Element Count
****
Number of rain gages 14
Number of subcatchments ... 7
Number of nodes 9
Number of links 8
Number of pollutants 0
Number of land uses 0

****
Raingage Summary
****

Name	Data Source	Data Type	Recording Interval
100yr_24hr_SCS_TypeII	100yr_24hr_SCS_TypeII	INTENSITY	6 min.
100yr_4hr_Chicago	100yr_4hr_Chicago	INTENSITY	5 min.
10yr_24hr_SCS_TypeII	10yr_24hr_SCS_TypeII	INTENSITY	6 min.
10yr_4hr_Chicago	10yr_4hr_Chicago	INTENSITY	5 min.
25mm_4hr_Chicago	25mm_4hr_Chicago	INTENSITY	10 min.
25yr_24hr_SCS_TypeII	25yr_24hr_SCS_TypeII	INTENSITY	6 min.
25yr_4hr_Chicago	25yr_4hr_Chicago	INTENSITY	5 min.
2yr_24hr_SCS_TypeII	2yr_24hr_SCS_TypeII	INTENSITY	6 min.
2yr_4hr_Chicago	2yr_4hr_Chicago	INTENSITY	5 min.
50yr_24hr_SCS_TypeII	50yr_24hr_SCS_TypeII	INTENSITY	6 min.
50yr_4hr_Chicago	50yr_4hr_Chicago	INTENSITY	5 min.
5yr_24hr_SCS_TypeII	5yr_24hr_SCS_TypeII	INTENSITY	6 min.
5yr_4hr_Chicago	5yr_4hr_Chicago	INTENSITY	5 min.
Timmins_Storm_(0-25)	Timmins_Storm_(0-25)	INTENSITY	60 min.

****
Subcatchment Summary
****

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
201	3.61	2123.65	66.00	2.0000	Timmins_Storm_(0-25)	SU1
202	0.75	188.32	50.00	6.0000	Timmins_Storm_(0-25)	SU1
203	0.53	314.00	50.00	2.0000	Timmins_Storm_(0-25)	J4

EX1	3.08	205.16	7.00	5.0000 Timmins_Storm_(0-25)	J4
UN1	0.32	187.06	50.00	2.0000 Timmins_Storm_(0-25)	OF2
UN2	0.17	57.55	7.00	0.5000 Timmins_Storm_(0-25)	OF1
UN3	0.52	304.65	50.00	2.0000 Timmins_Storm_(0-25)	J1

****
Node Summary
****

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
J1	JUNCTION	188.00	0.60	0.0	
J3	JUNCTION	186.25	0.60	0.0	
J4	JUNCTION	187.44	0.50	0.0	
J5	JUNCTION	187.22	0.50	0.0	
J6	JUNCTION	185.60	2.00	0.0	
J7	JUNCTION	185.45	0.90	0.0	
OF1	OUTFALL	184.00	0.00	0.0	
OF2	OUTFALL	185.44	0.60	0.0	
SU1	STORAGE	184.60	2.95	0.0	

****
Link Summary
****

Name	From Node	To Node	Type	Length	%Slope	Roughness
C1	J1	J3	CONDUIT	352.3	0.4967	0.0400
C2	J3	J7	CONDUIT	159.6	0.5012	0.0400
C3	J4	J5	CONDUIT	89.9	0.2447	0.0250
C4	J5	SU1	CONDUIT	98.7	0.2534	0.0250
C5	J6	J7	CONDUIT	52.8	0.2843	0.0130
C6	J7	OF2	CONDUIT	1.0	1.0001	0.0400
OR1	SU1	J6	ORIFICE			
OR2	SU1	J6	WEIR			

****
Cross Section Summary
****

Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow
C1	TRAPEZOIDAL	0.60	2.88	0.42	6.60	1	2.86
C2	TRAPEZOIDAL	0.60	2.88	0.42	6.60	1	2.88

C3	TRAPEZOIDAL	0.50	1.25	0.30	4.00	1	1.11
C4	TRAPEZOIDAL	0.50	1.25	0.30	4.00	1	1.13
C5	CIRCULAR	0.90	0.64	0.23	0.90	1	0.97
C6	TRAPEZOIDAL	0.60	2.88	0.42	6.60	1	4.06

****
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
****

****
Analysis Options
****
Flow Units ..... CMS
Process Models:
  Rainfall/Runoff ..... YES
  RDII ..... NO
  Snowmelt ..... NO
  Groundwater ..... NO
  Flow Routing ..... YES
  Ponding Allowed ..... NO
  Water Quality ..... NO
Infiltration Method ..... GREEN_AMPT
Flow Routing Method ..... DYNWAVE
Starting Date 01/05/2017 00:00:00
Ending Date 01/07/2017 00:00:00
Antecedent Dry Days 0.0
Report Time Step 00:00:05
Wet Time Step 00:00:05
Dry Time Step 00:00:05
Routing Time Step ..... 5.00 sec
Variable Time Step ..... YES
Maximum Trials 8
Number of Threads 1
Head Tolerance ..... 0.001500 m

**********	Volume	Depth
Runoff Quantity Continuity	hectare-m	mm
**********	---------	-------
Total Precipitation	1.733	193.000
Evaporation Loss	0.000	0.000
Infiltration Loss	0.251	27.988

Surface Runoff	1.474	164.194
Final Storage	0.007	0.818
Continuity Error (%)	0.000	

Flow Routing Continuity	Volume hectare-m	Volume 10^6 ltr
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	1.474	14.740
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	1.458	14.575
Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.101	1.010
Final Stored Volume	0.118	1.175
Continuity Error (%)	0.000	

