Site Servicing & Stormwater Management Report

Mansfield Ski Club
Township of Mulmur

WMI 15-319
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Prepared by

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Appendices

1.0 Introduction

WMI & Associates Limited has been retained by the Mansfield Ski Club (MSC) to prepare a Site Servicing & Stormwater Management Report in support of Site Plan Approval (SPA) associated with the re-development/expansion to the existing Mansfield Ski Club located in the Township of Mulmur, Ontario. The Site Servicing & Stormwater Management Report provided herein has been based on discussions with the Township of Mulmur staff and all proposed works are considered to be in conformance with the current engineering design standards.

The subject area of the Mansfield Ski Club property which is proposed for re-development is comprised of 3.63ha. The property is located north of the 15th Sideroad, south of the 17th Sideroad, east of the 5th Line and approximately 600m west of County Road 18 (Airport Road). The property address is 628213 15th Sideroad, P.O. Box 75 RPO Mansfield, Mulmur, ON. Refer to **FIG 1** in **Appendix A** for the Site Location Plan.

The proposed MSC re-development will include the existing uses such as the Main Chalet, Ski House and GM Office as well as the renovation of the existing Administration Building into Office and Personal Business space at ground level and 15 residential units/lofts on the second level (Building ‘B’, 652m^2 existing ground floor + 128m^2 proposed ground floor = 780m^2 total), a new building consists of Office and Personal Business space at ground level and 10 residential units/lofts on the second level (Building ‘A’, 630m^2 ground floor + 252m^2 mezzanine = 882m^2 total) and 6 separate stacked Townhouse buildings totaling 66 residential units. The existing gravel parking lot is proposed to be expanded but will remain surfaced with gravel with the exception of a section located adjacent to the existing Main Chalet building which is proposed as interlocking paver stone and the main drive aisle around Building ‘A’ which is proposed to be asphalt. This report will summarize all servicing such as stormwater management, sanitary, water and utilities as well as site grading. A separate Traffic Impact Opinion letter is provided herein as **Appendix E**.

2.0 Sanitary Servicing

2.1 Background

Considering the existing condition (private sewage treatment system located on-site) and lack of municipal services within the area of the subject lands, no sanitary servicing is currently allocated to the subject lands. A new private sanitary sewage collection and treatment system is proposed to facilitate the re-development/expansion of the MSC. The proposed sanitary services for the subject site have been designed in accordance with municipal design standards. Estimated sanitary sewage design flows have been calculated using the sewage flow design criteria set-out in the MECP's Design Guidelines for Sewage Works (2008) in conjunction with Tables 8.2.1.3.A. and

8.2.1.3.B. of the 2012 Ontario Building Code (OBC). Using the aforementioned tables, the total daily sewage design flow rate for the proposed condition of the re-development was determined to be 118,950L/day.

Refer to **Appendix B** for the Sanitary Service Design Calculations.

2.2 Proposed Sanitary Sewer System

An internal sanitary sewer system is proposed within the re-development, complete with sanitary service laterals to each building as illustrated on the General Servicing Plan North (**GENN**). The proposed sanitary sewer system will drain via gravity to the northeast corner of the subject lands, to a proposed Waterloo Biofilter sewage treatment system that will ultimately surface discharge treated effluent to the adjacent Pine River.

The proposed sanitary sewer system will be been designed to accommodate the full build-out condition of the re-development.

2.3 Existing Treatment & Subsurface Disposal System

Based on the background information provided to us and our correspondence with staff at the MSC, it is our understanding that the current sanitary sewage collection system consists of a 150mm diameter gravity sewer which collects sewage generated from both the existing 2-storey administration building and the 2-storey main chalet building. The sanitary sewer system discharges to an existing sewage pump chamber and the existing Ski House and GM Office building discharge downstream of the pump chamber directly into the existing sewage treatment system via individual forcemains due to grade constraints.

The existing pump chamber is located approximately 20m southeast of the main chalet at the east limit of the gravel parking area. From the existing pump chamber, the sewage is lifted and pumped into a Northern Purification System (NPS), model GC-2 complete with a 24-hour rated capacity of 22,700L/day. In addition to the systems rated capacity of 22,700L/day, a reserve volume of 9,100L and an additional 18,000L surge tank located immediately east of the NPS system provide additional upstream storage for contingency purposes. From the GC-2 unit, the sewage is pumped southeast approximately 40m to two (2) existing filter beds located immediately east of the existing gravel driveway/easement serving the existing chalets to the northeast of the MSC's main chalet building.

Each of the original water sources (drilled well, bored well and river water) were previously metered and recorded by the MSC. This information was provided to WMI & Associates Limited in early 2016 for the months of December 2014 to March 2015 and was analyzed to determine the total daily sewage flows experienced at the MSC during a full ski season in order to confirm actual sewage flow values experienced by the existing sewage treatment system. It was determined based on the above mentioned water consumption records for December 2014 to March 2015, that the average total daily sewage flow produced at the MSC over this period of operation was 6.6m^3/day (6,600L/day) and the maximum daily sewage flow recorded was 17.8m^3/day (17,800L/day).

Since the 2014-2015 ski season the on-site water source and treatment system have been updated. Based on recent discussions with MSC staff, there are now two water meters located within the Main Chalet. The main meter records the total number of cubic meters (m^3) of water supplied to the Main Chalet from the sole water source which is currently a 150mm diameter drilled well (PW2) as of May of 2016. A separate and smaller water meter is located in series and downstream of the main meter. This submeter only reads the amount of treated water in imperial gallons (IG) that is distributed to the Main Chalet, Administration Building, Ski House and GM Office building. Untreated (non-potable) water that by-passes the submeter is solely used for water closets and urinals within the Main Chalet.

More recently, total water usage (800.9m^3) from Dec. 26, 2019 to March 15, 2020 was provided to WMI & Associates Limited along with the total number of operational days within the subject ski season (58 days). All meter readings provided below are from the main meter referenced above and account for all water used (treated and untreated). From this data, it was determined that the Average Day Demand (total daily sewage design flow produced at the MSC) over last ski season was 13.8m^3/day (13,800L/day). Daily water use records also indicated the following:

Table 1: 2019-2020 Ski Season Water Consumption Log

Description	Date	Meter Reading (m^3)	Usage (m^3)
First Day of Meter Reading	Dec. 26/19	7509.3	
Typical Saturday	Jan. 18/20	7701.5	5.3
Ladies Day	Jan. 24/20	7771.3	21.5
Men’s Day	Feb. 7/20	7913.6	9.7
Family Day Weekend (Sunday)	Feb. 16/20	8035.1	27.7
Typical Thursday	Feb. 27/20	8147.8	9.4
Final Day of Operation	Mar. 15/20	8310.2	9.7

Based on the above, the Maximum Day Demand (maximum sewage flow) recorded was 27.7m^3/day (27,700L/day) resulting in a peaking factor of 2.0 currently experienced at the MSC.

As per the monitoring data provided in **Table 1**, the existing sewage treatment system only experienced 1 day (Sunday Feb. 16/20 during the Family Day long weekend) where it was slightly beyond its rated capacity of 22,700L/day. As a result of the presence of the reserve volume and surge tank, this rare exceedance was handled without any issues as the additional flow was able to be attenuated while maintaining dosage to the filter beds at/below the systems rated capacity. Considering the above and the Average Day Demand of 13,800L/day, the existing sewage treatment system is considered to be working well within its rated capacity.

Additional details with respect to the existing sewage treatment system and its capacity can be found in **Appendix F**, Ski House Development at the Mansfield Ski Club, Sewage Treatment System Analysis prepared by WMI & Associates Limited, dated January 20, 2016.

2.4 Proposed Treatment & Surface Disposal System

Due to the larger footprint required by a typical leaching bed system, the limited space available on-site that is under 4:1 (H:V) slope required to accommodate a conventional leaching bed and the numerous existing residential dwellings located down gradient which are all individually serviced by private wells and subsurface septic systems, a Waterloo Biofilter system complete with surface discharge is proposed to treat and ultimately discharge the effluent via a proposed storm sewer system running north down the Chalet Ski run and then east to the Pine River located approximately 500m northeast of the proposed re-development. Refer to the Site Servicing Outlet Plan provided in **Appendix A** for additional details. The Waterloo Biofilter system will be fully constructed as part of the Phase 1A of the development.

The Total Daily Sanitary Design Flow Calculations and Sanitary Sewer Design Sheet are provided in **Appendix B** for reference. Refer to the General Servicing Plan North (**GENN**) for additional details.

2.4.1 Waterloo Biofilter System (Surface Disposal)

The associated collection, transmission, treatment and disposal of domestic sewage from the MSC re-development has been designed based on a *Rated Capacity* of **1.38L/s** (118,950L/day) total daily design flow. Approximately one (1.0) days' worth of additional storage has been built into the design of the Waterloo Biofilter system which is considered to balance out any peaking of sewage inflows (2 x 60,000L Balancing Tanks for a total of 120,000L) The following outlines the components of the proposed Waterloo Biofilter treatment system:

Grease Interceptor (by others and external to the Main Chalet building)
One (1) exterior oil/grease interceptor, having a capacity of approximately 6,600 L (3353 mm(L) x 2134 mm(W) x 1638 mm(H) + riser), to receive all kitchen sink wastewater from the main chalet, discharging into the sanitary sewer system prior to the trash tank. Any other restaurant type uses proposed on-site will also be required to install individual oil/grease interceptors prior to discharging to the proposed sanitary sewage treatment system;

Trash Tank
One (1) single compartment trash tank, having a capacity of approximately 60,000 L (7315 mm(L) x 3302 mm(W) x 3550 mm(H) +riser), with the inlet and outlet equipped with a baffle, discharging into anaerobic digester tank #1;

Anaerobic Digester Tanks #1 and #2
Two (2) single compartment anaerobic digester tanks, operating in series, each having a capacity of approximately 60,000 L (7315 mm(L) x 3302 mm(W) x 3550 mm(H) +riser), with the inlets equipped with an InnerTube and the outlets equipped with a baffle, discharging into the aeration tank;

Aeration Tank
One (1) double-compartment aeration tank, having a capacity of approximately 60,000 L (7315 mm(L) x 3302 mm(W) x 3550 mm(H) +riser), with the inlet equipped with an InnerTube, equipped with two (2) aerators, and the outlet equipped with a baffle, discharging into anaerobic digester tank #3;

Anaerobic Digester Tank #3
One (1) single compartment anaerobic digester tank, having a capacity of approximately 60,000 L (7315 mm(L) x 3302 mm(W) x 3550 mm(H) +riser), with the inlet equipped with an InnerTube, equipped with a return pump to the trash tank, and the outlet equipped with six (6) effluent filters, discharging into balance tank #1;

Balance Tanks
Two (2) single compartment balance tanks, each having a capacity of approximately 60,000 L (7315 mm(L) x 3302 mm(W) x 3550 mm(H) +riser), connected by bottom drains, balance tank #2 is equipped with two (2) pairs of pumps, with each pair discharging to two (2) Waterloo Biofilter bulk-filled treatment tanks;
WATERLOO BIOFILTER BULK-FILLED TANKS

Four (4) single compartment Waterloo Biofilter bulk-filled tanks, each having a capacity of approximately 55,000 L (7315 mm(L) x 3302 mm(W) x 3050 mm(H) +riser), housing approximately 55 m3 of Biofilter medium; connected by bottom drains, draining into Waterloo Biofilter basket Biofilter tank #1;

Waterloo Biofilter Bulk-Filled Tanks

Two (2) single compartment Waterloo Biofilter basket tanks, each having a capacity of approximately 55,000 L (7315 mm(L) x 3302 mm(W) x 3050 mm(H) +riser), each housing three (3) baskets with approximately 10 m3 of Biofilter medium per basket (60 m3 total); tank #1 with three (3) simplex pumps and two (2) duplex pumps, simplex pump #1 recirculating to the trash tank, simplex pump #2 dosing Waterloo Biofilter basket tanks #1 and #2 on a closed loop, simplex pump #3 dosing sand filters on a closed loop, duplex pumps discharging to the UV disinfection units;

Sand Filters

Two (2) sand filter polishing units located an above ground control building; draining back to basket tank #1;

UV Disinfection Units

Four (4) UV disinfection units located in the above ground control building; discharging to the effluent sampling and disposal chamber;

Effluent Sampling & Outfall

One (1) disposal tank complete with on-demand duplex pumps will be provided downstream of the UV disinfection units which will be used for both effluent sampling and disposal. The pumps will discharge via a 133.6m long forcemain from the sewage treatment system, west to the proposed outlet storm sewer system (MH1) located northwest of the existing Main Chalet building.

One (1) sodium aluminate dosing system located in the above ground control building, metering sodium aluminate chemical into the trash tank and/or anaerobic digester tank #3;

One (1) alkalinity dosing system located in the above ground control building, metering alkalinity into anaerobic digester tank #3;

One (1) bacteria dosing system located in the above ground control building, metering bacteria into balance tank #1;

Waterloo Smart Panel

All new pumps in the system are run by a Waterloo Smart Panel. The Waterloo Smart Panel provides remote monitoring, control, and data logging over a stable wireless cellular network. This functionality allows for real time operational adjustments to optimize system performance. The Waterloo Smart Panel also immediately notifies the operator of a pump failure or high-level alarm, providing them with vital information to limit site visits while keeping the system running properly.

Effluent Objectives

- The *Owner* shall use best efforts to design, construct and operate the *Works* with the objective that the concentrations of the materials named below as effluent parameters are not exceeded in the effluent being discharged from the *Works*.

Table 2 – Effluent Objectives	
Effluent Parameter	**Concentration Objective** (mg/L unless otherwise indicated)
cB0D5	10.0
Total Suspended Solids	10.0
Total Phosphorus	0.5
Total Ammonia Nitrogen	3.0
*E. Coli**	100 organisms/100 mL (*Geometric Mean Density)*
pH of the effluent maintained between 6.5 to 8.5, inclusive, at all times	

* Disinfection of the effluent to be continuous throughout the year, however, for compliance purposes, the *Geometric Mean Density* shall be calculated such that the annual *Geometric Mean Density* of *E. Coli* does not exceed Column 2 of Table 2 above.

Effluent Limits

- The *Owner* shall design and construct the proposed Works and operate and maintain the *Works* such that the concentrations of the materials named below as effluent parameters are not exceeded in the effluent being discharged from the *Works*.

Table 3 – Effluent Limits	
Effluent Parameter	**Concentration Limit** (mg/L unless otherwise indicated)
cB0D5	15.0
Total Suspended Solids	15.0
Total Phosphorus	1.0
Total Ammonia Nitrogen	5.0
*E. Coli**	200 organisms/100 mL (*Geometric Mean Density)*
pH of the effluent maintained between 6.0 to 9.0, inclusive, at all times	

* Disinfection of the effluent to be continuous throughout the year, however, for compliance purposes, the *Geometric Mean Density* shall be calculated such that the annual *Geometric Mean Density* of *E. Coli* does not exceed Column 2 of Table 3 above.

Effluent Loading Limits

- The *Owner* shall design and construct the proposed Works and operate and maintain the *Works* such that the concentrations of the materials named below as effluent parameters are not exceeded in the effluent being discharged from the *Works*.

Table 4 – Effluent Loading Limits

Effluent Parameter	**Concentration Loading Limit** (kg/day unless otherwise indicated)
cB0D5	1.8
Total Suspended Solids	1.8
Total Phosphorus	0.12
Total Ammonia Nitrogen	0.6

Monitoring & Recording

The *Owner* shall, upon commencement of operation of the *Works*, carry out the following monitoring program:

1) All samples and measurements taken for the purposes of this *Approval* are to be taken at a time and in a location characteristic of the quality and quantity of the effluent stream over the time period being monitored.

- For the purposes of this condition, bi-weekly means once every <u>two</u> weeks.

- Samples shall be collected at the locations and frequencies as specified below, by means of the specified sample type and analyzed for each parameter listed and all results recorded:

Raw Sewage Monitoring

Sampling Location:	Trash Tank
Sampling Type:	Grab
Sampling Frequency:	Bi-Weekly
Sampling Parameters:	BOD_5, Total Suspended Solids, Total Kjeldahl Nitrogen (TKN), Total Phosphorus, Temperature, pH, and Alkalinity

Effluent Monitoring

Sampling Location:	Above Ground Control Building/Pump Station
Sampling Type:	Grab
Sampling Frequency:	Bi-Weekly
Sampling Parameters:	$cBOD_5$, Total Suspended Solids, Total Ammonia Nitrogen, Total Phosphorus, *E. Coli*, Temperature, pH, and Alkalinity

Ministry of the Environment, Conservation and Parks (MECP) Pre-Consultation
A pre-consultation meeting with the MECP was conducted on August 9, 2016 at the Guelph District Office to review the proposed sewage treatment and disposal options for the re-development.

In addition to the pre-consultation meeting noted above, a conference call with the MECP was undertaken on April 4, 2017 to further investigate/discuss the proposed Work Plan for the Assimilative Capacity Study which was being completed at the time by Hutchison Environmental Sciences Ltd (dated September 20, 2016) in support of the proposed sewage treatment systems surface disposal to the Pine River.

Refer to **Appendix G** for the aforementioned correspondence with the MECP as well as a copy of their comments related to the ACS works received on July 14, 2017 and their final approval of the ACS received on January 31, 2019.

3.0 Water Servicing

3.1 General

There are no municipal water services within the subject area. As a result, the two (2) existing drilled wells (PW1 and PW2) as well as two (2) additional wells (PW3 and PW4) will ultimately be utilized to supply the necessary domestic water for the proposed re-development of the MSC. Based on the MECP's classification provided under the Drinking-Water Systems (DWS) Regulation (O. Reg. 170/03) mandated under the Safe Drinking Water Act (SDWA), the existing and proposed DWS's are classified as a "Small Non-Municipal Non-Residential" system and a "Non-Municipal Year Round Residential" system respectively. The proposed re-developments drinking water system will ultimately be detailed in an Engineers Evaluation Report (EER) upon the completion of construction of the system as regulated under O. Reg. 170/03 Schedule 21. The supply and distribution system external to the proposed water treatment system are detailed in the following sections of this report.

3.2 Existing Water Supply

The MSC operates seasonally, typically between late December and early April. The MSC monitors and records during times of operation, the water consumption for each of its sources of water that service the existing Main Chalet which also feeds 3 other standalone structures (i.e. Administration Building, GM Office and Ski House). The MSC primary domestic water supply was previously a 150mm diameter drilled well located just west of the southwest corner of Block 2. The drilled well consists of highly mineralized water quality (poor) and a low yield of approximately 27.3L/min. One other source of potable water which was rarely used, was an existing bored well located just northeast of the Main Chalet building on the Chalet Run ski slope. The bored well consisted of good quality water but was low yielding (4.5-9L/min). Lastly, the remaining water source which was previously used to supply all existing water closets and urinals (non-potable) within the Main Chalet, was the Pine River located immediately northeast of the MSC.

As per the recommendations outlined within the Hydrogeology and Test Drilling Report dated June 2016 and its addendum dated May 2, 2019 both prepared by Morrison Environmental Limited (under separate cover), the existing dug well has since been decommissioned in accordance with the Ontario Regulation 903. Based on our understanding and discussions with MSC staff, the existing drilled well adjacent to Block 2 has been disconnected from existing water system and will be decommissioned during Phase 1C.

Since May of 2016 a 150mm diameter drilled well referred to as PW2 has serviced the Administration Building, GM Office and Ski House, as well as the Main Chalet which feeds each of the aforementioned buildings. Well PW2 is located immediately east of the MSC property entrance off of the 17th Sideroad. An additional 150mm diameter well (PW1) was also installed at the same time and in the general vicinity of PW2 but this well has not been connected to the existing water system to date.

From PW2 the water is currently supplied to an existing 2500gal holding tank buried immediately north of the Main Chalet via a Gould’s 13GS10 well pump and existing 38mm water line. From the holding tank an existing Gould’s 65GS30 submersible pump complete with a constant pressure controller supplies raw water to the existing mechanical room within the Main Chalet. From the Main Chalet the water supply is both treated and distributed internally as well as externally to the other existing buildings on-site.

Refer to the documents noted above for detailed information related to the existing wells/water supply for the subject site.

3.3 Proposed Water Supply

Due to the low yields of the original drilled and dug wells located on-site, two new drilled wells consisting of 150mmø (6 inch nominal) casings, have been extended to a depth of 13.1m and are located at the northeast corner of MSC property immediately east of the property entrance off of the 17th Sideroad. PW1 is located closest to the 17th Sideroad with PW2 53.4m directly south of PW1. The new test wells are located at the base of the escarpment approximately 650m north of the proposed re-development area. Refer to the Proposed Snow Making Pond & Well Location Plan (**SMPLP**) for the well locations.

Based on discussions with Morrison Environmental Limited, a total of four (4) individual drilled wells each capable of yielding 20igpm (91L/min), as per the existing two (2) drilled wells (PW1 and PW2) pump test results, are proposed to adequately service the re-development at the MSC. As per MECP requirements, the four (4) wells will be capable of supplying the re-developments full build-out condition Maximum Day Demand (MDD) of 369,509L/day (256.6L/min).

Two (2) of the drilled wells (PW1 and PW3) will alternate duty once PW3 is constructed. Assuming PW3 will have a similar yield as PW1, a Gould's 13GS10 well pump will supply water from each well individually via an existing 38mm water line to the existing 2500gal holding tank buried immediately north of the Main Chalet. Based on the pump test for PW1 and the existing well pump and system-head curve, 16USGPM will be supplied from PW1 to the existing holding tank. Similarly, the other two (2) drilled wells (PW2 and PW4) will alternate duty and supply water via a proposed 50mm water line to the existing 2500gal holding tank. Based on the pump test for PW2 and the proposed well pump and system-head curve, 29USGPM will be supplied from PW2 to the existing holding tank using a Gould's 25GS20 well pump. A total of 45USGPM can be supplied to the holding tank when both water lines are running. This is consistent with the 24/7 combined pump test for PW1 and PW2 which was completed by Morrison Environmental Limited (37.4IGPM or 45USGPM). This well pump setup will provide contingency by limiting the loading on each of the wells and their respective pumping/supply infrastructure.

From the existing 2500gal holding tank raw water will be supplied via an existing Gould's 65GS30 submersible pump complete with a constant pressure controller to the proposed water treatment system located within the basement of the Main Chalets proposed addition. An additional and identical pump will be installed within the existing holding tank for contingency purposes.

The proposed mechanical room located within the basement of the Main Chalet's addition will house all of the necessary equipment to provide both primary and secondary disinfection of the raw water prior to pumping it through the proposed potable water distribution system. The water treatment system will consist of a treatment skid complete with filtration and UV treatment, an Ozone skid, water softening equipment, Day Tanks connected in series and a booster skid.

Considering that the proposed water treatment system has a rated capacity of 40USGPM (151.2L/min), treated water will be stored in Day Tanks in order to accommodate the MDD and PHD conditions. In the full build-out condition of the re-development, the PHD is 397.8L/min which requires 14,797L of Day Tank storage ((397.8L/min – 151.2L/min) x 60min) and the MDD is 256.6L/min which requires 151,781L of Day Tank storage ((256.6L/min – 151.2L/min) x 1440min). To accommodate the governing volume of 151,781L, five (5) 7300IG (33,142L) Day Tanks connected in series have been accounted for within the mechanical room space requirements. Considering that the re-development is proposed to be constructed in phases, initially two (2) 7300IG (33,142L) Day Tanks connected in series are proposed. Water usage will be monitored and as demand increase, additional Day Tank storage will be incorporated into the mechanical room accordingly. This approach will allow actual demand to drive any necessary additional storage costs rather than theoretical demand.

The proposed booster skid will consist of 3 pumps designed in a lead/lag/standby configuration. Each pump is designed for 70USGPM (264.6L/min) at 95psi. Therefore, the system is capable of providing a maximum flow of 140 USGPM (529.2L/min) when the two pumps are running in parallel (lead/lag configuration). The booster skid will be set and controlled to maintain the necessary maximum and minimum flows/pressures within the 100mm diameter domestic water distribution system.

As previously noted, upon completion of construction of the water treatment system an Engineers Evaluation Report will be prepared and submitted to the MECP to confirm the DWS's compliance with O. Reg. 170/03.

3.4 Design

Based on the Ministry of the Environment, Conservation and Parks (MECP) Design Guidelines dated 2008 and Tables 8.2.1.3.A. and 8.2.1.3.B. of the 2012 Ontario Building Code (OBC), the total daily domestic water supply flow rates were calculated for each of the buildings proposed within the re-development. The Average Daily Demand (ADD) for the re-development was determined to be 118,950L/day (82.6L/min), the Maximum Daily Demand (MDD) was determined to be 369,509L/day (256.6L/min) and the Peak Hourly Demand (PHD) was determined to be 572,852L/day (397.8L/min).

The Water Supply Design Calculations are provided in **Appendix B** for reference. Refer to the General Servicing Plan North (**GENN**), Water Treatment Facility Plan (**WF**), Site Servicing Outlet Plan (**SSOP**) and the Proposed Snow Making Pond & Well Location Plan (**SMPLP**) for additional details.

3.5 Fire Protection

As a result of the sites absence of an accessible municipal water supply for fire protection and based on Subsections 3.2.5.7. and A-3.2.5.7. of the 2012 Ontario Building Code (OBC), Division B, Part 3, the proposed re-development is required to provide on-site Fire Protection Water Storage. Each of the existing and proposed buildings were analysed individually to determine an associated fire protection water storage volume and flow rate based on the guidelines listed above.

The largest of the proposed buildings (Building ‘B’) governed the fire storage volume requirement with a total volume of 162,162L. Based on Table 2 provided in the OBC A.3.2.5.7., the required minimum water supply flow rate is 5400L/min and is to be provided within an unobstructed distance of 90m from the nearest hydrant to the buildings main entrance. Considering the total storage volume of 162,162L and the minimum water supply flow rate of 5400L/min, the minimum 30-minute duration can be provided as required by the OBC.

In order to provide the necessary fire protection water storage on-site, four (4) 50,000L concrete water storage tanks (or approved equivalent) are proposed. In an effort to reduce the potential for stagnation and the associated water quality impacts associated with an oversized domestic water distribution system, as well as to eliminate the need for standby power, the fire supply system is proposed to be a standalone system pressurized via static head/elevation. The fire storage tanks are proposed west of the re-development area, up the ski hill at a minimum ground grade of 342.50m. Based on the elevated 200,000L of fire storage water and the proposed 250mmø and 150mmø fire supply mains complete with four (4) proposed fire hydrants, the required flow rates will be provided within the required distance of each building at the minimum allowable pressure of 20psi. A proposed connection to the snow making supply line in the vicinity of the storage tanks will be used to fill the tanks with water from the proposed snow making pond when necessary. A low level alarm will be installed to ensure that the tanks stay full at all times.

The Water Supply Design Calculations and Fire Protection Water Storage Design Calculations are provided in **Appendix B**. Refer to the General Servicing Plan North (**GENN**) and Fire Water Storage Plan (**FWS**) for additional details.

3.6 Temporary Water Servicing for Phase 1A (Block 1)

As noted above, the proposed re-development has been broken up into construction phases. Phase 1A consists of the construction of Block 1 which is a 12 unit Townhouse complete with 2 bedrooms per unit resulting in an average day demand (ADD) of 13,200L/day based on 275L/cap/day. The average day demand (ADD) for the existing condition at the MSC which was confirmed to be 13,800L/day based on 2019-2020 ski season water meter reading records resulting in an interim condition total ADD of 27,000L/day.

Based on the existing well pump (PW2) and supply line configuration, 16USGPM (60.5L/min) is able to be supplied to the existing 2500gal (9450L) holding tank providing sufficient flow to accommodate the MDD for Phase 1A (49.5L/min). The existing holding tank and Gould's 65GS30 pump located within it will sufficiently accommodate a PHD condition.

To service Block 1 with water in Phase 1A, a 50mmø water service will be extended from the Main Chalet's water system to the northeast corner of Block 1. To avoid further servicing conflicts in this area during future phases of construction, the existing water service to the Ski House will be connected into the proposed Phase 1A 50mmø water service immediately north of Block 1. When the complete water distribution system in constructed during future phases, the section of the proposed 50mmø water service closest to the Main Chalet will be removed both ends of the Phase 1A 50mmø watermain will be extended and connected into the proposed 100mmø watermain for looping purposes.

Primary disinfection of the water supply for Block 1 will be provided within the Main Chalet via the existing water treatment system. The water service for Block 1 will need to be internally distributed within the building to each of the 12 units from the single 50mmø water service connection. A mechanical room/space within Block 1 at the water services entrance into the building will be required to facilitate the installation of a UV unit (NSF 55 standard) for secondary treatment purposes. Ultimately when the complete water treatment and distribution system is in place, the UV system within Block 1 can be removed if necessary.

Refer to the General Servicing Plan North (**GENN**) for additional details.

4.0 Stormwater Management

4.1 Design Criteria Guidelines

The stormwater management features that have been designed for this site include grass filter strips, enhanced grass swales (Low Impact Development (LID) controls), storm sewer, and a dry detention basin which will form an integrated treatment train approach for providing both stormwater quality and quantity control.

The stormwater management design for the site will incorporate the policies and criteria of a number of agencies, including the Ministry of the Environment, Conservation and Parks (MECP), Nottawasaga Valley Conservation Authority (NVCA) and the Township of Mulmur (Township). Considering the size and type of re-development proposed and the desire to provide both water balance and stormwater quality control for the site runoff, additional design guidance has been provided based on the Low Impact Development Stormwater Management Planning & Design Guide (LID Manual) prepared by the Credit Valley Conservation (CVC) and the Toronto and Region Conservation Authority (TRCA), Version 1.0, dated 2010. The above noted agencies stormwater design criteria for the proposed re-development are summarized below:

- Stormwater quality controls will be provided based on the guidelines described in the Ministry of the Environment, Stormwater Management Planning and Design Manual dated March 2003 and the LID Manual. Following the MOE and LID Guidelines noted above, the stormwater management design utilized for the site will provide water quality control at an Enhanced Level of Protection (minimum of 80% Total Suspended Solids removal efficiency). NVCA Guidelines will be used as a reference for the design of the stormwater management system.
- The Ontario Ministry of Transportation (MTO) rainfall intensity-duration-frequency (IDF) curve lookup tool was used to confirm the rainfall IDF data for the site which was ultimately utilized to determine the peak flow rates and runoff volumes generated both on and off-site (external drainage area).
- Stormwater quality control will be provided via the use of enhanced grass swales complete with grass filter strips upstream for pre-treatment as well as a dry detention basin located downstream. Additionally, the storm sewer's inlet structures will have deep sumps that will allow sedimentation of particulates upstream of the dry detention basin. The proposed treatment train approach is premised on the stormwater being both filtrated as well as infiltrated into the in-situ soils where possible.
- Stormwater quantity control will be provided via the use of a dry detention basin to attenuate the post-development peak flows for each of the analyzed design storm events to their respective pre-development target rates, including extended detention of the 25mm runoff volume.

- Erosion and sediment control shall be provided during the construction phase and until the site is fully stabilized.

4.2 Pre-Development Condition

4.2.1. General

The subject lands (site/re-development area) for all intents and purposes of this stormwater management report has been considered as the 3.86ha area comprised of the MSC's existing infrastructure (Main Chalet, Administration Building, Ski House and GM Office building) and the gravel parking lot.

The majority of the site is considered to be gravel and unimproved lands consisting of small trees and shrubs along with heavy grass cover. Runoff from the majority of the site (south portion, PRE1 drainage area) is considered to concentrate via overland flow at the predominant drainage feature located at the southeast corner of the site. The aforementioned drainage feature is an existing swale traversing the adjacent lands to the east of the site which outlets at an existing 800mmø CSP cross culvert located under the 15th Sideroad. The runoff from the residual site area (north portion, PRE2 drainage area) is considered to also concrete via overland flow at the northeast corner of the subject lands. The topography of the subject lands can be described as having a moderate slope, with an average grade in the range of approximately 5.6% and 9.3% in a west to east direction for the PRE1 and PRE2 areas respectively.

Refer to the Pre-Development Drainage Plan, **FIG 2** provided in **Appendix A** for additional details.

4.2.2. External Drainage

The subject lands are considered to be self-contained with no external drainage contributing runoff as a result of the existing ditch and culvert by-pass system presently in-place along the west and southern limits of the site. All external drainage is captured and conveyed via an existing network of swales located along the west property boundary. Immediately west of the southwest corner of the existing Administration Building, an inlet structure and pipe system are used to capture the runoff generated by a localized section of the existing Kids Ski Run. The drainage pipe then discharges into an existing ditch which runs north to south along the west limit of the gravel parking lot. The existing ditch intercepts all external runoff directed to the west limit of the subject lands. At the southwest corner of the site, both the runoff from the north side of the 15th Sideroad municipal right-of-way as well as the discharge from the adjacent detention basin located immediately west of the subject lands, is conveyed via existing swales to the aforementioned perimeter ditch located on-site. At the southwest limit of the site the converged swale network discharges into an existing CSP culvert which traverses the gravel parking lot in a west to east direction. Lastly, from the east limit of the site at the outlet of the existing CSP culvert, the external runoff is discharged into an existing swale and is conveyed along with the site runoff, across the neighbouring property, east to an 800mmø CSP cross culvert located under the 15th Sideroad. From the 15th Sideroad cross culvert the runoff is conveyed downstream through a series of grass covered road side ditches, swales as well as two existing dry ponds/basins prior to reaching the ultimate receiver, the Pine River which is located approximately 1050m downstream of the site.

Refer to the Downstream Drainage Outlet Plan, **FIG 5** provided in **Appendix A** for additional details.

The external drainage area is bound to the south by the 15th Sideroad, to the west by top of the escarpment and to the north by a natural split in the existing topography. The topographic relief over the 11.71ha external drainage area is approximately 80m which falls in a west-east direction towards the site. The external drainage area consists of a portion of the estate lot subdivision (Lloyd's Traverse Crescent) located at the top of the escarpment, a portion of the 15th Sideroad and 5th Line right-of-way's, as well as some pasture, treed and unimproved lands. The majority of the external runoff is captured by the existing dry pond/basin located immediately west of the southwest corner of the subject lands where the runoff is attenuated prior to being released to the site. The hydrologic modelling and stormwater management design provided herein has conservatively not accounted for the peak flow attenuation/storage provided upstream of the site within the existing dry pond/basin.

Refer to the External Drainage Plan, **FIG 4** provided in **Appendix A** for additional details.

4.2.3. Soil Conditions

According to the Soils Map of Dufferin County, Ontario, Soil Survey Report No. 38 prepared for the Department of Agriculture, the site and external drainage areas consist of Dunedin clay which is described as having good drainage characteristics. Dunedin clay belongs to Hydrologic Soil Group 'D'.

The Runoff Coefficients and Curve Numbers associated with the site and external drainage area were computed by calculating weighted values based on corresponding land uses and soil type. The Hydrologic Soil Group was determined in accordance with the Ontario Ministry of Transportation (MTO) Soil Classification System. It should be noted that, in an effort to be conservative the peak flows and runoff volumes calculated for the site are based on the native soils (Dunedin Clay) although it is assumed that the majority of the site area is comprised of fill material having improved drainage characteristics over the native clay soils.

A Geotechnical Investigation conducted in May 2018 by Shad & Associates Inc. (Preliminary Geotechnical Investigation June 21, 2018) consisting of the drilling and sampling of eight (8) boreholes as well as their further sample analyses completed to further define the existing site soil conditions. A supplementary letter provided by Shad & Associates dated March 20, 2020 was provided to support the construction of the fire route. Lastly, an Addendum to the Geotechnical Investigation (Shad & Associates, April 22, 2020) was also provided to support the construction of the asphalt areas, dry detention basin, site services, snow making pond, etc.

Refer to **Appendix H** for each of the documents referenced above.

4.3 Post-Development Conditions

4.3.1. General

The proposed site works include the renovation of the existing Administration Building into Office and Personal Business space at ground level and 15 residential units/lofts on the second level (Building 'B', 652m^2 existing ground floor + 128m^2 proposed ground floor = 780m^2 total), a new building consists of Office and Personal Business space at ground level and 10 residential units/lofts on the second level (Building 'A', 630m^2 ground floor + 252m^2 mezzanine = 882m^2 total) and 6 separate stacked Townhouse buildings totaling 66 residential units. The existing gravel parking lot is proposed to be expanded but will remain surfaced with gravel with the exception of a section located adjacent to the existing Main Chalet building which is proposed as interlocking paver stone and the main drive aisle around Building 'A' which is proposed to be asphalt. The runoff generated from the site area will be directed west to east across the subject lands as in the existing condition.

Refer to **FIG 3** in **Appendix A** for the Post-Development Drainage Plan and the stormwater management design calculations provided in **Appendix C** for additional details.

4.3.2. Post-Development Drainage

Post-development drainage patterns on-site will be generally consistent with that of the existing condition.

The proposed re-development will consist of overland sheet flow drainage as in the existing condition and will concentrate at the northeast and southeast corners of the subject lands similar to the existing condition. Although the proposed parking lot surface will remain as gravel, as per the NVCA design standards this area has been conservatively considered as asphalt (impervious surface) in the post-development condition hydrologic modelling and associated design calculations.

Due to the lack of a sufficient drainage outlet at the northeast corner of the site and in an effort to mitigate any adverse impacts the proposed re-development may have on the adjacent lands to the northeast of the site (down gradient along the escarpment), the site has been graded such that the drainage area directed to the northeast corner has been reduced in magnitude relative to that of the pre-development condition thereby resulting in reduced peak flows and runoff volumes released off-site in the post-development condition. The post-development drainage area directed to the northeast corner of the site will be reduced from 1.40ha (PRE2) to 0.89ha (POST2) and will be graded such that flows are in the form of overland sheet flow leaving the site rather than concentrated flow in order to resemble that of the existing condition.

The residual site area (2.74ha, POST1) will be directed to the southeast corner of the site via a combination of both storm sewer and overland sheet flow over a series of grassed filter strips, and an enhanced grass swale prior to discharging into a proposed dry detention basin. The proposed dry detention basin will be used to attenuate the post-development peak flows to the corresponding pre-development target rates (or less) for each of the 2-100 year design storm events. Each of the aforementioned stormwater management features will be used as part of a treatment train approach for the purposes of providing stormwater quality control for the contributing drainage area at an Enhanced Level of Protection (80% Total Suspended Solids Removal Efficiency), phosphorus reduction benefits and at source groundwater recharge (water balance) benefits.

External drainage patterns on-site will be generally consistent with that of the existing condition. A proposed ‘cut-off’ (grass) swale will be constructed along the west and southwest limits of the site to capture and convey the external runoff to a proposed ditch inlet catchbasin (DICB) which will ultimately convey the runoff through the proposed storm sewer system into the dry detention basin. In the event of a storm that generates a peak flow greater than the storm sewer capacity (25-year or less frequent storm event), the excess runoff will spill onto the parking lot to the north and will be conveyed overland to the proposed (south) enhanced grass swale along the eastern property line and ultimately into the proposed dry detention basin.

The attenuated peak flows from the dry detention basin will discharge to the existing drainage feature located immediately east of the basin which will ultimately convey all site and external runoff downstream to the existing 800mmø CSP cross culvert located under the 15th Sideroad. The proposed drainage patterns described above are consistent with the existing condition.

4.3.3. Rainfall Data

The 6, 12 and 24-hour SCS Type-II and the 4-hour Chicago Storm rainfall distributions were used for the 1:2, 1:5, 1:25 and 1:100 year design storm event hydrologic modelling. The SCS and Chicago storms were developed from the recorded rainfall data obtained from the MTO IDF Curve Lookup website.

4.4 Pre-Development Condition Modelling Results

Using the site and external drainage areas as illustrated on **FIG 2** and **FIG 4** and the program SWMHYMO, the total flows were determined for the 2-year, 5-year, 25-year and 100-year design storm events. These flows are summarized in **Tables 1a** and **1b** below. The hydrologic model runs for the pre-development 6-hour, 12-hour and 24-hour SCS Type-II and 4-hour Chicago storm distributions can be found in **Appendix D**.

Table 1a: Pre-Development Peak Flows – Site

Catchment	Area (ha)	Pre-Development Peak Flows (m^3/s) (24-hour SCS Type-II Storm Distribution)			
		2-yr	5-yr	25-yr	100-yr
PRE1	2.46	0.154	0.261	0.446	0.598
PRE2	1.40	0.100	0.165	0.280	0.373
EXT	11.71	0.592	0.948	1.529	2.025

Due to the more conservative values calculated for the peak flows, the design of all conveyance features (i.e. by-pass swale and storm sewer from it to the basin) were based on the 24-hour SCS Type-II storm distribution.

Table 1b: Pre-Development Peak Flow Target Rates – PRE1 & EXT Combined

Catchment PRE1 + EXT	Area (ha)	Pre-Development Peak Flows (m^3/s) (24-hour SCS Type-II Storm Distribution) (Post-Development Dry Detention Basin Target Rates)			
		2-yr	5-yr	25-yr	100-yr
TOTAL	14.17	0.743	1.192	1.914	2.537

In the post-development condition, catchments POST1 & EXT will both be routed through the stormwater management facility. To determine the pre-development target rates for these catchments, the combined peak flows for catchments PRE1 & EXT were modelled.

4.5 Post-Development Condition Modelling Results

The post-development peak flows are summarized in **Tables 2a** and **b** below.

Table 2a: Post-Development Uncontrolled Peak Flows - Site

Catchment	Area (ha)	Post-Development Peak Flows (m^3/s) (24-hour SCS Type-II Storm Distribution)			
		2-yr	5-yr	25-yr	100-yr
POST1	2.74	0.378	0.526	0.760	0.949
POST2	0.89	0.073	0.116	0.192	0.251
EXT	11.94	0.604	0.966	1.559	2.065

Table 2b: Post-Development Uncontrolled Peak Flows – POST1 & EXT Combined

Catchment POST1 + EXT	Area (ha)	Post-Development Peak Flows (m^3/s) (24-hour SCS Type-II Storm Distribution)			
		2-yr	5-yr	25-yr	100-yr
TOTAL	14.68	0.861	1.315	2.015	2.628

By comparing **Tables 1a and Table 1b** with **Table 2a and Table 2b respectively**, it is evident that the total uncontrolled post-development peak flows for the POST1 drainage area exceeds the pre-development targets (PRE1) and thus peak flow attenuation is required before releasing the site's runoff to the existing swale located east of the site. The proposed dry detention basin will be designed to incorporate the necessary quantity control for the runoff generated on-site.

Due to the reduced drainage area of the POST2 catchment relative to the PRE2 catchment, the corresponding post-development peak flows as well as runoff volumes, do not exceed the pre-development target values and as a result no stormwater attenuation is proposed within the POST2 catchment. Refer to **Table 3b** below for additional information. The absence of any stormwater management feature/facility aids in maintaining the overall drainage in the form of overland sheet flow similar to that of the existing condition. Considering the absence of a sufficient drainage outlet at the northeast corner of the site and the presence of the existing development downstream, it is was determined that reducing the overall peak flows and volumes as well as maintaining overland sheet flow drainage from this area of the site would be the preferred design approach.

4.6 Stormwater Quantity Control

A comparison between the 6-hour, 12-hour and 24-hour SCS Type-II and 4-hour Chicago storm distributions was completed to determine which storm distribution would be used for sizing the proposed stormwater management facility (dry detention basin). The design storms based on the 24-hour SCS Type-II storm distribution required greater storage volumes than the same design storms based on the other three (3) storm distributions when modelled using SWMHYMO. Therefore, the 24-hour SCS Type-II storm distribution was used to size the proposed stormwater management facility (dry detention basin).

Table 3a below summarizes the storage-storage-discharge characteristics for the dry detention basin and the corresponding uncontrolled and controlled post-development peak flows and pre-development target rates.

Table 3a: SWM Facility Characteristics

Storm Event (Year)	Area (ha)	Basin Inflow Post-Development Uncontrolled Peak Flow (m^3/s) (per Table 2b)	Basin Outflow Post-Development Controlled Peak Flow (m^3/s)	Storage Provided (m^3)	Estimated Water Levels (m)
2	14.68	0.861	0.709	741.9	296.12
5		1.315	1.120	921.8	296.32
25		2.015	1.784	1158.0	296.56
100		2.628	2.275	1364.0	296.61

Table 3b below summarizes the pre- and post-development peak flows and runoff volumes generated by the uncontrolled northeast portion of the re-development (Catchments PRE2 and POST2).

Table 3b: Uncontrolled Catchments (PRE2 & POST2)

Storm Event (Year)	Area (ha)	Pre-Development Uncontrolled Peak Flow (m^3/s) (per Table 1a)	Pre-Development Runoff Volume (m^3)	Post-Development Uncontrolled Peak Flow (m^3/s) (per Table 2a)	Post-Development Runoff Volume (m^3)
2	1.40 (PRE2) 0.89 (POST2)	0.100	354	0.073	266
5		0.165	550	0.116	396
25		0.280	868	0.192	605
100		0.373	1142	0.251	783

The erosion control volume (25mm runoff volume of 442.9m^3) can easily be accommodated within the basin. The 24-hour draw down of the 25mm runoff volume was targeted, but could not be achieved even using the MOE's minimum orifice size (75mmø). The drawdown time using a 75mmø orifice is 13.6 hours. As recommended in the MOE SWM Manual (2003), since the minimum orifice size will be used, a draw down time >12hrs is considered acceptable.

Refer to **Section 4.8** for the Dry Detention Basin Details.

4.7 Stormwater Quality Control

The stormwater management requirements for this site were determined based on the NVCA Design Guidelines. The appropriate level of quality control was determined to be an 'Enhanced' Level of Protection as defined by the MOE's Stormwater Management Planning & Design Manual (2003), which equates to the provision of 80% total suspended solids (TSS) removal efficiency.

In determining the stormwater management practices to implement for the proposed re-development, various methods were considered. During the review, the main factors considered were as follows:

- Existing land characteristics and uses (soils, topography, location, etc.);
- Local requirements and maintenance considerations with regard to quality control;
- Facility feasibility & proximity to a suitable stormwater outlet and the receiving watercourse (Pine River).
- Utilizing an 'integrated treatment train' approach to treat stormwater runoff;
- Ability to utilize landscaped areas and providing water balance and nutrient uptake benefits;

Based on the above noted factors, the application of a low impact enhanced grass swales complete with upstream grass filter strips (buffers) and a downstream dry detention basin, has been chosen as the preferred means of providing a complete treatment train approach for the treatment of contaminated stormwater runoff generated on-site.

Long shallow sloped enhanced grass swales are proposed to capture and convey all stormwater runoff prior to reaching the dry detention basin. Enhanced grass swales are considered advantageous as they can be integrated into the various landscape features proposed throughout the site. From a performance perspective they are beneficial in that they can function adequately when graded into areas of varying slope and will provide exceptional capture due to the longitudinal dimension and location of the swales with respect to the overland runoff's perpendicular direction of flow. The design of the enhanced grass swales is highly conducive to providing optimal capture of the site's stormwater runoff while facilitating a reduction in flow velocity as the runoff is conveyed downstream towards the proposed dry detention basin, and ultimately the site outlet. The enhanced grass swales will provide additional pre-treatment of the stormwater by means of vegetative filtration, infiltration, nutrient uptake and evapotranspiration.

The enhanced grass swales are proposed to be integrated into the site's landscaped area located at the eastern limit of the site's parking area. The enhanced grass swales will run parallel to the parking area boundary, capturing all contaminated runoff from the re-development. Based upon guidance from the LID Manual, the enhanced grass swales will consist of a 0.75 bottom width (minimum), 3:1 (H:V) side slopes, longitudinal slopes 1.0% or less, and flow velocities less than 0.5m/s during a 25mm design storm event. The site grading is such that runoff from all impervious area not captured by the storm sewer is directed to the enhanced grass swales before entering the dry detention basin.

Based on the information provided in the LID Guide, the median TSS removal rate for an enhanced grass swale is considered to be 76%. Considering the dry detention basins design is functionally similar to an enhanced grass swale, it has also been considered to have a median TSS removal rate of 76%. Based on the proposed treatment train which consists of a storm sewer with deep sumps/grass filter strips for pre-treatment in conjunction with the enhanced grass swales and dry detention basin, a minimum of 80% Total Suspended Solids (TSS) removal efficiency is considered to be achievable on-site.

With respect to overall water balance for the subject lands, the proposed SWM design is considered to have made every feasible effort to maintain the pre-development infiltration and evapo-transpiration rates. All proposed pervious surfaces have been kept to a maximum with respect to overall magnitude and are proposed to be landscaped as per the Landscape Plans (provided by others). The presence of the proposed grass filter strips, enhanced grass swales and the dry detention basin will inherently provide extended opportunity for nutrient uptake and evapotranspiration through the vegetative cover and extended detention (ponding) storage, prior to the site's stormwater runoff being released off-site.

Refer to the Site Grading Plan North (**SGRN**), Site Grading Plan South (**SGRS**), Site Servicing Plan North (**GENN**), Site Servicing Plan South (**GENS**) and the Stormwater Management Facility Plan (**SWM**) for additional details.

4.8 Total Phosphorus Removal Initiatives

Phosphorus removal initiatives are also proposed for the subject site, in accordance with the requirements of the NVCA.

Each of the on-site stormwater management features noted above will retain pollutants and nutrients (such as phosphorus). The proposed Best Management Practices (BMPs) have been designed as a treatment train to provide filtration, evapotranspiration, infiltration, and nutrient uptake.

Each proposed BMP (i.e. grass filter strips, enhanced grass swales and the dry detention basin) have been designed based on the runoff volume generated by a 25mm rainfall event. Considering this, the “first flush” of any rainfall event, which consists of the vast majority of pollutants and contaminants including phosphorus, will be captured, conveyed and retained on-site prior to be discharged downstream.

Using the NVCA PLDv2 Tool, the proposed re-development and associated stormwater management BMPs were modelled to determine the total post-development phosphorus export from the site. Based on the calculations, the total pre-development phosphorus export from the site is **0.81kg/yr**, and the total post-development phosphorus export from the site is **0.85kg/yr** with the proposed BMPs. Based on the above, the increase in phosphorus loading in the post-development condition through the implementation of the proposed BMPs is considered negligible relative to the pre-development condition.

For supporting calculations, refer to the NVCA PLDv2 Tool output summary located in **Appendix B**.

4.9 Dry Detention Basin Details

Details of the proposed Dry Detention Basin are summarized below:

- The proposed dry detention basin is designed to attenuate the stormwater runoff generated by the majority of the re-development (POST1 catchment) prior to releasing it off-site. Quantity control will be provided to attenuate each of the 2-100 year design storm post-development peak flows to the corresponding pre-development target rates. The first flush (25mm design storm runoff volume (erosion control volume)) of 442.9m^3 will be drawn down through a 75mmø orifice over a period of 13.6 hours which is consistent with the allowable 12 hour minimum for the minimum orifice size as specified in the MOE guidelines. This form of stormwater attenuation will provide inherent water balance benefits through both infiltration and evapotranspiration, suspended solids removal capabilities, and nutrient uptake through the vegetation provided within the basin.
- The proposed dry detention basin will include both an overland inlet swale located at the northeast limit of the basin and a piped inlet at the northwest limit of the basin. The proposed piped inlet will convey all design storm peak flows up to and including the 5-year design storm from the POST1 catchment area, as well as peak flows up to and including the 25-year design storm from the external lands located west of the site (EXT catchment area). The proposed overland inlet will convey all remaining design storm peak flows up to and including the 100-year design storm

from both the POST1 & EXT catchment area into the dry detention basin. Both the basin's inlets will be lined with filter cloth and rip-rap for erosion protection and are located as far away as possible from the basin's outlet structure to prevent short circuiting of the runoff through the dry detention basin.

- The dry detention basin will be constructed with a sediment forebay that will aid in the pre-treatment of stormwater as it enters the basin as well as concentrate the majority of basin maintenance to this area. Peak flow velocities will be reduced within the forebay promoting sedimentation prior to entering the main cell. The forebay will also inherently provide infiltration benefits.
- The dry detention basin has been designed to have 4:1 (H:V) side slopes, a maximum depth of 2.55m, a large flat base area of 121m^2, and a total storage capacity of 1772.5m^3.
- A 3.0m wide Maintenance Access will be constructed around the majority of the basin providing opportunity for vehicular access to the basin and its outlet structures. The Maintenance Access will begin at the proposed parking area north of the basin and extend around the western & southern perimeter of the basin terminating at the Overflow Spillway Weir.
- The basin's outlet structure will consist of a combination of an orifice plate and rectangular/triangular weir configured into a 600mm x 1200mm ditch inlet catchbasin (DICB) located at the basin's southeast limit. The 25mm design storm runoff volume will enter the outlet structure through and be attenuated by a 75mmø orifice plate (Invert Elevation = 294.35m) located within the DICB via a 150mmø a hickenbottom perforated pipe connection from the base of the basin. This extended detention volume (442.9m^3) will draw down over a period of 13.6hrs. In conjunction with the proposed orifice plate, a sharp-crested rectangular weir (0.9m wide, weir crest elevation = 295.55) cut into the face of DICB outlet structure, in combination with the sloped portion of the DICB (which will function as a triangular-shaped weir with 2:1 side slopes) is proposed to attenuate the peak flows of the remaining storm events within the dry detention basin. This outlet structure configuration will provide sufficient stormwater attenuation within the dry detention basin to control the post-development peak flows to the corresponding pre-development target rates for each of the 2-100 year design storm events. A proposed 900mmø outlet pipe from the control structure (DICB) will convey all of the 2-100 year design storm events to the existing site outlet.
- In the event of a partial blockage in the outlet structure or during a storm event less frequent than the 100-year design storm, the proposed Overflow Spillway Weir (broad-crested weir) will safely convey the flows to the existing site outlet. The Overflow Spillway Weir will be trapezoidal in shape, have a 4.0m bottom width and 10:1 side slopes. The Overflow Spillway weir will be lined with Turfstone Pavers to armour the weir against erosion and allow vehicular access over the weir if necessary. An Overflow Spillway will be constructed from the Overflow Spillway Weir to the site outlet at the eastern property line. The Overflow Spillway is sized to convey flows from the Overflow Spillway Weir (peak flows less frequent than the 100-year design storm). The Overflow Spillway will have a 2.0m bottom width, 4:1

side slopes, and be lined with filter cloth and rip-rap for erosion protection. Both the Overflow Spillway Weir and Overflow Spillway will be capable of safely conveying post-development peak flows generated by storm events less frequent than the 100-year design storm without any restriction in order to prevent any potential flood hazards associated with larger peak flows/runoff volumes.

Refer to **Appendix C** for supporting calculations.

4.10 Erosion & Sediment Controls

In accordance with NVCA policies, effective erosion and sediment control must be established prior to construction commencement and maintained until the site has been stabilized. Exposure of the soil during construction should be minimized to avoid erosion and sedimentation. The sites erosion potential may be mitigated through the use of sound erosion and sedimentation control measures. The following measures shall be carried out prior to construction and maintained until disturbed areas have been sufficiently stabilized/established:

Topsoil Stripping: Topsoil stripping will be reduced as much as possible on-site. Where grading is necessary, the exposed soil will be stabilized by seeding immediately upon being set to grade. Should topsoil stockpiling be required, the stockpiles will be kept at manageable levels for grass/weed cutting purposes.

Silt Fence: Silt fence will be placed along the down slope of all excavated material and along the perimeter of the site where grading is directed towards the property line to prevent sediment transport onto adjacent lands. Periodic inspections and repairs to the silt fence should be performed regularly, as well as after every rainfall event.

Vegetated Buffers: Existing grassland vegetation, wooded and/or lawn areas along the development limits are to be maintained wherever possible. These areas will provide a natural barrier to filter potentially sediment-laden overland flow before it is released from the site.

Conveyance Protection: Straw bale check dams will be placed within all swales immediately after being constructed, and should be removed only after the area has been fully stabilized.

Finally, the Site Engineer will be responsible for completing routine inspections of the sediment and erosion control structures throughout the construction phase of the re-development, particularly after rainfall events. All damaged or clogged control devices or fencing must be repaired immediately.

Refer to the Erosion and Sediment Control Plan (**ESC**) for additional details.

5.0 Grading

The proposed grading will meet the requirements of the site layout and stormwater management strategy. In order to achieve these goals the following design criteria were used;

- Grading of internal driveways, parking and landscaped areas to be completed according to current engineering design standards.
- Minimize earthworks operations on-site (i.e. minimize cut/fill) where possible.
- Provide overland conveyance of as much stormwater runoff as possible to the site outlet at the southeast limit of the property. Where existing topography does not allow for positive grading to the southeast corner, any uncontrolled runoff peak flows and volumes are to be less than or equal to that of the pre-development condition and in the form of overland sheet flow (not concentrated flow).
- Minimize the need for steep slopes and retaining walls where practical.

6.0 Traffic Impact Opinion

A separate Traffic Impact Opinion letter has been completed to ensure that no negative traffic impacts will result from the proposed re-development of the subject lands. Refer to **Appendix E** for the Traffic Impact Opinion letter.

7.0 Summary and Conclusions

In conclusion, this Site Servicing and Stormwater Management Report demonstrates how the proposed re-development can be serviced and integrated into the existing Mansfield Ski Club (MSC), without imposing any adverse impacts to the surrounding lands/environment. Specifically, we note the following:

- The re-development can be accommodated with private potable drinking water system consisting of four (4) drilled wells (2 existing and 2 proposed) located at the north limit of the property adjacent to the 17th Sideroad site entrance. From the four (4) drilled wells, two (2) separate raw water supply lines (1 existing and 1 proposed) will supply water from the wells to the existing holding tank buried at the northeast corner of the Main Chalet. From the existing holding tank raw water will be supplied to a proposed water treatment system located within the proposed basement addition of the Main Chalet. The proposed water treatment system will consist of the equipment necessary to treat the raw water in order to meet the requirements of O. Reg. 170/03 and will provide sufficient storage of treated water (Day Tanks) to accommodate the required domestic water supply during maximum day and peak hour demands. Secondary disinfection will be provided by means of chlorination for the proposed domestic water distribution system.

- Fire supply will be provided for the re-development by means of a gravity fed standalone fire supply distribution system complete with four (4) fire hydrants. Sufficient fire storage volume and flow will be provide by means of 4-50,000L concrete tanks connected in parallel and located west of the re-development up the existing ski hill at an elevation (static head) capable of providing the fire flows at 20psi pressure for each of the respective fire hydrants. A proposed connection to the snow making supply line in the vicinity of the storage tanks will be used to fill the tanks with water from the proposed snow making pond when necessary. A low level alarm will be installed to ensure that the tanks stay full at all times.
- Sanitary drainage will be provided via a proposed sanitary sewer system which will discharge the re-developments influent into an on-site sewage treatment system (Waterloo Biofilter system complete with surface disposal). The proposed on-site sewage treatment system will discharge the treated effluent safely back into the environment as determined by the previously completed and MECP approved Assimilative Capacity Study completed for the Pine River. The treated effluent will discharge into a proposed storm sewer system running down the Chalet Ski run immediately north of the Main Chalet, to base of the ski run where it will drain further east and ultimately into the Pine River.
- Stormwater quantity control will be provided to attenuate the post-development 2-100 year design storm peak flows to their corresponding pre-development target rates for the site via the use a dry detention basin complete with an outlet structure consisting of a combination of weirs and an orifice plate located within a ditch inlet catchbasin. An Overflow Spillway Weir and Overflow Spillway built into the southeast corner of the basin will convey peak flows to the site outlet in the event of a blockage of the outlet structure. The area at the northeast limit of the re-development area that is not able to be directed into the proposed dry detention basin has been reduced as much as possible through proposed re-grading, to ensure that all peak flows and runoff volumes in the post-development condition are equal to or less than those of the pre-development condition.
- Stormwater quality control, phosphorus reduction and overall water balance as per NVCA standards will be provided via the use of an integrated treatment train approach which will help minimize any negative impacts the proposed re-development may have on the existing quality of stormwater runoff. An 'Enhanced' Level of Protection, as defined in the MOE's Stormwater Management Planning & Design Manual, will be provided through the use of grass buffers (grass filter strips) for pre-treatment of the runoff, and enhanced grass swales in conjunction with a dry detention basin for their inherent water balance, phosphorus loading reduction and TSS removal efficiency benefits. Inlet structures within the proposed storm sewer on-site will consist of deep sumps to aid in TSS removal upstream of the dry detention basin. In addition to the treatment train approach noted above, all pervious surfaces have been maximized (gravel parking and landscaped areas) as

per the Landscaping Plans (by others), to match as closely as possible the post- to pre-development water balance (evapo-transpiration and infiltration) volumes on-site.

- The proposed grading scheme for the site can be achieved while maintaining existing overall drainage patterns. The site will consist of sufficient topographic relief to provide adequate overland sheet flow conveyance for the majority of the site's runoff in a northwest-southeast direction towards the proposed dry detention basin which will discharge to the sites existing outlet at the southeast corner of the property. Considering this, it is anticipated that the proposed re-development will not adversely affect existing major and/or minor system stormwater flow routes.
- A separate Traffic Impact Opinion letter has been completed to ensure that no negative traffic impacts will result from the proposed re-development of the subject lands.
- The use of silt fence, straw bale check dams, and existing vegetated buffers will ensure downstream stormwater quality is maintained during construction.

The site servicing design as described above is considered to be capable of adequately servicing the proposed re-development and the stormwater management system can be constructed and maintained as a feasible method of treating, controlling and discharging all stormwater run-off generated on-site safely to existing outlets. This Site Servicing and Stormwater Management Report and the associated engineering design drawings are based on information provided at the time of their preparation and are considered only applicable to the proposed works as described in this report. Any changes subsequent to the report and drawings date of issuance should be reviewed by WMI & Associates Ltd. to ensure applicability of the design contained within the documents.

Based on the above, we request that this report be received by the Township of Mulmur and the NVCA in support of the construction of the proposed re-development submitted on behalf of the MSC.

Respectfully submitted,

WMI & Associates Limited

Ben Daniels

REGISTERED PROFESSIONAL ENGINEER
J.W.LIGHTHEART
100140403
Dec 15/20
PROVINCE OF ONTARIO

Benjamin Daniels, B. Eng.

Jeremy W. Lightheart, P. Eng.

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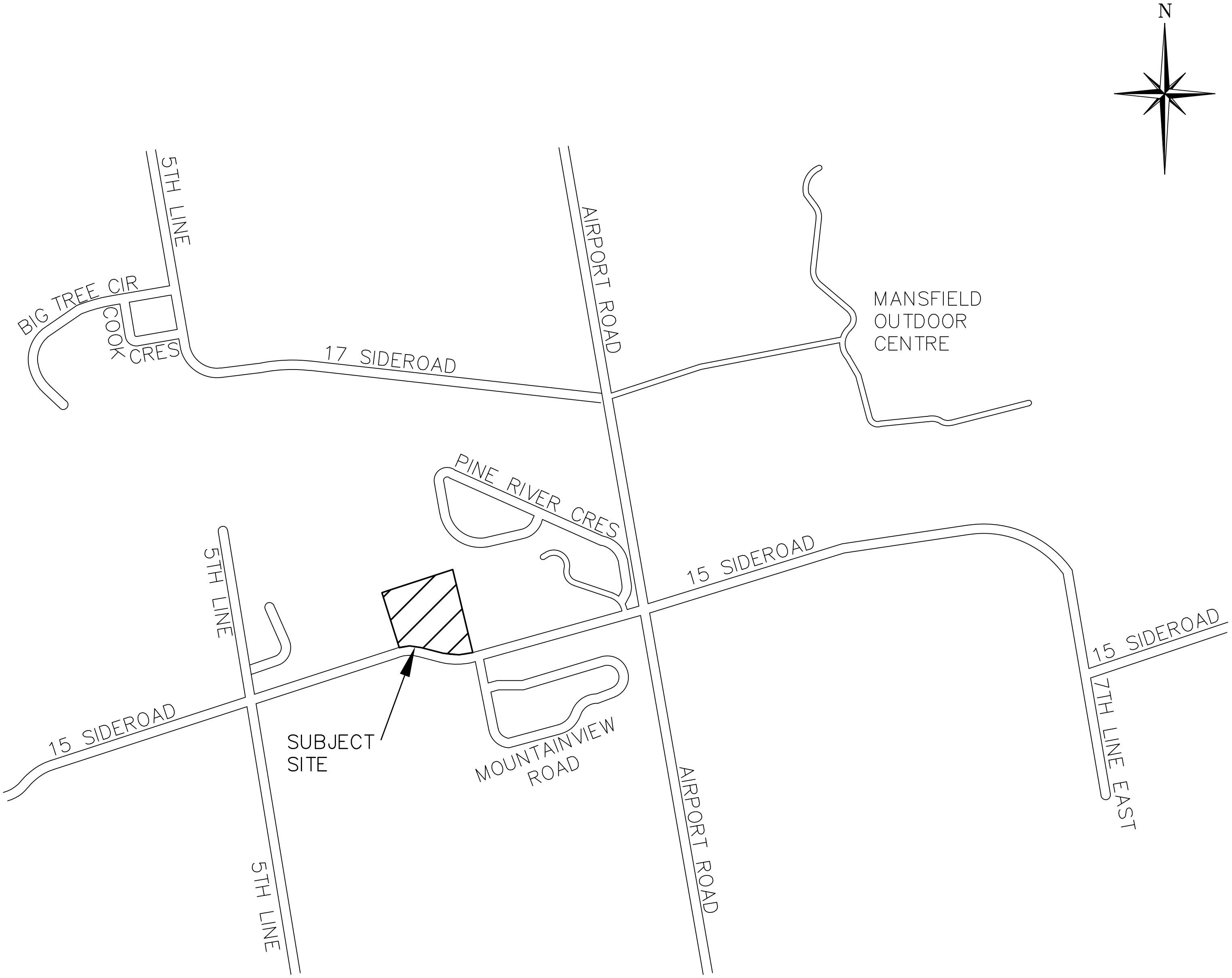
APPENDIX A

FIGURES



Drawing Title

SITE LOCATION PLAN

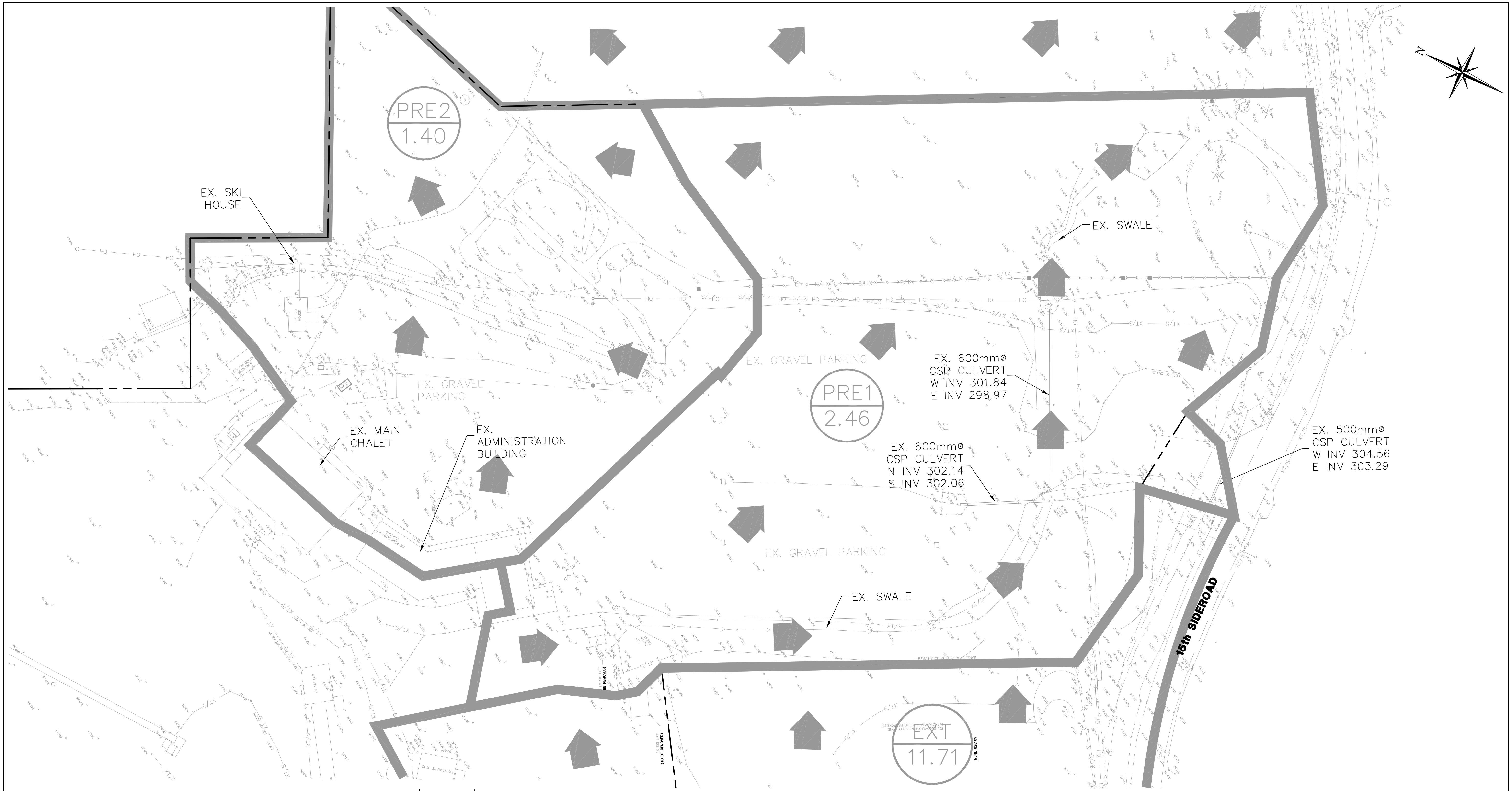
Project Title

MANSFIELD SKI CLUB

WMI & Associates Limited
119 Collier Street
Barrie, Ontario
L4M 1H5
705-797-2027
www.wmiengineering.ca

Drawn By AW	Checked By JWL	Figure No. FIG1
Scale N.T.S.	Project No. 15–319	

\\WMI–SERVER\wmi–server\Data\Projects\2015\15–319\CAD\WMI\Issue_No1\200810_Baseplan_15–319.dwg, FIG1, 1:25.4



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0 / 0.00 D.A. IDENTIFICATION

D.A. (HA)

▬ DRAINAGE BOUNDARY

⬅ DRAINAGE FLOW DIRECTION

Drawing Title

PRE-DEVELOPMENT DRAINAGE PLAN

Project Title

MANSFIELD SKI CLUB

WMI & Associates Limited
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Barrie, Ontario
L4M 1H5
705-797-2027
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Drawn By AW

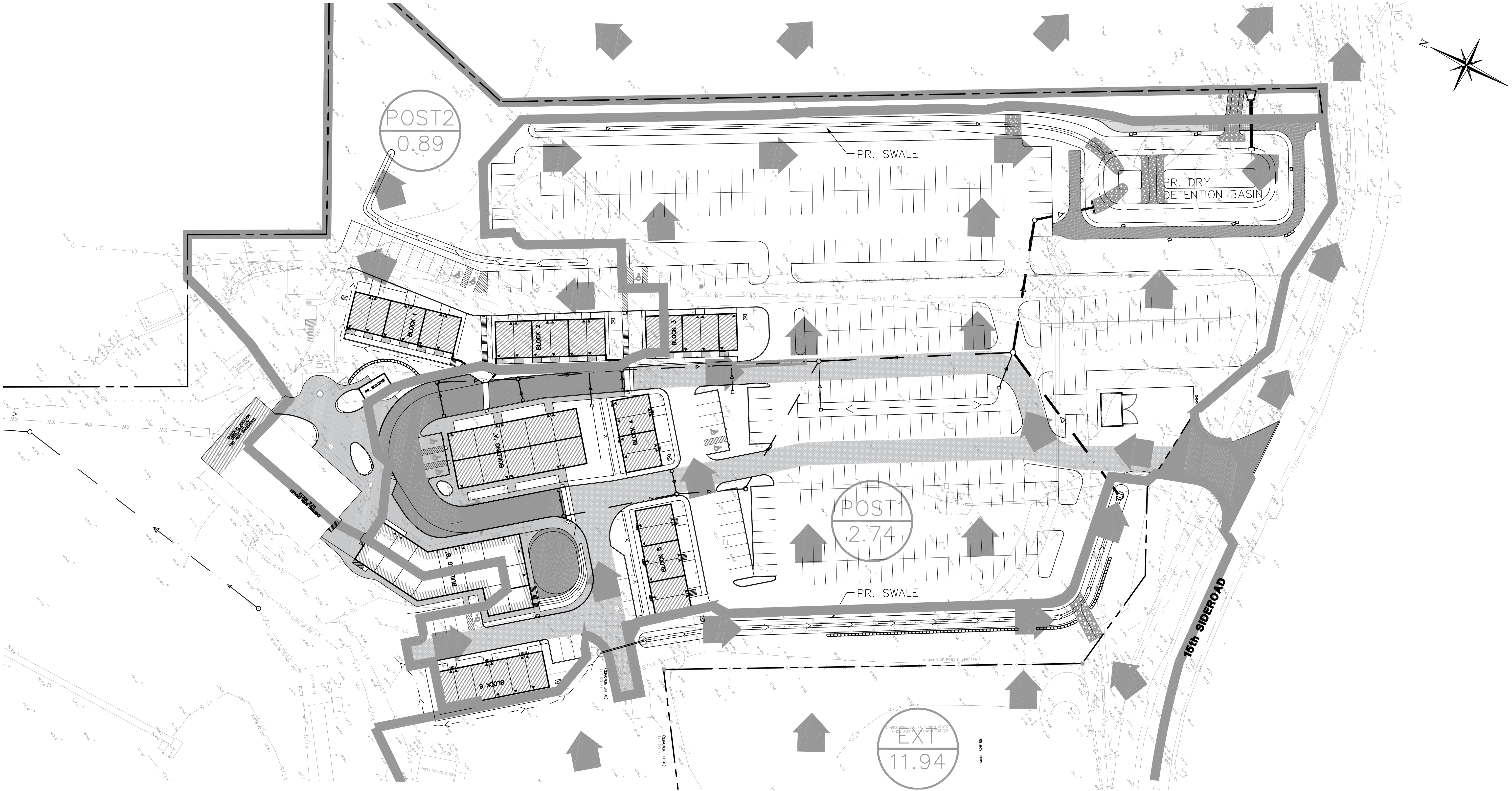
Checked By JWL

Figure No. FIG 2

Scale 1:1000

Project No. 15-319

\\WMI-SERVER\wmi-server\Data\Projects\2015\15-319\CAD\WMI\Issue_No2\201118_Baseplan_15-319.dwg, FIG2, 1:1



Legend:

0	D.A. IDENTIFICATION
0.00	D.A. (HA)
▬	DRAINAGE BOUNDARY
⇦	DRAINAGE FLOW DIRECTION

Drawing Title

POST-DEVELOPMENT
DRAINAGE PLAN

Project Title

MANSFIELD SKI CLUB

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Drawn By AW	Checked By JWL
Scale 1:1000	Project No. 15-319

Figure No.

FIG 3

Legend:

0	D.A. IDENTIFICATION
0.00	D.A. (HA)
▬	DRAINAGE BOUNDARY
⬅	DRAINAGE FLOW DIRECTION

Drawing Title

EXTERNAL DRAINAGE PLAN

Project Title

MANSFIELD SKI CLUB

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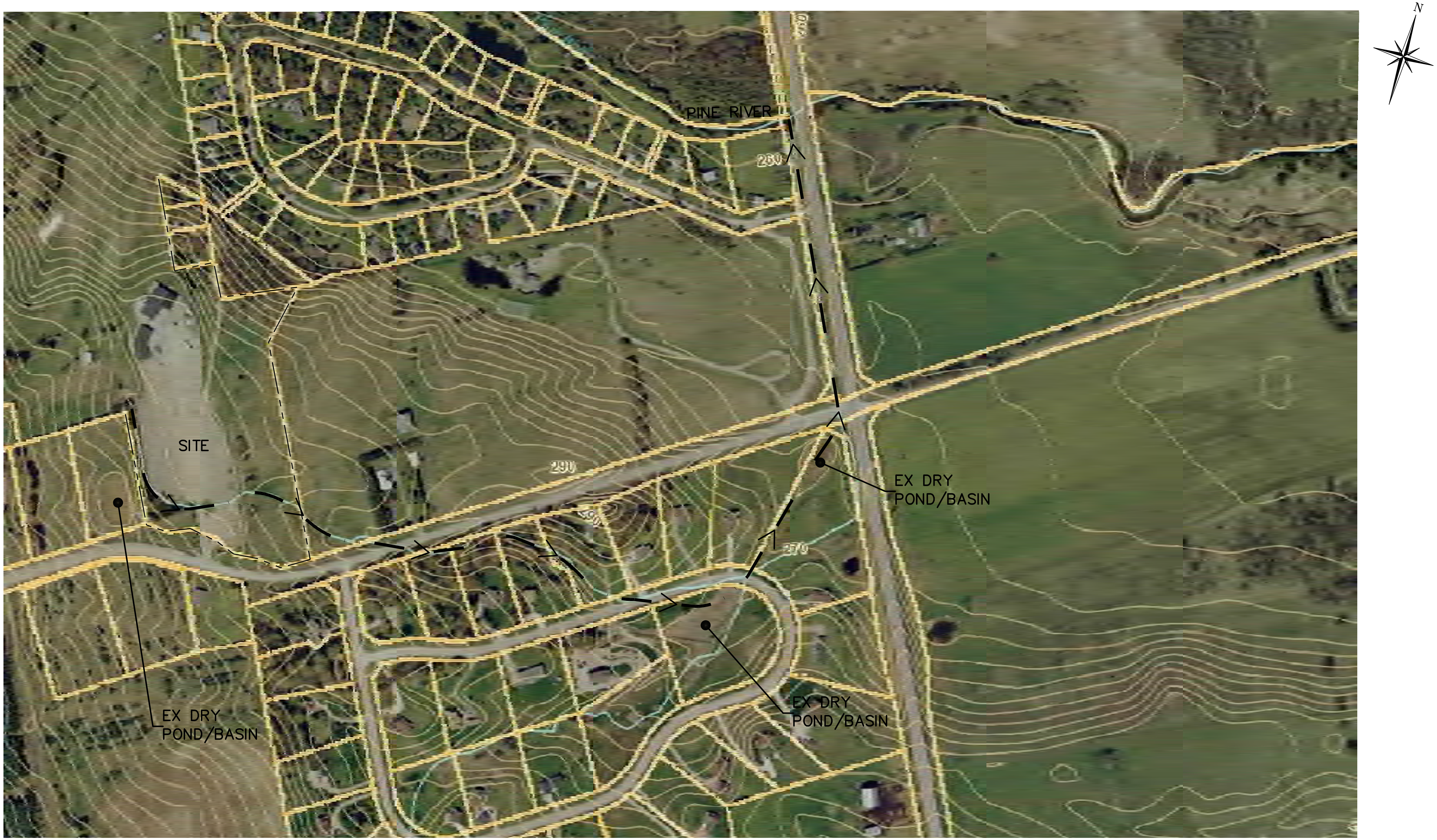
Drawn By AW	Checked By JWL	Figure No. FIG 4
Scale 1:3000	Project No. 15-319	

\\WMI-SERVER\wmi-server\Data\Projects\2015\15-319\CAD\WMI\Issue_No1\200810_Baseplan_15-319.dwg, FIG4, 1:1



Drawing Title

DOWNSTREAM DRAINAGE
OUTLET PLAN

Project Title

MANSFIELD SKI CLUB

WMI & Associates Limited
119 Collier Street
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L4M 1H5
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Drawn By AW	Checked By JWL	Figure No. FIG 5
Scale 1:4000	Project No. 15-319	

\\WMI-SERVER\wmi-server\Data\Projects\2015\15-319\CAD\WMI\Issue_No1\200810_Baseplan_15-319.dwg, FIG5, 1:1

APPENDIX B

WATER & SANITARY SEWAGE CALCULATIONS

WMI & Associates Limited
119 Collier Street, Barrie, Ontario L4M 1H5
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TOTAL DAILY DOMESTIC WATER SUPPLY FLOW CALCULATIONS
Mansfield Ski Club

Date: 10-Dec-20
Project No.: 15-319

Project: Mansfield Ski Club
Prepared By: JWL

▨ <<< **Elements Requiring Input Information**

Total Daily Design Flow Calculations

References:
- Ontario Building Code (OBC), 2012, Division B, Part 8, Table 8.2.1.3.A. Residential Occupancy & Table 8.2.1.3.B. Other Occupancies
- Ministry of the Environment (MOE), Design Guidelines for Drinking-Water Systems (2008), Chapter 3

Proposed Condition:

Establishment:	**# of people**	**# of water closets**	**# of fuel outlets**	**# of seats**	**Gross Floor Area (m^2)**	**Land Area (ha)**	**Total Daily Design Volume**		**Avg Day Demand ADD (L/day)**	**Max Day Demand MDD (L/day)**	**Peak Hourly Demand PHD (L/day)**
Existing Main Chalet, Admin Bldg (652m^2 ground floor + 158m^2 second floor), GM Office and Ski House							**13800**	L/day	13800	27600	55200
Subtotal =									**13800**	**27600**	**55200**
									Peaking Factor =	**2**	**4**
Peaking factor for the ADD and MDD are based on the water log consumption records from the 2019-2020 ski season. Peaking factor for the PHD was assumed to be double that of the MDD factor.											
Commercial/Institutional & Industrial Uses:											
Building A - Offices and Personal Business Space (630m^2 ground floor + 252m^2 mezzanine floor space)					**882.0**		**5**	L / 1.0m^2	4410	6615	13230
Building B - Offices and Personal Business Space (Increase in ground floor space from existing)					**128.0**		**5**	L / 1.0m^2	640	960	1920
Subtotal =					**1010**				**5050**	**7575**	**15150**
									Peaking Factor =	**1.5**	**3**
Residential Uses:											
Building A - Lofts (10 Units - Two (2) Bedrooms/Unit) (Second floor + third floor space)	**40**						**275**	L/person	11000	36740	55220
Building B - Lofts (15 Units - Two (2 Bedroom/Unit) (Second floor + third floor space)	**60**						**275**	L/person	16500	55110	82830
Staked Houses (66 Units - Two (2) Bedrooms/Unit)	**264**						**275**	L/person	72600	242484	364452
Subtotal =	**364**								**100100**	**334334**	**502502**
Refer to Table 3-1 and/or Table 3.3 of the MOE Design Guidelines for Drinking-Water Systems (2008) >>>									**Peaking Factor =**	**3.34**	**5.02**
TOTAL SITE WATER DEMAND (L/day) =									**118950**	**369509**	**572852**
(L/min) =									**82.6**	**256.6**	**397.8**

Flow Deficit during the Peak Hourly/Instantaneous Demand Rate:

Flow Deficit = Peak Hourly Demand Rate - Maximum Treatment Rate
= 397.8 L/min - 151.2 L/min
= 246.6 L/min

Required Inline Domestic Storage = Draw Down for Peak Hourly Demand Rate (1hr) x Flow Deficit
= 60 min x 246.6 L/min
= 14797 L

OR

Flow Deficit during the Max Day Demand Rate:

Flow Deficit = Max Day Demand Rate - Maximum Treatment Rate
= 256.6 L/min - 151.2 L/min
= 105.4 L/min

Required Inline Domestic Storage = Draw Down for Max Day Demand Rate (24hr) x Flow Deficit
= 1440 min x 105.4 L/min
= **151781 L GOVERNS**

Therefore, the Max Day Demand governs the required storage (Day tanks sizing). Within the domestic water treatment system there are two day tanks proposed to be installed as part of phase 1B which provide a total of 66,284L of storage. As additional storage is required throughout subsequent phases of the development, additional day tanks will be installed.

Notes:
- Number of bedrooms and offices and personal space areas are approximate and the information was provided by the architect and is subject to change.
- # of people for the Multi-Family Residential Dwellings (Townhouses, apartments, etc.) is calculated based on # of units x # of bedrooms x 2 people per bedroom.
- Residential flow is based on Apartments, Condos, Other Multi-family Dwellings (275L/day).
- Building 'A' is a total of 882m^2 (630m^2 proposed ground floor + 252m^2 proposed mezzanine floor space)
- Building 'B' is a total of 780m^2 (652m^2 existing ground floor + 128m^2 proposed ground floor space)

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FIRE PROTECTION WATER STORAGE
DESIGN CALCULATIONS
BUILDING B - Supplied to Fire Hydrant 4

Date: 10-Dec-20 **Project No.:** 15-319

Project: Mansfield Ski Club **Prepared By:** AW

▨ <<< **Elements Requiring Input Information**

Fire Protection Water Storage

Reference: Office of the Fire Marshal, OFM Guideline, Fire Protection Water Supply Guideline for Part 3 in the Ontario Building Code (OBC), October 1999
Subsection 3.2.2 of the Ontario Building Code, 2012

Building Classification:

-The proposed buildings are Classified as either A-2, B-1, B-2, B-3, C or D and they will be of combustible construction with fire separations and fire resistance ratings based on email from +VG (Architect) on Apr. 17, 2020. Therefore, the K value used is 18 based on Table 1 of OBC A.3.2.5.7., Water Supply Coefficient for group C and D classification.
- Building Volumes provided by VG+ (Architect) via email on Apr. 17, 2020

Therefore, based on Table 1 of OBC A.3.2.5.7., Water Supply Coefficient, K:

K = 18 (see notes above)

Calculate Q=KVS$_{TOTAL}$

K = 18 (see Step 1 above)

Approximate Building Volume:
V = Area x Height
+ Roof Volume

V = 8190.0 m^3 (see notes above, Building B is the governing building)

Approximate Exposure Distance From Proposed Buildings To:

				from Figure 1 (OBC, A.3.2.5.7.)	
West to Block 6 =	**12.0**	m	> > > > > >	S_W =	0
North to Main Chalet =	**8.8**	m	> > > > > >	S_N =	0.1
East to Building 'A' =	**14.0**	m	> > > > > >	S_E =	0
South to Block 5 =	**31.5**	m	> > > > > >	S_S =	0

S_{TOTAL} = 1 + (S_W + S_N +S_E + S_S)
= 1 + 0.1
S_{TOTAL} = 1.1

Minimum Water Supply,

Q = KVS$_{TOTAL}$
= **18** x **8190.0** x **1.1**
Q = 162,162 L

where,
Q = Minimum Water Supply (L)
K = Water Supply Coefficient
V = Building Volume (m^3)
S_{TOTAL} = Total Spatial Coefficient

Therefore, 4 x 50,000L fire storage tanks will be sufficient to provide the necessary Fire Protection Water Supply for the proposed development.

Water supply flow rate:

From Table 2, Required Minimum Water Supply Flow Rate (L/min), provided in the OBC A.3.2.5.7.,

Flow Rate = 5400 L/min

Based on OBC A.3.2.5.7., the water supply volume required should not be less than that needed to provide the minimum flow rate specified in Table 2 for a minimum duration of 30-minutes:

T = Minimum Water Supply/Flow Rate
= Q/F
= 162,162 ÷ 5400
T = 31 min > minimum 30min

where,
T = Duration (min)
Q = Minimum Water Supply (L)
F = Flow Rate (L/min)

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FIRE PROTECTION WATER STORAGE
DESIGN CALCULATIONS
Block 2 - Supplied to Fire Hydrant 3

Date: 10-Dec-20
Project No.: 15-319

Project: Mansfield Ski Club
Prepared By: AW

▨ <<< **Elements Requiring Input Information**

Fire Protection Water Storage

Reference: Office of the Fire Marshal, OFM Guideline, Fire Protection Water Supply Guideline for Part 3 in the Ontario Building Code (OBC), October 1999
Subsection 3.2.2 of the Ontario Building Code, 2012

Building Classification:

-The proposed buildings are Classified as either A-2, B-1, B-2, B-3, C or D and they will be of combustible construction with fire separations and fire resistance ratings based on email from +VG (Architect) on Apr. 17, 2020. Therefore, the K value used is 18 based on Table 1 of OBC A.3.2.5.7., Water Supply Coefficient for group C and D classification.
- Building Volumes provided by VG+ (Architect) via email on Apr. 17, 2020

Therefore, based on Table 1 of OBC A.3.2.5.7., Water Supply Coefficient, K:

K = 18 (see notes above)

Calculate Q=KVS$_{TOTAL}$

K = 18 (see Step 1 above)

Approximate Building Volume:
V = Area x Height
+ Roof Volume

V = 4095.0 m^3 (see notes above, Blcok 2 is the governing building)

Approximate Exposure Distance From Proposed Buildings To:

from Figure 1 (OBC, A.3.2.5.7.)

West to Building A =	**14.0**	m	> > > > > >	S_w =	0
North to Block 1 =	**9.0**	m		S_n =	0.1
South to Block 3 =	**11.0**	m		S_S =	0

S_{TOTAL} = 1 + (S_W + S_N +S_E + S_S)
= 1 + 0.1
S_{TOTAL} = 1.1

Minimum Water Supply,

Q = KVS$_{TOTAL}$
= **18** x **4095.0** x **1.1**
Q = 81,081 L

where,
Q = Minimum Water Supply (L)
K = Water Supply Coefficient
V = Building Volume (m^3)
S_{TOTAL} = Total Spatial Coefficient

Building 'B' is the governing building for the fire storage requirments.