Time-Step Critical Elements

Link C6 (64.28%)

Highest Flow Instability Indexes

Link C5 (4)
Link C6 (1)
Link OR2 (1)

Routing Time Step Summary

Minimum Time Step	:	0.50 sec
Average Time Step	:	2.11 sec
Maximum Time Step	:	5.00 sec
Percent in Steady State	:	0.00
Average Iterations per Step	:	2.00
Percent Not Converging	:	0.00

****
Subcatchment Runoff Summary
****

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff CMS	Runoff Coeff
201	193.00	0.00	0.00	14.40	177.28	6.40	0.44	0.919
202	193.00	0.00	0.00	21.40	170.60	1.29	0.09	0.884
203	193.00	0.00	0.00	21.29	170.71	0.91	0.06	0.884
EX1	193.00	0.00	0.00	47.77	145.09	4.46	0.35	0.752
UN1	193.00	0.00	0.00	21.29	170.71	0.54	0.04	0.884
UN2	193.00	0.00	0.00	41.74	151.12	0.25	0.02	0.783
UN3	193.00	0.00	0.00	21.29	170.71	0.88	0.06	0.884

****
Node Depth Summary
****

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min	Reported Max Depth Meters
J1	JUNCTION	0.03	0.08	188.08	0 06:26	0.08
J3	JUNCTION	0.03	0.07	186.32	0 06:55	0.07
J4	JUNCTION	0.13	0.31	187.75	0 07:00	0.31
J5	JUNCTION	0.15	0.34	187.56	0 07:00	0.34
J6	JUNCTION	0.26	0.58	186.18	0 07:01	0.58
J7	JUNCTION	0.09	0.21	185.66	0 07:01	0.21
OF1	OUTFALL	0.00	0.00	184.00	0 00:00	0.00
OF2	OUTFALL	0.08	0.19	185.63	0 07:01	0.19
SU1	STORAGE	1.60	2.04	186.64	0 07:00	2.04

****
Node Inflow Summary
****

	Maximum Lateral	Maximum Total	Time of Max	Lateral Inflow	Total Inflow	Flow Balance

Node	Type	Inflow CMS	Inflow CMS	Occurrence days	Occurrence hr:min	Volume 10^6 ltr	Volume 10^6 ltr	Error Percent
J1	JUNCTION	0.062	0.062	0	07:00	0.884	0.884	-0.068
J3	JUNCTION	0.000	0.065	0	06:39	0	0.885	0.038
J4	JUNCTION	0.410	0.410	0	07:00	5.38	5.38	-0.014
J5	JUNCTION	0.000	0.409	0	07:00	0	5.38	0.013
J6	JUNCTION	0.000	0.821	0	07:00	0	12.9	0.035
J7	JUNCTION	0.000	0.966	0	07:01	0	13.8	-0.007
OF1	OUTFALL	0.019	0.019	0	07:00	0.252	0.252	0.000
OF2	OUTFALL	0.038	0.918	0	07:00	0.543	14.3	0.000
SU1	STORAGE	0.528	0.935	0	07:00	7.69	14.1	0.000

****
Node Surcharge Summary
****

No nodes were surcharged.

****
Node Flooding Summary
****

No nodes were flooded.

****
Storage Volume Summary
****

Storage Unit	Average Volume 1000 m3	Avg Pcnt Full	Evap Pcnt Loss	Exfil Pcnt Loss	Maximum Volume 1000 m3	Max Pcnt Full	Time of Max Occurrence days hr:min	Maximum Outflow CMS
SU1	2.232	34	0	0	3.347	51	0 07:00	0.821

****
Outfall Loading Summary
****

	Flow	Avg	Max	Total

Outfall Node	Freq Pcnt	Flow CMS	Flow CMS	Volume 10^6 ltr
OF1	69.50	0.008	0.019	0.252
OF2	99.88	0.287	0.918	14.323
System	84.69	0.295	0.937	14.575

****
Link Flow Summary
****

Link	Type	Maximum |Flow| CMS	Time of Max Occurrence days hr:min	Maximum |Veloc| m/sec	Max/ Full Flow	Max/ Full Depth
C1	CONDUIT	0.065	0 06:39	0.29	0.02	0.12
C2	CONDUIT	0.064	0 06:55	0.18	0.02	0.23
C3	CONDUIT	0.409	0 07:00	0.63	0.37	0.65
C4	CONDUIT	0.408	0 07:00	0.81	0.36	0.55
C5	CONDUIT	0.902	0 07:01	3.47	0.93	0.44
C6	CONDUIT	0.885	0 07:01	1.22	0.22	0.33
OR1	ORIFICE	0.008	0 07:04			1.00
OR2	WEIR	0.813	0 07:00			0.63

****
Flow Classification Summary
****

Conduit	Adjusted /Actual Length	Fraction of Time in Flow Class: Dry	Up Dry	Down Dry	Sub Crit	Sup Crit	Up Crit	Down Crit	Norm Ltd	Inlet Ctrl
C1	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.86	0.00
C2	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.99	0.00
C3	1.00	0.01	0.15	0.00	0.84	0.00	0.00	0.00	0.98	0.00
C4	1.00	0.01	0.00	0.00	0.00	0.00	0.00	0.99	0.00	0.00
C5	1.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00
C6	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00

****

Conduit Surcharge Summary
****

No conduits were surcharged.

Analysis begun on: Thu Nov 28 15:16:47 2019
Analysis ended on: Thu Nov 28 15:16:48 2019
Total elapsed time: 00:00:01