Water supply flow rate:

From Table 2, Required Minimum Water Supply Flow Rate (L/min), provided in the OBC A.3.2.5.7.,

Flow Rate = 2700 L/min

Based on OBC A.3.2.5.7., the water supply volume required should not be less than that needed to provide the minimum flow rate specified in Table 2 for a minimum duration of 30-minutes:

T = Minimum Water Supply/Flow Rate
= Q/F
= 81,081 ÷ 2700
T = 31 min > minimum 30min

where,
T = Duration (min)
Q = Minimum Water Supply (L)
F = Flow Rate (L/min)

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Watermaim & Fire Supply Headloss Calculations
Mansfield Ski Club

▨ <<< **Elements Requiring Input Information**

Velocity, $V = \frac{Q}{A}$ (m/s)

where, Q = Flow (m^3/s)
A = Cross-Sectional Area (m^2)

Minor Head Loss, $H_L = (K_1+K_2+K_3\ldots) \times V^2/2g$

where, $\sum K = (K_1+K_2+K_3\ldots)$
V = mean velocity (m/s)
g = 9.81 (acceleration due to gravity, m/s^2)

Hazen -Williams Equation (re-arranged for Friction Slope)
(Friction Head Loss Calculation)

$$\text{Friction Slope, } S = \frac{(V)^{1/0.54}}{(0.85CR^{0.63})^{1/0.54}} \times 100 \text{ (m/100m)}$$

where, V = mean velocity (m/s)
k = 0.85 for SI units
C = Roughness Coefficient
R = hydraulic radius (m)

Total Head Loss = Friction Head Loss + Minor Head Loss

Pressure (psi) = Pressure Head (m) x 1.422

Total HGL = Ground Elev. + Pressure Head

Date: **10-Dec-20**
Project No: **15-319**
Prepared by: **AW**

Description	Pipe Design Coefficient C	Forcemain						Sum of Minor Loss Coeff. ∑K=	Minor Head Loss (m)	Total Head Loss (m)	Total Pressure Loss (psi)	Pressure @ Pt. A (psi)	Pressure Head @ Pt. A (m)	Ground Elev. @ Pt. A (m)	Total HGL @ Pt. A (m)	Ground Elev. @ Pt. B (m)	Total HGL @ Pt. B (m)	Pressure Head @ Pt. B (m)	Pressure @ Pt. B (psi)
		Flow (L/s)	Diameter (mm)	Velocity (m/s)	Unit Friction Head Loss (m/100m)	Distance (m)	Friction Head Loss (m)												
Fire Supply (20psi min.)																			
Hydrant 1 (at Block 6)	**110**	**90**	**250**	1.83	1.75	**241.90**	4.23	**2.52**	0.43	4.66	6.63	**0**	0.00	**339.45**	339.45	**305.90**	334.79	28.89	**41.08**
Hydrant 2 (at Building B)	**110**	**90**	**250**	1.83	1.75	**275.00**	4.81	**3.32**	0.57	5.38	7.65	**0**	0.00	**339.45**	339.45	**302.84**	334.07	31.23	**44.41**
Hydrant 3 (at Block 2)	**110**	**45**	**250**	0.92	0.48	**271.70**	1.32	**2.32**	0.10	1.42	2.01	**0**	0.00	**339.45**	339.45	**302.70**	338.03	35.33	**50.25**
	100	**45**	**150**	2.55	6.96	**24.80**	1.73	**2.12**	0.70	2.43	3.45	**50.25**	35.33	**302.70**	338.03	**298.15**	335.61	37.46	**53.27**
Hydrant 4 (at Building A)	**110**	**90**	**250**	1.83	1.75	**320.00**	5.60	**4.32**	0.74	6.34	9.01	**0.00**	0.00	**339.45**	339.45	**302.85**	333.11	30.26	**43.04**
Domestic Supply																			
of Block 6, PHD 40psi min.)	**100**	**6.6**	**100**	0.84	1.43	**107.00**	1.53	**1.84**	0.07	1.60	2.27	**48**	33.76	**302.00**	335.76	**306.00**	334.16	28.16	**40.04**
of Block 6, MDD 50psi min.)	**100**	**4.3**	**100**	0.55	0.65	**107.00**	0.69	**1.84**	0.03	0.72	1.03	**57**	40.08	**302.00**	342.08	**306.00**	341.36	35.36	**50.29**
Block 1 (MinHD 80psi)	**100**	**0.90**	**100**	0.11	0.04	**161.70**	0.06	**6.48**	0.00	0.06	0.09	**70**	49.23	**302.00**	351.23	**296.06**	351.16	55.10	**78.36**
	100	**0.90**	**50**	0.46	1.04	**42.50**	0.44	**0.12**	0.00	0.44	0.63	**78.36**	55.10	**296.06**	351.16	**294.30**	350.72	56.42	**80.23**

NOTES:

- Loss Coefficient:

Hydrant #1	**Hydrant #2**	**Hydrant #3**	**Hydrant #4**	**Domestic Watermain #1**	**Domestic Watermain #2**
1 - 45° Bends @ K=0.4	**3 - 45° Bends @ K=0.4**	**6 - 45° Bends @ K=0.4**	**3 - 45° Bends @ K=0.4**	**4- 45° Bends @ K=0.4**	**5- 45° Bends @ K=0.4**
2 - 90° Bends @ K=1	**2 - 90° Bends @ K=1**	**3 - 90° Bends @ K=1**	**3 - 90° Bends @ K=1**	**2 - Valves @ K=0.12**	**4 - 90° Bends @ K=1**
1 - Valves @ K=0.12	**1 - Valves @ K=0.12**	**2 - Valves @ K=0.12**	**1 - Valves @ K=0.12**	**Total 1.84**	**5 - Valves @ K=0.12**
Total 2.52	**Total 3.32**	**Total 5.64**	**Total 4.32**		**Total 6.6**

- The governing fire flow is based on Building 'B' which requires a flow of 90L/s. Hydrants 1, 2 & 4 fire supply lines are based on this flow and hydrant 3 is based on the required flow of 45L/s for Block 2.
- Assumed a starting pressure of 0 at the fire storage tanks located up the ski hill (gravity fed).
- Assumed a conservative starting elevation of 339.45 (342.15 - 2.70m = 339.45) as this is the lowest invert elevation of the 4 fire storage tanks.
- The worst case scenario for the domestic watermain was located at the southeast corner of Block 6 as this is the highest elevation of the domestic supply. The PHD flow of 6.6L/s was used in the calculation.
-80psi max. for MinHD (0.65 x ADD), 50psi min. for MDD and 40psi min. for PHD.

TECHNICAL BROCHURE

B5-25GS R8

FEATURES

Powered for Continuous Operation: All ratings are within the working limits of the motor as recommended by the motor manufacturer. Pump can be operated continuously without damage to the motor.

Field Serviceable: Units have left hand threads and are field serviceable with common tools and readily available repair parts.

Sand Handling Design: Our face clearance, floating impeller stack has proven itself for over 50 years as a superior sand handling, durable pump design.

FDA Compliant Non-Metallic Parts: Impellers, diffusers and bearing spiders are constructed of glass filled engineered composites. They are corrosion resistant and non-toxic.

Discharge Head/Check Valve: Cast 303 stainless steel for strength and durability. Two cast-in safety line loops for installer convenience. The built-in check valve is constructed of stainless steel and FDA compliant BUNA rubber for abrasion resistance and quiet operation.

Motor Adapter: Cast 303 stainless steel for rigid, accurate alignment of pump and motor. Easy access to motor mounting nuts using standard open end wrench.

Stainless Steel Casing: Polished stainless steel is strong and corrosion resistant.

Hex Shaft Design: Six sided shafts for positive impeller drive.

Engineered Polymer Bearings: The proprietary, engineered polymer bearing material is strong and resistant to abrasion and wear. The enclosed upper bearing is mounted in a durable Noryl® bearing spider for excellent abrasion resistance.

5GS, 7GS, 10GS, 13GS, 18GS & 25GS

5-25 GPM, ½ – 5 HP, 60 HZ, SUBMERSIBLE PUMPS

BUILT IN THE USA
ENGINEERED, ASSEMBLED & TESTED

GOULDS WATER TECHNOLOGY
a xylem brand

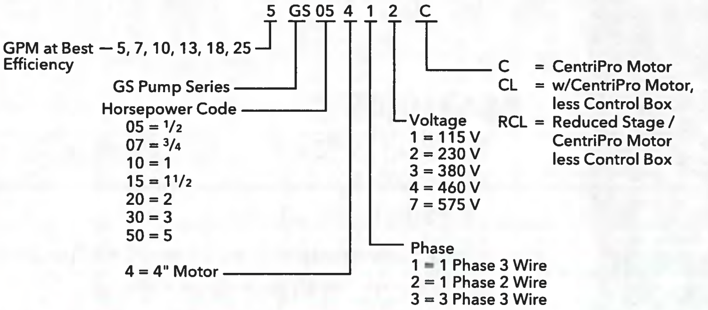
WATER END DATA

Series	Model	Required HP	Stages	Length (in)	Weight (lbs)
5GS	5GS05R	.5	9	12.9	8
	5GS05	.5	12	15.0	9
	5GS07	.75	15	17.0	11
	5GS10	1	20	21.7	13
	5GS15	1.5	26	25.8	15
	5GS20	2	33	31.6	19
7GS	7GS05R	.5	7	11.7	6
	7GS05	.5	10	13.8	7
	7GS07	.75	13	16.0	8
	7GS10	1	17	18.8	9
	7GS15	1.5	22	23.6	12
	7GS20	2	27	27.2	13
	7GS30	3	34	33.2	18
10GS	10GS05R*	0.5	8	12.2	7
	10GS05*	0.5	10	13.6	8
	10GS07*	0.75	14	16.4	9
	10GS10*	1	16	17.7	11
	10GS15	1.5	17	18.4	12
	10GS20	2	20	21.7	13
	10GS30	3	27	27.5	18
	10GS50R	5	35	33	21
	10GS50	5	42	40.2	24
13GS	13GS05	.5	5	10.1	6
	13GS07	.75	7	11.5	7
	13GS10	1	10	13.6	8
	13GS15	1.5	12	15.0	9
	13GS20	2	17	18.4	12
	13GS30	3	21	22.3	15
18GS	18GS07	.75	6	11.8	7
	18GS10	1	8	13.5	8
	18GS15	1.5	11	16.1	10
	18GS20	2	14	18.6	11
	18GS30	3	19	24.1	15
	18GS50R	5	24	28.3	17
	18GS50	5	30	34.4	21
25GS	25GS10	1	7	13.4	8
	25GS15	1.5	9	15.3	9
	25GS20	2	11	17.2	10
	25GS30	3	15	20.9	14
	25GS50R	5	22	28.7	17
	25GS50	5	26	33.4	21

*New High Head Hydraulic Design for models manufactured starting 8/2017

NOMENCLATURE

See price book for complete order numbers.



"GS" SERIES MATERIALS OF CONSTRUCTION

Part Name	Material
Discharge Head	AISI 303 SS
Check Valve Poppet	AISI 304 SS
Check Valve Seal	BUNA, FDA compliant
Check Valve Seat	AISI 304 SS
Check Valve Retaining Ring	AISI 302 SS
Bearing Spider - Upper	Noryl® GFN2
Bearing	Proprietary Engineered Polymer
Klipring	AISI 301 SS
Diffuser	Lexan®
Impeller	Noryl®
Bowl	AISI 304 SS
Intermediate Sleeve *	AISI 304 SS, Powder Metal
Intermediate Shaft Coupling *	AISI 304 SS, Powder Metal
Intermediate Bearing Spider *	Glass Filled Engineered Composite
Intermediate Bearing Spider *	AISI 303 SS
Shim	AISI 304 SS
Screws - Cable Guard	AISI 304 SS
Motor Adapter	AISI 303 SS
Casing	AISI 304 SS
Shaft	
Coupling	AISI 304 SS, Powder Metal
Cable Guard	AISI 304 SS
Suction Screen	AISI 304 SS

*See repair parts for where used.

SPECIFICATIONS

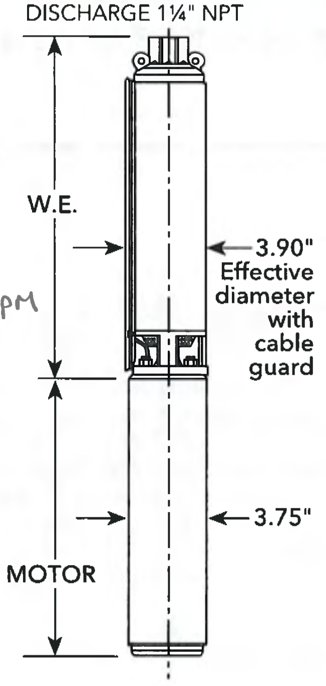
Model	Flow Range GPM	Horsepower Range	Best Efficiency GPM	Discharge Connection	Minimum Well Size	Rotation①
5GS	1.2 - 7.5	½ - 2	5	1¼	4"	CCW
7GS	1.5 - 10	½ - 3	7	1¼	4"	CCW
10GS	3 - 16	½ - 5	10	1¼	4"	CCW
13GS	4 - 20	½ - 3	13	1¼	4"	CCW
18GS	6 - 28	¾ - 5	18	1¼	4"	CCW
25GS	8 - 33	1 - 5	25	1¼	4"	CCW

① Rotation is counterclockwise when observed from pump discharge end.

running @ 16 USGPM based on ex 38 mm waterline

Total = 45 USGPM

would run @ 29 USGPM based on pr 50 mm waterline



CENTRIPRO 4" SINGLE-PHASE MOTORS

Order No.	Type	HP	Volts	Length in. (mm)	Weight lb. (kg.)
M05421	2-wire PSC	½	115	11.0 (279)	20 (9.1)
M05422		½	230	11.0 (279)	20 (9.1)
M07422		¾		12.4 (314)	23 (10.4)
M10422		1		13.3 (337)	25 (11.3)
M15422		1.5		14.9 (378)	29 (13.2)
M05411	3-wire	½	115	10.0 (253)	19 (8.6)
M05412		½	230	9.7 (246)	18 (8.2)
M07412		¾		10.8 (275)	22 (10)
M10412		1		11.7 (297)	23 (10.4)
M15412		1.5		13.6 (345)	28 (12.7)
M20412		2		15.1 (383)	31 (14.1)
M30412		3		18.3 (466)	40 (18.1)
M50412		5		27.7 (703)	70 (31.8)

NEMA MOTOR

- Corrosion resistant stainless steel construction.
- Built-in surge arrestor is provided on single phase motors through 5 HP.
- Stainless steel splined shaft.
- Hermetically sealed windings.
- Replaceable motor lead assembly.
- NEMA mounting dimensions.
- Control box is required with 3 wire single phase units.
- Three phase units require a magnetic starter with three leg Class 10 overload protection.

CENTRIPRO 4" THREE-PHASE MOTORS

Order No. by Voltage			HP	Length in. (mm)	Weight lb. (kg.)
200V	230V	460V			
M05430	M05432	M05434	½	10.8 (275)	22 (9.7)
M07430	M07432	M07434	¾	10.8 (275)	22 (9.7)
M10430	M10432	M10434	1	11.7 (297)	23 (10.4)
M15430	M15432	M15434	1.5	11.7 (297)	23 (10.4)
M20430	M20432	M20434	2	13.8 (351)	28 (12.7)
M30430	M30432	M30434	3	15.3 (389)	32 (14.5)
M50430	M50432	M50434	5	21.7 (550)	55 (24.9)
M75430	M75432	M75434	7.5	27.7 (703)	70 (1.8)

Order No.	HP	Volts	Length in. (mm)	Weight lb. (kg.)
M15437	1.5	575	11.7 (297)	23 (10.4)
M20437	2		15.3 (389)	32 (14.5)
M30437	3		15.3 (389)	32 (14.5)
M50437	5		27.7 (703)	70 (31.8)
M75437	7.5		27.7 (703)	70 (31.8)

AGENCY LISTINGS

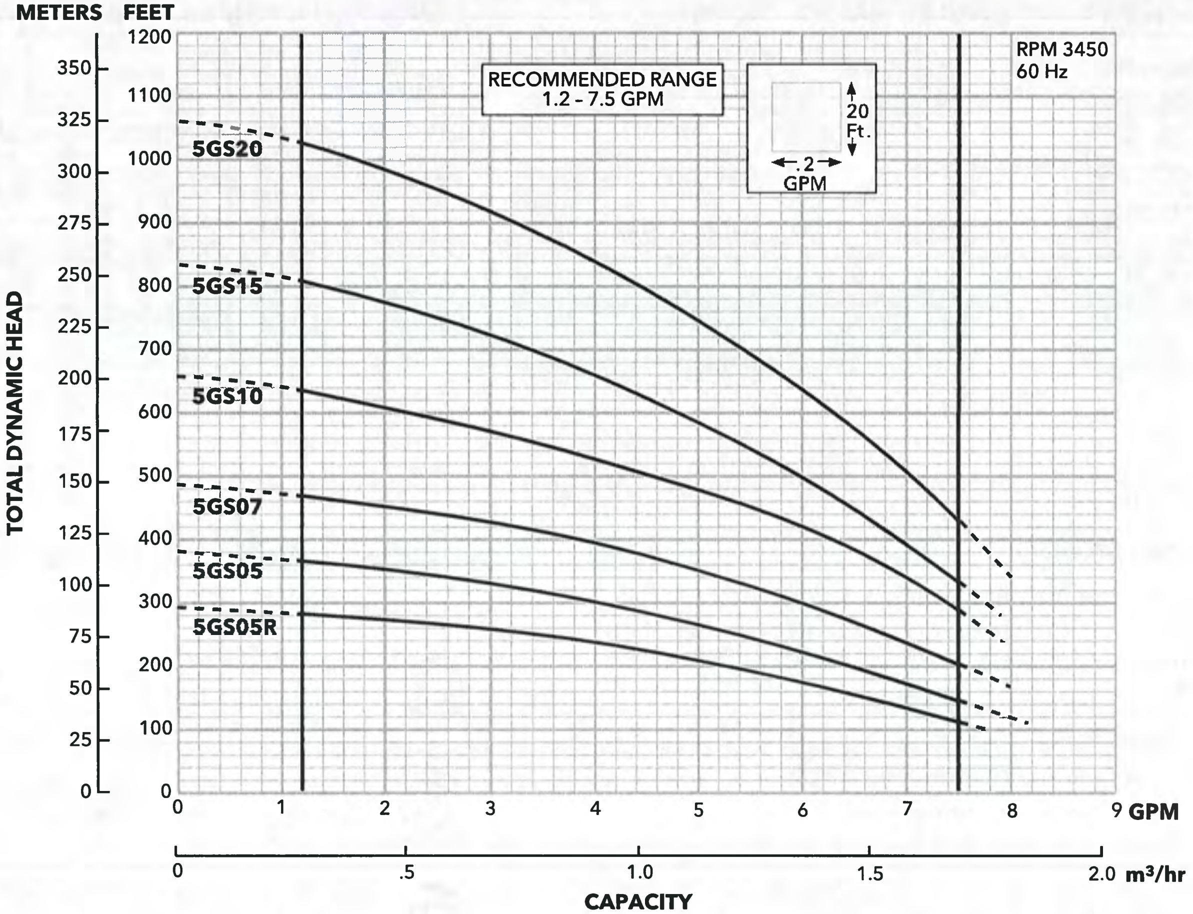
Pump/Water End and CentriPro Motor - tested to UL778 and CAN 22.2 by CSA International (Canadian Standards Association)

CentriPro Motor - Certified to NSF/ANSI 61, Annex G, Drinking Water System Components 4P49

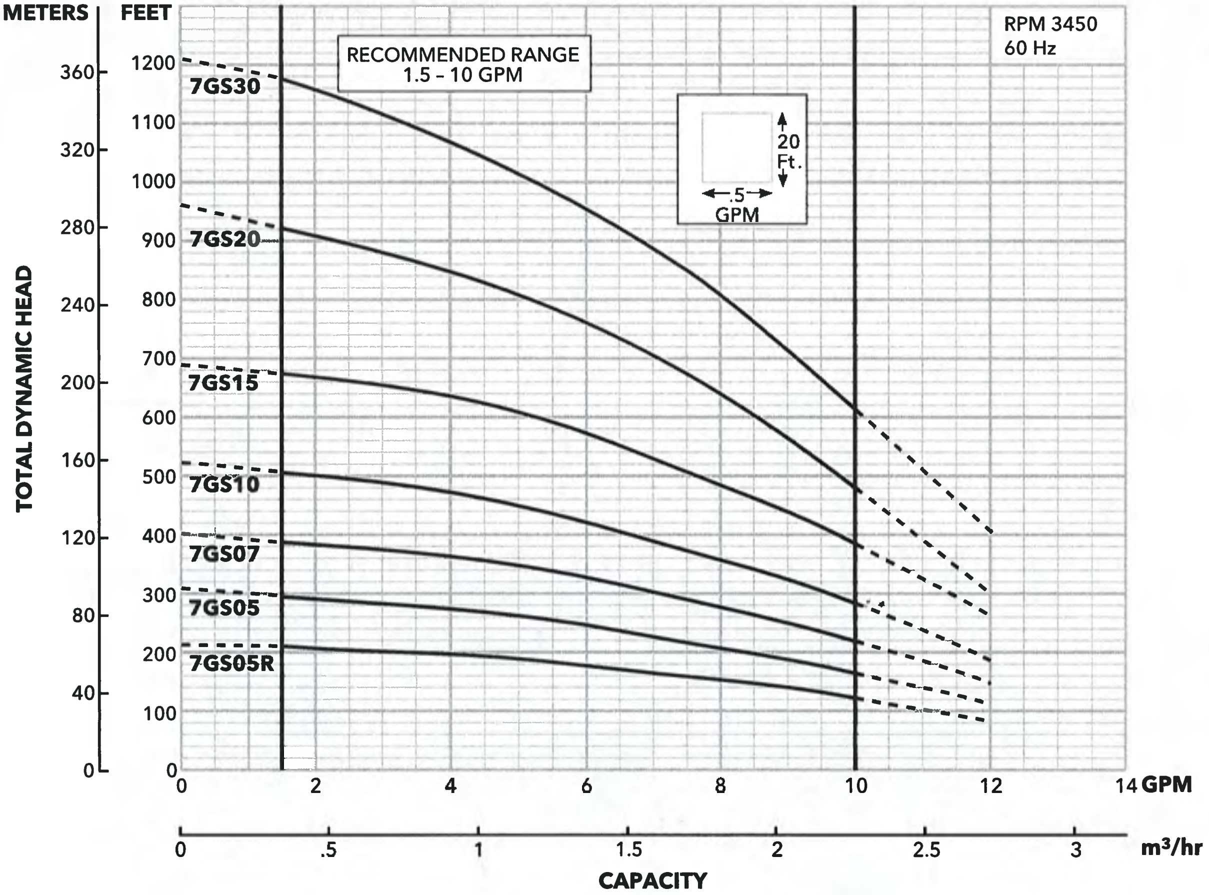
NSF/ANSI 372 – Drinking Water System Components – Lead Content

CLASS 6853 01 - Low Lead Content Certification Program - - Plumbing Products

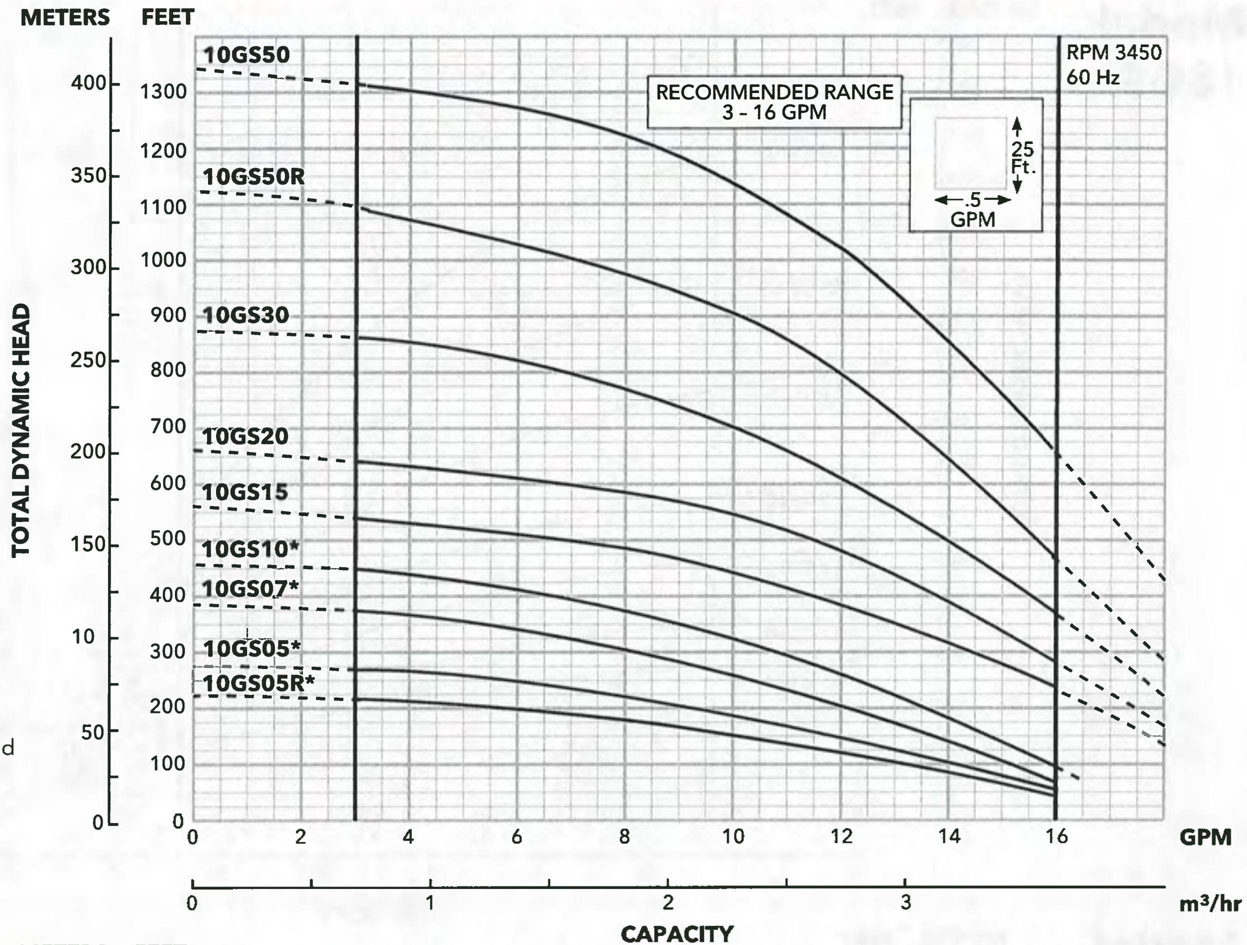
Model 5GS



Model 7GS



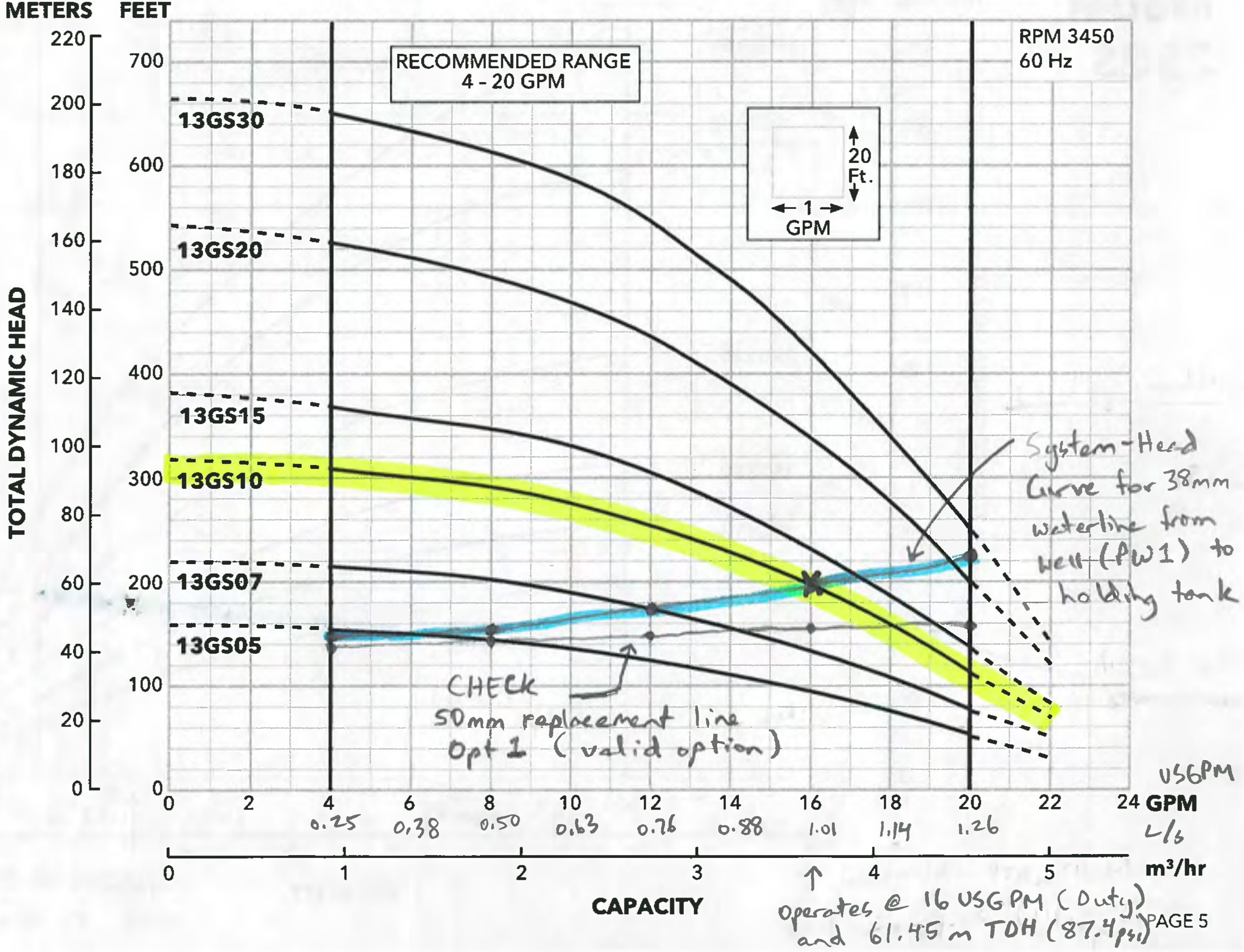
Model 10GS



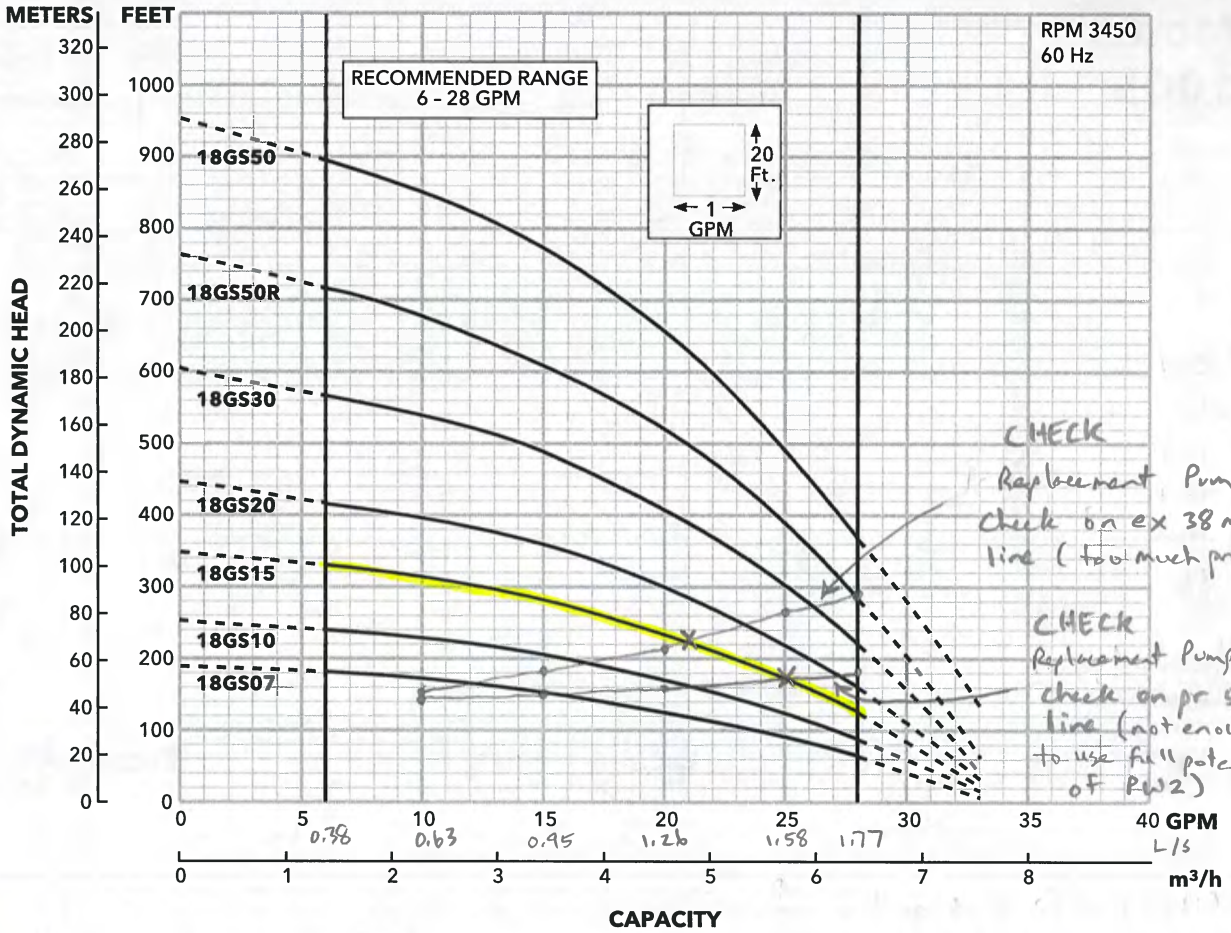
New High Head Hydraulic Design for models manufactured starting 8/2017

* HH Versions

Model 13GS



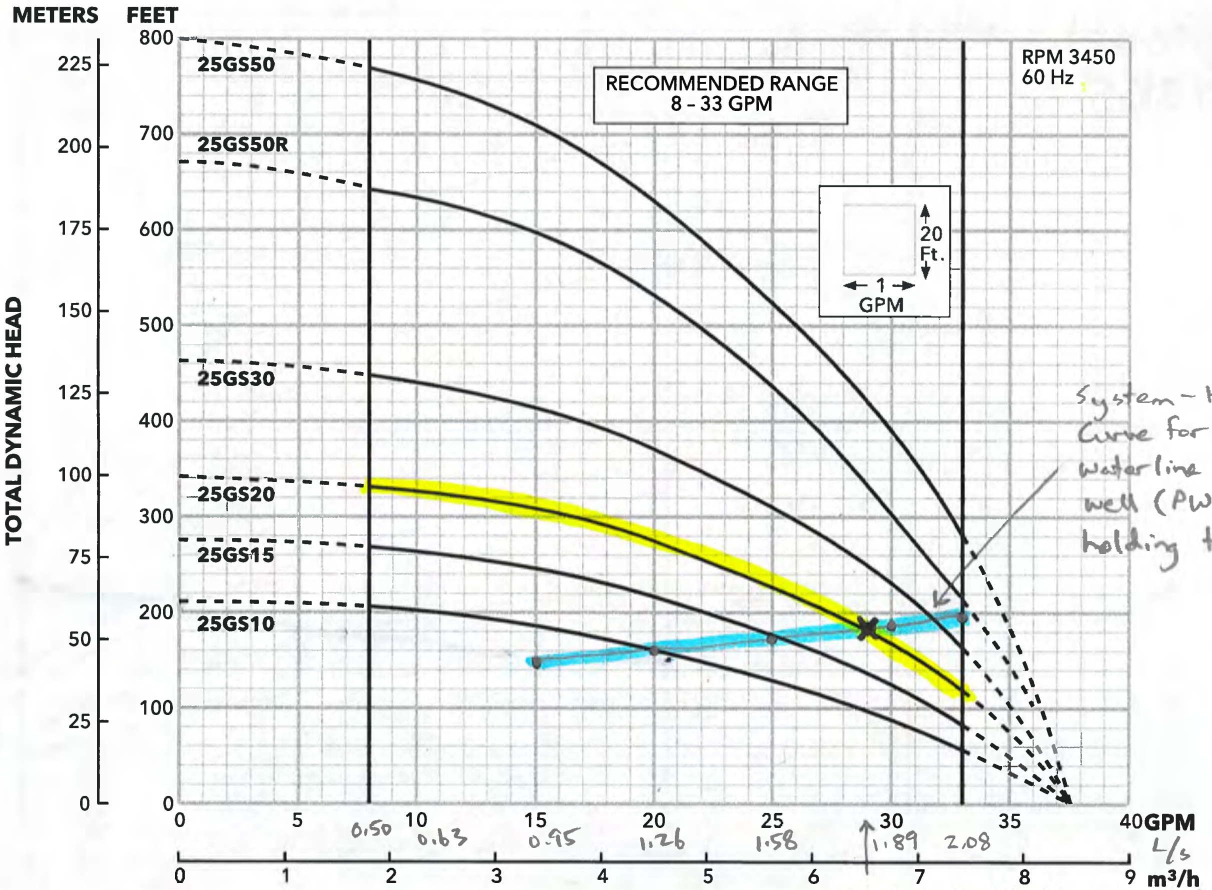
Model 18GS



CHECK
Replacement Pump Opt 2
Check on ex 38 mm
line (too much pressure)

CHECK
Replacement Pump Opt 2
check on pr 50mm
line (not enough flow
to use full potential
of PW2)

Model 25GS



System-Head
Curve for 50mm
waterline from
well (PW2) to
holding tank

Operates @ 29 USGPM (Duty)
and 54.78m TDH (77.9 psi)

MODEL 5GS

SELECTION CHART

Horsepower Range ½ – 2, Recommended Range 1.2 – 7.5 GPM, 60 Hz, 3450 RPM

Pump Model	HP	PSI	Depth to Water in Feet/Ratings in GPM (Gallons per Minute)																																
			20	40	60	80	100	120	140	160	180	200	220	240	260	280	300	340	380	420	460	500	540	580	620	660	700	740	780	820	860	900	940	980	1020
5GS05R	½	0						7.4	6.9	6.3	5.8	5.3	4.7	4.0	3.0	1.4																			
		20				7.3	6.7	6.2	5.6	5.1	4.5	3.8	2.6																						
		30			7.2	6.6	6.1	5.6	5.0	4.4	3.6	2.3																							
		40		7.1	6.6	6.0	5.5	4.9	4.3	3.4	2.1																								
		50	7.0	6.5	5.9	5.4	4.9	4.2	3.3	1.8																									
		60	6.4	5.8	5.3	4.8	4.1	3.1	1.6																										
Shut-off PSI			118	109	101	92	83	75	66	57	49	40	31	23	14	5																			
5GS05	½	0							7.7	7.3	6.9	6.4	6.0	5.6	5.1	4.7	4.1	2.6																	
		20					7.5	7.1	6.7	6.3	5.9	5.4	5.0	4.5	3.9	3.2	2.3																		
		30				7.5	7.1	6.7	6.2	5.8	5.4	4.9	4.4	3.8	3.1	2.1																			
		40			7.4	7.0	6.6	6.2	5.7	5.3	4.9	4.3	3.7	2.9	1.9																				
		50	7.7	7.4	6.9	6.5	6.1	5.7	5.2	4.8	4.2	3.6	2.8	1.8																					
		60	7.3	6.9	6.5	6.0	5.6	5.2	4.7	4.2	3.5	2.6	1.6																						
Shut-off PSI			156	147	138	130	121	112	104	95	86	78	69	60	52	43	34	17																	
5GS07	¾	0										7.6	7.3	7.0	6.6	6.3	5.9	5.2	4.4	3.3	1.6														
		20								7.5	7.2	6.9	6.5	6.2	5.8	5.5	5.1	4.2	3.1	1.3															
		30							7.5	7.2	6.8	6.5	6.1	5.8	5.4	5.0	4.6	3.6	2.1																
		40						7.4	7.1	6.8	6.4	6.1	5.7	5.4	5.0	4.6	4.1	2.8																	
		50					7.4	7.1	6.7	6.4	6.0	5.7	5.3	4.9	4.5	4.0	3.4	1.8																	
		60			7.6	7.3	7.0	6.7	6.3	6.0	5.6	5.3	4.9	4.4	3.9	3.3	2.6																		
Shut-off PSI					184	175	167	158	149	141	132	123	115	106	97	89	80	63	45	28	11														
5GS10	1	0															7.5	7.0	6.5	5.9	5.3	4.6	3.8	2.8	1.6										
		20												7.6	7.4	7.2	7.0	6.4	5.9	5.2	4.5	3.7	2.6												
		30											7.6	7.4	7.2	6.9	6.7	6.1	5.5	4.8	4.0	3.1	1.9												
		40										7.6	7.4	7.1	6.9	6.6	6.3	5.8	5.1	4.4	3.5	2.5													
		50									7.5	7.3	7.1	6.8	6.6	6.3	6.0	5.4	4.7	3.9	2.9	1.7													
		60								7.5	7.3	7.1	6.8	6.5	6.3	6.0	5.7	5.0	4.3	3.4	2.3														
Shut-off PSI										214	206	197	188	180	171	162	154	136	119	102	84	67	50	32	15										
5GS15	1½	0																7.5	7.2	6.8	6.3	5.9	5.5	5.1	4.6	4.1	3.5	2.8	1.8						
		20														7.6	7.5	7.1	6.7	6.3	5.8	5.4	5.0	4.5	4.0	3.4	2.6	1.6							
		30													7.6	7.5	7.3	6.9	6.5	6.0	5.6	5.2	4.7	4.2	3.7	3.0	2.1								
		40												7.6	7.4	7.3	7.1	6.6	6.2	5.8	5.3	4.9	4.5	3.9	3.3	2.5	1.4								
		50											7.6	7.4	7.2	7.0	6.8	6.4	6.0	5.5	5.1	4.7	4.2	3.6	2.9	1.9									
		60										7.6	7.4	7.2	7.0	6.8	6.6	6.1	5.7	5.3	4.8	4.4	3.8	3.2	2.4										
Shut-off PSI												274	265	257	248	239	231	213	196	179	162	144	127	110	92	75	58	40	23						
5GS20	2	0																			7.4	7.1	6.8	6.4	6.1	5.7	5.4	5.0	4.7	4.3	3.9	3.3	2.7		
		20																		7.4	7.1	6.7	6.4	6.0	5.7	5.3	5.0	4.6	4.2	3.8	3.3	2.6	1.9		
		30																	7.5	7.2	6.9	6.5	6.2	5.8	5.5	5.1	4.8	4.4	4.0	3.5	2.9	2.2			
		40																	7.3	7.0	6.7	6.3	6.0	5.6	5.3	4.9	4.6	4.2	3.7	3.2	2.5	1.7			
		50																7.5	7.2	6.8	6.5	6.1	5.8	5.4	5.1	4.7	4.3	3.9	3.4	2.8	2.1				
		60															7.6	7.3	7.0	6.6	6.3	5.9	5.6	5.2	4.9	4.5	4.1	3.6	3.1	2.4	1.6				
Shut-off PSI																	328	311	293	276	259	242	224	207	190	172	155	138	120	103	86	68	51		

MODEL 7GS

SELECTION CHART

Horsepower Range ½ – 1, Recommended Range 1.5 – 10 GPM, 60 Hz, 3450 RPM

Pump Model	HP	PSI	Depth to Water in Feet/Ratings in GPM (Gallons per Minute)																											
			20	40	60	80	100	120	140	160	180	200	220	240	260	280	300	320	340	360	380	400	420	440	460	480	500	540	580	620
7GS05R	½	0						10.2	8.9	7.5	5.9	3.6																		
		20				9.8	8.5	7.0	5.3	2.5																				
		30			9.6	8.3	6.8	4.9	1.9																					
		40		9.4	8.1	6.5	4.6	1.2																						
		50	9.2	7.8	6.3	4.2	0.5																							
		60	7.6	6.0	3.8																									
Shut-off PSI			85	77	68	59	51	42	33	25	16	7																		
7GS05	½	0								10.1	9.2	8.3	7.4	6.3	5.0	3.4														
		20						9.8	9.0	8.1	7.1	6.0	4.6	2.7																
		30					9.7	8.8	7.9	6.9	5.8	4.3	2.4																	
		40			10.4	9.6	8.7	7.8	6.7	5.6	4.1	2.0																		
		50		10.3	9.4	8.5	7.6	6.6	5.4	3.8	1.7																			
		60	10.2	9.3	8.4	7.5	6.4	5.1	3.5																					
Shut-off PSI			125	116	107	99	90	81	73	64	55	47	38	29	21	12														
7GS07	¾	0											10.0	9.3	8.6	7.9	7.1	6.2	5.2	4.0	2.4									
		20								10.4	9.8	9.1	8.4	7.7	6.9	6.0	4.9	3.5	1.8											
		30							10.3	9.7	9.0	8.3	7.5	6.7	5.8	4.7	3.3	1.5												
		40						10.2	9.5	8.9	8.2	7.4	6.6	5.6	4.5	3.1														
		50					10.1	9.4	8.8	8.1	7.3	6.5	5.5	4.3	2.8															
		60				10.0	9.3	8.7	7.9	7.2	6.3	5.3	4.1	2.5																
Shut-off PSI						140	131	122	114	105	96	88	79	70	62	53	44	36	27	18	10									
7GS10	1	0														10.1	9.6	9.0	8.5	7.9	7.3	6.7	6.0	5.3	4.4	3.4	2.1			
		20											10.4	9.9	9.4	8.9	8.3	7.7	7.1	6.5	5.8	5.0	4.1	3.0	1.6					
		30										10.3	9.9	9.3	8.8	8.2	7.6	7.0	6.4	5.7	4.9	4.0	2.8							
		40									10.3	9.8	9.2	8.7	8.1	7.5	6.9	6.3	5.6	4.8	3.8	2.6								
		50								10.2	9.7	9.2	8.6	8.0	7.4	6.8	6.2	5.4	4.6	3.7	2.4									
		60							10.1	9.6	9.1	8.5	7.9	7.3	6.7	6.0	5.3	4.5	3.5	2.2										
Shut-off PSI									166	158	149	140	132	123	114	106	97	88	80	71	62	54	45	36	28	19	10			

Horsepower Range 1½ – 3, Recommended Range 1.5 – 10 GPM, 60 Hz, 3450 RPM

Pump Model	HP	PSI	Depth to Water in Feet/Ratings in GPM (Gallons per Minute)																										
			200	220	240	260	280	300	340	380	420	460	500	540	580	620	660	700	740	780	820	860	900	940	980	1020	1060	1100	1140
7GS15	1½	0								10.2	9.3	8.5	7.6	6.8	5.9	4.7	2.6												
		20							10.1	9.2	8.3	7.5	6.7	5.8	4.5	2.1													
		30						10.4	9.6	8.7	7.8	7.0	6.2	5.1	3.3														
		40					10.3	9.9	9.1	8.2	7.4	6.6	5.6	4.2	1.6														
		50				10.3	9.9	9.4	8.6	7.7	6.9	6.0	4.9	2.9															
		60			10.2	9.8	9.4	8.9	8.1	7.2	6.4	5.4	3.9																
Shut-off PSI					194	186	177	168	151	134	116	99	82	64	47	30	12												
7GS20	2	0											9.8	9.3	8.7	8.4	7.8	7.1	6.3	5.4	4.5	3.5	2.2						
		20										9.8	9.3	8.7	8.4	7.7	6.9	6.2	5.3	4.3	3.2	2.8							
		30									9.9	9.5	9.0	8.5	7.9	7.2	6.4	5.7	4.4	3.7									
		40								10.0	9.7	9.2	8.7	8.3	7.5	6.7	6.0	5.2	4.1	3.0									
		50								9.9	9.4	8.9	8.5	7.8	7.2	6.3	5.5	4.7	3.5										
		60							10.0	9.6	9.1	8.7	8.2	7.4	6.6	5.8	5.0	4.0											
Shut-off PSI									268	251	234	216	199	182	165	147	130	113	95	80	61	43	26						
7GS30	3	0														9.8	9.5	9.2	8.7	8.3	7.9	7.4	6.8	6.2	5.4	4.7	3.9	3.0	2.0
		20													9.8	9.4	9.2	8.7	8.3	7.8	7.2	6.7	6.2	5.3	4.5	3.7	3.3	1.7	
		30												10.0	9.6	9.2	8.8	8.5	8.0	7.5	6.9	6.3	5.7	4.8	4.1	3.2	2.3		
		40											10.0	9.7	9.4	9.0	8.6	8.2	7.7	7.2	6.6	5.9	5.2	4.4	3.6	2.7	1.7		
		50											9.9	9.5	9.2	8.7	8.4	7.9	7.4	6.8	6.3	5.5	4.8	3.9	3.1	2.2			
		60										10.0	9.7	9.3	9.0	8.6	8.1	7.6	7.0	6.5	5.8	5.1	4.2	3.4	2.5	1.5			
Shut-off PSI												320	303	286	268	251	234	216	199	182	165	147	130	113	95	78	61	43	27

MODEL 10GS

SELECTION CHART Horsepower Range ½ - 3, Recommended Range 3 - 16 GPM, 60 Hz, 3450 RPM

Pump Model	HP	PSI	Depth to Water in Feet/Ratings in GPM (Gallons per Minute)																						
			20	40	60	80	100	120	140	160	180	200	220	240	260	280	300	320	340	360	380	400	420	440	460
10GS05R*	½	0			15.3	14.2	13.1	12.0	10.9	9.8	8.4	6.1	2.1												
		20	15.0	13.9	12.8	11.6	10.6	9.4	7.8	5.1	0.3														
		30	13.7	12.6	11.5	10.4	9.2	7.5	4.6																
		40	12.4	11.3	10.2	9.0	7.2	3.9																	
		50	11.1	10.1	8.8	6.8	3.2																		
		60	9.9	8.5	6.4	2.5																			
Shut-off PSI			89	80	72	63	54	46	37	28	20	11	2												
10GS05*	½	0			15.7	14.9	14.1	13.3	12.4	11.4	10.4	9.3	8.0	6.3	3.9										
		20	15.4	14.7	13.9	13.0	12.1	11.1	10.1	8.9	7.5	5.7	2.9												
		30	14.6	13.8	12.9	12.0	11.0	9.9	8.7	7.3	5.3	2.3													
		40	13.6	12.8	11.8	10.8	9.7	8.5	7.0	4.9	1.7														
		50	12.6	11.7	10.6	9.5	8.3	6.8	4.5	1.0															
		60	11.5	10.5	9.3	8.1	6.5	4.1	0.2																
Shut-off PSI			113	105	96	87	79	70	61	53	44	35	27	18	9	1									
10GS07*	¾	0				15.7	15.2	14.6	14.0	13.4	12.7	12.0	11.4	10.8	10.1	9.5	8.7	7.7	6.4	4.6	2.1				
		20	16.0	15.5	15.0	14.5	13.8	13.2	12.5	11.8	11.2	10.6	9.9	9.2	8.4	7.3	5.9	3.9	1.2						
		30	15.5	15.0	14.4	13.7	13.1	12.4	11.7	11.1	10.5	9.8	9.1	8.3	7.1	5.6	3.5	0.7							
		40	14.9	14.3	13.6	12.9	12.3	11.6	11.0	10.4	9.7	9.0	8.1	6.9	5.3	3.1	0.2								
		50	14.2	13.5	12.8	12.2	11.5	10.9	10.3	9.6	8.9	8.0	6.7	5.0	2.7										
		60	13.4	12.7	12.1	11.4	10.8	10.2	9.5	8.7	7.8	6.5	4.7	2.3											
Shut-off PSI			161	152	143	135	126	118	109	100	92	83	74	66	57	48	40	31	22	14	5				
10GS10*	1	0					15.7	15.2	14.8	14.4	14.0	13.6	13.2	12.7	12.1	11.4	10.7	10.0	9.3	8.6	7.9	7.0	5.7	3.8	0.6
		20		16.0	15.5	15.0	14.6	14.3	13.9	13.5	13.0	12.5	11.9	11.2	10.5	9.8	9.1	8.4	7.6	6.7	5.2	2.9			
		30	16.0	15.4	15.0	14.6	14.2	13.9	13.4	13.0	12.4	11.8	11.1	10.4	9.7	9.0	8.3	7.5	6.5	4.9	2.5				
		40	15.3	14.9	14.5	14.2	13.8	13.4	12.9	12.3	11.6	11.0	10.3	9.6	8.9	8.2	7.4	6.3	4.6	2.0					
		50	14.8	14.5	14.1	13.7	13.3	12.8	12.2	11.5	10.9	10.1	9.5	8.8	8.1	7.2	6.1	4.3	1.5						
		60	14.4	14.1	13.7	13.2	12.7	12.1	11.4	10.7	10.0	9.4	8.7	7.9	7.1	5.8	3.9	0.9							
Shut-off PSI			192	184	175	166	158	149	140	132	123	114	106	97	88	80	71	62	54	45	36	28	19	10	2

Pump Model	HP	PSI	Depth to Water in Feet/Ratings in GPM (Gallons per Minute)																											
			20	40	60	80	100	120	140	160	180	200	220	240	260	280	300	340	380	420	460	500	540	580	620	660	700	740	780	820
10GS15	1½	0												15.7	15.3	14.8	14.4	13.3	12.2	10.9	9.3	7.1	3.0							
		20									16.0	15.6	15.2	14.7	14.3	13.7	13.2	11.9	10.6	9.0	6.5									
		30								15.9	15.5	15.2	14.6	14.2	13.5	13.1	12.6	11.3	9.7	7.6	4.0									
		40							15.8	15.5	15.1	14.6	14.2	13.5	13.0	12.5	11.8	10.3	8.8	6.0										
		50						15.7	15.4	14.9	14.5	14.0	13.4	12.8	12.3	11.7	11.0	9.4	7.4	3.4										
		60					15.7	15.3	14.8	14.4	13.9	13.3	12.8	12.2	11.6	10.9	10.1	8.1	5.6											
Shut-off PSI							197	188	180	171	162	154	144	136	128	119	110	93	76	58	41	24	6							
10GS20	2	0														16.0	15.7	14.9	14.2	13.4	12.4	11.4	10.0	8.2	5.8					
		20												15.9	15.5	15.3	14.8	14.1	13.2	12.2	11.0	9.9	8.0	5.2						
		30											15.8	15.4	15.1	14.7	14.4	13.5	12.7	11.7	10.3	8.8	6.5							
		40										15.8	15.4	15.1	14.7	14.4	14.0	12.9	12.2	10.9	9.5	7.8	3.9							
		50								16.1	15.7	15.3	15.0	14.6	14.2	14.0	13.4	12.5	11.5	10.1	8.5	6.0								
		60							16.0	15.7	15.3	14.9	14.5	14.2	13.8	13.4	12.8	11.8	10.7	9.1	7.2	3.4								
Shut-off PSI									225	216	208	199	190	182	173	164	156	139	121	104	87	69	52	35	17					
10GS30	3	0																	15.8	15.2	14.6	14.0	13.3	12.6	11.9	11.0	10.0	9.0	7.5	5.8
		20																15.7	15.1	14.5	13.9	13.2	12.5	11.8	10.9	9.9	8.8	7.2	5.4	
		30															15.9	15.4	14.8	14.2	13.4	12.8	12.0	11.3	10.3	9.3	8.1	6.2	3.8	
		40														15.9	15.6	15.0	14.4	13.8	13.1	12.4	11.5	10.8	9.7	8.6	7.1	4.7		
		50												16.0	15.8	15.6	15.3	14.7	14.1	13.3	12.7	11.9	11.0	10.2	9.1	7.8	6.0	3.0		
		60											16.0	15.8	15.5	15.2	14.8	14.3	13.7	12.9	12.3	11.4	10.6	9.6	8.3	6.8	4.5			
Shut-off PSI													284	275	267	258	249	232	215	197	180	163	145	128	111	94	76	59	42	24

Horsepower Range 5, Recommended Range 3 - 16 GPM, 60 Hz, 3450 RPM

Pump Model	HP	PSI	Depth to Water in Feet/Ratings in GPM (Gallons per Minute)																		
			340	380	420	460	500	540	580	620	660	700	740	780	820	860	900	940	980	1020	1060
10GS50R	5	0					15.6	15.1	14.6	14.2	13.7	13.3	12.8	12.3	11.7	11.0	10.2	9.2	7.9	6.3	4.3
		20			16.0	15.5	15.0	14.6	14.1	13.6	13.2	12.7	12.2	11.6	10.9	10.1	9.0	7.6	6.0	3.9	
		30			15.7	15.3	14.8	14.3	13.8	13.4	12.9	12.4	11.9	11.2	10.4	9.5	8.2	6.7	4.9		
		40		16.0	15.5	15.0	14.5	14.0	13.6	13.1	12.6	12.1	11.5	10.8	9.9	8.8	7.4	5.7	3.6		
		50		15.7	15.2	14.7	14.2	13.8	13.3	12.9	12.4	11.8	11.1	10.3	9.3	8.0	6.5	4.5			
		60	15.9	15.4	14.9	14.4	14.0	13.5	13.0	12.6	12.0	11.4	10.7	9.7	8.6	7.2	5.4	3.2			
Shut-off PSI			341	324	306	289	272	255	237	220	203	185	168	151	133	116	99	81	64	47	29

Pump Model	HP	PSI	Depth to Water in Feet/Ratings in GPM (Gallons per Minute)																						
			440	480	520	560	600	640	680	720	760	800	840	880	920	960	1000	1040	1080	1120	1160	1200	1240	1280	1320
10GS50	5	0						16	15.5	15.2	14.9	14.5	14	13.5	13	12.5	12	11.5	10.8	10.2	9.5	8.5	7	5.2	
		20					15.9	15.4	15.1	14.8	14.5	13.9	13.4	12.9	12.4	11.9	11.3	10.7	10.1	9.4	8.2	6.8	4.3		
		30					15.6	15.2	14.9	14.6	14.2	13.7	13.1	12.6	12.1	11.6	11.0	10.4	9.8	8.8	7.5	6.0	3.0		
		40				15.8	15.3	15.1	14.7	14.4	13.8	13.3	12.8	12.3	11.8	11.2	10.6	10.0	9.2	7.9	6.6	4.1			
		50				15.5	15.2	14.9	14.6	14.1	13.6	13.0	12.5	12.1	11.5	10.9	10.3	9.7	8.6	7.3	5.6				
		60			15.7	15.3	15.0	14.7	14.3	13.7	13.2	12.7	12.2	11.7	11.1	10.5	9.9	9.0	7.7	6.5	3.2				
Shut-off PSI					346	329	312	294	277	260	242	225	208	191	173	156	139	121	104	87	69	52	35	17	

* HH Versions

MODEL 13GS

SELECTION CHART

Horsepower Range ½ – 3, Recommended Range 4 – 20 GPM, 60 Hz, 3450 RPM

Pump Model	HP	PSI	Depth to Water in Feet/Ratings in GPM (Gallons per Minute)																											
			20	40	60	80	100	120	140	160	180	200	220	240	260	280	300	340	380	420	460	500	540	580	620	660	700	740	780	820
13GS05	½	0			19.0	17.5	15.3	12.5	8.2																					
		20	18.8	16.5	14.5	12.0	8.0																							
		30	16.0	13.4	11.0	4.1																								
		40	13.3	10.6	4.0																									
		50	9.8																											
		60																												
Shut-off PSI			60	52	43	35	26	17	9																					
13GS07	¾	0				19.7	18.5	17.0	15.0	13.2	11.5	8.5																		
		20		19.4	18.0	16.4	14.8	12.9	10.5	6.0																				
		30	18.9	17.5	16.0	14.6	12.5	10.0	5.0																					
		40	17.4	15.9	14.4	12.4	9.7	4.0																						
		50	15.4	13.8	12.0	9.5																								
		60	13.2	11.5	8.5																									
Shut-off PSI			86	78	69	61	52	43	35	26	17	8																		
13GS10	1	0						19.6	18.4	17.6	16.6	15.4	14.1	12.8	11.4	9.5	6.0													
		20			20.0	19.4	18.5	17.2	16.3	15.0	13.8	12.5	11.0	8.5	4.0															
		30		20.0	19.2	18.2	17.1	15.8	14.7	13.6	12.2	10.5	7.5																	
		40	19.9	19.0	18.0	17.0	15.7	14.6	13.5	12.0	10.1	7.3																		
		50	18.8	17.8	16.8	15.5	14.5	13.0	11.6	9.9	7.0																			
		60	17.6	16.6	15.4	14.1	12.8	11.4	9.5	6.0																				
Shut-off PSI			128	119	110	102	93	84	76	67	58	50	41	32	24	15	6													
13GS15	1½	0							19.7	18.9	18.2	17.3	16.3	15.2	14.2	13.2	12.1	8.7												
		20					19.5	18.4	17.9	17.0	16.0	15.1	14.1	12.9	11.8	10.2	8.8													
		30			20.2	19.4	18.6	17.6	16.8	15.8	14.9	14.0	12.6	11.5	9.9	7.9	4.0													
		40		20.0	19.3	18.5	17.5	16.6	15.7	14.8	13.9	12.5	11.4	9.5	7.3	4.0														
		50	20.0	19.1	18.3	17.4	16.4	15.5	14.5	13.6	12.3	11.0	9.2	6.3																
		60	18.9	18.2	17.3	16.3	15.2	14.2	13.3	12.1	11.0	8.7	5.6																	
Shut-off PSI			156	147	139	130	121	113	104	95	87	78	69	61	52	43	35	17												
13GS20	2	0										20.0	19.5	19.0	18.3	17.9	17.2	15.8	14.4	12.6	10.5	7.7								
		20								19.8	19.4	18.8	18.2	17.6	17.0	16.3	15.6	14.1	12.4	10.2	6.8									
		30							19.7	19.3	18.7	18.2	17.4	16.8	16.2	15.5	14.8	13.1	11.1	8.8										
		40						19.6	19.2	18.6	18.1	17.3	16.7	16.1	15.4	14.7	13.8	12.0	9.8	6.0										
		50				20.1	19.5	19.1	18.4	18.0	17.2	16.6	16.0	15.2	14.6	13.7	12.9	10.8	8.5											
		60			20.0	19.5	19.0	18.3	17.9	17.2	16.5	15.8	15.1	14.4	13.6	12.6	11.5	9.2	5.0											
Shut-off PSI					206	198	189	180	172	163	155	146	137	129	120	111	103	85	68	51	33	16								
13GS30	3	0													19.8	19.4	18.9	18.0	17.1	16.0	14.6	13.5	11.9	10.0	7.3					
		20											19.6	19.2	18.9	18.3	17.9	17.0	15.9	14.7	13.3	11.8	9.7	6.9						
		30									20.0	19.5	19.1	18.8	18.2	17.8	17.4	16.4	15.2	13.9	12.3	10.5	8.3	4.0						
		40								20.0	19.4	19.1	18.7	18.2	17.8	17.3	16.8	15.6	14.5	13.0	11.4	9.5	6.0							
		50							19.9	19.5	19.0	18.6	18.1	17.7	17.2	16.7	16.1	14.9	13.7	12.0	10.1	7.9								
		60						19.8	19.4	18.9	18.5	18.0	17.5	17.1	16.6	16.0	15.4	14.2	12.9	11.0	9.0	5.0								
Shut-off PSI								235	226	217	209	200	191	183	174	165	157	139	122	104	87	70	53	35	18					

MODEL 18GS

SELECTION CHART

Horsepower Range ¾ – 5, Recommended Range 6 – 28 GPM, 60 Hz, 3450 RPM

Pump Model	HP	PSI	Depth to Water in Feet/Ratings in GPM (Gallons per Minute)																										
			20	40	60	80	100	120	140	160	180	200	220	240	260	280	300	340	380	420	460	500	540	580	620	660	700	740	780	820	860
18GS07	¾	0			28.2	26.5	24.0	21.0	17.9	13.5																					
		20	27.7	25.9	23.0	20.0	16.5	10.8																							
		30	25.0	22.0	18.8	15.7	9.5																								
		40	22.2	18.9	15.1	9.0																									
		50	18.4	15.0	7.5																										
		60	13.5	5.0																											
Shut-off PSI			74	66	58	49	40	32	23	14																					
18GS10	1	0					27.0	25.5	23.6	21.2	18.8	15.9	12.0																		
		20		28.0	26.6	25.1	22.7	20.0	17.6	14.0	10.0																				
		30	27.9	26.1	24.3	22.2	19.8	17.1	13.8	8.3																					
		40	26.0	24.1	22.0	19.7	17.0	13.1	8.0																						
		50	24.0	22.0	19.1	16.5	13.0	7.1																							
		60	21.0	18.6	15.8	12.0																									
Shut-off PSI			103	94	86	77	68	60	51	42	34	25	16																		
18GS15	1½	0						28.4	27.2	26.0	24.8	23.0	21.4	19.6	17.5	15.0	12.1														
		20				27.8	26.8	25.4	24.0	22.2	20.6	18.8	16.7	14.0	10.0																
		30			27.7	26.5	25.3	23.8	22.0	20.2	18.5	16.1	13.5	10.0																	
		40		27.5	26.3	25.0	23.6	22.0	20.1	18.1	16.0	13.1	9.5																		
		50	27.6	26.4	25.0	23.4	21.8	20.0	18.0	15.5	13.0	9.2																			
		60	26.0	24.6	23.0	21.2	19.5	17.5	15.0	12.0	7.9																				
Shut-off PSI			143	134	126	117	108	100	91	82	74	65	56	48	39	30	22														
18GS20	2	0								28.0	27.1	26.2	25.1	24.0	22.9	21.4	20.0	16.8	12.8												
		20						27.8	26.8	25.8	24.6	23.7	22.6	21.0	19.5	18.0	16.0	11.6													
		30					27.5	26.5	25.5	24.5	23.3	22.1	20.6	19.0	17.5	15.8	13.6	6.5													
		40			28.5	27.4	26.4	25.4	24.4	23.2	22.0	20.5	18.9	17.4	15.7	13.5	11.0														
		50		28.0	27.2	26.2	25.3	24.3	23.0	21.8	20.3	18.7	17.0	15.3	13.1	10.5	6.0														
		60	28.0	27.1	26.2	25.1	24.0	22.9	21.4	20.0	18.3	16.8	14.8	12.8	9.5																
Shut-off PSI			183	174	165	157	148	139	131	122	113	105	96	87	79	70	61	44	27												
18GS30	3	0											28.0	27.4	26.7	26.0	25.0	23.5	21.5	19.2	16.9	14.2	10.5								
		20									27.7	27.0	26.3	25.8	24.9	24.0	23.0	21.0	18.9	16.5	13.5	9.0									
		30								27.6	26.9	26.2	25.5	24.8	23.9	22.9	21.9	19.8	17.5	14.9	11.2										
		40							27.5	26.9	26.2	25.4	24.6	23.8	22.8	21.8	20.9	18.5	16.0	13.3	8.0										
		50						27.4	26.8	26.0	25.2	24.5	23.6	22.6	21.7	20.6	19.5	17.3	14.5	11.0											
		60				28.0	27.4	26.7	26.0	25.0	24.3	23.5	22.5	21.5	20.5	19.2	18.0	15.7	12.8	7.0											
Shut-off PSI						225	216	208	199	190	182	173	164	156	147	139	130	113	95	78	61	43	26								
18GS50R	5	0															27.7	26.6	25.4	24.0	22.5	20.8	19.0	16.9	14.5	11.7	8.1				
		20													27.6	27.0	26.4	25.2	23.8	22.2	20.5	18.7	16.6	14.1	11.2	7.4					
		30											28.0	27.5	26.9	26.3	25.7	24.4	22.9	21.3	19.5	17.5	15.2	12.5	9.1						
		40										27.9	27.4	26.8	26.2	25.6	25.0	23.5	22.0	20.3	18.4	16.2	13.7	10.6	6.7						
		50									27.9	27.3	26.7	26.1	25.5	24.8	24.1	22.7	21.0	19.2	17.2	14.8	12.0	8.5							
		60								27.8	27.2	26.7	26.1	25.4	24.7	24.0	23.3	21.7	20.0	18.1	15.9	13.3	10.1	6.0							
Shut-off PSI										261	252	244	235	226	218	209	200	183	166	148	131	114	96	79	62	44	27				
18GS50	5	0																	27.9	26.8	25.8	24.8	23.7	22.6	21.2	19.9	18.4	16.8	14.8	12.4	9.7
		20																27.5	26.6	25.6	24.5	23.3	22.2	21.0	19.8	18.0	16.2	14.3	12.0	8.8	
		30															28.0	26.9	26.0	25.0	23.9	22.9	21.6	20.3	18.6	17.0	15.0	13.0	10.2	6.2	
		40														28.0	27.4	26.3	25.3	24.4	23.2	22.1	20.1	19.4	17.9	16.0	14.0	11.6	8.0		
		50													27.9	27.3	26.8	25.9	24.9	23.8	22.7	21.3	20.1	18.5	16.9	14.9	12.8	10.0	6.0		
		60												27.9	27.2	26.8	26.2	25.2	24.1	23.0	21.9	20.7	19.2	17.5	15.8	13.6	11.0	7.8			
Shut-off PSI														307	298	290	281	264	246	229	212	195	177	160	143	125	108	91	73	56	39

MODEL 25GS

SELECTION CHART

Horsepower Range 1 – 5, Recommended Range 8 – 33 GPM, 60 Hz, 3450 RPM

Pump Model	HP	PSI	Depth to Water in Feet/Ratings in GPM (Gallons per Minute)																									
			20	40	60	80	100	120	140	160	180	200	220	240	260	280	300	340	380	420	460	500	540	580	620	660	700	740
25GS10	1	0			32.8	30.8	28.6	26.2	23.5	20.0	16.2	11.0																
		20	31.8	30.0	27.5	25.2	22.0	19.0	15.0	8.0																		
		30	29.6	27.2	25.0	21.6	18.0	14.0																				
		40	27.1	24.9	21.5	17.9	13.9																					
		50	24.3	21.0	17.5	13.0																						
		60	20.0	16.2	11.0																							
Shut-off PSI			82	74	65	56	48	39	30	22	13	4																
25GS15	1½	0				33.0	31.8	30.3	28.8	26.9	24.8	22.0	19.8	16.5	11.0													
		20		32.6	31.2	29.6	28.0	26.0	23.8	21.0	18.1	14.8	8.0															
		30	32.5	31.0	29.5	27.6	25.6	23.2	20.9	17.9	14.0																	
		40	30.9	29.4	27.5	25.5	23.1	20.8	17.7	13.6																		
		50	29.0	27.2	25.1	22.9	20.4	17.2	13.0																			
		60	26.9	24.8	22.0	19.8	16.5	11.0																				
Shut-off PSI			111	103	94	85	77	68	59	51	42	33	25	16	7													
25GS20	2	0						33.0	31.8	30.4	29.0	27.4	25.7	22.6	21.5	19.3	15.4											
		20				32.7	31.3	30.0	28.6	26.8	25.0	22.9	20.9	18.3	14.3	9.0												
		30			32.3	31.0	29.6	28.5	26.4	24.5	22.6	20.5	18.0	14.0	8.0													
		40			30.9	29.5	28.2	26.3	24.3	22.4	20.4	17.8	13.6	8.0														
		50		30.5	29.4	28.0	26.0	24.1	22.1	20.0	17.2	13.2																
		60	30.4	29.0	27.4	25.7	22.6	21.5	19.3	15.4	12.2																	
Shut-off PSI			139	130	121	113	104	95	87	78	69	61	52	43	35	26	17											
25GS30	3	0								33.0	32.2	31.5	30.5	29.6	28.3	27.1	25.8	22.6	19.0	14.0								
		20						32.8	32.0	31.0	30.0	29.0	27.9	26.6	25.0	23.8	21.9	20.0	12.6									
		30					32.6	31.8	30.9	30.0	28.8	27.6	26.5	24.9	23.4	21.6	19.9	15.2	8.0									
		40				32.5	31.7	30.9	29.9	28.8	27.5	26.2	24.7	23.3	21.5	19.9	17.8	11.9										
		50			32.3	31.6	30.8	29.8	28.5	27.3	26.0	24.5	23.0	21.2	19.5	17.4	11.5											
		60	33.0	32.2	31.5	30.5	29.6	28.3	27.1	25.8	24.1	22.6	20.9	19.0	16.9	14.0	10.0											
Shut-off PSI			191	183	174	165	157	148	139	131	122	113	105	96	87	79	70	53	35	18								
25GS50R	5	0											32.7	32.2	31.7	31.2	30.5	29.1	27.3	25.3	23.3	21.4	19.3	16.5	11.7			
		20								33.0	32.5	32.1	31.5	31.0	30.3	29.6	28.8	27.0	25.0	23.0	21.1	18.9	15.9	10.6				
		30							32.9	32.5	32.0	31.5	30.9	30.2	29.5	28.7	27.8	25.9	23.9	21.9	19.9	17.4	13.3					
		40						32.9	32.4	31.9	31.4	30.8	30.1	29.4	28.5	27.6	26.7	24.7	22.7	20.8	18.6	15.3						
		50					32.8	32.3	31.8	31.3	30.7	30.0	29.2	28.4	27.5	26.5	25.6	23.6	21.6	19.6	16.9							
		60				32.7	32.2	31.7	31.2	30.6	29.9	29.1	28.3	27.4	26.4	25.4	24.4	22.4	20.4	18.2	14.6							
Shut-off PSI						252	243	234	226	217	208	200	191	182	174	165	156	139	122	104	87	70	52	35	18			
25GS50	5	0														33.0	32.5	31.5	30.2	29.0	27.6	26.0	24.2	22.4	20.5	18.3	15.8	12.0
		20												32.9	32.3	31.8	31.3	30.0	28.8	27.2	25.8	23.9	22.0	20.0	17.8	15.0	11.0	
		30											32.8	32.2	31.8	31.2	30.5	29.3	27.9	26.4	24.8	22.9	21.0	18.9	16.2	13.0	8.0	
		40										32.7	32.1	31.7	31.1	30.4	29.9	28.5	27.1	25.4	23.7	21.9	19.9	17.5	14.5	10.5		
		50									32.6	32.1	31.6	31.0	30.3	29.9	29.2	27.8	26.3	24.5	22.6	21.8	18.7	16.0	12.7			
		60							33.0	32.5	32.0	31.5	30.8	30.2	29.8	29.0	28.3	26.9	25.1	23.3	21.5	19.5	17.0	14.0	9.5			
Shut-off PSI									286	277	268	260	251	242	234	225	216	199	182	165	147	130	113	95	78	61	43	26

Let's Solve Water

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Existing 38mm Waterline from Well PW1 (13GS10 pump) - System Head Curve
Mansfield Ski Club

▨ <<< **Elements Requiring Input Information**

Date: **10-Dec-20**
Project No: **15-319**
Prepared by: **JWL**

Velocity, $V = \frac{Q_P}{A}$ (m/s, MOE Requirements: 0.8m/s - 2.5m/s)
where, Q_P = Peak Sewage Flow (m^3/s)
A = Cross-Sectional Area (m^2)

Minor Head Loss, $H_L = (K_1+K_2+K_3\ldots) \times V^2/2g$
where, $\sum K = (K_1+K_2+K_3\ldots)$
V = mean velocity (m/s), (F/M allowable range is 0.8-2.5m/s)
g = 9.81 (acceleration due to gravity, m/s^2)

<u>Hazen -Williams Equation (re-arranged for Friction Slope)</u>
(Forcemain Head Loss Calculation)

$$\text{Friction Slope, } S = \frac{(V)^{1/0.54}}{(0.85CR^{0.63})^{1/0.54}} \times 100 \ \text{(m/100m)}$$

where, V = mean velocity (m/s)
k = 0.85 for SI units
C = Roughness Coefficient
R = hydraulic radius (m)

Static Head, $h_{S,\,MAX} = h_F - h_{LWL}$ (m)
Static Head, $h_{S,\,MEDIAN} = h_F - h_{MWL}$ (m)
Static Head, $h_{S,\,MIN} = h_F - h_{HWL}$ (m)
where, h_F = Forcemain Max. Elev. Along Length (m
h_{LWL} = Wet Well Low Water Level (m)
h_{MWL} = Wet Well Median Water Level (m)
h_{HWL} = Wet Well High Water Level (m)

Total Dynamic Head, $h_{D,\,MAX} = h_{S,\,MAX} + h_{T.H.L.}$ (m)
Total Dynamic Head, $h_{D,\,MEDIAN} = h_{S,\,MEDIAN} + h_{T.H.L.}$ (m)
Total Dynamic Head, $h_{D,\,MIN} = h_{S,\,MIN} + h_{T.H.L.}$ (m)
where, $h_{S,\,MAX}$ = Maximum Static Head (m)
$h_{S,\,MEDIAN}$ = Median Static Head (m)
$h_{S,\,MIN}$ = Minimum Static Head (m)
$h_{T.H.L.}$ = Total Head Loss (m)

Pipe Design Coefficient C	Forcemain						Fittings Head Loss (m)	Pump Station Head Loss (m)	Total Head Loss (m)	Wet Well Low Water Level (m)	Wet Well Median Water Level (m)	Wet Well High Water Level (m)	Forcemain Max. Elev. Along Length (m)	Static Head			Total Dynamic Head		
	Flow (L/s)	Diameter (mm)	Velocity (m/s)	Head Loss (m/100m)	Distance (m)	Head Loss (m)								MAX. (m)	Median (m)	MIN. (m)	MAX. (m)	Median (m)	MIN. (m)
Wet Well							$\sum K_F$=	$\sum K_{PS}$=											
Low Water Level							8.36												
120	**0.25**	**38**	0.22	0.27	**593.90**	1.57	0.02	0.00	1.60	**256.66**	258.66	**260.66**	**301.75**	45.09	43.09	41.09	46.69	44.69	42.69
120	**0.5**	38	0.44	0.96	593.90	5.68	0.08	0.00	5.77	256.66	258.66	260.66	301.75	45.09	43.09	41.09	50.86	48.86	46.86
120	**0.76**	38	0.67	2.08	593.90	12.34	0.19	0.00	12.54	256.66	258.66	260.66	301.75	45.09	43.09	41.09	57.63	55.63	53.63
120	**1.01**	38	0.89	3.52	593.90	20.90	0.34	0.00	21.24	256.66	258.66	260.66	301.75	45.09	43.09	41.09	66.33	64.33	62.33
120	**1.26**	38	1.11	5.30	593.90	31.48	0.53	0.00	32.01	256.66	258.66	260.66	301.75	45.09	43.09	41.09	77.10	75.10	73.10
Wet Well																			
Median Water Level																			
130	0.25	38	0.22	0.23	593.90	1.36	0.02	0.00	1.38	256.66	258.66	260.66	301.75	45.09	43.09	41.09	46.47	**44.47**	42.47
130	0.5	38	0.44	0.83	593.90	4.90	0.08	0.00	4.98	256.66	258.66	260.66	301.75	45.09	43.09	41.09	50.07	**48.07**	46.07
130	**0.76**	38	0.67	1.79	593.90	10.64	0.19	0.00	10.84	256.66	258.66	260.66	301.75	45.09	43.09	41.09	55.93	**53.93**	51.93
130	1.01	38	**0.89**	3.03	593.90	18.02	0.34	0.00	18.36	256.66	258.66	260.66	301.75	45.09	43.09	41.09	63.45	**61.45**	59.45
130	1.26	38	1.11	4.57	593.90	27.14	0.53	0.00	27.67	256.66	258.66	260.66	301.75	45.09	43.09	41.09	72.76	**70.76**	68.76
Wet Well																			
High Water Level																			
140	0.25	38	0.22	0.20	593.90	1.18	0.02	0.00	1.20	256.66	258.66	260.66	301.75	45.09	43.09	41.09	46.29	44.29	42.29
140	0.5	38	0.44	0.72	593.90	4.27	0.08	0.00	4.36	256.66	258.66	260.66	301.75	45.09	43.09	41.09	49.45	47.45	45.45
140	**0.76**	38	0.67	1.56	593.90	9.28	0.19	0.00	9.47	256.66	258.66	260.66	301.75	45.09	43.09	41.09	54.56	52.56	50.56
140	1.01	38	0.89	2.65	593.90	15.71	0.34	0.00	16.05	256.66	258.66	260.66	301.75	45.09	43.09	41.09	61.14	59.14	57.14
140	1.26	38	1.11	3.98	593.90	23.66	0.53	0.00	24.19	256.66	258.66	260.66	301.75	45.09	43.09	41.09	69.28	67.28	65.28

NOTES: **- Loss Coefficients:** **<u>Wells - Holding Tank</u>**
7 - 90° Bends @ K=1.0, pitless adapter and into shop through pressure tank and back out of shop
3 - Valves @ K=0.12, 2 curb stops outside of shop and 1 valve at pressure tank
1- Exit loss into holding tank @ K=1.0

- Maximum Pressure Ratings for various watermain pipe diameters: **50mm** 200psi SDR 21 **75mm** 200psi SDR 21 **100mm** 235psi DR18 305psi DR14

- The water treatment system capacity is 40 USGPM. The two (2) existing wells (PW1 (north) and PW2 (south)) will be attached to separate water lines running from each well to the existing holding tank at the Main Chalet. The two (2) wells will operate together as needed to supply water to the treatment system and will eventually alternate duty with the two (2) additional proposed wells once constructed. PW1 is considered to have a yield of 17 IPGM (20.4 USGPM OR 1.29 L/s) at a depth of 4.2m below ground grade (262.86m-4.2m=258.66m) based on its pump test.

- The well low water level and high water level have been set at 2.0m below and above the water depth determined during the pump test on the well. Ground grade in the area of the existing holding tank has been used as the Max. Elevation of the waterline to be conservative.

- This system-head curve when plotted against the pump-head curve for the existing well pump (Goulds 13GS1010412C), the operating flow capacity of the existing 38mm waterline is 13.3 IPGM (16 USGPM OR 1.01 L/s) @ TDH of 201.6 ft (61.45 m OR 87.4 psi). The pressue is good (ideally between 80-90 psi) and the cleansing velocity is good (0.70m/s min. for hard water).

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Proposed 50mm Waterline from Well PW2 (25GS20 pump) - System Head Curve
Mansfield Ski Club

▨ <<< **Elements Requiring Input Information**

Date: **10-Dec-20**
Project No: **15-319**
Prepared by: **JWL**

Velocity, V = $\frac{Q_P}{A}$ (m/s, MOE Requirements: 0.8m/s - 2.5m/s)
where, Q_P = Peak Sewage Flow (m^3/s)
A = Cross-Sectional Area (m^2)
Minor Head Loss, $H_L = (K_1+K_2+K_3\ldots) \times V^2/2g$
where, $\sum K = (K_1+K_2+K_3\ldots)$
V = mean velocity (m/s), (F/M allowable range is 0.8-2.5m/s)
g = 9.81 (acceleration due to gravity, m/s^2)

Hazen -Williams Equation (re-arranged for Friction Slope)
(Forcemain Head Loss Calculation)

$$\text{Friction Slope, } S = \frac{(V)^{1/0.54}}{(0.85CR^{0.63})^{1/0.54}} \times 100 \text{ (m/100m)}$$

where, V = mean velocity (m/s)
k = 0.85 for SI units
C = Roughness Coefficient
R = hydraulic radius (m)

Static Head, $h_{S,\ MAX} = h_F - h_{LWL}$ (m)
Static Head, $h_{S,\ MEDIAN} = h_F - h_{MWL}$ (m)
Static Head, $h_{S,\ MIN} = h_F - h_{HWL}$ (m)
where, h_F = Forcemain Max. Elev. Along Length (m
h_{LWL} = Wet Well Low Water Level (m)
h_{MWL} = Wet Well Median Water Level (m)
h_{HWL} = Wet Well High Water Level (m)

Total Dynamic Head, $h_{D,\ MAX} = h_{S,\ MAX} + h_{T.H.L.}$ (m)
Total Dynamic Head, $h_{D,\ MEDIAN} = h_{S,\ MEDIAN} + h_{T.H.L.}$ (m)
Total Dynamic Head, $h_{D,\ MIN} = h_{S,\ MIN} + h_{T.H.L.}$ (m)
where, $h_{S,\ MAX}$ = Maximum Static Head (m)
$h_{S,\ MEDIAN}$ = Median Static Head (m)
$h_{S,\ MIN}$ = Minimum Static Head (m)
$h_{T.H.L.}$ = Total Head Loss (m)

Pipe Design Coefficient C	Forcemain						Fittings Head Loss (m)	Pump Station Head Loss (m)	Total Head Loss (m)	Wet Well Low Water Level (m)	Wet Well Median Water Level (m)	Wet Well High Water Level (m)	Forcemain Max. Elev. Along Length (m)	Static Head			Total Dynamic Head		
	Flow (L/s)	Diameter (mm)	Velocity (m/s)	Head Loss (m/100m)	Distance (m)	Head Loss (m)								MAX. (m)	Median (m)	MIN. (m)	MAX. (m)	Median (m)	MIN. (m)
Wet Well Low Water Level							$\sum K_F$= 8.36	$\sum K_{PS}$=											
120	**0.95**	**50**	0.48	0.83	**540.50**	4.46	0.10	0.00	4.56	**258.34**	260.34	**262.34**	**301.75**	43.41	41.41	39.41	47.97	45.97	43.97
120	**1.26**	50	0.64	1.39	540.50	7.53	0.18	0.00	7.70	258.34	260.34	262.34	301.75	43.41	41.41	39.41	51.11	49.11	47.11
120	**1.58**	50	0.80	2.12	540.50	11.45	0.28	0.00	11.72	258.34	260.34	262.34	301.75	43.41	41.41	39.41	55.13	53.13	51.13
120	**1.89**	50	0.96	2.95	540.50	15.95	0.39	0.00	16.34	258.34	260.34	262.34	301.75	43.41	41.41	39.41	59.75	57.75	55.75
120	**2.08**	50	1.06	3.52	540.50	19.05	0.48	0.00	19.52	258.34	260.34	262.34	301.75	43.41	41.41	39.41	62.93	60.93	58.93
Wet Well Median Water Level																			
130	0.95	50	0.48	0.71	540.50	3.85	0.10	0.00	3.95	258.34	260.34	262.34	301.75	43.41	41.41	39.41	47.36	**45.36**	43.36
130	1.26	50	0.64	1.20	540.50	6.49	0.18	0.00	6.67	258.34	260.34	262.34	301.75	43.41	41.41	39.41	50.08	**48.08**	46.08
130	1.58	50	**0.80**	1.83	540.50	9.87	0.28	0.00	10.15	258.34	260.34	262.34	301.75	43.41	41.41	39.41	53.56	**51.56**	49.56
130	1.89	50	**0.96**	2.54	540.50	13.75	0.39	0.00	14.15	258.34	260.34	262.34	301.75	43.41	41.41	39.41	57.56	**55.56**	53.56
130	2.08	50	1.06	3.04	540.50	16.42	0.48	0.00	16.90	258.34	260.34	262.34	301.75	43.41	41.41	39.41	60.31	**58.31**	56.31
Wet Well High Water Level																			
140	0.95	50	0.48	0.62	540.50	3.35	0.10	0.00	3.45	258.34	260.34	262.34	301.75	43.41	41.41	39.41	46.86	44.86	42.86
140	1.26	50	0.64	1.05	540.50	5.66	0.18	0.00	5.83	258.34	260.34	262.34	301.75	43.41	41.41	39.41	49.24	47.24	45.24
140	**1.58**	50	0.80	1.59	540.50	8.60	0.28	0.00	8.88	258.34	260.34	262.34	301.75	43.41	41.41	39.41	52.29	50.29	48.29
140	1.89	50	0.96	2.22	540.50	11.99	0.39	0.00	12.38	258.34	260.34	262.34	301.75	43.41	41.41	39.41	55.79	53.79	51.79
140	2.08	50	1.06	2.65	540.50	14.32	0.48	0.00	14.79	258.34	260.34	262.34	301.75	43.41	41.41	39.41	58.20	56.20	54.20

NOTES:

- Loss Coefficients: **Wells - Holding Tank**
7 - 90° Bends @ K=1.0, pitless adapter and into shop through pressure tank and back out of shop
3 - Valves @ K=0.12, 2 curb stops outside of shop and 1 valve at pressure tank
1- Exit loss into holding tank @ K=1.0

- Maximum Pressure Ratings for various watermain pipe diameters: **50mm** 200psi SDR 21 **75mm** 200psi SDR 21 **100mm** 235psi DR18 305psi DR14

- The water treatment system capacity is 40 USGPM. The two (2) existing wells (PW1 (north) and PW2 (south)) will be attached to separate water lines running from each well to the existing holding tank at the Main Chalet. The two (2) wells will operate together as needed to supply water to the treatment system and will eventually alternate duty with the two (2) additional proposed wells once constructed. PW2 is considered to have a yield of 25 IPGM (30.0 USGPM OR 1.89 L/s) at a depth of 2.8m below ground grade (263.14m-2.8m=260.34m) based on its pump test.

- The well low water level and high water level have been set at 2.0m below and above the water depth determined during the pump test on the well. Ground grade in the area of the existing holding tank has been used as the Max. Elevation of the waterline to be conservative.

- This system-head curve when plotted against the pump-head curve for the proposed well pump (Goulds 25GS20412C), the operating flow capacity of the proposed 50mm waterline is 24.1 IPGM (29 USGPM OR 1.83 L/s) @ 179.7 ft (54.78 m OR 77.9 psi). The pressue is good (ideally between 80-90 psi) and the cleansing velocity is good (0.70m/s min. for hard water).

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Sanitary Sewer Design Sheet
Mansfield Ski Club

▨ <<< **Elements Requiring Input Information**

Peak Flow Formulas:

Q_{pop} = (P*q*M)/86.4 (L/s)
$Q_{Comm/Inst}$ = Design Flow x Peaking Factor (L/s)
Q_{Ind} = Design Flow x Peaking Factor (L/s)
Q_{Infilt} = i*A (L/s), where A = Area (ha)
$Q_d = Q_{pop} + Q_{Comm/Inst} + Q_{Ind} + Q_{Infilt}$ (L/s)

MOE Velocity Requirements: 0.6m/s - 3.0m/s

where, P = population in 1000's
q = residential sewage unit flow rate
M = Ultimate Flow Factor (residential peaking factor)
(Harmon) $M=1+(14/(4+P^{0.5}))$
Q_{pop} = peak population flow (L/s)
$Q_{Comm/Inst}$ = peak commercial/institutional flow (L/s)
Q_{Ind} = peak industrial flow (L/s)
Q_{Infilt} = peak extraneous (i.e. infiltration) flow (L/s)
i = **peak** extraneous (i.e. infiltration) unit flow rate
Q_d = total peak design flow (L/s)

Comm/Inst Peaking Factor: **3**
Ex Main Chalet Peaking Factor: **4**
Res - SFD Single Family Dwellings: q: L/cap./day ppd =
Res - MFD Multi-Family Dwellings: q: **275** L/cap./day ppu = **4**
Infiltration
i: **1.38** L/mm Ø/100m/hr
(as per MOE Guidelines use 1.38 for sewer design & 0.31 (avg) - 0.78 (peak) for PS/STS)
Mannings Coefficient
n: **0.013**

Date: **10-Dec-20**
Project No: **15-319**
Prepared by: **AW**

Location			Sewage Flow Calculation Data															Sewer Calculation Data					Sewer Profile Data					
Block/ Building	Upstream MH	Downstream MH	Res - SFD # of Units	Res - SFD # of People	Res - MFD # of Units	Res - MFD # of People	Comm/Inst Total Daily Flow (L/day)	Ex Uses Total Daily Flow (L/day)	Cum. Res - SFD # of People	Cum. Res - MFD # of People	Cum. Comm/Inst Total Daily Flow (L/day)	Cum. Industrial Total Daily Flow (L/day)	Residential Peaking Factor	Sewage Flow (L/s)	Infiltration		Total Flow (L/s)	Dia. (mm)	Slope (%)	Length (m)	Capacity (L/s)	Velocity (m/s)	Fall in Sewer (m)	Drop in MH (m)	Top of Grate Elevation (m)		Invert Elevation (m)	
															Individual (L/s)	Cumulative (L/s)								DS	US	DS	US	DS
Block 6	**MH K**	**MH J**		0	**12**	48			0	48	0	0	4.32	0.66	0.015	0.015	0.68	**200**	**3.8**	**19.7**	66.70	2.06	0.75	**0.90**	**305.72**	305.10	302.67	301.92
Block 5	**MH J**	**MH H**		0	**12**	48			0	96	0	0	4.25	1.30	0.021	0.036	1.33	**200**	**6.0**	**27.2**	83.81	2.58	1.63	**0.90**	**305.10**	302.71	301.02	299.39
Ex Uses	**MH L**	**MH I**		0		0		**13800**	0	0	0	13800		0.64	0.036	0.036	0.67	**200**	**1.0**	**47.0**	34.22	1.06	0.47	**0.05**	**301.60**	302.72	299.45	298.98
Bldg B	**MH I**	**MH H**		0	**15**	60	**640**		0	60	640	13800	4.30	1.48	0.030	0.066	1.55	**200**	**1.0**	**38.6**	34.22	1.06	0.39	**0.05**	**302.72**	302.71	298.93	298.54
Bldg A	**MH H**	**MH G**		0	**10**	40	**4410**		0	196	5050	13800	4.15	3.40	0.021	0.123	3.53	**200**	**1.0**	**27.7**	34.22	1.06	0.28	**0.10**	**302.71**	302.25	298.49	298.21
Block 4	**MH G**	**MH F**		0		0			0	196	5050	13800	4.15	3.40	0.016	0.138	3.54	**200**	**1.3**	**20.3**	39.46	1.22	0.27	**0.10**	**302.25**	301.43	298.11	297.84
	MH F	**MH E**		0	**8**	32			0	228	5050	13800	4.13	3.81	0.013	0.152	3.96	**200**	**2.8**	**17.4**	57.26	1.77	0.49	**0.08**	**301.43**	300.45	297.74	297.25
	MH E	**MH D**		0		0			0	228	5050	13800	4.13	3.81	0.019	0.171	3.98	**200**	**5.5**	**24.6**	80.24	2.47	1.35	**0.10**	**300.45**	298.02	297.17	295.82
Block 3 & 2	**MH D**	**MH C**		0	**22**	88			0	316	5050	13800	4.07	4.91	0.055	0.225	5.13	**200**	**3.8**	**71.5**	66.70	2.06	2.72	**0.05**	**298.02**	296.06	295.72	293.00
Block 1	**MH C**	**MH B**		0		0			0	316	5050	13800	4.07	4.91	0.018	0.244	5.15	**200**	**2.1**	**23.9**	49.23	1.52	0.49	**0.05**	**296.06**	294.63	292.95	292.46
	MH B	**MH A**		0	**12**	48			0	364	5050	13800	4.04	5.49	0.007	0.251	5.75	**200**	**0.6**	**9.7**	26.50	0.82	0.06	**0.05**	**294.63**	294.35	292.41	292.35
	MH A	**BIO**		0		0			0	364	5050	13800	4.04	5.49	0.004	0.255	5.75	**200**	**4.9**	**4.7**	75.74	2.34	0.23	**0.05**	**294.35**	**294.48**	292.30	**292.07**
			Individual Totals:	0	91	364	5050	13800																				
			Cumulative # of People (SFD + MFD):	364																								

NOTES: - # of people for the Multi-Family Residential Dwellings (Townhouses, apartments, etc.) is calculated based on # of units x population density (people per unit = # of bedrooms x 2 people per bedroom).
- The flows from the existing buildings (Main Chalet, Admin Building, GM office & Ski house) have all be conservatively assumed to enter the sewage system from the existing Main Chalet Building for the purposes of sizing the sanitary sewer system.
- Refer to the Total Daily Domestic Water Supply Flow Calcs spreadsheet for the determination of all input flow data within this spreadsheet. The slight difference in peak flows between these two spreadsheets is solely the result of the use of the Harmon equation to determine the peaking factors used for sanitary sewer calculations <u>AND</u> Tables 3-1 and Table 3.3 of the MOE Design Guidelines for Drinking-Water Systems (2008) which uses slightly different peaking factors.

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Sewage Pump Station Design - System Head Curve
Mansfield Ski Club - Sewage Treatment System Discharge Pump Station

▨ <<< **Elements Requiring Input Information**

Date: **10-Dec-20**
Project No: **15-319**
Prepared by: **JWL**

Velocity, $V = \frac{Q_P}{A}$ (m/s, MOE Requirements: 0.8m/s - 2.5m/s)

where, Q_P = Peak Sewage Flow (m^3/s)
A = Cross-Sectional Area (m^2)

Minor Head Loss, $H_L = (K_1+K_2+K_3\ldots) \times V^2/2g$
where, $\sum K = (K_1+K_2+K_3\ldots)$
V = mean velocity (m/s), (F/M allowable range is 0.8-2.5m/s)
g = 9.81 (acceleration due to gravity, m/s^2)

<u>Hazen -Williams Equation (re-arranged for Friction Slope)</u>
(Forcemain Head Loss Calculation)

$$\text{Friction Slope, } S = \frac{(V)^{1/0.54}}{(0.85CR^{0.63})^{1/0.54}} \times 100 \text{ (m/100m)}$$

where, V = mean velocity (m/s)
k = 0.85 for SI units
C = Roughness Coefficient
R = hydraulic radius (m)

Static Head, $h_{S,\,MAX} = h_F - h_{LWL}$ (m)
Static Head, $h_{S,\,MEDIAN} = h_F - h_{MWL}$ (m)
Static Head, $h_{S,\,MIN} = h_F - h_{HWL}$ (m)
where, h_F = Forcemain Max. Elev. Along Length (m
h_{LWL} = Wet Well Low Water Level (m)
h_{MWL} = Wet Well Median Water Level (m)
h_{HWL} = Wet Well High Water Level (m)

Total Dynamic Head, $h_{D,\,MAX} = h_{S,\,MAX} + h_{T.H.L.}$ (m)
Total Dynamic Head, $h_{D,\,MEDIAN} = h_{S,\,MEDIAN} + h_{T.H.L.}$ (m)
Total Dynamic Head, $h_{D,\,MIN} = h_{S,\,MIN} + h_{T.H.L.}$ (m)
where, $h_{S,\,MAX}$ = Maximum Static Head (m)
$h_{S,\,MEDIAN}$ = Median Static Head (m)
$h_{S,\,MIN}$ = Minimum Static Head (m)
$h_{T.H.L.}$ = Total Head Loss (m)

Pipe Design Coefficient C	Forcemain						Fittings Head Loss (m)	Pump Station Head Loss (m)	Total Head Loss (m)	Wet Well Low Water Level (m)	Wet Well Median Water Level (m)	Wet Well High Water Level (m)	Forcemain Max. Elev. Along Length (m)	Static Head			Total Dynamic Head		
	Flow (L/s)	Diameter (mm)	Velocity (m/s)	Head Loss (m/100m)	Distance (m)	Head Loss (m)								MAX. (m)	Median (m)	MIN. (m)	MAX. (m)	Median (m)	MIN. (m)
Wet Well Low Water Level							$\sum K_F$=	$\sum K_{PS}$=											
							2												
120	**1**	**50**	0.51	0.91	**133.60**	1.21	0.03	0.00	1.24	**290.80**	291.40	**292.00**	**299.93**	9.13	8.53	7.93	10.37	9.77	9.17
120	**2**	50	1.02	3.28	133.60	4.38	0.11	0.00	4.48	290.80	291.40	292.00	299.93	9.13	8.53	7.93	13.61	13.01	12.41
120	**2.5**	50	1.27	4.95	133.60	6.62	0.17	0.00	6.78	290.80	291.40	292.00	299.93	9.13	8.53	7.93	15.91	15.31	14.71
120	**3**	50	1.53	6.94	133.60	9.28	0.24	0.00	9.51	290.80	291.40	292.00	299.93	9.13	8.53	7.93	18.64	18.04	17.44
120	**4**	50	2.04	11.83	133.60	15.80	0.42	0.00	16.23	290.80	291.40	292.00	299.93	9.13	8.53	7.93	25.36	24.76	24.16
Wet Well Median Water Level																			
130	1	50	0.51	0.78	133.60	1.05	0.03	0.00	1.07	290.80	291.40	292.00	299.93	9.13	8.53	7.93	10.20	**9.60**	9.00
130	2	50	1.02	2.83	133.60	3.77	0.11	0.00	3.88	290.80	291.40	292.00	299.93	9.13	8.53	7.93	13.01	**12.41**	11.81
130	**2.5**	50	1.27	4.27	133.60	5.71	0.17	0.00	5.87	290.80	291.40	292.00	299.93	9.13	8.53	7.93	15.00	**14.40**	13.80
130	3	50	1.53	5.99	133.60	8.00	0.24	0.00	8.24	290.80	291.40	292.00	299.93	9.13	8.53	7.93	17.37	**16.77**	16.17
130	4	50	2.04	10.20	133.60	13.63	0.42	0.00	14.05	290.80	291.40	292.00	299.93	9.13	8.53	7.93	23.18	**22.58**	21.98
Wet Well High Water Level																			
140	1	50	0.51	0.68	133.60	0.91	0.03	0.00	0.94	290.80	291.40	292.00	299.93	9.13	8.53	7.93	10.07	9.47	8.87
140	2	50	1.02	2.46	133.60	3.29	0.11	0.00	3.40	290.80	291.40	292.00	299.93	9.13	8.53	7.93	12.53	11.93	11.33
140	**2.5**	50	1.27	3.72	133.60	4.97	0.17	0.00	5.14	290.80	291.40	292.00	299.93	9.13	8.53	7.93	14.27	13.67	13.07
140	3	50	1.53	5.22	133.60	6.97	0.24	0.00	7.21	290.80	291.40	292.00	299.93	9.13	8.53	7.93	16.34	15.74	15.14
140	4	50	2.04	8.89	133.60	11.88	0.42	0.00	12.30	290.80	291.40	292.00	299.93	9.13	8.53	7.93	21.43	20.83	20.23

NOTES:
- The Forcemain Flow (restricted flow through 4-UV systems is 2.5L/s and was provided by Waterloo Biofilter via email on May 14, 2020) used to design the Pump Station should be bound above and below with a range of values to provide a sufficient assessment of the System Head Curve for the particular pump station under all three (3) Pipe Design Conditions/Coefficients.
- Pump station head loss is assumed to be negligible based on discussions with John Brooks Company Ltd.
- Inlet pipe invert is 292.36m.
- Fitting headloss consists of a 90 elbow at the discharge point (K=1) and exit loss (K=1).

APPENDIX C

STORMWATER MANAGEMENT CALCULATIONS

Ontario IDF CURVE LOOKUP

Active coordinate

44° 11' 44" N, 80° 3' 14" W (44.195833,-80.054167)

Retrieved: Fri, 28 Jul 2017 19:56:22 GMT

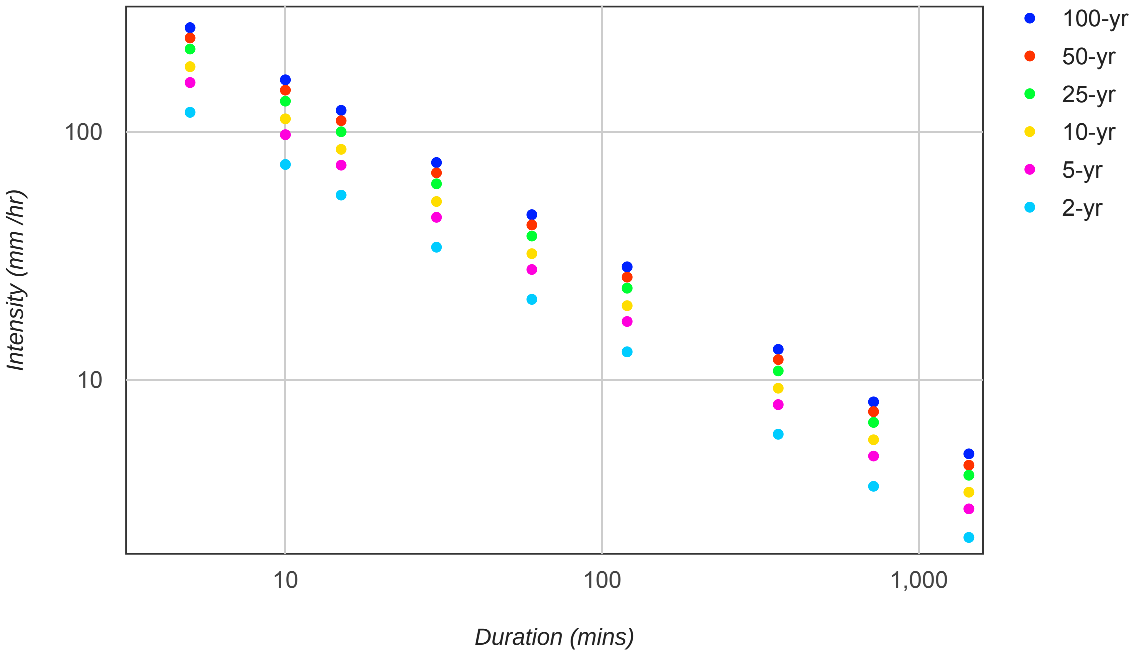
Location summary

These are the locations in the selection.

IDF Curve: 44° 11' 44" N, 80° 3' 14" W (44.195833,-80.054167)

Results

An IDF curve was found.


Coordinate: 44.195833, -80.054167
IDF curve year: 2010

Coefficient summary

IDF Curve: 44° 11' 44" N, 80° 3' 14" W (44.195833,-80.054167)

Retrieved: Fri, 28 Jul 2017 19:56:22 GMT

Data year: 2010
IDF curve year: 2010

Return period	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr
A	21.0	27.7	32.1	37.8	41.9	46.1
B	-0.699	-0.699	-0.699	-0.699	-0.699	-0.699

Statistics

Rainfall intensity (mm hr^{-1})

Duration	5-min	10-min	15-min	30-min	1-hr	2-hr	6-hr	12-hr	24-hr
2-yr	119.3	73.5	55.3	34.1	21.0	12.9	6.0	3.7	2.3
5-yr	157.3	96.9	73.0	45.0	27.7	17.1	7.9	4.9	3.0
10-yr	182.3	112.3	84.6	52.1	32.1	19.8	9.2	5.7	3.5
25-yr	214.7	132.3	99.6	61.4	37.8	23.3	10.8	6.7	4.1
50-yr	238.0	146.6	110.4	68.0	41.9	25.8	12.0	7.4	4.5
100-yr	261.8	161.3	121.5	74.8	46.1	28.4	13.2	8.1	5.0

Rainfall depth (mm)

Duration	5-min	10-min	15-min	30-min	1-hr	2-hr	6-hr	12-hr	24-hr
2-yr	9.9	12.2	13.8	17.0	21.0	25.9	36.0	44.4	54.7
5-yr	13.1	16.2	18.2	22.5	27.7	34.1	47.5	58.5	72.1
10-yr	15.2	18.7	21.1	26.1	32.1	39.5	55.0	67.8	83.6
25-yr	17.9	22.0	24.9	30.7	37.8	46.6	64.8	79.9	98.4
50-yr	19.8	24.4	27.6	34.0	41.9	51.6	71.9	88.5	109.1
100-yr	21.8	26.9	30.4	37.4	46.1	56.8	79.1	97.4	120.0

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STORMWATER MANAGEMENT CALCULATIONS
PRE-DEVELOPMENT CONDITION PARAMETERS

Date: 16-Nov-20
Project No.: 15-319

Project: Mansfield Ski Club
Prepared By: BD

Pre-Development Condition

Internal Drainage Areas				External Drainage Areas			
PRE1	=	2.46	ha	EXT	=	11.71	ha
PRE2	=	1.40	ha				
Total Internal Area	=	3.86	ha	Total External Area	=	11.71	ha

Soil Characteristics

(Soil Map of Simcoe County, Ontario, North Sheet, Soil Survey Report No. 29)

PRE & EXT
-> Duc
-> Dunedin
-> clay
-> Good Drainage
-> Hydrologic Soil Group (D)

To provide an accurate comparison between the pre- and post-development condition considering that both will consist of large gravel parking areas, the STANDHYD command was used for both conditions. To account for the large gravel area present within the pre-development condition, a composite "C" value was determined for the Buildings and parking area. Using the calculated composite "C" value, a "CA" ratio for the Building and Parking areas was determined and then working backwards, an equivalent "CA" ratio assuming all impervious surfaces was used to calculate an equivalent TIMP value for the pre-development conditions STANDHYD command to accurately account for the large packed gravel parking area.

SAMPLE CALCULATION:

PRE1 = 2.46 ha

$$C = \frac{\text{(Gravel "C" x Gravel Area) + (Building "C" x Building Area)}}{\text{(Gravel Area + Building Area)}}$$

$$= \frac{(0.6)(0.90ha) \text{ x } (0.95)(0.07ha)}{0.97ha}$$

$$C = 0.63$$

ACTUAL (gravel) >>> $CA_{RATIO} = (0.63)(0.97ha)$

$= 0.61$

TIMP $= \frac{0.07ha}{2.66ha}$

$= 2.63\%$

$$A_{EQUIVALENT} = \frac{CA_{RATIO}}{C_{IMPERVIOUS}}$$

$$= \frac{0.61}{0.95}$$

$$= 0.64 \text{ ha}$$

EQUIV. (Imp.) >>> $CA_{RATIO} = (0.95)(0.64ha)$

$= 0.61$

TIMP $= \frac{0.64ha}{2.66ha}$

= **24.10%**

PRE1 (Calib Standhyd Command)

Total Area = 2.46 ha

Impervious Areas:
Buildings = 0.06 ha
Gravel = 0.83 ha

Pervious Areas:
Unimproved = 1.47 ha
Treed = 0.09 ha

See above notes and sample calculations for the determination of the Equivalent TIMP value which accounts for the Buildings and Gravel areas.

Total Impervious Area = 0.64 ha
Total Pervious Area = 1.82 ha

XIMP = 1 %*
TIMP = 24 %

CN = 81 *
I_A = 8.1 mm

LGI = 100.0 m
SLPI = 2.0 %

LGP = 80.0 m
SLPP = 10.0 %

* XIMP was based on the assumption that the directly connected areas are the following:
- None of the Areas

* Refer to the CN & IA spreadsheet

EXT (Calib Nashyd Command)

Total Area = 11.71 ha

Buildings & Roads = 0.80 ha
Pasture = 2.60 ha
Lawn = 2.75 ha
Treed = 3.38 ha
Unimproved = 2.18 ha

CN = 83 *
I_A = 6.8 mm*
* Refer to the CN & I_A spreadsheet

C = 0.41
* Refer to the C spreadsheet

T_P = 0.24 hr*

*Refer to T_C & T_P Spreadsheet

PRE2 (Calib Standhyd Command)

Total Area = 1.40 ha

Impervious Areas:
Buildings = 0.06 ha
Gravel = 0.43 ha

Pervious Areas:
Unimproved = 0.91 ha

See above notes and sample calculations for the determination of the Equivalent TIMP value which accounts for the Buildings and Gravel areas.

Total Impervious Area = 0.33 ha
Total Pervious Area = 1.07 ha

XIMP = 1 %*
TIMP = 24 %

CN = 81 *
I_A = 8.0 mm

LGI = 45.0 m
SLPI = 3.5 %

LGP = 70.0 m
SLPP = 13.0 %

* XIMP was based on the assumption that the directly connected areas are the following:
- None of the Areas

* Refer to the CN & IA spreadsheet

SWMHYMO Results

Site Drainage Analysis:

The **24-hour SCS Type II Storm Distribution** was determined to govern the design of the proposed SWM Facility design based on the greater storage volumes required to attenuate the post-development peak flows to their corresponding pre-development target rates over those which were determined based on the other storm distributions.

24-hour SCS Type II Storm Distribution

PRE1

Peak Flow Rates

Q_2 = 0.154 m^3/s
Q_5 = 0.261 m^3/s
Q_{25} = 0.446 m^3/s
Q_{100} = 0.598 m^3/s

PRE2

Peak Flow Rates

Q_2 = 0.100 m^3/s
Q_5 = 0.165 m^3/s
Q_{25} = 0.280 m^3/s
Q_{100} = 0.373 m^3/s

Runoff Volumes

V_2 = 354 m^3
V_5 = 550 m^3
V_{25} = 868 m^3
V_{100} = 1142 m^3

Site + External Drainage Analysis:

The **24-hour SCS Type II Storm Distribution** was determined to govern the design of the proposed by-pass swale, by-pass storm sewer section and dry detention basin design based on the greater peak flows generated in comparison to the other storm distributions.

24-hour SCS Type II Storm Distribution

EXT

Q_2 = 0.592 m^3/s
Q_5 = 0.948 m^3/s
Q_{25} = 1.529 m^3/s
Q_{100} = 2.025 m^3/s

TOTAL (PRE1 + EXT)

Q_2 = 0.743 m^3/s
Q_5 = 1.192 m^3/s
Q_{25} = 1.914 m^3/s
Q_{100} = 2.537 m^3/s

\\WMI-SERVER\wmi-server\Data\Projects\2015\15-319\Design\Storm\Issue_No2\[4_201116-SWMHYMO_Input_Parameters.xlsx]Pre-Development Condition

STORMWATER MANAGEMENT CALCULATIONS
POST-DEVELOPMENT CONDITION PARAMETERS

Date: 16-Nov-20 **Project No.:** 15-319

Project: Mansfield Ski Club **Prepared By:** BD

Post-Development Condition

Internal Drainage Areas				External Drainage Areas			
POST1	=	2.74	ha	EXT	=	11.94	ha
POST2	=	0.89	ha				
Total Internal Area	=	3.63	ha	Total External Area	=	11.94	ha

POST1 (Calib Standhyd Command)

Total Area = 2.74 ha

Impervious Areas:				Pervious Areas:			
Buildings/Parking	=	1.89	ha	Lawn	=	0.85	ha

All parking areas will be gravel with the exception of a small section of paver stones adjacent to the existing Main Chalet Building. As per NVCA design standards, the post-development peak flows are conservatively based on the gravel areas being considered as asphalt.

Total Impervious Area	=	1.89	ha	Total Pervious Area	=	0.85	ha
XIMP	=	59	%*	CN	=	84	*
TIMP	=	69	%	I_A	=	5.0	mm
LGI	=	300.0	m	LGP	=	6.0	m
SLPI	=	3.5	%	SLPP	=	33.3	%

* XIMP was based on the assumption that the directly connected areas are the following:

- All areas not directed towards the landscaped parking islands (grass filter strips).

* Refer to the CN & IA spreadsheet

POST2 (Calib Standhyd Command)

Total Area = 0.89 ha

Impervious Areas:				Pervious Areas:			
Buildings/Parking	=	0.19	ha	Lawn	=	0.70	ha

All parking areas will be gravel with the exception of a small section of paver stones adjacent to the existing Main Chalet Building. As per NVCA design standards, the post-development peak flows are conservatively based on the gravel areas being considered as asphalt.

Total Impervious Area	=	0.19	ha	Total Pervious Area	=	0.70	ha
XIMP	=	10.5	%*	CN	=	84	*
TIMP	=	21	%	I_A	=	5.0	mm
LGI	=	120.0	m	LGP	=	50.0	m
SLPI	=	6.0	%	SLPP	=	11.1	%

* XIMP was based on the assumption that the directly connected areas are the following:

- The east half of the buildings and the driveway/access road.

* Refer to the CN & IA spreadsheet

EXT

(Calib Nashyd Command)

Total Area = 11.94 ha

Buildings & Roads = 0.80 ha
Pasture = 2.60 ha
Lawn = 2.75 ha
Treed = 3.38 ha
Unimproved = 2.41 ha

CN = 83 *
I_A = 6.8 mm*
* Refer to the CN & I_A spreadsheet

C = 0.41
* Refer to the C spreadsheet

T_P = 0.24 hr*

*Refer to T_C & T_P Spreadsheet

SWMHYMO Results

Site Drainage Analysis:

The **24-hour SCS Type II Storm Distribution** was determined to govern the design of the proposed SWM Facility design based on the greater storage volumes required to attenuate the post-development peak flows to their corresponding pre-development target rates over those which were determined based on the other storm distributions.

24-hour SCS Type II Storm Distribution

SWM Facility

Uncontrolled Peak Flow Rates
Q_2 = 0.861 m^3/s
Q_5 = 1.315 m^3/s
Q_{25} = 2.015 m^3/s
Q_{100} = 2.628 m^3/s

Controlled Peak Flow Rates
Q_2 = 0.709 m^3/s
Q_5 = 1.120 m^3/s
Q_{25} = 1.784 m^3/s
Q_{100} = 2.275 m^3/s

Storage Volumes
V_2 = 741.9 m^3
V_5 = 921.8 m^3
V_{25} = 1158.0 m^3
V_{100} = 1364.0 m^3

POST2

Uncontrolled Peak Flow Rates
Q_2 = 0.073 m^3/s
Q_5 = 0.116 m^3/s
Q_{25} = 0.192 m^3/s
Q_{100} = 0.251 m^3/s

Runoff Volumes
V_2 = 266 m^3
V_5 = 396 m^3
V_{25} = 605 m^3
V_{100} = 783 m^3

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RUNOFF COEFFICIENT CALCULATIONS
"C" SPREADSHEET

Date: 2020-11-16

Project No.: 15-319

Project: Mansfield Ski Club

Prepared By: BD

RUNOFF COEFFICIENT NUMBERS

Land Cover		Hydrologic Soil Groups		
		A-AB	B-BC	C-D
Cultivated Land	0 - 5% grade	0.22	0.35	0.55
	5 - 10% grade	0.3	0.45	0.6
	10 - 30% grade	0.4	0.65	0.7
Pasture Land	0 - 5% grade	0.1	0.28	0.4
	5 - 10% grade	0.15	0.35	0.45
	10 - 30% grade	0.22	0.4	0.55
Woodlot or Cutover	0 - 5% grade	0.08	0.25	0.35
	5 - 10% grade	0.12	0.3	0.42
	10 - 30% grade	0.18	0.35	0.52
Lakes and Wetlands		0.05	0.05	0.05
Impervious Area	(i.e. buildings, roads, parking lot, etc.)	0.95	0.95	0.95
Gravel	(not used for proposed parking or storage areas)	0.4	0.5	0.6
Residential	Single Family	0.3	0.4	0.5
	Multiple (i.e. semi, townhouse, apartment, etc.)	0.5	0.6	0.7
Industrial	Light	0.55	0.65	0.75
	Heavy	0.65	0.75	0.85
Commercial		0.6	0.7	0.8
Unimproved Areas		0.1	0.2	0.3
Lawn	< 2% grade	0.05	0.11	0.17
	2 - 7% grade	0.1	0.16	0.22
	> 7% grade	0.15	0.25	0.35

Ref: Runoff Coefficient Numbers - Adapted from Design Chart 1.07, Ontario Ministry of Transportation, "MTO Drainage Management Manual", MTO. (1997)

▨ <<< **Elements Requiring Input Information**

PRE-DEVELOPMENT CONDITION - SITE (PRE1)

Land Cover		Hydrologic Soil Groups		
		A-AB	B-BC	C-D
Cultivated Land	0 - 5% grade			
	5 - 10% grade			
	10 - 30% grade			
Pasture Land	0 - 5% grade			
	5 - 10% grade			
	10 - 30% grade			
Woodlot or Cutover	0 - 5% grade			0.09
	5 - 10% grade			
	10 - 30% grade			
Lakes and Wetlands				
Impervious Area	(i.e. buildings, roads, parking lot, etc.)			0.06
Gravel	(not used for proposed parking or storage areas)			0.83
Residential	Single Family			
	Multiple (i.e. semi, townhouse, apartment, etc.)			
Industrial	Light			
	Heavy			
Commercial				
Unimproved Areas				1.47
Lawn	< 2% grade			
	2 - 7% grade			
	> 7% grade			

Total Area (ha) = 2.46

Runoff Coefficient, C = **0.42**

PRE-DEVELOPMENT CONDITION - SITE (PRE2)

Land Cover		Hydrologic Soil Groups		
		A-AB	B-BC	C-D
Cultivated Land	0 - 5% grade			
	5 - 10% grade			
	10 - 30% grade			
Pasture Land	0 - 5% grade			
	5 - 10% grade			
	10 - 30% grade			
Woodlot or Cutover	0 - 5% grade			
	5 - 10% grade			
	10 - 30% grade			
Lakes and Wetlands				
Impervious Area	(i.e. buildings, roads, parking lot, etc.)			0.06
Gravel	(not used for proposed parking or storage areas)			0.43
Residential	Single Family			
	Multiple (i.e. semi, townhouse, apartment, etc.)			
Industrial	Light			
	Heavy			
Commercial				
Unimproved Areas				0.91
Lawn	< 2% grade			
	2 - 7% grade			
	> 7% grade			

Total Area (ha) = 1.40 **Runoff Coefficient, C = 0.42**

POST-DEVELOPMENT CONDITION - SITE (POST1)

Land Cover		Hydrologic Soil Groups		
		A-AB	B-BC	C-D
Cultivated Land	0 - 5% grade			
	5 - 10% grade			
	10 - 30% grade			
Pasture Land	0 - 5% grade			
	5 - 10% grade			
	10 - 30% grade			
Woodlot or Cutover	0 - 5% grade			
	5 - 10% grade			
	10 - 30% grade			
Lakes and Wetlands				
Impervious Area	(i.e. buildings, roads, parking lot, etc.)			1.89
Gravel	(not used for proposed parking or storage areas)			
Residential	Single Family			
	Multiple (i.e. semi, townhouse, apartment, etc.)			
Industrial	Light			
	Heavy			
Commercial				
Unimproved Areas				
Lawn	< 2% grade			
	2 - 7% grade			
	> 7% grade			0.85

Total Area (ha) = 2.74 **Runoff Coefficient, C = 0.76**

POST-DEVELOPMENT CONDITION - SITE (POST2)

Land Cover		Hydrologic Soil Groups		
		A-AB	B-BC	C-D
Cultivated Land	0 - 5% grade			
	5 - 10% grade			
	10 - 30% grade			
Pasture Land	0 - 5% grade			
	5 - 10% grade			
	10 - 30% grade			
Woodlot or Cutover	0 - 5% grade			
	5 - 10% grade			
	10 - 30% grade			
Lakes and Wetlands				
Impervious Area	(i.e. buildings, roads, parking lot, etc.)			0.19
Gravel	(not used for proposed parking or storage areas)			
Residential	Single Family			
	Multiple (i.e. semi, townhouse, apartment, etc.)			
Industrial	Light			
	Heavy			
Commercial				
Unimproved Areas				
Lawn	< 2% grade			
	2 - 7% grade			
	> 7% grade			0.70

Total Area (ha) = 0.89 **Runoff Coefficient, C = 0.48**

EXTERNAL DRAINAGE AREA (EXT)

Land Cover		Hydrologic Soil Groups		
		A-AB	B-BC	C-D
Cultivated Land	0 - 5% grade			
	5 - 10% grade			
	10 - 30% grade			
Pasture Land	0 - 5% grade			2.6
	5 - 10% grade			
	10 - 30% grade			
Woodlot or Cutover	0 - 5% grade			
	5 - 10% grade			
	10 - 30% grade			3.38
Lakes and Wetlands				
Impervious Area	(i.e. buildings, roads, parking lot, etc.)			0.8
Gravel	(not used for proposed parking or storage areas)			
Residential	Single Family			
	Multiple (i.e. semi, townhouse, apartment, etc.)			
Industrial	Light			
	Heavy			
Commercial				
Unimproved Areas				2.41
Lawn	< 2% grade			
	2 - 7% grade			2.75
	> 7% grade			

Total Area (ha) = 11.94 **Runoff Coefficient, C = 0.41**

#N/A

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CURVE NUMBER & INITIAL ABSTRACTION CALCULATIONS
CN & IA SPREADSHEET

Date: 2020-11-16 **Project No.:** 15-319

Project: Mansfield Ski Club **Prepared By:** BD

SCS CURVE NUMBERS (AMC II (NORMAL) CONDITION) — INITIAL RAINFALL ABSTRACTION

	Hydrologic Soil Groups							IA
Land Cover	**A**	**AB**	**B**	**BC**	**C**	**CD**	**D**	**(mm)**
Wetlands/Lakes/SWMF's	50	50	50	50	50	50	50	
Woods	32	46	60	67	73	76	79	10
Meadows	38	51	65	71	76	79	81	8
Pasture/Lawn	49	59	69	74	79	82	84	5
Cultivated	62	68	74	78	82	84	86	7
Impervious Areas	100	100	100	100	100	100	100	2

Ref: SCS Curve Numbers - Adapted from Design Chart 1.09, Ontario Ministry of Transportation, "MTO Drainage Management Manual", MTO.(1997)
Ref: Initial Rainfall Abstraction Values - UNESCO, Manual on Drainage in Urbanized Areas, (1987)
Ref: AMC I & III Condition SCS Curve Number Values - Modern Sewer Design, Third Edition (Canadian), pg. 69, Table 3.6, (1996)

NOTES:
- **AMC II Condition** SCS Curve Number values are not applicable to frozen soils or to the period where snowmelt contributes to stormwater runoff.
- **STANDHYD COMMANDS** (Swmhymo) - CN values are based solely on the **pervious surfaces** within the catchment.
- **NASHYD COMMANDS** (Swmhymo) - CN values are based on both the **pervious and impervious surfaces** within the catchment (composite CN value).

▨ <<< **Elements Requiring Input Information**

PRE-DEVELOPMENT CONDITION - SITE (PRE1)

(gravel area was accounted for in an equivalent impervious area calculation to account for the existing compacted gravel surface on-site)

Area per Land Cover Type and Hydrologic Soil Group

	Hydrologic Soil Groups						
Land Cover	**A**	**AB**	**B**	**BC**	**C**	**CD**	**D**
Wetlands/Lakes/SWMF's							
Woods							0.09
Meadows							1.47
Pasture/Lawn							
Cultivated							
Impervious Areas							

(for Standhyd Command)
Pervious Area (ha) = 1.56

CN(I) = 64
CN(II) = 81
CN(III) = 92

IA (mm) = 8.1

PRE-DEVELOPMENT CONDITION - SITE (PRE2)

(gravel area was accounted for in an equivalent impervious area calculation to account for the existing compacted gravel surface on-site)

Area per Land Cover Type and Hydrologic Soil Group

	Hydrologic Soil Groups						
Land Cover	**A**	**AB**	**B**	**BC**	**C**	**CD**	**D**
Wetlands/Lakes/SWMF's							
Woods							
Meadows							0.91
Pasture/Lawn							
Cultivated							
Impervious Areas							

(for Standhyd Command)
Pervious Area (ha) = 0.91

CN(I) = 64
CN(II) = 81
CN(III) = 92

IA (mm) = 8.0

POST-DEVELOPMENT CONDITION - SITE (POST1)

Area per Land Cover Type and Hydrologic Soil Group

	Hydrologic Soil Groups						
Land Cover	**A**	**AB**	**B**	**BC**	**C**	**CD**	**D**
Wetlands/Lakes/SWMF's							
Woods							
Meadows							
Pasture/Lawn							0.85
Cultivated							
Impervious Areas							

(for Standhyd Command)

Pervious Area (ha) = 0.85

CN(I) = 68
CN(II) = 84
CN(III) = 93

IA (mm) = 5.0

POST-DEVELOPMENT CONDITION - SITE (POST2)

Area per Land Cover Type and Hydrologic Soil Group

	Hydrologic Soil Groups						
Land Cover	**A**	**AB**	**B**	**BC**	**C**	**CD**	**D**
Wetlands/Lakes/SWMF's							
Woods							
Meadows							
Pasture/Lawn							0.7
Cultivated							
Impervious Areas							

(for Standhyd Command)

Pervious Area (ha) = 0.70

CN(I) = 68
CN(II) = 84
CN(III) = 93

IA (mm) = 5.0

External Drainage Area (EXT)

Area per Land Cover Type and Hydrologic Soil Group

	Hydrologic Soil Groups						
Land Cover	**A**	**AB**	**B**	**BC**	**C**	**CD**	**D**
Wetlands/Lakes/SWMF's							
Woods							3.38
Meadows							2.41
Pasture/Lawn							5.35
Cultivated							
Impervious Areas							0.8

(for Nashyd Command)

Total Area (ha) = 11.94

CN(I) = 67
CN(II) = 83
CN(III) = 93

IA (mm) = 6.8

#N/A

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TIME OF CONCENTRATION & TIME TO PEAK CALCULATIONS
T_C & T_P SPREADSHEET

Date: 31-Jul-17
Project No.: 15-319

Project: Mansfield Ski Club
Prepared By: TG

OVERLAND SHEET FLOW TIME OF CONCENTRATION (T_C) CALCULATION, $T_{C,\ OVER}$

The Runoff Coefficient 'C' governs which Time of Concentration Formula is used:
C > 0.40 Bransby Williams Formula
C <= 0.40 Airport Formula (FAA Equation)
Ref: MTO, Drainage Management Manual, pg 28, Ch. 8, 1997

▨ <<< **Elements Requiring Input Information**

Catchment I.D.	Area (ha)	h_1 (m)	h_2 (m)	Length (m)	Runoff Coefficient	h_{DELTA} (m)	Slope (%)
EXT	11.94	388	308	755.3	0.41	80.0	10.6

$T_{C,\ OVER}$ (min.)	
Airport Formula	Bransby Williams Formula
	21.0

Airport Formula (FAA Equation)

$$T_{C,\ OVER} = \frac{3.26\ (1.1\text{-}C)\ (L)^{0.5}}{(S)^{0.33}} \quad \text{(min.)}$$

where,
C = Runoff Coefficient
L = Length of Overland Flow Path, (m)
S = Avg. Slope of Overland Flow Path, (%)

Bransby Williams Formula

$$T_{C,\ OVER} = \frac{0.057\ (L)}{(S)^{0.2}\ (A)^{0.1}} \quad \text{(min.)}$$

where,
L = Length of Overland Flow Path, (m)
S = Avg. Slope of Overland Flow Path, (%)
A = Catchment Area, (ha)

CHANNELIZED FLOW TIME OF CONCENTRATION (T_C) CALCULATION, $T_{C,\ CHAN}$

Refer to separate sheet attached for the calculation of the Velocity values (i.e. Flow Master Output, Manning's Channel Spreadsheet, etc.).

Catchment I.D.	Length (m)	Velocity (m/s)

$T_{C,\ CHAN}$ (min.)

$$T_{C,\ CHAN} = \frac{L}{V} \quad \text{(min.)}$$

where,
L = Length of Channel, (m)
V = Flow Velocity in Channel, (m/s)

PIPED FLOW TIME OF CONCENTRATION (T_C) CALCULATION, $T_{C,\ PIPE}$

Refer to separate sheet attached for the calculation of the Velocity values (i.e. Culvert Master Output, Manning's Pipe Spreadsheet, etc.).

Catchment I.D.	Length (m)	Velocity (m/s)

$T_{C,\ PIPE}$ (min.)

$$T_{C,\ PIPE} = \frac{L}{V} \quad \text{(min.)}$$

where,
L = Length of Pipe, (m)
V = Flow Velocity in Pipe, (m/s)

TOTAL TIME OF CONCENTRATION (T_C) AND TIME TO PEAK (T_P) CALCULATION, $T_{C,\ TOTAL}$, $T_{P,\ TOTAL}$

The Total Time of Concentration and Time to Peak values consist of a combination of the Overland, Channel and/or Pipe travel times.

Catchment I.D.	$T_{C,\ OVER}$ (min.)	$T_{C,\ CHAN}$ (min.)	$T_{C,\ PIPE}$ (min.)
EXT	21.0		

$T_{C,\ TOTAL}$ (min.)	$T_{P,\ TOTAL}$ (min.)
21.0	**14.1**

$$T_{C,\ TOTAL} = T_{C,\ OVER} + T_{C,\ CHAN} + T_{C,\ PIPE} \quad \text{(min.)}$$

$$T_{P,\ TOTAL} = 0.67 \times T_{C,\ TOTAL} \quad \text{(min.)}$$

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STAGE-STORAGE CALCULATIONS
SWM FACILITY DESIGN SPREADSHEET

Date: 16-Nov-20
Project No.: 15-319
Project: Mansfield Ski Club
Prepared By: BD

▨ <<< **Elements Requiring Input Information**

Required Permanent Pool Volume = m^3
Provided Permanent Pool Volume = m^3

Bottom Elevation, Base = 294.35 m
Normal Water Level Elevation, NWL = 294.35 m (for dry facilities, NWL is assumed at Base)
Top Elevation, Top = 296.90 m

Stage-Storage Information:

Description	**Elevation (m)**	**Stage (m)**	**Area 1 (m^2)**	**Area 2 (m^2)**	**Total Area (m^2)**	**Avg. Area (m^2)**	**Incremental Storage Volume (m^3)**	**Total Storage Volume (m^3)**	**Total Storage Volume Above NWL (m^3)**
Base	294.35	0.00	121.3		121.3	-	-	0.0	0.0
	295.35	1.00	385.8		385.8	253.6	253.6	253.6	0.0
	295.35	1.00	561.1		561.1	473.5	0.5	254.0	0.0
	296.60	2.25	1232.9		1232.9	897.0	1120.4	1374.4	0.0
Top	296.90	2.55	1421.5		1421.5	1327.2	398.2	1772.5	0.0

^
Only increments of 0.01m are valid

Determining the <u>Water Surface Elevation</u> of a <u>known Storage Volume</u>:

		Total Storage Incl. P.P.	Active Storage Only
Extended Detention	Storage Volume =	442.9	
	W.S. Elevation =	295.70	
2-year	Storage Volume =	741.9	
	W.S. Elevation =	296.12	
5-year	Storage Volume =	921.8	
	W.S. Elevation =	296.32	
25-year	Storage Volume =	1158	
	W.S. Elevation =	296.56	
100-year	Storage Volume =	1364	
	W.S. Elevation =	296.61	
Regional	Storage Volume =	1080	
	W.S. Elevation =	296.48	

Determining the <u>Storage Volume</u> at a <u>known Water Surface Elevation</u>:

		Total Storage Incl. P.P.	Active Storage Only
Description	W.S. Elevation =		
	Storage Volume =		

\\WMI-SERVER\wmi-server\Data\Projects\2015\15-319\Design\Storm\Issue_No2\[5_201116_SWM_Facility_Design.xlsx]Stage-Storage

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EXTENDED DETENTION VOLUME DRAWDOWN TIME & PEAK FLOW CALCULATIONS
SWM FACILITY DESIGN SPREADSHEET

Date: 16-Nov-20 **Project No.:** 15-319

Project: Mansfield Ski Club **Prepared By:** BD

▨ <<< **Elements Requiring Input Information**

Active Storage Stage-Area Relationship (from Table above):

	Elevation (m)	**Stage (m)**	**Total Area (m^2)**
NWL	294.35	0.00	121.3
	295.35	1.00	385.8
	295.35	1.00	561.1
	296.60	2.25	1232.9
Top	296.90	2.55	1421.5

Extended Detention Drawdown Time:

t = $0.66C_2h^{1.5}+2C_3h^{0.5}/2.75Ao$ (MOE Equation 4.11)

where, t = drawdown time (sec)
C_2 = slope coeff. from area-depth linear regression
C_3 = intercept from area-depth linear regression
h_{CL} = maximum head (extended detention volume) acting on centroid of orifice (m)
Extended Detention Elev = extended detention water surface elevation (m)
Orifice Invert Elev = control orifice invert elevation (m)
A_O = orifice cross-sectional area (m^2)

Orifice Coefficient, C = 0.63 (typically C=0.63 for orifice plate design)
Orifice Plate Diameter, D_O = 75 mm (minimum recommended orifice size is a **75mm** diameter)
A_O = 0.00442 m^2
Extended Detention Elev = 295.70 m
Orifice Invert Elev = 294.35 m
h_{CL} = 1.312 m
C_2 = 501.03 <<<
C_3 = 42.81 <<<

within each of these two (2) formulas the arrays must be changed to match the range of values listed in the table above (i.e. Stage & Total Area columns)

t = 49000 sec
t = **13.6** hr

NOTE: The recommended drawdown time is 24hr but if an orifice size smaller than the required minimum (75mm dia.) is necessary to achieve the 24hr drawdown time than a minimum 12hr drawdown time is considered to be acceptable).

Quality Storm Peak Release Rate from Facility:

Q_P = $CA_O(2gh_{CL})^{0.5}$ (Orifice Flow Equation)

where, g = acceleration due to gravity (m/s^2)
h_{CL} = maximum head (extended detention volume) acting on centroid of orifice (m)

g = 9.81 m/s^2

Q_P = **0.0141** m^3/s

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STAGE-STORAGE-DISCHARGE (S-S-D) CALCULATIONS
SWM FACILITY

Date: 16-Nov-20 **Project No.:** 15-319

Project: Mansfield Ski Club **Prepared By:** BD

▨ <<< **Elements Requiring Input Information**

Unsubmerged Orifice (Weir Flow)

$Q = C_W L H^{3/2}$ (m^3/s)

where, Q = Flow through unsubmerged orifice (m^3/s)
C_W = Weir Coefficient
H = Head/Depth of water acting on weir measured from above the crest/invert of orifice (m)
L = Length of weir (m)
D = Diameter of Pipe/Orifice (m)
For circular vertical weir,
L = Wetted Perimeter
$L = D \times \cos^{-1}((D/2 - H)/(D/2))$
For circular horizontal weir,
L = Circumference
L = 3.14 x D

Submerged Orifice (Orifice Flow)

$Q = C_O A_O (2gH)^{1/2}$ (m^3/s)

where, Q = Flow through submerged orifice (m^3/s)
C_O = Orifice Discharge Coefficient
A_O = Cross-sectional area of orifice (m^2)
g = Gravitational acceleration ($9.81m^2/s$)
For circular vertical orifice,
H = Head/Depth of water acting on orifice measured from centroid of the opening (m)
For circular horizontal orifice,
H = Head/Depth of water acting on orifice measured from above the invert (m)

Unsubmerged Weir (Weir Flow)

Rectangular Broad- & Sharp-Crested Weirs
$Q = C_W L H^{3/2}$ (m^3/s)
Triangular Broad-Crested Weirs
$Q = 1.225H^{5/2}\tan(Theta/2)$ (m^3/s)
Triangular Sharp-Crested Weirs
$Q = 0.581(8/15)(2g)^{1/2}\tan(Theta/2)H^{5/2}$ (m^3/s)
Trapezoidal Broad- & Sharp-Crested Weirs
$Q_{TRAPEZOIDAL} = Q_{RECTANGULAR} + Q_{TRIANGULAR}$ (m^3/s)

where, Q = Flow through unsubmerged weir (m^3/s)
C_W = Weir Coefficient
(1.65 for Broad-Crested)
(1.80 for Sharp-Crested)
H = Head/Depth of water acting on weir measured from above the crest (m)
L = Length of weir measured perpendicular to flow direction (m)
Theta/2 = Angle of side slope measured from vertical axis (degrees)
g = Gravitational acceleration ($9.81m^2/s$)

Submerged Weir (Orifice Flow)

Submerged Sharp-Crested Weirs
$Q = C_O A_O (2gH)^{1/2}$ (m^3/s)

where, Q = Flow through submerged weir opening (m^3/s)
C_O = Orifice Discharge Coefficient
A_O = Cross-sectional area of opening (m^2)
g = Gravitational acceleration ($9.81m^2/s$)
H = Head/Depth of water acting on orifice measured from centroid of the opening (m)

NOTES: **Orifice Flow Notes**

- **Vertical Orifice Flow** calculations assume weir flow up to the centroid/center of orifice and then orifice flow above the crown/top of the orifice. Between the centroid and crown of the orifice is a flow transition stage from weir to orifice flow and is calculated based on a linear interpolation between the known weir flow at the centroid of the orifice and the known orifice flow at the crown.
- **Horizontal Orifice Flow** calculations assume weir flow up to one-quarter of the orifices diameter (0.25xD) and then orifice flow above three-quarters of the orifices diameter (0.75xD). Between (0.25xD) and (0.75xD) exists a flow transition stage which is calculated based on a linear interpolation between the known weir flow at (0.25xD) and the known orifice flow at (0.75xD).

Weir Flow Notes

- **Orifice control** is only applicable if the weir opening is submerged and not exposed to atmospheric pressure for all ranges of water elevations.
- For all Weir Types, **orifice control** occurs when the water surface elevation is equal to or greater than the crown/top of the opening.

\\WMI-SERVER\wmi-server\Data\Projects\2015\15-319\Design\Storm\Issue_No2\[6_201116_Detailed_S-S-D_Table.xlsx]S-S-D Table

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Starting Water Elevation, m = **294.35**
Incremental Depth, m = **0.05**

	Orifice 1	Orifice 2	Orifice 3	Weir 1	Weir 2	Weir 3	
Orifice Type =	**Vertical**			**Rectangular Sharp-Crested**	**Triangular Broad-Crested**	**Trapezoidal Broad-Crested**	= Weir Type
Orifice Invert Elev., m =	**294.35**			**295.55**	**296.25**	**296.55**	= Weir Crest Elev., m
Incremental Depth, m =	0.05	0.05	0.05	0.05	0.05	0.05	= Incremental Depth, m
Water Elev. @ Inflow, m =	**294.35**						= Weir Openings Crown Elev., m (if appl.)
Orifice Diameter, m =	**0.075**			**0.90**		**4.00**	= Weir Length, m
Centroid of Orifice, m =	294.388			**1.80**	**1.65**	**1.65**	= Weir Coefficient
Orifice Area, m^2 =	0.0044				**2**	**10**	= Side Slope (H:1)
Orifice Coefficient =	**0.63**				63	84	= Theta/2, Degrees
Weir Coefficient =	**1.80**						= Centroid of Orifice, m (if appl.)
							= Orifice Area, m^2 (if appl.)
							= Orifice Coefficient (if appl.)

NOTES:

Elevation (m)	Area 1 (m^2)	Area 2 (m^2)	Total Area (m^2)	Storage Volume (m^3)
294.35	121.3		121.3	**0.0**
295.35	385.8		385.8	**253.6**
295.35	561.1		561.1	**254.0**
296.60	1232.9		1232.9	**1374.4**
296.90	1421.5		1421.5	**1772.5**

^
Only increments of 0.01m are valid

Description	Elevation (m)	Orifice 1 Flow (m^3/s)	Orifice 2 Flow (m^3/s)	Orifice 3 Flow (m^3/s)	Weir 1 Flow (m^3/s)	Weir 2 Flow (m^3/s)	Weir 3 Flow (m^3/s)	Total Flow (m^3/s)	Total Storage Volume (m^3)	Notes
Base	**294.35**	0.0000						**0.0000**	**0.0**	
	294.40	0.0015						**0.0015**	**6.3**	
	294.45	0.0031						**0.0031**	**13.1**	
	294.50	0.0041						**0.0041**	**20.5**	
	294.55	0.0050						**0.0050**	**28.4**	
	294.60	0.0057						**0.0057**	**36.8**	
	294.65	0.0063						**0.0063**	**45.9**	
	294.70	0.0069						**0.0069**	**55.7**	
	294.75	0.0074						**0.0074**	**66.1**	
	294.80	0.0079						**0.0079**	**77.2**	
	294.85	0.0084						**0.0084**	**89.1**	
	294.90	0.0088						**0.0088**	**101.7**	
	294.95	0.0092						**0.0092**	**115.0**	
	295.00	0.0096						**0.0096**	**129.2**	
	295.05	0.0100						**0.0100**	**144.2**	
	295.10	0.0104						**0.0104**	**160.1**	
	295.15	0.0108						**0.0108**	**176.9**	
	295.20	0.0111						**0.0111**	**194.6**	
	295.25	0.0114						**0.0114**	**213.3**	
	295.30	0.0118						**0.0118**	**232.9**	
	295.35	0.0121						**0.0121**	**253.5**	
	295.40	0.0124						**0.0124**	**277.7**	
	295.45	0.0127						**0.0127**	**302.7**	
	295.50	0.0130						**0.0130**	**328.7**	
	295.55	0.0133			0.000			**0.0133**	**355.7**	
	295.60	0.0136			0.018			**0.0317**	**383.7**	
	295.65	0.0139			0.051			**0.0651**	**412.8**	
	295.70	0.0141			0.094			**0.1082**	**443.0**	**Extended Detention (Q=0.108m3/s, V=442.9m3 at 295.70m)**
	295.75	0.0144			0.145			**0.1593**	**474.3**	
	295.80	0.0147			0.203			**0.2172**	**506.7**	
	295.85	0.0149			0.266			**0.2811**	**540.3**	
	295.90	0.0152			0.335			**0.3506**	**575.1**	
	295.95	0.0154			0.410			**0.4252**	**611.2**	
	296.00	0.0157			0.489			**0.5047**	**648.6**	
	296.05	0.0159			0.573			**0.5887**	**687.2**	
	296.10	0.0161			0.661			**0.6769**	**727.2**	**2-year storm (Q=0.709m3/s, V=741.9m3 at 296.12m)**
	296.15	0.0164			0.753			**0.7693**	**768.6**	
	296.20	0.0166			0.849			**0.8656**	**811.3**	
	296.25	0.0168			0.949	0.000		**0.9656**	**855.5**	
	296.30	0.0170			1.052	0.001		**1.0706**	**901.1**	
	296.35	0.0173			1.159	0.008		**1.1842**	**948.3**	**5-year storm (Q=1.120m3/s, V=921.8m3 at 296.32m)**
	296.40	0.0175			1.270	0.021		**1.3084**	**997.0**	
	296.45	0.0177			1.383	0.044		**1.4447**	**1047.2**	**Regional storm (Q=1.540m3/s, V=1080.0m3 at 296.48m)**
	296.50	0.0179			1.500	0.077		**1.5945**	**1099.0**	
	296.55	0.0181			1.620	0.121	0.000	**1.7589**	**1152.4**	**25-year storm (Q=1.784m3/s, V=1158.0m3 at 296.56m)**
Freeboard	296.60	0.0183			1.743	0.178	0.081	**2.0195**	**1207.5**	**100-year storm (Q=2.275m3/s, V=1364.0m3 at 296.61m)**
	296.65	0.0185			1.869	0.248	0.247	**2.3829**	**1430.0**	
	296.70	0.0187			1.998	0.333	0.490	**2.8396**	**1487.0**	
	296.75	0.0189			2.130	0.433	0.809	**3.3911**	**1545.4**	
	296.80	0.0191			2.264	0.550	1.208	**4.0406**	**1605.3**	
	296.85	0.0193			2.401	0.683	1.688	**4.7921**	**1666.6**	
Top	296.90	0.0195			2.541	0.835	2.254	**5.6495**	**1729.3**	

Culvert Calculator Report
15-319 SWM Facility Outlet Pipe

Comments: Outlet Pipe sized to convey the attenuated 100-year peak flow rate (2.275cu.m/s) released from the SWM Facility.

Solve For: Headwater Elevation

Culvert Summary

Allowable HW Elevation	296.61	m	Headwater Depth/Height	2.38	
Computed Headwater Eleva	296.38	m	Discharge	2.2750	m^3/s
Inlet Control HW Elev.	296.38	m	Tailwater Elevation	294.07	m
Outlet Control HW Elev.	296.05	m	Control Type	Inlet Control	

Grades

Upstream Invert	294.20	m	Downstream Invert	294.07	m
Length	12.50	m	Constructed Slope	0.010400	m/m

Hydraulic Profile

Profile	CompositeM2PressureProfile		Depth, Downstream	0.85	m
Slope Type	Mild		Normal Depth	N/A	m
Flow Regime	Subcritical		Critical Depth	0.85	m
Velocity Downstream	3.59	m/s	Critical Slope	0.012573	m/m

Section

Section Shape	Circular		Mannings Coefficient	0.013	
Section Material	Concrete		Span	0.91	m
Section Size	900 mm		Rise	0.91	m
Number Sections	1				

Outlet Control Properties

Outlet Control HW Elev.	296.05	m	Upstream Velocity Head	0.61	m
Ke	0.50		Entrance Loss	0.31	m

Inlet Control Properties

Inlet Control HW Elev.	296.38	m	Flow Control	Submerged	
Inlet Type	Square edge w/headwall		Area Full	0.7	m^2
K	0.00980		HDS 5 Chart	1	
M	2.00000		HDS 5 Scale	1	
C	0.03980		Equation Form	1	
Y	0.67000				

Worksheet for Trapezoidal Channel - Basin Overflow Spillway E-E

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Roughness Coefficient	0.069	
Channel Slope	33.30	%
Normal Depth	0.30	m
Left Side Slope	4.0	H:V
Right Side Slope	4.0	H:V
Bottom Width	2.00	m

Results

Discharge	2.878	m³/s
Flow Area	0.96	m²
Wetted Perimeter	4.47	m
Hydraulic Radius	0.21	m
Top Width	4.40	m
Critical Depth	0.44	m
Critical Slope	7.15	%
Velocity	3.00	m/s
Velocity Head	0.46	m
Specific Energy	0.76	m
Froude Number	2.05	
Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	m
Length	0.00	m
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	m
Profile Description		
Profile Headloss	0.00	m
Downstream Velocity	Infinity	m/s
Upstream Velocity	Infinity	m/s
Normal Depth	0.30	m
Critical Depth	0.44	m
Channel Slope	33.30	%

Worksheet for Trapezoidal Channel - Basin Overflow Spillway E-E

GVF Output Data

Critical Slope	7.15	%

Messages

Notes

The governing release rate from the basin is the 100-year design storm controlled peak flow (24 hour SCS Type-II Distribution) which is 2.275cms

The Basin Overflow Spillway Capacity is 2.878cms.

Rating Table for Trapezoidal Channel - Basin Overflow Spillway E-E

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Roughness Coefficient	0.069	
Channel Slope	33.30	%
Normal Depth	0.30	m
Left Side Slope	4.0	H:V
Right Side Slope	4.0	H:V
Bottom Width	2.00	m

Normal Depth (m)	Discharge (m³/s)	Velocity (m/s)	Flow Area (m²)	Wetted Perimeter (m)	Top Width (m)
0.00		0.00	0.00	2.00	2.00
0.01	0.008	0.38	0.02	2.08	2.08
0.02	0.025	0.60	0.04	2.16	2.16
0.03	0.049	0.78	0.06	2.25	2.24
0.04	0.080	0.93	0.09	2.33	2.32
0.05	0.117	1.07	0.11	2.41	2.40
0.06	0.160	1.19	0.13	2.49	2.48
0.07	0.209	1.31	0.16	2.58	2.56
0.08	0.263	1.42	0.19	2.66	2.64
0.09	0.323	1.52	0.21	2.74	2.72
0.10	0.388	1.62	0.24	2.82	2.80
0.11	0.459	1.71	0.27	2.91	2.88
0.12	0.535	1.80	0.30	2.99	2.96
0.13	0.616	1.88	0.33	3.07	3.04
0.14	0.703	1.96	0.36	3.15	3.12
0.15	0.796	2.04	0.39	3.24	3.20
0.16	0.894	2.12	0.42	3.32	3.28
0.17	0.997	2.19	0.46	3.40	3.36
0.18	1.107	2.26	0.49	3.48	3.44
0.19	1.222	2.33	0.52	3.57	3.52
0.20	1.342	2.40	0.56	3.65	3.60
0.21	1.469	2.46	0.60	3.73	3.68
0.22	1.601	2.53	0.63	3.81	3.76

Rating Table for Trapezoidal Channel - Basin Overflow Spillway E-E

Input Data

Normal Depth (m)	Discharge (m^3/s)	Velocity (m/s)	Flow Area (m^2)	Wetted Perimeter (m)	Top Width (m)
0.23	1.740	2.59	0.67	3.90	3.84
0.24	1.884	2.65	0.71	3.98	3.92
0.25	2.034	2.71	0.75	4.06	4.00
0.26	2.190	2.77	0.79	4.14	4.08
0.27	2.353	2.83	0.83	4.23	4.16
0.28	2.521	2.89	0.87	4.31	4.24
0.29	2.696	2.94	0.92	4.39	4.32
0.30	2.878	3.00	0.96	4.47	4.40

100-yr controlled release rate from the basin is 2.275cms

Cross Section for Trapezoidal Channel - Basin Overflow Spillway E-E

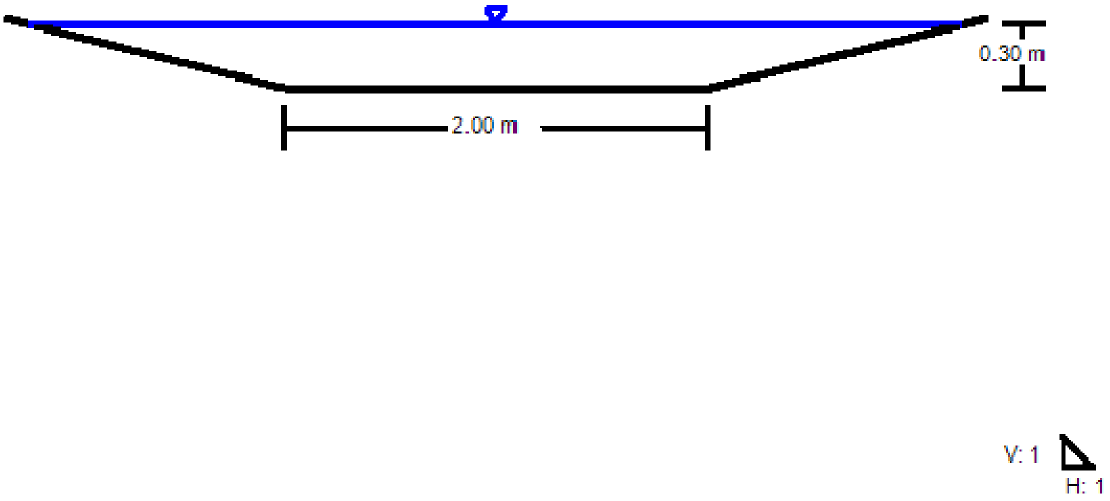
Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Roughness Coefficient	0.069	
Channel Slope	33.30	%
Normal Depth	0.30	m
Left Side Slope	4.0	H:V
Right Side Slope	4.0	H:V
Bottom Width	2.00	m
Discharge	2.878	m³/s

Cross Section Image



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Storm Sewer Design Sheet
Mansfield Ski Club

▨ <<< **Elements Requiring Input Information**

Rational Method Calculation:

$Q = 2.78*(C_F*C*I*A)$

where,

Q = peak flow rate (L/s)
C_F = runoff coefficient factor for storms **> 10-yr** (C_F = 1.0 for the 2, 5 & 10-yr storm events and C_F = 1.1, 1.2 & 1.25 for the 25, 50 & 100-yr storm events respectively)
C = runoff coefficient
I = rainfall intensity (mm/hr)
A = area (ha)

Manning's Formula Calculation:

$V = (k*R^{2/3}*S^{1/2}) / n$ $Q = V*A$

MOE Velocity Requirements: 0.8m/s - 6.0m/s

where,

V = mean velocity (m/s)
k = 1.0 for SI units
R = hydraulic radius (m)
S = friction slope (m/m)
n = Mannings Coefficient **0.013**

Rainfall Intensity Calculation:

$I = A*T^B$ Rainfall IDF Data: http://www.mto.gov.on.ca/IDF_Curves/terms.shtml

where,

I = Rainfall Intensity (mm/hr)
T = Time of Concentration (hr)
A = Rainfall IDF Coefficient
B = Rainfall IDF Coefficient

	5-year	25-year
A =	**27.7**	**37.8**
B =	**-0.699**	**-0.699**
Runoff Coeff. Factors, C_F =	1.00	1.10

Date: **10-Dec-20**
Project No: **15-319**
Prepared by: **AW**

Location			Runoff Calculation Data										Sewer Calculation Data							Sewer Profile Data					
Street	Upstream MH	Downstream MH	Drainage Areas (ha)				Individual 2.78CA	Accumulated 2.78CA	Time of Concentration (mins)	Storm Event	Rainfall Intensity (mm/hr)	Peak Runoff Flow (L/s)	Diameter (mm)	Slope (%)	Length (m)	Capacity (L/s)	Velocity (m/s)	Pipe Flow Time (mins)	Pipe Storage Volume (m^3)	Fall in Sewer (m)	Drop in MH (m)	Top of Grate Elevation (m)		Invert Elevation (m)	
			C = **0.20**	C = **0.40**	C = **0.65**	C = **0.75**															DS	US	DS	US	DS
Site Drainage to SWM basin	**CBMH 11**	**CBMH 12**				**0.14**	0.29	0.29	**10.00**	**5-year**	96.92	28.29	**300**	**0.5**	**20.50**	71.33	0.98	0.35	1.5	0.10	**0.05**	**301.82**	301.71	299.95	299.85
	CBMH 12	**CBMH 14**				**0.05**	0.10	0.40	10.35	**5-year**	94.62	37.48	**300**	**0.5**	**26.60**	71.33	0.98	0.45	1.9	0.13	**0.05**	**301.71**	301.53	299.80	299.67
	CBMH 14	**MH 18**				**0.06**	0.13	0.52	10.80	**5-year**	91.83	47.86	**300**	**3.4**	**51.60**	185.47	2.54	0.34	3.8	1.74	**0.05**	**301.53**	299.75	299.62	297.88
	CBMH 21	**CBMH 15**				**0.07**	0.15	0.15	**10.00**	**5-year**	96.92	14.15	**300**	**1.4**	**29.50**	118.08	1.62	0.30	2.2	0.40	**0.05**	**302.71**	302.35	301.10	300.70
	CBMH 15	**CBMH 16**				**0.25**	0.52	0.67	10.30	**5-year**	94.91	63.33	**300**	**4.6**	**17.30**	216.13	2.96	0.10	1.3	0.79	**0.05**	**302.35**	301.36	300.65	299.86
	CBMH 16	**MH 18**				**0.10**	0.21	0.88	10.40	**5-year**	94.29	82.57	**300**	**5.0**	**38.20**	226.48	3.10	0.21	2.8	1.93	**0.05**	**301.36**	299.75	299.81	297.88
										5-year															
	MH 18	**MH 20**				**0.14**	0.29	1.69	11.14	**5-year**	89.87	151.77	**450**	**0.5**	**50.70**	210.32	1.28	0.66	8.3	0.25	**0.05**	**299.75**	300.02	297.83	297.58
	CB 20A	**MH 20**				**0.17**	0.35	0.35	**10.00**	**5-year**	96.92	34.35	**300**	**4.0**	**9.00**	201.76	2.77	0.05	0.7	0.36	**0.40**	**300.19**	300.02	298.29	297.93
	DICB 23	**MH 20**								**25-year**		**1559.00**	**675**	**5.0**	**46.00**	1960.88	5.31	0.14	17.0	2.30	**0.05**	**302.07**	300.02	299.88	297.58
	MH 20	**MH 21**				**0.00**	0.00	2.04	11.80	**25-year**	117.80	1823.77	**675**	**4.5**	**34.50**	1860.26	5.04	0.11	12.7	1.55	**0.03**	**300.02**	297.85	297.53	295.98
	MH 21	**HEADWALL**				**0.00**	0.00	2.04	11.92	**25-year**	117.01	1822.00	**675**	**4.6**	**15.30**	1880.81	5.09	0.05	5.7	0.70	**0.00**	**297.85**	**296.15**	295.95	**295.25**
Septic Effluent Discharge to Pine River	**MH 1**	**MH 2**										**2.50**	**200**	**13.9**	**76.1**	127.57	3.93	0.32	2.5	10.58	**0.90**	**301.43**	290.80	299.88	289.30
	MH 2	**MH 3**										**2.50**	**200**	**16.3**	**50.1**	138.02	4.26	0.20	1.6	8.15	**0.90**	**290.80**	281.75	288.40	280.25
	MH 3	**MH 4**										**2.50**	**200**	**13.2**	**100.5**	124.46	3.84	0.44	3.3	13.30	**0.90**	**281.75**	267.55	279.35	266.05
	MH 4	**MH 5**										**2.50**	**200**	**2.4**	**84.0**	53.45	1.65	0.85	2.7	2.05	**0.05**	**267.55**	264.55	265.15	263.10
	MH 5	**MH 6**										**2.50**	**200**	**3.8**	**49.5**	66.96	2.06	0.40	1.6	1.90	**0.05**	**264.55**	262.65	263.05	261.15
	MH 6	**MH 7**										**2.50**	**200**	**0.9**	**55.9**	31.73	0.98	0.95	1.8	0.48	**0.04**	**262.65**	261.30	261.10	260.62
	MH 7	**MH 8**										**2.50**	**200**	**0.5**	**50.1**	24.19	0.75	1.12	1.6	0.25	**0.03**	**261.30**	260.86	260.58	260.33
	MH 8	**MH 9**										**2.50**	**200**	**0.5**	**37.8**	24.19	0.75	0.84	1.2	0.19	**0.03**	**260.86**	261.05	260.30	260.11
	MH 9	**OUTLET**										**2.50**	**200**	**0.8**	**5.1**	30.60	0.94	0.09	0.2	0.04	**0.00**	**261.05**	**260.04**	260.08	**260.04**
		Sum of Drainage Areas (ha):	0.00	0.00	0.00	0.98																			
		Total Drainage Area (ha):	0.98																						

NOTES: - The septic effluent forcemain flow (restricted flow through 4-UV systems is 2.5L/s and was provided by Waterloo Biofilter via email on May 14, 2020) and was used to design the Pump Station, forcemain and downstream storm sewer.
- The peak flow into DICB 23 (by-pass swale flow) is 1559L/s and is based on the SWMHYMO hydrologic model (25-yr design storm peak flow based on the 24-hr SCS Type-II storm distribution from the external drainage area (EXT)).

Worksheet for Trapezoidal Channel - External By-Pass Swale A-A

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Roughness Coefficient	0.040	
Channel Slope	1.00	%
Normal Depth	0.50	m
Left Side Slope	3.0	H:V
Right Side Slope	3.0	H:V
Bottom Width	1.00	m

Results

Discharge	1.401	m³/s
Flow Area	1.25	m²
Wetted Perimeter	4.16	m
Hydraulic Radius	0.30	m
Top Width	4.00	m
Critical Depth	0.40	m
Critical Slope	2.59	%
Velocity	1.12	m/s
Velocity Head	0.06	m
Specific Energy	0.56	m
Froude Number	0.64	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	m
Length	0.00	m
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	m
Profile Description		
Profile Headloss	0.00	m
Downstream Velocity	Infinity	m/s
Upstream Velocity	Infinity	m/s
Normal Depth	0.50	m
Critical Depth	0.40	m
Channel Slope	1.00	%

Worksheet for Trapezoidal Channel - External By-Pass Swale A-A

GVF Output Data

Critical Slope	2.59	%

Messages

Notes

The governing 100-year design storm peak flow (24 SCS Type-II Distribution) from the upstream external drainage area is 2.065cms.

Only the downstream section of the External By-pass swale (section graded at 2.4% longitudinal slope) will experience the total 100-year flow noted above. The rest of the External By-pass swale (section graded at 1.0% longitudinal slope) will only receive drainage from the backslope of the existing dry ponds east bank and some local drainage at the upstream end of the swale off of the base of the ski hill which is considerably less runoff.

Rating Table for Trapezoidal Channel - External By-Pass Swale A-A

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Roughness Coefficient	0.040	
Channel Slope	1.00	%
Normal Depth	0.50	m
Left Side Slope	3.0	H:V
Right Side Slope	3.0	H:V
Bottom Width	1.00	m

Normal Depth (m)	Discharge (m³/s)	Velocity (m/s)	Flow Area (m²)	Wetted Perimeter (m)	Top Width (m)
0.00		0.00	0.00	1.00	1.00
0.01	0.001	0.11	0.01	1.06	1.06
0.02	0.004	0.18	0.02	1.13	1.12
0.03	0.007	0.23	0.03	1.19	1.18
0.04	0.012	0.27	0.04	1.25	1.24
0.05	0.018	0.31	0.06	1.32	1.30
0.06	0.024	0.35	0.07	1.38	1.36
0.07	0.032	0.38	0.08	1.44	1.42
0.08	0.040	0.41	0.10	1.51	1.48
0.09	0.050	0.44	0.11	1.57	1.54
0.10	0.060	0.46	0.13	1.63	1.60
0.11	0.071	0.49	0.15	1.70	1.66
0.12	0.084	0.51	0.16	1.76	1.72
0.13	0.097	0.54	0.18	1.82	1.78
0.14	0.111	0.56	0.20	1.89	1.84
0.15	0.126	0.58	0.22	1.95	1.90
0.16	0.142	0.60	0.24	2.01	1.96
0.17	0.159	0.62	0.26	2.08	2.02
0.18	0.178	0.64	0.28	2.14	2.08
0.19	0.197	0.66	0.30	2.20	2.14
0.20	0.217	0.68	0.32	2.26	2.20
0.21	0.238	0.70	0.34	2.33	2.26
0.22	0.261	0.71	0.37	2.39	2.32

Rating Table for Trapezoidal Channel - External By-Pass Swale A-A

Input Data

Normal Depth (m)	Discharge (m³/s)	Velocity (m/s)	Flow Area (m²)	Wetted Perimeter (m)	Top Width (m)
0.23	0.284	0.73	0.39	2.45	2.38
0.24	0.309	0.75	0.41	2.52	2.44
0.25	0.335	0.77	0.44	2.58	2.50
0.26	0.362	0.78	0.46	2.64	2.56
0.27	0.390	0.80	0.49	2.71	2.62
0.28	0.420	0.81	0.52	2.77	2.68
0.29	0.450	0.83	0.54	2.83	2.74
0.30	0.482	0.85	0.57	2.90	2.80
0.31	0.515	0.86	0.60	2.96	2.86
0.32	0.549	0.88	0.63	3.02	2.92
0.33	0.585	0.89	0.66	3.09	2.98
0.34	0.622	0.91	0.69	3.15	3.04
0.35	0.660	0.92	0.72	3.21	3.10
0.36	0.700	0.93	0.75	3.28	3.16
0.37	0.741	0.95	0.78	3.34	3.22
0.38	0.783	0.96	0.81	3.40	3.28
0.39	0.826	0.98	0.85	3.47	3.34
0.40	0.871	0.99	0.88	3.53	3.40
0.41	0.918	1.00	0.91	3.59	3.46
0.42	0.966	1.02	0.95	3.66	3.52
0.43	1.015	1.03	0.98	3.72	3.58
0.44	1.066	1.04	1.02	3.78	3.64
0.45	1.118	1.06	1.06	3.85	3.70
0.46	1.172	1.07	1.09	3.91	3.76
0.47	1.227	1.08	1.13	3.97	3.82
0.48	1.283	1.10	1.17	4.04	3.88
0.49	1.342	1.11	1.21	4.10	3.94
0.50	1.401	1.12	1.25	4.16	4.00

68% of total EXT 100-yr flow of 2.065cms which is more than will be directed to this section of the swale

Cross Section for Trapezoidal Channel - External By-Pass Swale A-A

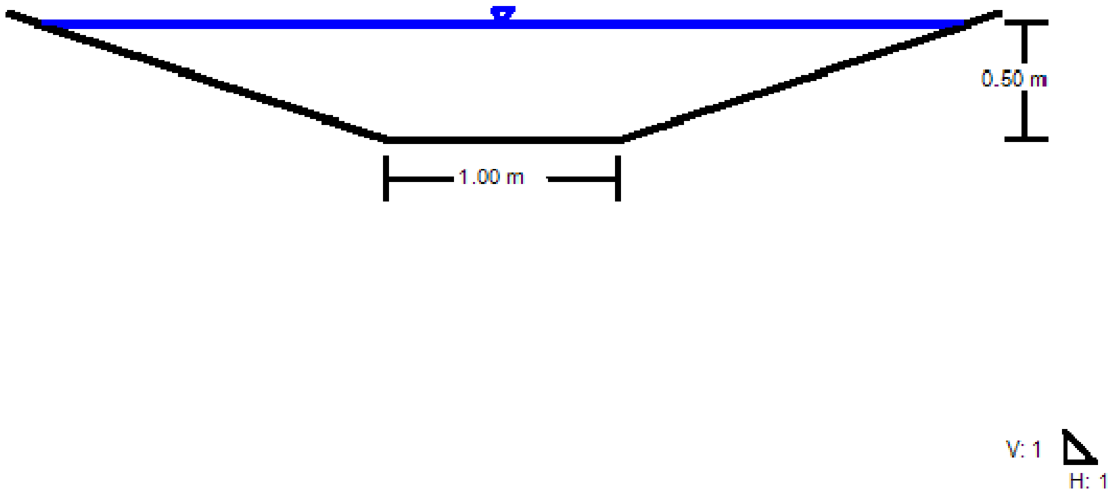
Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Roughness Coefficient	0.040	
Channel Slope	1.00	%
Normal Depth	0.50	m
Left Side Slope	3.0	H:V
Right Side Slope	3.0	H:V
Bottom Width	1.00	m
Discharge	1.401	m³/s

Cross Section Image



Worksheet for Trapezoidal Channel - External By-Pass Swale B-B

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Roughness Coefficient	0.040	
Channel Slope	2.40	%
Normal Depth	0.50	m
Left Side Slope	3.0	H:V
Right Side Slope	3.0	H:V
Bottom Width	1.00	m

Results

Discharge	2.171	m^3/s
Flow Area	1.25	m^2
Wetted Perimeter	4.16	m
Hydraulic Radius	0.30	m
Top Width	4.00	m
Critical Depth	0.50	m
Critical Slope	2.44	%
Velocity	1.74	m/s
Velocity Head	0.15	m
Specific Energy	0.65	m
Froude Number	0.99	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	m
Length	0.00	m
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	m
Profile Description		
Profile Headloss	0.00	m
Downstream Velocity	Infinity	m/s
Upstream Velocity	Infinity	m/s
Normal Depth	0.50	m
Critical Depth	0.50	m
Channel Slope	2.40	%

Worksheet for Trapezoidal Channel - External By-Pass Swale B-B

GVF Output Data

Critical Slope	2.44	%

Messages

Notes

The governing 100-year design storm peak flow (24 SCS Type-II Distribution) from the upstream external drainage area is 2.065cms.

Section B-B is located at DICBMH 23 which is where the total flow from the upstream external lands (EXT) will be collected.

Rating Table for Trapezoidal Channel - External By-Pass Swale B-B

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Roughness Coefficient	0.040	
Channel Slope	2.40	%
Normal Depth	0.50	m
Left Side Slope	3.0	H:V
Right Side Slope	3.0	H:V
Bottom Width	1.00	m

Normal Depth (m)	Discharge (m³/s)	Velocity (m/s)	Flow Area (m²)	Wetted Perimeter (m)	Top Width (m)
0.00		0.00	0.00	1.00	1.00
0.01	0.002	0.18	0.01	1.06	1.06
0.02	0.006	0.27	0.02	1.13	1.12
0.03	0.012	0.35	0.03	1.19	1.18
0.04	0.019	0.42	0.04	1.25	1.24
0.05	0.028	0.48	0.06	1.32	1.30
0.06	0.038	0.53	0.07	1.38	1.36
0.07	0.050	0.59	0.08	1.44	1.42
0.08	0.063	0.63	0.10	1.51	1.48
0.09	0.077	0.68	0.11	1.57	1.54
0.10	0.093	0.72	0.13	1.63	1.60
0.11	0.111	0.76	0.15	1.70	1.66
0.12	0.130	0.79	0.16	1.76	1.72
0.13	0.150	0.83	0.18	1.82	1.78
0.14	0.172	0.86	0.20	1.89	1.84
0.15	0.195	0.90	0.22	1.95	1.90
0.16	0.220	0.93	0.24	2.01	1.96
0.17	0.247	0.96	0.26	2.08	2.02
0.18	0.275	0.99	0.28	2.14	2.08
0.19	0.305	1.02	0.30	2.20	2.14
0.20	0.336	1.05	0.32	2.26	2.20
0.21	0.369	1.08	0.34	2.33	2.26
0.22	0.404	1.11	0.37	2.39	2.32

Rating Table for Trapezoidal Channel - External By-Pass Swale B-B

Input Data

Normal Depth (m)	Discharge (m³/s)	Velocity (m/s)	Flow Area (m²)	Wetted Perimeter (m)	Top Width (m)
0.23	0.441	1.13	0.39	2.45	2.38
0.24	0.479	1.16	0.41	2.52	2.44
0.25	0.519	1.19	0.44	2.58	2.50
0.26	0.561	1.21	0.46	2.64	2.56
0.27	0.604	1.24	0.49	2.71	2.62
0.28	0.650	1.26	0.52	2.77	2.68
0.29	0.697	1.29	0.54	2.83	2.74
0.30	0.747	1.31	0.57	2.90	2.80
0.31	0.798	1.33	0.60	2.96	2.86
0.32	0.851	1.36	0.63	3.02	2.92
0.33	0.906	1.38	0.66	3.09	2.98
0.34	0.964	1.40	0.69	3.15	3.04
0.35	1.023	1.43	0.72	3.21	3.10
0.36	1.084	1.45	0.75	3.28	3.16
0.37	1.147	1.47	0.78	3.34	3.22
0.38	1.213	1.49	0.81	3.40	3.28
0.39	1.280	1.51	0.85	3.47	3.34
0.40	1.350	1.53	0.88	3.53	3.40
0.41	1.422	1.56	0.91	3.59	3.46
0.42	1.496	1.58	0.95	3.66	3.52
0.43	1.572	1.60	0.98	3.72	3.58
0.44	1.651	1.62	1.02	3.78	3.64
0.45	1.732	1.64	1.06	3.85	3.70
0.46	1.815	1.66	1.09	3.91	3.76
0.47	1.900	1.68	1.13	3.97	3.82
0.48	1.988	1.70	1.17	4.04	3.88
0.49	2.078	1.72	1.21	4.10	3.94
0.50	2.171	1.74	1.25	4.16	4.00

100-yr peak flow
from EXT is
2.065cms

Cross Section for Trapezoidal Channel - External By-Pass Swale B-B

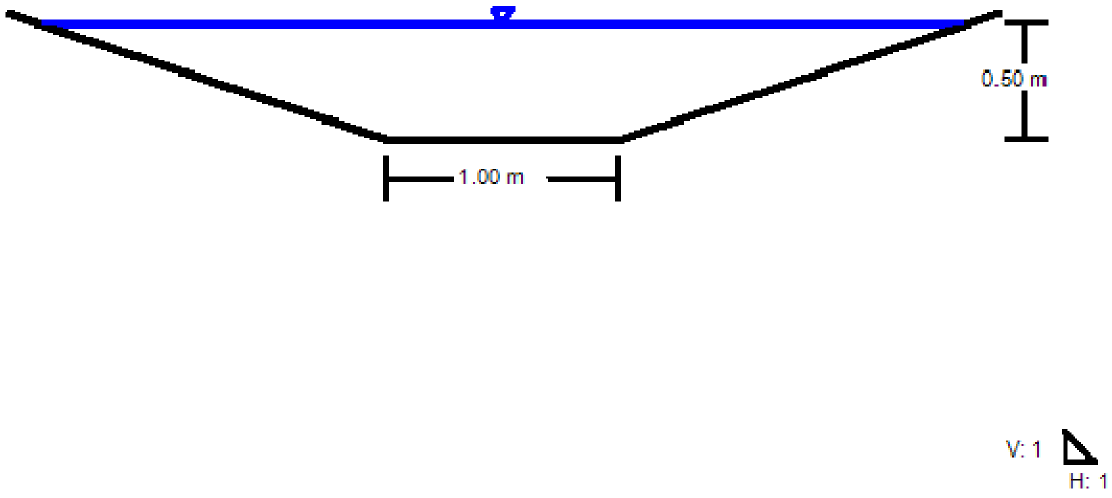
Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Roughness Coefficient	0.040	
Channel Slope	2.40	%
Normal Depth	0.50	m
Left Side Slope	3.0	H:V
Right Side Slope	3.0	H:V
Bottom Width	1.00	m
Discharge	2.171	m³/s

Cross Section Image



Worksheet for External By-Pass Spill Overland Flow

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Roughness Coefficient	0.030	
Channel Slope	6.00	%
Normal Depth	0.10	m
Left Side Slope	50.0	H:V
Right Side Slope	50.0	H:V

Results

Discharge	0.506	m³/s
Flow Area	0.47	m²
Wetted Perimeter	9.67	m
Hydraulic Radius	0.05	m
Top Width	9.67	m
Critical Depth	0.12	m
Critical Slope	2.28	%
Velocity	1.08	m/s
Velocity Head	0.06	m
Specific Energy	0.16	m
Froude Number	1.57	
Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	m
Length	0.00	m
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	m
Profile Description		
Profile Headloss	0.00	m
Downstream Velocity	Infinity	m/s
Upstream Velocity	Infinity	m/s
Normal Depth	0.10	m
Critical Depth	0.12	m
Channel Slope	6.00	%
Critical Slope	2.28	%

Worksheet for External By-Pass Spill Overland Flow

Messages

Notes

The 100-year peak flow from the upstream external drainage area (EXT) is 2.065cms. The External by-pass section storm sewer has been sized to convey the 25-year peak flow (1.559cms) from the external drainage area (EXT).

Therefore, a peak flow of 0.506cms (2.065-1.559cms) has been used to calculate the External By-pass spill (overland flow to the basin).

Rating Table for External By-Pass Spill Overland Flow

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Roughness Coefficient	0.030	
Channel Slope	6.00	%
Normal Depth	0.10	m
Left Side Slope	50.0	H:V
Right Side Slope	50.0	H:V

Normal Depth (m)	Discharge (m³/s)	Velocity (m/s)	Flow Area (m²)	Wetted Perimeter (m)	Top Width (m)
0.00			0.00	0.00	0.00
0.01	0.001	0.24	0.01	1.00	1.00
0.02	0.008	0.38	0.02	2.00	2.00
0.03	0.022	0.50	0.05	3.00	3.00
0.04	0.048	0.60	0.08	4.00	4.00
0.05	0.087	0.70	0.13	5.00	5.00
0.06	0.142	0.79	0.18	6.00	6.00
0.07	0.214	0.87	0.25	7.00	7.00
0.08	0.306	0.95	0.32	8.00	8.00
0.09	0.418	1.03	0.41	9.00	9.00
0.10	0.554	1.11	0.50	10.00	10.00

100yr - 25yr peak flow from EXT is 0.506cms

Cross Section for External By-Pass Spill Overland Flow

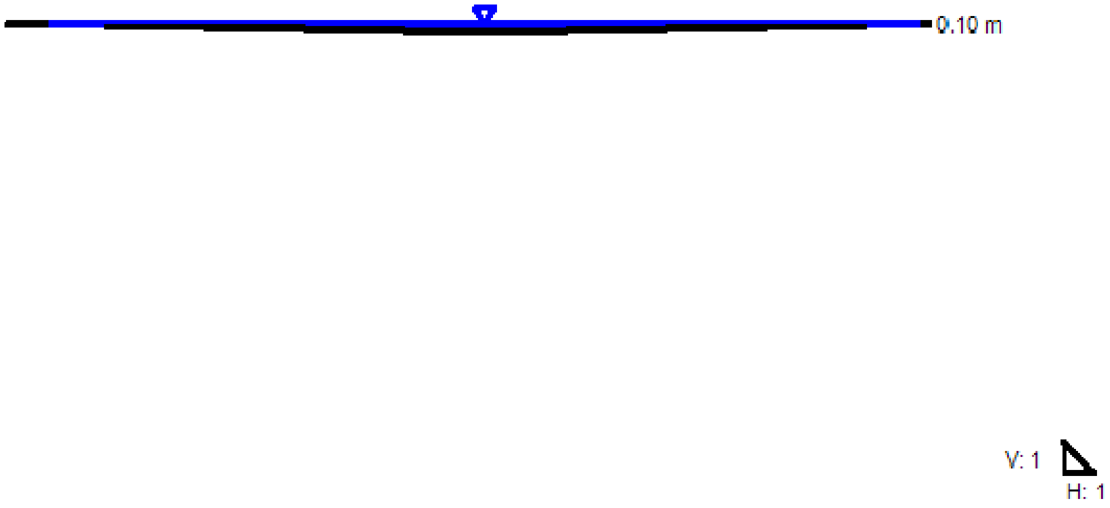
Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Roughness Coefficient	0.030	
Channel Slope	6.00	%
Normal Depth	0.10	m
Left Side Slope	50.0	H:V
Right Side Slope	50.0	H:V
Discharge	0.506	m³/s

Cross Section Image



Worksheet for Trapezoidal Channel - North Enhanced Grass Swale

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Roughness Coefficient	0.040	
Channel Slope	1.00	%
Normal Depth	0.50	m
Left Side Slope	3.0	H:V
Right Side Slope	3.0	H:V
Bottom Width	1.00	m

Results

Discharge	1.401	m³/s
Flow Area	1.25	m²
Wetted Perimeter	4.16	m
Hydraulic Radius	0.30	m
Top Width	4.00	m
Critical Depth	0.40	m
Critical Slope	2.59	%
Velocity	1.12	m/s
Velocity Head	0.06	m
Specific Energy	0.56	m
Froude Number	0.64	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	m
Length	0.00	m
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	m
Profile Description		
Profile Headloss	0.00	m
Downstream Velocity	Infinity	m/s
Upstream Velocity	Infinity	m/s
Normal Depth	0.50	m
Critical Depth	0.40	m
Channel Slope	1.00	%

Worksheet for Trapezoidal Channel - North Enhanced Grass Swale

GVF Output Data

Critical Slope	2.59	%

Messages

Notes

The governing 100-year design storm peak flow (24 hour SCS Type-II Distribution) from the upstream Site drainage area (POST1) is 0.949cms and the 25mm Chicago Storm peak flow is 0.255cms.

Of the 2.74ha of POST1, 0.85ha is captured and conveyed to the basin by the EGS at the east limit of the site since the upstream storm sewer will collect the remaining area during a 25mm design storm event. Considering this, 31% of the above noted flows will be experienced within the EGS.

Pro-ration:
25mm peak flow = 0.079cms

Conservatively the EGS has been designed to accommodate the entire 100-year design storm peak flow from POST1 (0.949cms) although a portion of this will be intercepted and conveyed to the basin via the proposed storm sewer system.

Rating Table for Trapezoidal Channel - North Enhanced Grass Swale

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Roughness Coefficient	0.040	
Channel Slope	1.00	%
Normal Depth	0.50	m
Left Side Slope	3.0	H:V
Right Side Slope	3.0	H:V
Bottom Width	1.00	m

Normal Depth (m)	Discharge (m³/s)	Velocity (m/s)	Flow Area (m²)	Wetted Perimeter (m)	Top Width (m)
0.00		0.00	0.00	1.00	1.00
0.01	0.001	0.11	0.01	1.06	1.06
0.02	0.004	0.18	0.02	1.13	1.12
0.03	0.007	0.23	0.03	1.19	1.18
0.04	0.012	0.27	0.04	1.25	1.24
0.05	0.018	0.31	0.06	1.32	1.30
0.06	0.024	0.35	0.07	1.38	1.36
0.07	0.032	0.38	0.08	1.44	1.42
0.08	0.040	0.41	0.10	1.51	1.48
0.09	0.050	0.44	0.11	1.57	1.54
0.10	0.060	0.46	0.13	1.63	1.60
0.11	0.071	0.49	0.15	1.70	1.66
0.12	0.084	0.51	0.16	1.76	1.72
0.13	0.097	0.54	0.18	1.82	1.78
0.14	0.111	0.56	0.20	1.89	1.84
0.15	0.126	0.58	0.22	1.95	1.90
0.16	0.142	0.60	0.24	2.01	1.96
0.17	0.159	0.62	0.26	2.08	2.02
0.18	0.178	0.64	0.28	2.14	2.08
0.19	0.197	0.66	0.30	2.20	2.14
0.20	0.217	0.68	0.32	2.26	2.20
0.21	0.238	0.70	0.34	2.33	2.26
0.22	0.261	0.71	0.37	2.39	2.32

25mm peak flow to the EGS is 0.079cms

Rating Table for Trapezoidal Channel - North Enhanced Grass Swale

Input Data

Normal Depth (m)	Discharge (m³/s)	Velocity (m/s)	Flow Area (m²)	Wetted Perimeter (m)	Top Width (m)
0.23	0.284	0.73	0.39	2.45	2.38
0.24	0.309	0.75	0.41	2.52	2.44
0.25	0.335	0.77	0.44	2.58	2.50
0.26	0.362	0.78	0.46	2.64	2.56
0.27	0.390	0.80	0.49	2.71	2.62
0.28	0.420	0.81	0.52	2.77	2.68
0.29	0.450	0.83	0.54	2.83	2.74
0.30	0.482	0.85	0.57	2.90	2.80
0.31	0.515	0.86	0.60	2.96	2.86
0.32	0.549	0.88	0.63	3.02	2.92
0.33	0.585	0.89	0.66	3.09	2.98
0.34	0.622	0.91	0.69	3.15	3.04
0.35	0.660	0.92	0.72	3.21	3.10
0.36	0.700	0.93	0.75	3.28	3.16
0.37	0.741	0.95	0.78	3.34	3.22
0.38	0.783	0.96	0.81	3.40	3.28
0.39	0.826	0.98	0.85	3.47	3.34
0.40	0.871	0.99	0.88	3.53	3.40
0.41	0.918	1.00	0.91	3.59	3.46
0.42	0.966	1.02	0.95	3.66	3.52
0.43	1.015	1.03	0.98	3.72	3.58
0.44	1.066	1.04	1.02	3.78	3.64
0.45	1.118	1.06	1.06	3.85	3.70
0.46	1.172	1.07	1.09	3.91	3.76
0.47	1.227	1.08	1.13	3.97	3.82
0.48	1.283	1.10	1.17	4.04	3.88
0.49	1.342	1.11	1.21	4.10	3.94
0.50	1.401	1.12	1.25	4.16	4.00

100-yr peak flow to EGS is 0.949cms (conservative estimate)

Cross Section for Trapezoidal Channel - North Enhanced Grass Swale

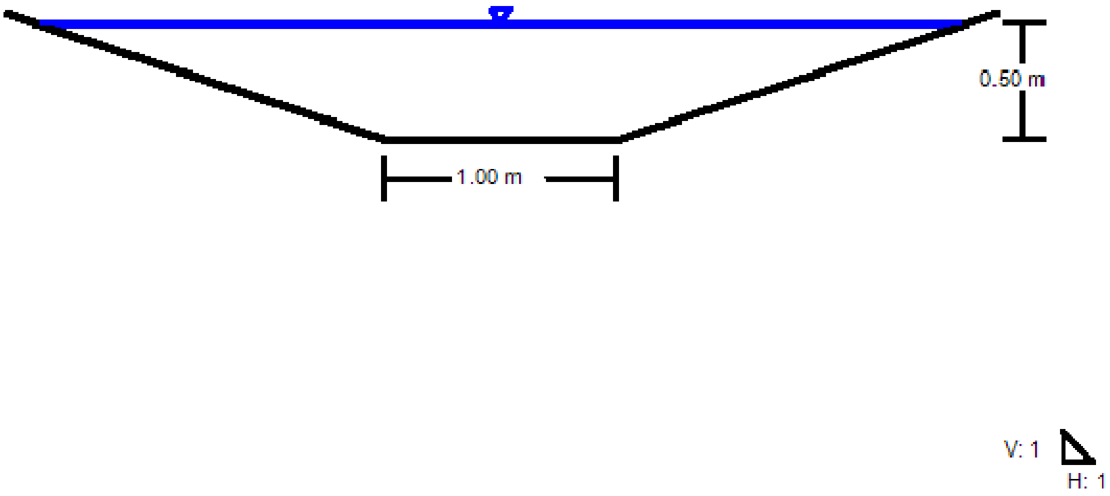
Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Roughness Coefficient	0.040	
Channel Slope	1.00	%
Normal Depth	0.50	m
Left Side Slope	3.0	H:V
Right Side Slope	3.0	H:V
Bottom Width	1.00	m
Discharge	1.401	m³/s

Cross Section Image



Worksheet for Trapezoidal Channel - South Enhanced Grass Swale

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Roughness Coefficient	0.040	
Channel Slope	1.00	%
Normal Depth	0.75	m
Left Side Slope	3.0	H:V
Right Side Slope	3.0	H:V
Bottom Width	1.00	m

Results

Discharge	3.441	m³/s
Flow Area	2.44	m²
Wetted Perimeter	5.74	m
Hydraulic Radius	0.42	m
Top Width	5.50	m
Critical Depth	0.62	m
Critical Slope	2.30	%
Velocity	1.41	m/s
Velocity Head	0.10	m
Specific Energy	0.85	m
Froude Number	0.68	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	m
Length	0.00	m
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	m
Profile Description		
Profile Headloss	0.00	m
Downstream Velocity	Infinity	m/s
Upstream Velocity	Infinity	m/s
Normal Depth	0.75	m
Critical Depth	0.62	m
Channel Slope	1.00	%

Worksheet for Trapezoidal Channel - South Enhanced Grass Swale

GVF Output Data

Critical Slope	2.30	%

Messages

Notes

The governing 100-year design storm peak flow (24 hour SCS Type-II Distribution) from the upstream Site drainage area (POST1) is 0.949cms and the 25mm Chicago Storm peak flow is 0.255cms.

Of the 2.74ha of POST1, 0.85ha is captured and conveyed to the basin by the EGS at the east limit of the site since the upstream storm sewer will collect the remaining area during a 25mm design storm event. Considering this, 31% of the above noted flows will be experienced within the EGS.

Pro-ration:
25mm peak flow = 0.079cms

Conservatively the EGS has been designed to accommodate the entire 100-year design storm peak flow from POST1 (0.949cms) although a portion of this will be intercepted and conveyed to the basin via the proposed storm sewer system.
The downstream portion of the EGS has been sized to convey the External By-pass Spill Overland Flow (0.506cms) and the governing 100-year deisgn peak flow (0.949cms) from POST1 for a total of 1.455cms.

Rating Table for Trapezoidal Channel - South Enhanced Grass Swale

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Roughness Coefficient	0.040	
Channel Slope	1.00	%
Normal Depth	0.75	m
Left Side Slope	3.0	H:V
Right Side Slope	3.0	H:V
Bottom Width	1.00	m

Normal Depth (m)	Discharge (m³/s)	Velocity (m/s)	Flow Area (m²)	Wetted Perimeter (m)	Top Width (m)
0.00		0.00	0.00	1.00	1.00
0.01	0.001	0.11	0.01	1.06	1.06
0.02	0.004	0.18	0.02	1.13	1.12
0.03	0.007	0.23	0.03	1.19	1.18
0.04	0.012	0.27	0.04	1.25	1.24
0.05	0.018	0.31	0.06	1.32	1.30
0.06	0.024	0.35	0.07	1.38	1.36
0.07	0.032	0.38	0.08	1.44	1.42
0.08	0.040	0.41	0.10	1.51	1.48
0.09	0.050	0.44	0.11	1.57	1.54
0.10	0.060	0.46	0.13	1.63	1.60
0.11	0.071	0.49	0.15	1.70	1.66
0.12	0.084	0.51	0.16	1.76	1.72
0.13	0.097	0.54	0.18	1.82	1.78
0.14	0.111	0.56	0.20	1.89	1.84
0.15	0.126	0.58	0.22	1.95	1.90
0.16	0.142	0.60	0.24	2.01	1.96
0.17	0.159	0.62	0.26	2.08	2.02
0.18	0.178	0.64	0.28	2.14	2.08
0.19	0.197	0.66	0.30	2.20	2.14
0.20	0.217	0.68	0.32	2.26	2.20
0.21	0.238	0.70	0.34	2.33	2.26
0.22	0.261	0.71	0.37	2.39	2.32

25mm peak flow to the EGS is 0.079cms

Rating Table for Trapezoidal Channel - South Enhanced Grass Swale

Input Data

Normal Depth (m)	Discharge (m^3/s)	Velocity (m/s)	Flow Area (m^2)	Wetted Perimeter (m)	Top Width (m)
0.23	0.284	0.73	0.39	2.45	2.38
0.24	0.309	0.75	0.41	2.52	2.44
0.25	0.335	0.77	0.44	2.58	2.50
0.26	0.362	0.78	0.46	2.64	2.56
0.27	0.390	0.80	0.49	2.71	2.62
0.28	0.420	0.81	0.52	2.77	2.68
0.29	0.450	0.83	0.54	2.83	2.74
0.30	0.482	0.85	0.57	2.90	2.80
0.31	0.515	0.86	0.60	2.96	2.86
0.32	0.549	0.88	0.63	3.02	2.92
0.33	0.585	0.89	0.66	3.09	2.98
0.34	0.622	0.91	0.69	3.15	3.04
0.35	0.660	0.92	0.72	3.21	3.10
0.36	0.700	0.93	0.75	3.28	3.16
0.37	0.741	0.95	0.78	3.34	3.22
0.38	0.783	0.96	0.81	3.40	3.28
0.39	0.826	0.98	0.85	3.47	3.34
0.40	0.871	0.99	0.88	3.53	3.40
0.41	0.918	1.00	0.91	3.59	3.46
0.42	0.966	1.02	0.95	3.66	3.52
0.43	1.015	1.03	0.98	3.72	3.58
0.44	1.066	1.04	1.02	3.78	3.64
0.45	1.118	1.06	1.06	3.85	3.70
0.46	1.172	1.07	1.09	3.91	3.76
0.47	1.227	1.08	1.13	3.97	3.82
0.48	1.283	1.10	1.17	4.04	3.88
0.49	1.342	1.11	1.21	4.10	3.94
0.50	1.401	1.12	1.25	4.16	4.00
0.51	1.463	1.13	1.29	4.23	4.06
0.52	1.526	1.15	1.33	4.29	4.12
0.53	1.590	1.16	1.37	4.35	4.18
0.54	1.656	1.17	1.41	4.42	4.24
0.55	1.724	1.18	1.46	4.48	4.30
0.56	1.793	1.19	1.50	4.54	4.36
0.57	1.864	1.21	1.54	4.60	4.42
0.58	1.937	1.22	1.59	4.67	4.48
0.59	2.011	1.23	1.63	4.73	4.54

100-yr peak flow to EGS is 1.455cms (conservative estimate)

Rating Table for Trapezoidal Channel - South Enhanced Grass Swale

Input Data

Normal Depth (m)	Discharge (m³/s)	Velocity (m/s)	Flow Area (m²)	Wetted Perimeter (m)	Top Width (m)
0.60	2.087	1.24	1.68	4.79	4.60
0.61	2.165	1.25	1.73	4.86	4.66
0.62	2.245	1.27	1.77	4.92	4.72
0.63	2.326	1.28	1.82	4.98	4.78
0.64	2.409	1.29	1.87	5.05	4.84
0.65	2.494	1.30	1.92	5.11	4.90
0.66	2.580	1.31	1.97	5.17	4.96
0.67	2.668	1.32	2.02	5.24	5.02
0.68	2.759	1.33	2.07	5.30	5.08
0.69	2.851	1.35	2.12	5.36	5.14
0.70	2.944	1.36	2.17	5.43	5.20
0.71	3.040	1.37	2.22	5.49	5.26
0.72	3.138	1.38	2.28	5.55	5.32
0.73	3.237	1.39	2.33	5.62	5.38
0.74	3.338	1.40	2.38	5.68	5.44
0.75	3.441	1.41	2.44	5.74	5.50

Cross Section for Trapezoidal Channel - South Enhanced Grass Swale

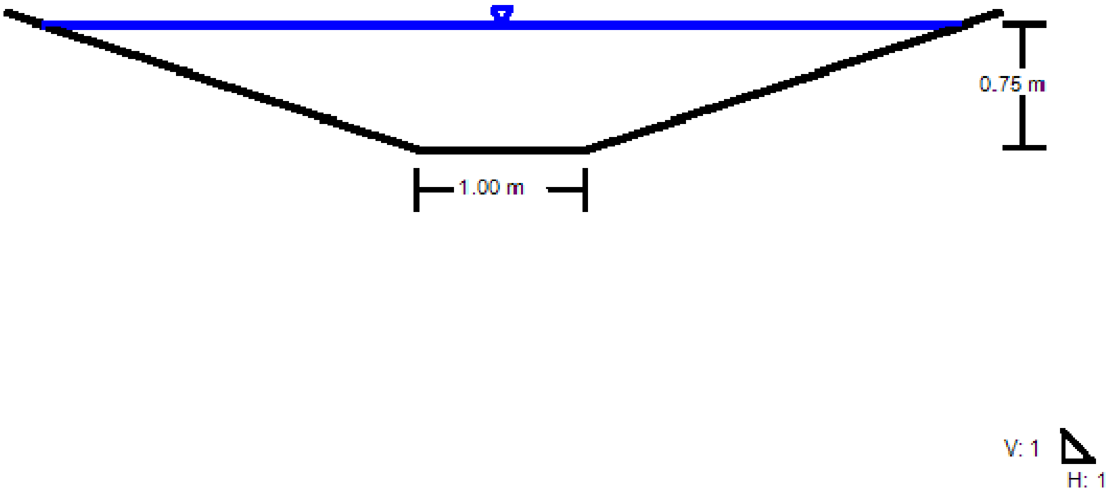
Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Roughness Coefficient	0.040	
Channel Slope	1.00	%
Normal Depth	0.75	m
Left Side Slope	3.0	H:V
Right Side Slope	3.0	H:V
Bottom Width	1.00	m
Discharge	3.441	m³/s

Cross Section Image



Development Export Summary

Development :15-319 Mansfield Ski Club

Pre-Development Phosphorus Export

DEVELOPMENT : 15-319 Mansfield Ski Club

Landuse		Area (ha)	P coeff (kg/ha)	Pload (kg/yr)
Urban				
Commercial		3.86	0.20	0.81
	Urban Land use Class Total :	**3.86**		**0.81**
	Development Total :	**3.86**		**0.81**

Cropland Site Sediment & Phosphorus Pre-Development Export

DEVELOPMENT : 15-319 Mansfield Ski Club

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-Development Phosphorus Export

DEVELOPMENT : 15-319 Mansfield Ski Club

Landuse		Area (ha)	P coeff (kg/ha)	Pload (kg/yr)
Urban				
Commercial		3.63	0.20	1.16
	Urban Land use Class Total :	**3.63**		**1.16**
	Development Total :	**3.63**		**1.16**

12/11/2020 Page 1 of 1

Updated : Sept 2014

Cropland Site Sediment & Phosphorus Post-Development Export

DEVELOPMENT : 15-319 Mansfield Ski Club

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) :

12/11/2020 Page 1 of 1

Post Dev BMP

Area (ha)	Treated Area %	P coefficient	P coefficient	P Load Reduction (kg/yr)	Rationale
Best Management Practices (BMP) Applied (and Rationale)					
Commercial					
0.93	100	0.20	65 %	0.12	POST1. Treatment train of enhanced grass swales (55%), and dry detention basin (10%). Total Treatment Train efficiency of (65%)
User Entry					
Commercial					
1.52	100	0.20	10 %	0.03	POST1
Dry Detention Ponds					
Commercial					
0.29	100	0.20	75 %	0.04	POST1. Treatment train of grass filter strips (65%), and dry detention basin (10%). Total Treatment Train efficiency of (75%)
User Entry					
Commercial					
0.89	100	0.20	65 %	0.12	POST2
Vegetated Filter Strips/Stream Buffers					

Development Area P and BMP Summary

Total PreDevelopment Area (ha):	3.86
PreDevelopment Area excluding Wetlands (ha):	3.86
Total PostDevelopment Area (ha):	3.63
Total Area treated by BMP's (ha):	3.63
Treated Area total:	3.63
Total PreDevelopment Load (kg/yr):	0.81
Total PostDevelopment Load (kg/yr):	1.16
Total P Load Reduction with BMP's (kg/yr):	0.31
Minimum P Load Reduction Required:	0.35
Total PostDevelopment Load with BMP's (kg/yr)	0.85

Conclusion : Net increase in P load, additional reduction is required.

Post Dev Construction

APPENDIX D

HYDROLOGIC MODELING (SWMHYMO)

- **Pre-Development Condition**
- **Post-Development Condition**

SENSITIVITY ANALYSIS COMPARISON CHARTS

ACTUAL

24HR SCS **PRE DEVELOPMENT**

STORM	PRE1	EXT1	PRE1 + EXT1	PRE2
	cms	cms	cms	cms
2	0.154	0.592	0.743	0.100
5	0.261	0.948	1.192	0.165
25	0.446	1.529	1.914	0.280
100	0.598	2.025	2.537	0.373

24HR SCS **POST DEVELOPMENT**

STORM	POST1	EXT1	SWM Facility	STORAGE	POST2
	cms	cms	cms	cum	cms
2	0.378	0.604	0.709	741.9	0.073
5	0.526	0.966	1.120	921.8	0.116
25	0.76	1.559	1.784	1158.0	0.192
100	0.949	2.065	2.275	1364.0	0.251

12HR SCS **PRE DEVELOPMENT**

STORM	PRE1	EXT1	PRE1 + EXT1	PRE2
	cms	cms	cms	cms
2	0.101	0.437	0.538	0.064
5	0.177	0.727	0.902	0.110
25	0.306	1.217	1.511	0.186
100	0.419	1.642	2.038	0.252

12HR SCS **POST DEVELOPMENT**

STORM	POST1	EXT1	SWM Facility	STORAGE	POST2
	cms	cms	cms	cum	cms
2	0.252	0.446	0.536	663.0	0.050
5	0.349	0.742	0.892	823.2	0.08
25	0.499	1.241	1.483	1061.0	0.129
100	0.622	1.674	2.036	1218.0	0.171

6HR SCS **PRE DEVELOPMENT**

STORM	PRE1	EXT1	PRE1 + EXT1	PRE2
	cms	cms	cms	cms
2	0.069	0.304	0.373	0.045
5	0.130	0.537	0.665	0.082
25	0.237	0.942	1.172	0.148
100	0.336	1.307	1.627	0.207

6HR SCS **POST DEVELOPMENT**

STORM	POST1	EXT1	SWM Facility	STORAGE	POST2
	cms	cms	cms	cum	cms
2	0.221	0.310	0.362	580.7	0.037
5	0.309	0.547	0.660	719.7	0.062
25	0.445	0.960	1.140	930.2	0.106
100	0.558	1.333	1.590	1098.0	0.144

4HR CHI **PRE DEVELOPMENT**

STORM	PRE1	EXT1	PRE1 + EXT1	PRE2
	cms	cms	cms	cms
2	0.054	0.224	0.277	0.036
5	0.118	0.424	0.529	0.080
25	0.252	0.795	0.988	0.167
100	0.387	1.146	1.415	0.255

4HR CHI **POST DEVELOPMENT**

STORM	POST1	EXT1	SWM Facility	STORAGE	POST2
	cms	cms	cms	cum	cms
2	0.359	0.229	0.252	525.0	0.032
5	0.516	0.433	0.494	643.6	0.065
25	0.773	0.810	0.915	833.5	0.120
100	0.99	1.168	1.312	998.3	0.182

Pre-Development Condition
24-hour SCS Type-II Storm Distribution

```
2     Metric units
*#******************************************************************************
*#  Project Name: [Mansfield Ski Club]    Project Number: [15-319]
*#  Date        : 07-31-2017
*#  Modeller    : [J. Lightheart]
*#  Company     : WMI & Associates Ltd.
*#  License #   :  2880720
*#******************************************************************************
*
* Pre-Development Condition - Mansfield Ski Club
*
*% 2-year SCS Type-II Storm Dist. based on Mansfield, ON. rainfall (24-hr)
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[1]
*%                   ["2SCS24.stm"] <--storm filename
*%-----------------|-----------------------------------------------------------|
READ STORM          STORM_FILENAME=["STORM.001"]
*%-----------------|-----------------------------------------------------------|
* SITE
* To account for the existing packed gravel surfaces on-site, the TIMP value
* was calibrated (see design calcs)
CALIB STANDHYD      ID=[1], NHYD=["PRE1"], DT=[1](min), AREA=[2.46](ha),
                    XIMP=[0.01], TIMP=[0.24], DWF=[0](cms), LOSS=[2],
                    SCS curve number CN=[81],
                    Pervious   surfaces: IAper=[8.1](mm), SLPP=[10](%),
                                         LGP=[80](m), MNP=[0.25], SCP=[0](min),
                    Impervious surfaces: IAimp=[2.0](mm), SLPI=[2.0](%),
                                         LGI=[100](m), MNI=[0.013], SCI=[0](min),
                    RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
*%-----------------|-----------------------------------------------------------|
* EXTERNAL
CALIB NASHYD        ID=[2], NHYD=["EXT"], DT=[1]min, AREA=[11.71](ha),
                    DWF=[0](cms),  CN/C=[83], IA=[6.8](mm),
                    N=[3], TP=[0.24]hrs,
                    RAINFALL=[ ,  ,  ,  , ](mm/hr),  END=-1
*%-----------------|-----------------------------------------------------------|
* TOTAL
ADD HYD             IDsum=[3], NHYD=["TOTAL"], IDs to add=[1+2]
*%-----------------|-----------------------------------------------------------|
* SITE
* To account for the existing packed gravel surfaces on-site, the TIMP value
* was calibrated (see design calcs)
CALIB STANDHYD      ID=[4], NHYD=["PRE2"], DT=[1](min), AREA=[1.40](ha),
                    XIMP=[0.01], TIMP=[0.24], DWF=[0](cms), LOSS=[2],
                    SCS curve number CN=[81],
                    Pervious   surfaces: IAper=[8.0](mm), SLPP=[13](%),
                                         LGP=[70](m), MNP=[0.25], SCP=[0](min),
                    Impervious surfaces: IAimp=[2.0](mm), SLPI=[3.5](%),
                                         LGI=[45](m), MNI=[0.013], SCI=[0](min),
                    RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
*%-----------------|-----------------------------------------------------------|
*% 5-year SCS Type-II Storm Dist. based on Mansfield, ON. rainfall (24-hr)
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[2]
*%                   ["5SCS24.stm"] <--storm filename
```

```
*%-----------------|-----------------------------------------------------------|
*% 25-year SCS Type-II Storm Dist. based on Mansfield, ON. rainfall (24-hr)
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[3]
*%                   ["25SCS24.stm"] <--storm filename
*%-----------------|-----------------------------------------------------------|
*% 100-year SCS Type-II Storm Dist. based on Mansfield, ON. rainfall (24-hr)
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[4]
*%                   ["100SCS24.stm"] <--storm filename
*%-----------------|-----------------------------------------------------------|
*% Timmins Regional Storm (12-hr)
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[5]
*%                   ["12regtim.o89"] <--storm filename
*%-----------------|-----------------------------------------------------------|
FINISH
```

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

SSSSS   W   W   M   M   H   H   Y   Y   M   M    OOO         222     000    11   77777 ==
S       W W W   MM MM   H   H    Y Y    MM MM   O   O          2    0   0   11   7   7
SSSSS   W W W   M M M   HHHHH     Y     M M M   O   O          2    0   0   11       7
    S    W W    M   M   H   H     Y     M   M   O   O       222     0   0   11      7
SSSSS    W W    M   M   H   H     Y     M   M    OOO        2       0   0   11     7   ==
                                                            2       0   0   11    7    #
      StormWater Management HYdrologic Model                 222     000    11    7    ==

******************************************************************************************
**************************************  SWMHYMO Ver4.05.0  ********************************
******************  A single event and continuous hydrologic simulation model  ***********
******************     based on the principles of HYMO and its successors      ***********
******************                 OTTHYMO-83 and OTTHYMO-89.                  ***********
******************************************************************************************
****************** Distributed by:  J.F. Sabourin and Associates Inc.          ***********
******************                  Ottawa,  Ontario: (613) 836-3884           ***********
******************                  Gatineau, Quebec: (819) 243-6858           ***********
******************                  E-Mail: swmhymo@jfsa.com                   ***********
******************************************************************************************

++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
++++++++++++++++++ Licensed user: WMI & Associates Ltd.                        +++++++++++
++++++++++++++++++               Barrie                SERIAL#:2880720         +++++++++++
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

******************************************************************************************
******************           ++++++ PROGRAM ARRAY DIMENSIONS ++++++            ***********
******************           Maximum value for ID numbers  :     11            ***********
******************           Max. number of rainfall points: 105408            ***********
******************           Max. number of flow points    : 105408            ***********
******************************************************************************************


*******************************   D E T A I L E D   O U T P U T   ***********************
******************************************************************************************
*                 RUN DATE: 2020-11-16     TIME: 11:19:20     RUN COUNTER: 000002
******************************************************************************************
* Input   file: C:\Temp\15-319\EX\24-hour_SCS\2-CYRSCS.dat
* Output  file: C:\Temp\15-319\EX\24-hour_SCS\2-CYRSCS.out
* Summary file: C:\Temp\15-319\EX\24-hour_SCS\2-CYRSCS.sum
* User comments:
* 1:_____________________________________________________________________________________
* 2:_____________________________________________________________________________________
* 3:_____________________________________________________________________________________
******************************************************************************************

-------------------------------------------------------------------------------------------
R0001:C00001-------------------------------------------------------------------------------
*#*******************************************************************************
*#  Project Name: [Mansfield Ski Club]    Project Number: [15-319]
*#  Date        : 07-31-2017
```

```
*#  Modeller    : [J. Lightheart]
*#  Company     : WMI & Associates Ltd.
*#  License #   :  2880720
*#*******************************************************************************
*
* Pre-Development Condition - Mansfield Ski Club
*
--------------------
| START           | Project  dir.:C:\Temp\15-319\EX\24-hour_SCS\
-------------------- Rainfall dir.:C:\Temp\15-319\EX\24-hour_SCS\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 0001
    NSTORM=   1
           #  1=2SCS24.stm
-------------------------------------------------------------------------------------------
R0001:C00002-------------------------------------------------------------------------------
--------------------
| READ STORM       |  Filename: C:\Temp\15-319\EX\24-hour_SCS\2SCS24.stm
| Ptotal=  54.70 mm|  Comments: 2-Year SCS Type-II Storm Distribution (24-hour) Mansfield,
--------------------
      TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME
     hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm
      0:12    .547|   4:12   1.094|   8:12   1.641|  12:12  10.940|  16:12   1.368|  20:12
      0:24    .547|   4:24   1.094|   8:24   1.641|  12:24   6.838|  16:24   1.367|  20:24
      0:36    .547|   4:36   1.094|   8:36   1.641|  12:36   4.923|  16:36   1.367|  20:36
      0:48    .547|   4:48   1.094|   8:48   1.641|  12:48   4.650|  16:48   1.367|  20:48
      1:00    .547|   5:00   1.094|   9:00   1.641|  13:00   3.282|  17:00    .820|  21:00
      1:12    .547|   5:12   1.094|   9:12   1.641|  13:12   2.735|  17:12    .821|  21:12
      1:24    .547|   5:24   1.094|   9:24   1.641|  13:24   2.735|  17:24   1.094|  21:24
      1:36    .547|   5:36   1.094|   9:36   1.641|  13:36   2.735|  17:36    .821|  21:36
      1:48    .547|   5:48   1.094|   9:48   1.641|  13:48   2.735|  17:48   1.094|  21:48
      2:00    .547|   6:00   1.094|  10:00   1.641|  14:00   2.735|  18:00    .821|  22:00
      2:12    .547|   6:12   1.094|  10:12   3.008|  14:12   1.641|  18:12    .821|  22:12
      2:24    .547|   6:24   1.094|  10:24   3.009|  14:24   1.641|  18:24    .820|  22:24
      2:36    .547|   6:36   1.094|  10:36   3.008|  14:36   1.641|  18:36   1.094|  22:36
      2:48    .547|   6:48   1.094|  10:48   3.009|  14:48   1.641|  18:48    .821|  22:48
      3:00    .547|   7:00   1.094|  11:00   3.008|  15:00   1.641|  19:00    .821|  23:00
      3:12    .547|   7:12   1.094|  11:12   4.102|  15:12   1.367|  19:12   1.094|  23:12
      3:24    .547|   7:24   1.094|  11:24   6.017|  15:24   1.367|  19:24    .821|  23:24
      3:36    .547|   7:36   1.094|  11:36  14.495|  15:36   1.367|  19:36   1.094|  23:36
      3:48    .547|   7:48   1.094|  11:48  30.085|  15:48   1.367|  19:48    .821|  23:48
      4:00    .547|   8:00   1.094|  12:00  61.538|  16:00   1.367|  20:00   1.094|  24:00

-------------------------------------------------------------------------------------------
R0001:C00003-------------------------------------------------------------------------------
* SITE
* To account for the existing packed gravel surfaces on-site, the TIMP value
* was calibrated (see design calcs)
--------------------------
| CALIB STANDHYD         |   Area    (ha)=    2.46
| 01:PRE1       DT= 1.00 |   Total Imp(%)=   24.00   Dir. Conn.(%)=    1.00
--------------------------
```

```
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .59        1.87
     Dep. Storage     (mm)=       2.00        8.10
     Average Slope     (%)=       2.00       10.00
     Length            (m)=     100.00       80.00
     Mannings n           =       .013        .250

     Max.eff.Inten.(mm/hr)=      61.54       45.14
                over (min)        3.00       12.00
     Storage Coeff.  (min)=       2.52 (ii)   11.59 (ii)
     Unit Hyd. Tpeak (min)=       3.00       12.00
     Unit Hyd. peak  (cms)=        .42         .10
                                                            *TOTALS*
     PEAK FLOW       (cms)=        .00         .15           .154 (iii)
     TIME TO PEAK    (hrs)=      12.00       12.10         12.100
     RUNOFF VOLUME    (mm)=      52.70       24.94         25.225
     TOTAL RAINFALL   (mm)=      54.70       54.70         54.700
     RUNOFF COEFFICIENT   =        .96         .46           .461

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  81.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

---------------------------------------------------------------------------------------------
R0001:C00004---------------------------------------------------------------------------------
* EXTERNAL
--------------------------
| CALIB NASHYD           |   Area    (ha)=   11.710   Curve Number   (CN)= 83.00
| 02:EXT        DT= 1.00 |   Ia      (mm)=    6.800   # of Linear Res.(N)=  3.00
--------------------------   U.H. Tp(hrs)=     .240

     Unit Hyd Qpeak  (cms)=    1.864

     PEAK FLOW       (cms)=     .592 (i)
     TIME TO PEAK    (hrs)=   12.150
     DURATION        (hrs)=   25.667, (dddd|hh:mm:)=   1|01:40
     AVERAGE FLOW    (cms)=     .029
     RUNOFF VOLUME    (mm)=   22.962
     TOTAL RAINFALL   (mm)=   54.700
     RUNOFF COEFFICIENT   =     .420

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

---------------------------------------------------------------------------------------------
R0001:C00005---------------------------------------------------------------------------------
* TOTAL
------------------------
| ADD HYD              |
| 03:TOTAL             |   ID:NHYD           AREA     QPEAK    TPEAK      R.V.     DWF
------------------------                     (ha)     (cms)    (hrs)      (mm)   (cms)
                     ID 1 01:PRE1           2.460      .154   12.100    25.225    .000
                    +ID 2 02:EXT           11.710      .592   12.150    22.962    .000
```

```
                     ==================================================================
                     SUM   03:TOTAL         14.170      .743   12.133    23.355    .000

  NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

---------------------------------------------------------------------------------------------
R0001:C00006---------------------------------------------------------------------------------
* SITE
* To account for the existing packed gravel surfaces on-site, the TIMP value
* was calibrated (see design calcs)
--------------------------
| CALIB STANDHYD         |   Area    (ha)=    1.40
| 04:PRE2       DT= 1.00 |   Total Imp(%)=   24.00   Dir. Conn.(%)=    1.00
--------------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .34        1.06
     Dep. Storage     (mm)=       2.00        8.00
     Average Slope     (%)=       3.50       13.00
     Length            (m)=      45.00       70.00
     Mannings n           =       .013        .250

     Max.eff.Inten.(mm/hr)=      61.54       46.83
                over (min)        1.00        9.00
     Storage Coeff.  (min)=       1.32 (ii)    8.95 (ii)
     Unit Hyd. Tpeak (min)=       1.00        9.00
     Unit Hyd. peak  (cms)=        .90         .13
                                                            *TOTALS*
     PEAK FLOW       (cms)=        .00         .10           .100 (iii)
     TIME TO PEAK    (hrs)=      12.00       12.07         12.067
     RUNOFF VOLUME    (mm)=      52.58       25.01         25.281
     TOTAL RAINFALL   (mm)=      54.70       54.70         54.700
     RUNOFF COEFFICIENT   =        .96         .46           .462

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  81.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

---------------------------------------------------------------------------------------------
R0001:C00007---------------------------------------------------------------------------------
  ** END OF RUN :    0

*********************************************************************************************




--------------------
| START            | Project  dir.:C:\Temp\15-319\EX\24-hour_SCS\
-------------------- Rainfall dir.:C:\Temp\15-319\EX\24-hour_SCS\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
```

```
    NRUN  = 0002
    NSTORM=   1
           #  1=5SCS24.stm
-------------------------------------------------------------------------------------------
R0002:C00002-------------------------------------------------------------------------------
*#******************************************************************************
*#  Project Name: [Mansfield Ski Club]    Project Number: [15-319]
*#  Date        : 07-31-2017
*#  Modeller    : [J. Lightheart]
*#  Company     : WMI & Associates Ltd.
*#  License #   :  2880720
*#******************************************************************************
*
* Pre-Development Condition - Mansfield Ski Club
*
-------------------------------------------------------------------------------------------
R0002:C00002-------------------------------------------------------------------------------
--------------------
| READ STORM       |  Filename: C:\Temp\15-319\EX\24-hour_SCS\5SCS24.stm
| Ptotal=  72.10 mm|  Comments: 5-Year SCS Type-II Storm Distribution (24-hour) Mansfield,
--------------------
      TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME
     hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm
      0:12    .721|   4:12   1.442|   8:12   2.163|  12:12  14.420|  16:12   1.803|  20:12
      0:24    .721|   4:24   1.442|   8:24   2.163|  12:24   9.013|  16:24   1.802|  20:24
      0:36    .721|   4:36   1.442|   8:36   2.163|  12:36   6.489|  16:36   1.802|  20:36
      0:48    .721|   4:48   1.442|   8:48   2.163|  12:48   6.129|  16:48   1.802|  20:48
      1:00    .721|   5:00   1.442|   9:00   2.163|  13:00   4.326|  17:00   1.081|  21:00
      1:12    .721|   5:12   1.442|   9:12   2.163|  13:12   3.605|  17:12   1.082|  21:12
      1:24    .721|   5:24   1.442|   9:24   2.163|  13:24   3.605|  17:24   1.442|  21:24
      1:36    .721|   5:36   1.442|   9:36   2.163|  13:36   3.605|  17:36   1.082|  21:36
      1:48    .721|   5:48   1.442|   9:48   2.163|  13:48   3.605|  17:48   1.442|  21:48
      2:00    .721|   6:00   1.442|  10:00   2.163|  14:00   3.605|  18:00   1.082|  22:00
      2:12    .721|   6:12   1.442|  10:12   3.965|  14:12   2.163|  18:12   1.082|  22:12
      2:24    .721|   6:24   1.442|  10:24   3.966|  14:24   2.163|  18:24   1.081|  22:24
      2:36    .721|   6:36   1.442|  10:36   3.965|  14:36   2.163|  18:36   1.442|  22:36
      2:48    .721|   6:48   1.442|  10:48   3.966|  14:48   2.163|  18:48   1.082|  22:48
      3:00    .721|   7:00   1.442|  11:00   3.965|  15:00   2.163|  19:00   1.082|  23:00
      3:12    .721|   7:12   1.442|  11:12   5.408|  15:12   1.802|  19:12   1.442|  23:12
      3:24    .721|   7:24   1.442|  11:24   7.931|  15:24   1.802|  19:24   1.082|  23:24
      3:36    .721|   7:36   1.442|  11:36  19.106|  15:36   1.802|  19:36   1.442|  23:36
      3:48    .721|   7:48   1.442|  11:48  39.655|  15:48   1.802|  19:48   1.082|  23:48
      4:00    .721|   8:00   1.442|  12:00  81.113|  16:00   1.802|  20:00   1.442|  24:00

-------------------------------------------------------------------------------------------
R0002:C00003-------------------------------------------------------------------------------
* SITE
* To account for the existing packed gravel surfaces on-site, the TIMP value
* was calibrated (see design calcs)
--------------------------
| CALIB STANDHYD         |   Area    (ha)=    2.46
| 01:PRE1       DT= 1.00 |   Total Imp(%)=   24.00   Dir. Conn.(%)=    1.00
--------------------------
```

```
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .59         1.87
     Dep. Storage     (mm)=       2.00         8.10
     Average Slope     (%)=       2.00        10.00
     Length            (m)=     100.00        80.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      81.11        71.18
                over (min)        2.00        10.00
     Storage Coeff.  (min)=       2.26 (ii)    9.82 (ii)
     Unit Hyd. Tpeak (min)=       2.00        10.00
     Unit Hyd. peak  (cms)=        .52          .11
                                                              *TOTALS*
     PEAK FLOW       (cms)=        .01          .26             .261 (iii)
     TIME TO PEAK    (hrs)=      12.00        12.07           12.067
     RUNOFF VOLUME    (mm)=      70.10        38.88           39.198
     TOTAL RAINFALL   (mm)=      72.10        72.10           72.101
     RUNOFF COEFFICIENT   =        .97          .54             .544

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  81.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------------------
R0002:C00004-------------------------------------------------------------------------------
* EXTERNAL
--------------------------
| CALIB NASHYD           |   Area    (ha)=   11.710   Curve Number   (CN)= 83.00
| 02:EXT        DT= 1.00 |   Ia      (mm)=    6.800   # of Linear Res.(N)=  3.00
--------------------------   U.H. Tp(hrs)=     .240

     Unit Hyd Qpeak  (cms)=    1.864

     PEAK FLOW       (cms)=     .948 (i)
     TIME TO PEAK    (hrs)=   12.133
     DURATION        (hrs)=   25.667, (dddd|hh:mm:)=   1|01:40
     AVERAGE FLOW    (cms)=     .046
     RUNOFF VOLUME    (mm)=   36.345
     TOTAL RAINFALL   (mm)=   72.101
     RUNOFF COEFFICIENT   =     .504

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

-------------------------------------------------------------------------------------------
R0002:C00005-------------------------------------------------------------------------------
* TOTAL
------------------------
| ADD HYD              |
| 03:TOTAL             |   ID:NHYD            AREA     QPEAK    TPEAK      R.V.     DWF
------------------------                      (ha)     (cms)    (hrs)      (mm)   (cms)
                      ID 1 01:PRE1           2.460      .261   12.067    39.198    .000
                     +ID 2 02:EXT           11.710      .948   12.133    36.345    .000
```

```
                     ==================================================================
                     SUM   03:TOTAL         14.170     1.192   12.117    36.840    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------------------
R0002:C00006-------------------------------------------------------------------------------
* SITE
* To account for the existing packed gravel surfaces on-site, the TIMP value
* was calibrated (see design calcs)
--------------------------
| CALIB STANDHYD         |   Area    (ha)=    1.40
| 04:PRE2       DT= 1.00 |   Total Imp(%)=   24.00   Dir. Conn.(%)=    1.00
--------------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .34         1.06
     Dep. Storage     (mm)=       2.00         8.00
     Average Slope     (%)=       3.50        13.00
     Length            (m)=      45.00        70.00
     Mannings n          =        .013         .250

     Max.eff.Inten.(mm/hr)=      81.11        72.46
                over (min)        1.00         8.00
     Storage Coeff.  (min)=       1.18 (ii)    7.59 (ii)
     Unit Hyd. Tpeak (min)=       1.00         8.00
     Unit Hyd. peak  (cms)=        .97          .15
                                                          *TOTALS*
     PEAK FLOW       (cms)=        .00          .16           .165 (iii)
     TIME TO PEAK    (hrs)=      11.93        12.05         12.033
     RUNOFF VOLUME    (mm)=      70.02        38.95         39.260
     TOTAL RAINFALL   (mm)=      72.10        72.10         72.101
     RUNOFF COEFFICIENT   =        .97          .54           .545

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
             CN* =  81.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------------------
R0002:C00007-------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------
R0002:C00002-------------------------------------------------------------------------------
  ** END OF RUN :    1

*******************************************************************************************





--------------------
| START            | Project  dir.:C:\Temp\15-319\EX\24-hour_SCS\
-------------------- Rainfall dir.:C:\Temp\15-319\EX\24-hour_SCS\
```

```
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 0003
    NSTORM=   1
           #  1=25SCS24.stm
-------------------------------------------------------------------------------------------
R0003:C00002-------------------------------------------------------------------------------
*#******************************************************************************
*#  Project Name: [Mansfield Ski Club]    Project Number: [15-319]
*#  Date        : 07-31-2017
*#  Modeller    : [J. Lightheart]
*#  Company     : WMI & Associates Ltd.
*#  License #   :  2880720
*#******************************************************************************
*
* Pre-Development Condition - Mansfield Ski Club
*
-------------------------------------------------------------------------------------------
R0003:C00002-------------------------------------------------------------------------------
--------------------
| READ STORM       |  Filename: C:\Temp\15-319\EX\24-hour_SCS\25SCS24.stm
| Ptotal=  98.40 mm|  Comments: 25-Year SCS Type-II Storm Distribution (24-hour) Mansfield,
--------------------
      TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME
     hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm
      0:12    .984|   4:12   1.968|   8:12   2.952|  12:12  19.680|  16:12   2.460|  20:12
      0:24    .984|   4:24   1.968|   8:24   2.952|  12:24  12.300|  16:24   2.460|  20:24
      0:36    .984|   4:36   1.968|   8:36   2.952|  12:36   8.856|  16:36   2.460|  20:36
      0:48    .984|   4:48   1.968|   8:48   2.952|  12:48   8.364|  16:48   2.460|  20:48
      1:00    .984|   5:00   1.968|   9:00   2.952|  13:00   5.904|  17:00   1.476|  21:00
      1:12    .984|   5:12   1.968|   9:12   2.952|  13:12   4.920|  17:12   1.476|  21:12
      1:24    .984|   5:24   1.968|   9:24   2.952|  13:24   4.920|  17:24   1.968|  21:24
      1:36    .984|   5:36   1.968|   9:36   2.952|  13:36   4.920|  17:36   1.476|  21:36
      1:48    .984|   5:48   1.968|   9:48   2.952|  13:48   4.920|  17:48   1.968|  21:48
      2:00    .984|   6:00   1.968|  10:00   2.952|  14:00   4.920|  18:00   1.476|  22:00
      2:12    .984|   6:12   1.968|  10:12   5.412|  14:12   2.952|  18:12   1.476|  22:12
      2:24    .984|   6:24   1.968|  10:24   5.412|  14:24   2.952|  18:24   1.476|  22:24
      2:36    .984|   6:36   1.968|  10:36   5.412|  14:36   2.952|  18:36   1.968|  22:36
      2:48    .984|   6:48   1.968|  10:48   5.412|  14:48   2.952|  18:48   1.476|  22:48
      3:00    .984|   7:00   1.968|  11:00   5.412|  15:00   2.952|  19:00   1.476|  23:00
      3:12    .984|   7:12   1.968|  11:12   7.380|  15:12   2.460|  19:12   1.968|  23:12
      3:24    .984|   7:24   1.968|  11:24  10.824|  15:24   2.460|  19:24   1.476|  23:24
      3:36    .984|   7:36   1.968|  11:36  26.076|  15:36   2.460|  19:36   1.968|  23:36
      3:48    .984|   7:48   1.968|  11:48  54.120|  15:48   2.460|  19:48   1.476|  23:48
      4:00    .984|   8:00   1.968|  12:00 110.700|  16:00   2.460|  20:00   1.968|  24:00

-------------------------------------------------------------------------------------------
R0003:C00003-------------------------------------------------------------------------------
* SITE
* To account for the existing packed gravel surfaces on-site, the TIMP value
* was calibrated (see design calcs)
--------------------------
| CALIB STANDHYD         |   Area    (ha)=    2.46
```

```
| 01:PRE1       DT= 1.00 |   Total Imp(%)=   24.00   Dir. Conn.(%)=    1.00
-------------------------
                               IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .59         1.87
     Dep. Storage     (mm)=       2.00         8.10
     Average Slope     (%)=       2.00        10.00
     Length            (m)=     100.00        80.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=     110.70       112.01
                over (min)        2.00         8.00
     Storage Coeff.  (min)=       1.99 (ii)    8.30 (ii)
     Unit Hyd. Tpeak (min)=       2.00         8.00
     Unit Hyd. peak  (cms)=        .56          .14
                                                             *TOTALS*
     PEAK FLOW       (cms)=        .01          .44            .446 (iii)
     TIME TO PEAK    (hrs)=      12.00        12.05          12.033
     RUNOFF VOLUME    (mm)=      96.40        61.61          61.961
     TOTAL RAINFALL   (mm)=      98.40        98.40          98.399
     RUNOFF COEFFICIENT   =        .98          .63            .630

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  81.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-----------------------------------------------------------------------------------------------
R0003:C00004-----------------------------------------------------------------------------------
* EXTERNAL
-------------------------
| CALIB NASHYD            |   Area    (ha)=   11.710   Curve Number   (CN)= 83.00
| 02:EXT        DT= 1.00 |   Ia      (mm)=    6.800   # of Linear Res.(N)=  3.00
-------------------------   U.H. Tp(hrs)=     .240

     Unit Hyd Qpeak  (cms)=    1.864

     PEAK FLOW       (cms)=    1.529 (i)
     TIME TO PEAK    (hrs)=   12.133
     DURATION        (hrs)=   25.667, (dddd|hh:mm:)=   1|01:40
     AVERAGE FLOW    (cms)=     .074
     RUNOFF VOLUME    (mm)=   58.420
     TOTAL RAINFALL   (mm)=   98.399
     RUNOFF COEFFICIENT   =     .594

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

-----------------------------------------------------------------------------------------------
R0003:C00005-----------------------------------------------------------------------------------
* TOTAL
------------------------
| ADD HYD               |
| 03:TOTAL              |   ID:NHYD           AREA     QPEAK    TPEAK      R.V.     DWF
------------------------                      (ha)     (cms)    (hrs)      (mm)   (cms)
```

```
                       ID 1 01:PRE1           2.460      .446   12.033    61.961    .000
                      +ID 2 02:EXT           11.710     1.529   12.133    58.420    .000
                      ======================================================================
                      SUM   03:TOTAL         14.170     1.914   12.100    59.034    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-----------------------------------------------------------------------------------------------
R0003:C00006-----------------------------------------------------------------------------------
* SITE
* To account for the existing packed gravel surfaces on-site, the TIMP value
* was calibrated (see design calcs)
-------------------------
| CALIB STANDHYD          |   Area    (ha)=    1.40
| 04:PRE2       DT= 1.00 |   Total Imp(%)=   24.00   Dir. Conn.(%)=    1.00
-------------------------
                               IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .34         1.06
     Dep. Storage     (mm)=       2.00         8.00
     Average Slope     (%)=       3.50        13.00
     Length            (m)=      45.00        70.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=     110.70       113.33
                over (min)        1.00         6.00
     Storage Coeff.  (min)=       1.04 (ii)    6.40 (ii)
     Unit Hyd. Tpeak (min)=       1.00         6.00
     Unit Hyd. peak  (cms)=       1.05          .18
                                                             *TOTALS*
     PEAK FLOW       (cms)=        .00          .28            .280 (iii)
     TIME TO PEAK    (hrs)=      11.92        12.02          12.017
     RUNOFF VOLUME    (mm)=      96.28        61.68          62.027
     TOTAL RAINFALL   (mm)=      98.40        98.40          98.399
     RUNOFF COEFFICIENT   =        .98          .63            .630

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  81.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-----------------------------------------------------------------------------------------------
R0003:C00007-----------------------------------------------------------------------------------
-----------------------------------------------------------------------------------------------
R0003:C00002-----------------------------------------------------------------------------------
-----------------------------------------------------------------------------------------------
R0003:C00002-----------------------------------------------------------------------------------
  ** END OF RUN :    2

***********************************************************************************************
```

```
--------------------
| START            | Project  dir.:C:\Temp\15-319\EX\24-hour_SCS\
-------------------- Rainfall dir.:C:\Temp\15-319\EX\24-hour_SCS\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 0004
    NSTORM=   1
           #  1=100SCS24.stm
---------------------------------------------------------------------------------------------
R0004:C00002---------------------------------------------------------------------------------
*#*******************************************************************************
*#  Project Name: [Mansfield Ski Club]    Project Number: [15-319]
*#  Date        : 07-31-2017
*#  Modeller    : [J. Lightheart]
*#  Company     : WMI & Associates Ltd.
*#  License #   :  2880720
*#*******************************************************************************
*
* Pre-Development Condition - Mansfield Ski Club
*
---------------------------------------------------------------------------------------------
R0004:C00002---------------------------------------------------------------------------------
--------------------
| READ STORM       |  Filename: C:\Temp\15-319\EX\24-hour_SCS\100SCS24.stm
| Ptotal= 120.00 mm|  Comments: 100-Year SCS Type-II Storm Distribution (24-hour)
--------------------
      TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME
     hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm
      0:12   1.200|   4:12   2.400|   8:12   3.600|  12:12  24.000|  16:12   3.000|  20:12
      0:24   1.200|   4:24   2.400|   8:24   3.600|  12:24  15.000|  16:24   3.000|  20:24
      0:36   1.200|   4:36   2.400|   8:36   3.600|  12:36  10.800|  16:36   3.000|  20:36
      0:48   1.200|   4:48   2.400|   8:48   3.600|  12:48  10.200|  16:48   3.000|  20:48
      1:00   1.200|   5:00   2.400|   9:00   3.600|  13:00   7.200|  17:00   1.800|  21:00
      1:12   1.200|   5:12   2.400|   9:12   3.600|  13:12   6.000|  17:12   1.800|  21:12
      1:24   1.200|   5:24   2.400|   9:24   3.600|  13:24   6.000|  17:24   2.400|  21:24
      1:36   1.200|   5:36   2.400|   9:36   3.600|  13:36   6.000|  17:36   1.800|  21:36
      1:48   1.200|   5:48   2.400|   9:48   3.600|  13:48   6.000|  17:48   2.400|  21:48
      2:00   1.200|   6:00   2.400|  10:00   3.600|  14:00   6.000|  18:00   1.800|  22:00
      2:12   1.200|   6:12   2.400|  10:12   6.600|  14:12   3.600|  18:12   1.800|  22:12
      2:24   1.200|   6:24   2.400|  10:24   6.600|  14:24   3.600|  18:24   1.800|  22:24
      2:36   1.200|   6:36   2.400|  10:36   6.600|  14:36   3.600|  18:36   2.400|  22:36
      2:48   1.200|   6:48   2.400|  10:48   6.600|  14:48   3.600|  18:48   1.800|  22:48
      3:00   1.200|   7:00   2.400|  11:00   6.600|  15:00   3.600|  19:00   1.800|  23:00
      3:12   1.200|   7:12   2.400|  11:12   9.000|  15:12   3.000|  19:12   2.400|  23:12
      3:24   1.200|   7:24   2.400|  11:24  13.200|  15:24   3.000|  19:24   1.800|  23:24
      3:36   1.200|   7:36   2.400|  11:36  31.800|  15:36   3.000|  19:36   2.400|  23:36
      3:48   1.200|   7:48   2.400|  11:48  66.000|  15:48   3.000|  19:48   1.800|  23:48
      4:00   1.200|   8:00   2.400|  12:00 135.000|  16:00   3.000|  20:00   2.400|  24:00

---------------------------------------------------------------------------------------------
R0004:C00003---------------------------------------------------------------------------------
* SITE
```

```
* To account for the existing packed gravel surfaces on-site, the TIMP value
* was calibrated (see design calcs)
--------------------------
| CALIB STANDHYD         |   Area    (ha)=    2.46
| 01:PRE1       DT= 1.00 |   Total Imp(%)=   24.00   Dir. Conn.(%)=    1.00
--------------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .59         1.87
     Dep. Storage     (mm)=       2.00         8.10
     Average Slope     (%)=       2.00        10.00
     Length            (m)=     100.00        80.00
     Mannings n          =       .013         .250

     Max.eff.Inten.(mm/hr)=     135.00       145.09
                over (min)       2.00         8.00
     Storage Coeff.  (min)=       1.84 (ii)    7.53 (ii)
     Unit Hyd. Tpeak (min)=       2.00         8.00
     Unit Hyd. peak  (cms)=        .59          .15
                                                          *TOTALS*
     PEAK FLOW       (cms)=        .01          .59           .598 (iii)
     TIME TO PEAK    (hrs)=      12.00        12.03         12.033
     RUNOFF VOLUME    (mm)=     118.00        81.15         81.527
     TOTAL RAINFALL   (mm)=     120.00       120.00        120.000
     RUNOFF COEFFICIENT   =        .98          .68           .679

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  81.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

---------------------------------------------------------------------------------------------
R0004:C00004---------------------------------------------------------------------------------
* EXTERNAL
--------------------------
| CALIB NASHYD           |   Area    (ha)=   11.710   Curve Number   (CN)= 83.00
| 02:EXT        DT= 1.00 |   Ia      (mm)=    6.800   # of Linear Res.(N)=  3.00
--------------------------   U.H. Tp(hrs)=     .240

     Unit Hyd Qpeak  (cms)=    1.864

     PEAK FLOW       (cms)=    2.025 (i)
     TIME TO PEAK    (hrs)=   12.133
     DURATION        (hrs)=   25.667, (dddd|hh:mm:)=   1|01:40
     AVERAGE FLOW    (cms)=     .098
     RUNOFF VOLUME    (mm)=   77.557
     TOTAL RAINFALL   (mm)=  120.000
     RUNOFF COEFFICIENT   =     .646

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

---------------------------------------------------------------------------------------------
R0004:C00005---------------------------------------------------------------------------------
* TOTAL
```

```
------------------------
| ADD HYD              |
| 03:TOTAL             |   ID:NHYD            AREA     QPEAK    TPEAK      R.V.     DWF
------------------------                      (ha)     (cms)    (hrs)      (mm)   (cms)
                      ID 1 01:PRE1           2.460      .598   12.033    81.527    .000
                     +ID 2 02:EXT           11.710     2.025   12.133    77.557    .000
                     ==================================================================
                     SUM   03:TOTAL         14.170     2.537   12.100    78.246    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------------------
R0004:C00006-------------------------------------------------------------------------------
* SITE
* To account for the existing packed gravel surfaces on-site, the TIMP value
* was calibrated (see design calcs)
--------------------------
| CALIB STANDHYD         |   Area    (ha)=    1.40
| 04:PRE2       DT= 1.00 |   Total Imp(%)=   24.00   Dir. Conn.(%)=    1.00
--------------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .34         1.06
     Dep. Storage     (mm)=       2.00         8.00
     Average Slope     (%)=       3.50        13.00
     Length            (m)=      45.00        70.00
     Mannings n          =        .013         .250

     Max.eff.Inten.(mm/hr)=     135.00       146.45
                over (min)        1.00         6.00
     Storage Coeff.  (min)=        .96 (ii)    5.80 (ii)
     Unit Hyd. Tpeak (min)=       1.00         6.00
     Unit Hyd. peak  (cms)=       1.10          .19
                                                           *TOTALS*
     PEAK FLOW       (cms)=        .01          .37           .373 (iii)
     TIME TO PEAK    (hrs)=      11.92        12.02         12.017
     RUNOFF VOLUME    (mm)=     117.92        81.22         81.596
     TOTAL RAINFALL   (mm)=     120.00       120.00        120.000
     RUNOFF COEFFICIENT   =        .98          .68           .680

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  81.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------------------
R0004:C00007-------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------
R0004:C00002-------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------
R0004:C00002-------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------
R0004:C00002-------------------------------------------------------------------------------
  ** END OF RUN :    3
```

```
*******************************************************************************************




--------------------
| START            | Project  dir.:C:\Temp\15-319\EX\24-hour_SCS\
-------------------- Rainfall dir.:C:\Temp\15-319\EX\24-hour_SCS\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 0005
    NSTORM=   1
           #  1=12regtim.o89
-------------------------------------------------------------------------------------------
R0005:C00002-------------------------------------------------------------------------------
*#******************************************************************************
*#  Project Name: [Mansfield Ski Club]    Project Number: [15-319]
*#  Date        : 07-31-2017
*#  Modeller    : [J. Lightheart]
*#  Company     : WMI & Associates Ltd.
*#  License #   :  2880720
*#******************************************************************************
*
* Pre-Development Condition - Mansfield Ski Club
*
-------------------------------------------------------------------------------------------
R0005:C00002-------------------------------------------------------------------------------
--------------------
| READ STORM       |  Filename: C:\Temp\15-319\EX\24-hour_SCS\12regtim.o89
| Ptotal= 193.00 mm|  Comments: TIMMINS REGIONAL STORM (12-hour)
--------------------
      TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME
     hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm
      1:00  15.000|   3:00  10.000|   5:00   5.000|   7:00  43.000|   9:00  23.000|  11:00
      2:00  20.000|   4:00   3.000|   6:00  20.000|   8:00  20.000|  10:00  13.000|  12:00

-------------------------------------------------------------------------------------------
R0005:C00003-------------------------------------------------------------------------------
* SITE
* To account for the existing packed gravel surfaces on-site, the TIMP value
* was calibrated (see design calcs)
--------------------------
| CALIB STANDHYD         |   Area    (ha)=    2.46
| 01:PRE1       DT= 1.00 |   Total Imp(%)=   24.00   Dir. Conn.(%)=    1.00
--------------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .59         1.87
     Dep. Storage     (mm)=       2.00         8.10
     Average Slope     (%)=       2.00        10.00
     Length            (m)=     100.00        80.00
     Mannings n          =        .013         .250
```

```
     Max.eff.Inten.(mm/hr)=      43.00        50.88
                over (min)        3.00        12.00
     Storage Coeff.  (min)=       2.91 (ii)   11.56 (ii)
     Unit Hyd. Tpeak (min)=       3.00        12.00
     Unit Hyd. peak  (cms)=        .39          .10
                                                           *TOTALS*
     PEAK FLOW       (cms)=        .00          .26           .262 (iii)
     TIME TO PEAK    (hrs)=       6.95         7.00          7.000
     RUNOFF VOLUME    (mm)=     191.00       150.04        150.449
     TOTAL RAINFALL   (mm)=     193.00       193.00        193.000
     RUNOFF COEFFICIENT   =        .99          .78           .780

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  81.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------------------
R0005:C00004-------------------------------------------------------------------------------
* EXTERNAL
--------------------------
| CALIB NASHYD           |   Area    (ha)=   11.710   Curve Number   (CN)= 83.00
| 02:EXT        DT= 1.00 |   Ia      (mm)=    6.800   # of Linear Res.(N)=  3.00
--------------------------   U.H. Tp(hrs)=     .240

     Unit Hyd Qpeak  (cms)=    1.864

     PEAK FLOW       (cms)=    1.215 (i)
     TIME TO PEAK    (hrs)=    7.017
     DURATION        (hrs)=   13.667, (dddd|hh:mm:)=   0|13:40
     AVERAGE FLOW    (cms)=     .346
     RUNOFF VOLUME    (mm)=  145.537
     TOTAL RAINFALL   (mm)=  193.000
     RUNOFF COEFFICIENT   =     .754

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

-------------------------------------------------------------------------------------------
R0005:C00005-------------------------------------------------------------------------------
* TOTAL
------------------------
| ADD HYD              |
| 03:TOTAL             |   ID:NHYD            AREA     QPEAK    TPEAK      R.V.     DWF
------------------------                      (ha)     (cms)    (hrs)      (mm)   (cms)
                      ID 1 01:PRE1           2.460      .262    7.000   150.449    .000
                     +ID 2 02:EXT           11.710     1.215    7.017   145.537    .000
                     ==================================================================
                     SUM   03:TOTAL         14.170     1.477    7.017   146.390    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------------------
```

```
R0005:C00006-------------------------------------------------------------------------------
* SITE
* To account for the existing packed gravel surfaces on-site, the TIMP value
* was calibrated (see design calcs)
--------------------------
| CALIB STANDHYD         |   Area    (ha)=    1.40
| 04:PRE2       DT= 1.00 |   Total Imp(%)=   24.00   Dir. Conn.(%)=    1.00
--------------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .34         1.06
     Dep. Storage     (mm)=       2.00         8.00
     Average Slope     (%)=       3.50        13.00
     Length            (m)=      45.00        70.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      43.00        50.96
                over (min)        2.00         9.00
     Storage Coeff.  (min)=       1.52 (ii)    8.90 (ii)
     Unit Hyd. Tpeak (min)=       2.00         9.00
     Unit Hyd. peak  (cms)=        .66          .13
                                                           *TOTALS*
     PEAK FLOW       (cms)=        .00          .15           .151 (iii)
     TIME TO PEAK    (hrs)=       6.87         7.00          7.000
     RUNOFF VOLUME    (mm)=     191.00       150.11        150.522
     TOTAL RAINFALL   (mm)=     193.00       193.00        193.000
     RUNOFF COEFFICIENT   =        .99          .78           .780

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  81.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------------------
R0005:C00007-------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------
R0005:C00002-------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------
R0005:C00002-------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------
R0005:C00002-------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------
R0005:C00002-------------------------------------------------------------------------------
--------------------
| FINISH           |
--------------------
-------------------------------------------------------------------------------------------
*******************************************************************************************
     WARNINGS / ERRORS / NOTES
     -------------------------
   Simulation ended on 2020-11-16     at 11:19:20
===========================================================================================
```

Pre-Development Condition
12-hour SCS Type-II Storm Distribution

```
2     Metric units
*#******************************************************************************
*#  Project Name: [Mansfield Ski Club]    Project Number: [15-319]
*#  Date        : 07-31-2017
*#  Modeller    : [J. Lightheart]
*#  Company     : WMI & Associates Ltd.
*#  License #   :  2880720
*#******************************************************************************
*
* Pre-Development Condition - Mansfield Ski Club
*
*% 2-year SCS Type-II Storm Dist. based on Mansfield, ON. rainfall (12-hr)
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[1]
*%                   ["2SCS12.stm"] <--storm filename
*%-----------------|-----------------------------------------------------------|
READ STORM          STORM_FILENAME=["STORM.001"]
*%-----------------|-----------------------------------------------------------|
* SITE
* To account for the existing packed gravel surfaces on-site, the TIMP value
* was calibrated (see design calcs)
CALIB STANDHYD      ID=[1], NHYD=["PRE1"], DT=[1](min), AREA=[2.46](ha),
                    XIMP=[0.01], TIMP=[0.24], DWF=[0](cms), LOSS=[2],
                    SCS curve number CN=[81],
                    Pervious   surfaces: IAper=[8.1](mm), SLPP=[10](%),
                                         LGP=[80](m), MNP=[0.25], SCP=[0](min),
                    Impervious surfaces: IAimp=[2.0](mm), SLPI=[2.0](%),
                                         LGI=[100](m), MNI=[0.013], SCI=[0](min),
                    RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
*%-----------------|-----------------------------------------------------------|
* EXTERNAL
CALIB NASHYD        ID=[2], NHYD=["EXT"], DT=[1]min, AREA=[11.71](ha),
                    DWF=[0](cms),  CN/C=[83], IA=[6.8](mm),
                    N=[3], TP=[0.24]hrs,
                    RAINFALL=[ ,  ,  ,  , ](mm/hr),  END=-1
*%-----------------|-----------------------------------------------------------|
* TOTAL
ADD HYD             IDsum=[3], NHYD=["TOTAL"], IDs to add=[1+2]
*%-----------------|-----------------------------------------------------------|
* SITE
* To account for the existing packed gravel surfaces on-site, the TIMP value
* was calibrated (see design calcs)
CALIB STANDHYD      ID=[4], NHYD=["PRE2"], DT=[1](min), AREA=[1.40](ha),
                    XIMP=[0.01], TIMP=[0.24], DWF=[0](cms), LOSS=[2],
                    SCS curve number CN=[81],
                    Pervious   surfaces: IAper=[8.0](mm), SLPP=[13](%),
                                         LGP=[70](m), MNP=[0.25], SCP=[0](min),
                    Impervious surfaces: IAimp=[2.0](mm), SLPI=[3.5](%),
                                         LGI=[45](m), MNI=[0.013], SCI=[0](min),
                    RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
*%-----------------|-----------------------------------------------------------|
*% 5-year SCS Type-II Storm Dist. based on Mansfield, ON. rainfall (12-hr)
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[2]
*%                   ["5SCS12.stm"] <--storm filename
```

```
*%-----------------|-----------------------------------------------------------|
*% 25-year SCS Type-II Storm Dist. based on Mansfield, ON. rainfall (12-hr)
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[3]
*%                   ["25SCS12.stm"] <--storm filename
*%-----------------|-----------------------------------------------------------|
*% 100-year SCS Type-II Storm Dist. based on Mansfield, ON. rainfall (12-hr)
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[4]
*%                   ["100SCS12.stm"] <--storm filename
*%-----------------|-----------------------------------------------------------|
*% Timmins Regional Storm (12-hr)
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[5]
*%                   ["12regtim.o89"] <--storm filename
*%-----------------|-----------------------------------------------------------|
FINISH
```

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

 SSSSS   W   W   M   M   H   H   Y   Y   M   M    OOO          222     000    11   77777 ==
 S       W W W   MM MM   H   H    Y Y    MM MM   O   O           2    0   0   11   7   7
 SSSSS   W W W   M M M   HHHHH     Y     M M M   O   O           2    0   0   11       7
     S    W W    M   M   H   H     Y     M   M   O   O        222    0   0   11      7
 SSSSS    W W    M   M   H   H     Y     M   M    OOO         2       0   0   11     7   ==
                                                              2       0   0   11    7    #
       StormWater Management HYdrologic Model                  222     000    11    7    ==

 ******************************************************************************************
 **************************************  SWMHYMO Ver4.05.0  *******************************
 ******************  A single event and continuous hydrologic simulation model  ***********
 ******************     based on the principles of HYMO and its successors      ***********
 ******************                 OTTHYMO-83 and OTTHYMO-89.                  ***********
 ******************************************************************************************
 ****************** Distributed by:  J.F. Sabourin and Associates Inc.          ***********
 ******************                  Ottawa,  Ontario: (613) 836-3884           ***********
 ******************                  Gatineau, Quebec: (819) 243-6858           ***********
 ******************                  E-Mail: swmhymo@jfsa.com                   ***********
 ******************************************************************************************

 ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
 ++++++++++++++++++ Licensed user: WMI & Associates Ltd.                        +++++++++++
 ++++++++++++++++++               Barrie                SERIAL#:2880720         +++++++++++
 ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

 ******************************************************************************************
 ******************          ++++++ PROGRAM ARRAY DIMENSIONS ++++++             ***********
 ******************          Maximum value for ID numbers  :     11             ***********
 ******************          Max. number of rainfall points: 105408             ***********
 ******************          Max. number of flow points    : 105408             ***********
 ******************************************************************************************


 *******************************   D E T A I L E D   O U T P U T   ************************
 ******************************************************************************************
 *                RUN DATE: 2020-11-16     TIME: 11:20:26     RUN COUNTER: 000004
 ******************************************************************************************
 * Input   file: C:\Temp\15-319\EX\12-hour_SCS\2-CYRSCS.dat
 * Output  file: C:\Temp\15-319\EX\12-hour_SCS\2-CYRSCS.out
 * Summary file: C:\Temp\15-319\EX\12-hour_SCS\2-CYRSCS.sum
 * User comments:
 * 1:______________________________________________________________________________________
 * 2:______________________________________________________________________________________
 * 3:______________________________________________________________________________________
 ******************************************************************************************

-------------------------------------------------------------------------------------------
R0001:C00001-------------------------------------------------------------------------------
*#******************************************************************************
*#  Project Name: [Mansfield Ski Club]    Project Number: [15-319]
*#  Date        : 07-31-2017
```

```
*#  Modeller    : [J. Lightheart]
*#  Company     : WMI & Associates Ltd.
*#  License #   :  2880720
*#******************************************************************************
*
* Pre-Development Condition - Mansfield Ski Club
*
--------------------
| START            | Project  dir.:C:\Temp\15-319\EX\12-hour_SCS\
-------------------- Rainfall dir.:C:\Temp\15-319\EX\12-hour_SCS\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 0001
    NSTORM=   1
           #  1=2SCS12.stm
-------------------------------------------------------------------------------------------
R0001:C00002-------------------------------------------------------------------------------
--------------------
| READ STORM       |  Filename: C:\Temp\15-319\EX\12-hour_SCS\2SCS12.stm
| Ptotal=  44.40 mm|  Comments: 2-Year SCS Type-II Storm Distribution (12-hour) Mansfield,
--------------------
      TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME
     hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm
      0:30    .888|   2:30   1.776|   4:30   2.664|   6:30   7.992|   8:30   1.776|  10:30
      1:00    .888|   3:00   1.776|   5:00   3.552|   7:00   3.552|   9:00   1.776|  11:00
      1:30    .888|   3:30   1.776|   5:30   5.328|   7:30   2.664|   9:30   1.776|  11:30
      2:00    .888|   4:00   1.776|   6:00  39.960|   8:00   2.664|  10:00    .888|  12:00

-------------------------------------------------------------------------------------------
R0001:C00003-------------------------------------------------------------------------------
* SITE
* To account for the existing packed gravel surfaces on-site, the TIMP value
* was calibrated (see design calcs)
--------------------------
| CALIB STANDHYD         |   Area    (ha)=    2.46
| 01:PRE1       DT= 1.00 |   Total Imp(%)=   24.00   Dir. Conn.(%)=    1.00
--------------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .59         1.87
     Dep. Storage     (mm)=       2.00         8.10
     Average Slope     (%)=       2.00        10.00
     Length            (m)=     100.00        80.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      39.96        26.88
                over (min)        3.00        14.00
     Storage Coeff.  (min)=       2.99 (ii)   14.16 (ii)
     Unit Hyd. Tpeak (min)=       3.00        14.00
     Unit Hyd. peak  (cms)=        .38          .08
                                                           *TOTALS*
     PEAK FLOW       (cms)=        .00          .10          .101 (iii)
     TIME TO PEAK    (hrs)=       5.77         6.10         6.100
     RUNOFF VOLUME    (mm)=      42.40        17.37        17.622
```

```
          TOTAL RAINFALL   (mm)=      44.40        44.40         44.400
          RUNOFF COEFFICIENT   =        .95          .39           .397

            (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
                CN* =  81.0    Ia = Dep. Storage  (Above)
           (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
          (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

     ------------------------------------------------------------------------------------------
     R0001:C00004------------------------------------------------------------------------------
     * EXTERNAL
     --------------------------
     | CALIB NASHYD            |   Area    (ha)=   11.710   Curve Number   (CN)= 83.00
     | 02:EXT        DT= 1.00 |   Ia      (mm)=    6.800   # of Linear Res.(N)=  3.00
     --------------------------   U.H. Tp(hrs)=     .240

          Unit Hyd Qpeak  (cms)=    1.864

          PEAK FLOW       (cms)=     .437 (i)
          TIME TO PEAK    (hrs)=    6.117
          DURATION        (hrs)=   13.667, (dddd|hh:mm:)=   0|13:40
          AVERAGE FLOW    (cms)=     .038
          RUNOFF VOLUME    (mm)=   15.774
          TOTAL RAINFALL   (mm)=   44.400
          RUNOFF COEFFICIENT   =     .355

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

     ------------------------------------------------------------------------------------------
     R0001:C00005------------------------------------------------------------------------------
     * TOTAL
     ------------------------
     | ADD HYD              |
     | 03:TOTAL             |   ID:NHYD            AREA     QPEAK    TPEAK      R.V.     DWF
     ------------------------                       (ha)     (cms)    (hrs)      (mm)   (cms)
                           ID 1 01:PRE1           2.460      .101    6.100    17.622    .000
                          +ID 2 02:EXT           11.710      .437    6.117    15.774    .000
                          =================================================================
                          SUM   03:TOTAL         14.170      .538    6.117    16.095    .000

        NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

     ------------------------------------------------------------------------------------------
     R0001:C00006------------------------------------------------------------------------------
     * SITE
     * To account for the existing packed gravel surfaces on-site, the TIMP value
     * was calibrated (see design calcs)
     --------------------------
     | CALIB STANDHYD          |   Area    (ha)=    1.40
     | 04:PRE2       DT= 1.00 |   Total Imp(%)=   24.00   Dir. Conn.(%)=    1.00
     --------------------------
                                 IMPERVIOUS    PERVIOUS (i)
          Surface Area     (ha)=        .34         1.06
```

```
          Dep. Storage     (mm)=       2.00         8.00
          Average Slope     (%)=       3.50        13.00
          Length            (m)=      45.00        70.00
          Mannings n           =       .013         .250

          Max.eff.Inten.(mm/hr)=      39.96        27.73
                     over (min)        2.00        11.00
          Storage Coeff.  (min)=       1.57 (ii)   10.97 (ii)
          Unit Hyd. Tpeak (min)=       2.00        11.00
          Unit Hyd. peak  (cms)=        .65          .10
                                                                *TOTALS*
          PEAK FLOW       (cms)=        .00          .06           .064 (iii)
          TIME TO PEAK    (hrs)=       5.68         6.07          6.067
          RUNOFF VOLUME    (mm)=      42.40        17.43         17.676
          TOTAL RAINFALL   (mm)=      44.40        44.40         44.400
          RUNOFF COEFFICIENT   =        .95          .39           .398

            (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
                CN* =  81.0    Ia = Dep. Storage  (Above)
           (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
          (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

     ------------------------------------------------------------------------------------------
     R0001:C00007------------------------------------------------------------------------------
       ** END OF RUN :    0

     ******************************************************************************************




     --------------------
     | START            | Project  dir.:C:\Temp\15-319\EX\12-hour_SCS\
     -------------------- Rainfall dir.:C:\Temp\15-319\EX\12-hour_SCS\
         TZERO =   .00 hrs on       0
         METOUT=   2 (output = METRIC)
         NRUN  = 0002
         NSTORM=   1
                #  1=5SCS12.stm
     ------------------------------------------------------------------------------------------
     R0002:C00002------------------------------------------------------------------------------
     *#****************************************************************************
     *#  Project Name: [Mansfield Ski Club]    Project Number: [15-319]
     *#  Date        : 07-31-2017
     *#  Modeller    : [J. Lightheart]
     *#  Company     : WMI & Associates Ltd.
     *#  License #   :  2880720
     *#****************************************************************************
     *
     * Pre-Development Condition - Mansfield Ski Club
     *
     ------------------------------------------------------------------------------------------
```

```
R0002:C00002------------------------------------------------------------------------------
--------------------
| READ STORM       |  Filename: C:\Temp\15-319\EX\12-hour_SCS\5SCS12.stm
| Ptotal=  58.50 mm|  Comments: 5-Year SCS Type-II Storm Distribution (12-hour) Mansfield,
--------------------
      TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME
     hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm
      0:30   1.170|   2:30   2.340|   4:30   3.510|   6:30  10.530|   8:30   2.340|  10:30
      1:00   1.170|   3:00   2.340|   5:00   4.680|   7:00   4.680|   9:00   2.340|  11:00
      1:30   1.170|   3:30   2.340|   5:30   7.020|   7:30   3.510|   9:30   2.340|  11:30
      2:00   1.170|   4:00   2.340|   6:00  52.650|   8:00   3.510|  10:00   1.170|  12:00

------------------------------------------------------------------------------------------
R0002:C00003------------------------------------------------------------------------------
* SITE
* To account for the existing packed gravel surfaces on-site, the TIMP value
* was calibrated (see design calcs)
--------------------------
| CALIB STANDHYD         |   Area    (ha)=    2.46
| 01:PRE1       DT= 1.00 |   Total Imp(%)=   24.00   Dir. Conn.(%)=    1.00
--------------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .59         1.87
     Dep. Storage     (mm)=       2.00         8.10
     Average Slope     (%)=       2.00        10.00
     Length            (m)=     100.00        80.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      52.65        43.09
                over (min)        3.00        12.00
     Storage Coeff.  (min)=       2.68 (ii)   11.93 (ii)
     Unit Hyd. Tpeak (min)=       3.00        12.00
     Unit Hyd. peak  (cms)=        .41          .09
                                                           *TOTALS*
     PEAK FLOW       (cms)=        .00          .17           .177 (iii)
     TIME TO PEAK    (hrs)=       5.75         6.07          6.067
     RUNOFF VOLUME    (mm)=      56.50        27.89         28.172
     TOTAL RAINFALL   (mm)=      58.50        58.50         58.500
     RUNOFF COEFFICIENT   =        .97          .48           .482

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  81.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

------------------------------------------------------------------------------------------
R0002:C00004------------------------------------------------------------------------------
* EXTERNAL
--------------------------
| CALIB NASHYD           |   Area    (ha)=   11.710   Curve Number   (CN)= 83.00
| 02:EXT        DT= 1.00 |   Ia      (mm)=    6.800   # of Linear Res.(N)=  3.00
--------------------------   U.H. Tp(hrs)=     .240
```

```
     Unit Hyd Qpeak  (cms)=    1.864

     PEAK FLOW       (cms)=     .727 (i)
     TIME TO PEAK    (hrs)=    6.100
     DURATION        (hrs)=   13.667, (dddd|hh:mm:)=   0|13:40
     AVERAGE FLOW    (cms)=     .061
     RUNOFF VOLUME    (mm)=   25.769
     TOTAL RAINFALL   (mm)=   58.500
     RUNOFF COEFFICIENT   =     .440

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

------------------------------------------------------------------------------------------
R0002:C00005------------------------------------------------------------------------------
* TOTAL
------------------------
| ADD HYD              |
| 03:TOTAL             |   ID:NHYD            AREA     QPEAK    TPEAK      R.V.     DWF
------------------------                      (ha)     (cms)    (hrs)      (mm)   (cms)
                      ID 1 01:PRE1           2.460      .177    6.067    28.172    .000
                     +ID 2 02:EXT           11.710      .727    6.100    25.769    .000
                     ==============================================================
                     SUM   03:TOTAL         14.170      .902    6.100    26.186    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

------------------------------------------------------------------------------------------
R0002:C00006------------------------------------------------------------------------------
* SITE
* To account for the existing packed gravel surfaces on-site, the TIMP value
* was calibrated (see design calcs)
--------------------------
| CALIB STANDHYD         |   Area    (ha)=    1.40
| 04:PRE2       DT= 1.00 |   Total Imp(%)=   24.00   Dir. Conn.(%)=    1.00
--------------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .34         1.06
     Dep. Storage     (mm)=       2.00         8.00
     Average Slope     (%)=       3.50        13.00
     Length            (m)=      45.00        70.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      52.65        44.06
                over (min)        1.00         9.00
     Storage Coeff.  (min)=       1.40 (ii)    9.22 (ii)
     Unit Hyd. Tpeak (min)=       1.00         9.00
     Unit Hyd. peak  (cms)=        .87          .12
                                                           *TOTALS*
     PEAK FLOW       (cms)=        .00          .11           .110 (iii)
     TIME TO PEAK    (hrs)=       5.63         6.03          6.033
     RUNOFF VOLUME    (mm)=      56.31        27.95         28.230
     TOTAL RAINFALL   (mm)=      58.50        58.50         58.500
     RUNOFF COEFFICIENT   =        .96          .48           .483
```

```
             (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
                 CN* =  81.0    Ia = Dep. Storage  (Above)
            (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
           (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

      -------------------------------------------------------------------------------------------
      R0002:C00007-------------------------------------------------------------------------------
      -------------------------------------------------------------------------------------------
      R0002:C00002-------------------------------------------------------------------------------
        ** END OF RUN :    1

      *******************************************************************************************





      --------------------
      | START            | Project  dir.:C:\Temp\15-319\EX\12-hour_SCS\
      -------------------- Rainfall dir.:C:\Temp\15-319\EX\12-hour_SCS\
          TZERO =   .00 hrs on        0
          METOUT=   2 (output = METRIC)
          NRUN  = 0003
          NSTORM=   1
                 #  1=25SCS12.stm
      -------------------------------------------------------------------------------------------
      R0003:C00002-------------------------------------------------------------------------------
      *#******************************************************************************
      *#  Project Name: [Mansfield Ski Club]    Project Number: [15-319]
      *#  Date        : 07-31-2017
      *#  Modeller    : [J. Lightheart]
      *#  Company     : WMI & Associates Ltd.
      *#  License #   :  2880720
      *#******************************************************************************
      *
      * Pre-Development Condition - Mansfield Ski Club
      *
      -------------------------------------------------------------------------------------------
      R0003:C00002-------------------------------------------------------------------------------
      --------------------
      | READ STORM       |  Filename: C:\Temp\15-319\EX\12-hour_SCS\25SCS12.stm
      | Ptotal=  79.90 mm|  Comments: 25-Year SCS Type-II Storm Distribution (12-hour) Mansfield,
      --------------------
            TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME
           hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm
            0:30   1.598|   2:30   3.196|   4:30   4.794|   6:30  14.382|   8:30   3.196|  10:30
            1:00   1.598|   3:00   3.196|   5:00   6.392|   7:00   6.392|   9:00   3.196|  11:00
            1:30   1.598|   3:30   3.196|   5:30   9.588|   7:30   4.794|   9:30   3.196|  11:30
            2:00   1.598|   4:00   3.196|   6:00  71.910|   8:00   4.794|  10:00   1.598|  12:00

      -------------------------------------------------------------------------------------------
      R0003:C00003-------------------------------------------------------------------------------
```

```
      * SITE
      * To account for the existing packed gravel surfaces on-site, the TIMP value
      * was calibrated (see design calcs)
      --------------------------
      | CALIB STANDHYD          |   Area    (ha)=    2.46
      | 01:PRE1       DT= 1.00 |   Total Imp(%)=   24.00   Dir. Conn.(%)=    1.00
      --------------------------
                                    IMPERVIOUS    PERVIOUS (i)
           Surface Area     (ha)=        .59         1.87
           Dep. Storage     (mm)=       2.00         8.10
           Average Slope     (%)=       2.00        10.00
           Length            (m)=     100.00        80.00
           Mannings n          =       .013         .250

           Max.eff.Inten.(mm/hr)=      71.91        69.07
                      over (min)       2.00        10.00
           Storage Coeff.  (min)=       2.37 (ii)   10.02 (ii)
           Unit Hyd. Tpeak (min)=       2.00        10.00
           Unit Hyd. peak  (cms)=        .50          .11
                                                                *TOTALS*
           PEAK FLOW       (cms)=        .00          .30          .306 (iii)
           TIME TO PEAK    (hrs)=       5.73         6.03         6.033
           RUNOFF VOLUME    (mm)=      77.90        45.46        45.786
           TOTAL RAINFALL   (mm)=      79.90        79.90        79.900
           RUNOFF COEFFICIENT   =        .97          .57          .573

             (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
                 CN* =  81.0    Ia = Dep. Storage  (Above)
            (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
           (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

      -------------------------------------------------------------------------------------------
      R0003:C00004-------------------------------------------------------------------------------
      * EXTERNAL
      --------------------------
      | CALIB NASHYD            |   Area    (ha)=   11.710   Curve Number   (CN)= 83.00
      | 02:EXT        DT= 1.00 |   Ia      (mm)=    6.800   # of Linear Res.(N)=  3.00
      --------------------------   U.H. Tp(hrs)=     .240

           Unit Hyd Qpeak  (cms)=    1.864

           PEAK FLOW       (cms)=    1.217 (i)
           TIME TO PEAK    (hrs)=    6.100
           DURATION        (hrs)=   13.667, (dddd|hh:mm:)=   0|13:40
           AVERAGE FLOW    (cms)=     .102
           RUNOFF VOLUME    (mm)=   42.707
           TOTAL RAINFALL   (mm)=   79.900
           RUNOFF COEFFICIENT   =     .534

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

      -------------------------------------------------------------------------------------------
      R0003:C00005-------------------------------------------------------------------------------
```

```
* TOTAL
------------------------
| ADD HYD              |
| 03:TOTAL             |   ID:NHYD            AREA     QPEAK    TPEAK      R.V.     DWF
------------------------                       (ha)     (cms)    (hrs)      (mm)   (cms)
                      ID 1 01:PRE1           2.460      .306    6.033    45.786    .000
                     +ID 2 02:EXT           11.710     1.217    6.100    42.707    .000
                     =================================================================
                     SUM   03:TOTAL         14.170     1.511    6.083    43.241    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------------------
R0003:C00006--------------------------------------------------------------------------------
* SITE
* To account for the existing packed gravel surfaces on-site, the TIMP value
* was calibrated (see design calcs)
--------------------------
| CALIB STANDHYD         |   Area    (ha)=    1.40
| 04:PRE2       DT= 1.00 |   Total Imp(%)=   24.00   Dir. Conn.(%)=    1.00
--------------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .34         1.06
     Dep. Storage     (mm)=       2.00         8.00
     Average Slope     (%)=       3.50        13.00
     Length            (m)=      45.00        70.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      71.91        69.80
                over (min)       1.00         8.00
     Storage Coeff.  (min)=       1.24 (ii)    7.74 (ii)
     Unit Hyd. Tpeak (min)=       1.00         8.00
     Unit Hyd. peak  (cms)=        .94          .14
                                                             *TOTALS*
     PEAK FLOW       (cms)=        .00          .18            .186 (iii)
     TIME TO PEAK    (hrs)=       5.73         6.02           6.000
     RUNOFF VOLUME    (mm)=      77.78        45.53          45.850
     TOTAL RAINFALL   (mm)=      79.90        79.90          79.900
     RUNOFF COEFFICIENT   =        .97          .57            .574

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  81.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------------------
R0003:C00007--------------------------------------------------------------------------------
--------------------------------------------------------------------------------------------
R0003:C00002--------------------------------------------------------------------------------
--------------------------------------------------------------------------------------------
R0003:C00002--------------------------------------------------------------------------------
  ** END OF RUN :    2
```

```
********************************************************************************************




--------------------
| START            | Project  dir.:C:\Temp\15-319\EX\12-hour_SCS\
-------------------- Rainfall dir.:C:\Temp\15-319\EX\12-hour_SCS\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 0004
    NSTORM=   1
           #  1=100SCS12.stm
--------------------------------------------------------------------------------------------
R0004:C00002--------------------------------------------------------------------------------
*#*****************************************************************************
*#  Project Name: [Mansfield Ski Club]    Project Number: [15-319]
*#  Date        : 07-31-2017
*#  Modeller    : [J. Lightheart]
*#  Company     : WMI & Associates Ltd.
*#  License #   :  2880720
*#*****************************************************************************
*
* Pre-Development Condition - Mansfield Ski Club
*
--------------------------------------------------------------------------------------------
R0004:C00002--------------------------------------------------------------------------------
--------------------
| READ STORM       |  Filename: C:\Temp\15-319\EX\12-hour_SCS\100SCS12.stm
| Ptotal=  97.40 mm|  Comments: 100-Year SCS Type-II Storm Distribution (12-hour)
--------------------
      TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME
     hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm
      0:30   1.948|   2:30   3.896|   4:30   5.844|   6:30  17.532|   8:30   3.896|  10:30
      1:00   1.948|   3:00   3.896|   5:00   7.792|   7:00   7.792|   9:00   3.896|  11:00
      1:30   1.948|   3:30   3.896|   5:30  11.688|   7:30   5.844|   9:30   3.896|  11:30
      2:00   1.948|   4:00   3.896|   6:00  87.660|   8:00   5.844|  10:00   1.948|  12:00

--------------------------------------------------------------------------------------------
R0004:C00003--------------------------------------------------------------------------------
* SITE
* To account for the existing packed gravel surfaces on-site, the TIMP value
* was calibrated (see design calcs)
--------------------------
| CALIB STANDHYD         |   Area    (ha)=    2.46
| 01:PRE1       DT= 1.00 |   Total Imp(%)=   24.00   Dir. Conn.(%)=    1.00
--------------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .59         1.87
     Dep. Storage     (mm)=       2.00         8.10
     Average Slope     (%)=       2.00        10.00
     Length            (m)=     100.00        80.00
```

```
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      87.66        90.73
                over (min)        2.00         9.00
     Storage Coeff.  (min)=       2.19 (ii)    9.05 (ii)
     Unit Hyd. Tpeak (min)=       2.00         9.00
     Unit Hyd. peak  (cms)=        .53          .13
                                                           *TOTALS*
     PEAK FLOW       (cms)=        .01          .41          .419 (iii)
     TIME TO PEAK    (hrs)=       5.85         6.02         6.017
     RUNOFF VOLUME    (mm)=      95.40        60.72        61.070
     TOTAL RAINFALL   (mm)=      97.40        97.40        97.400
     RUNOFF COEFFICIENT   =        .98          .62          .627

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  81.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------------------
R0004:C00004-------------------------------------------------------------------------------
* EXTERNAL
--------------------------
| CALIB NASHYD           |   Area    (ha)=   11.710   Curve Number   (CN)= 83.00
| 02:EXT        DT= 1.00 |   Ia      (mm)=    6.800   # of Linear Res.(N)=  3.00
--------------------------   U.H. Tp(hrs)=     .240

     Unit Hyd Qpeak  (cms)=    1.864

     PEAK FLOW       (cms)=    1.642 (i)
     TIME TO PEAK    (hrs)=    6.083
     DURATION        (hrs)=   13.667, (dddd|hh:mm:)=   0|13:40
     AVERAGE FLOW    (cms)=     .137
     RUNOFF VOLUME    (mm)=   57.552
     TOTAL RAINFALL   (mm)=   97.400
     RUNOFF COEFFICIENT   =     .591

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

-------------------------------------------------------------------------------------------
R0004:C00005-------------------------------------------------------------------------------
* TOTAL
------------------------
| ADD HYD              |
| 03:TOTAL             |   ID:NHYD            AREA     QPEAK    TPEAK      R.V.     DWF
------------------------                      (ha)     (cms)    (hrs)      (mm)   (cms)
                      ID 1 01:PRE1           2.460      .419    6.017    61.070    .000
                     +ID 2 02:EXT           11.710     1.642    6.083    57.552    .000
                     ==================================================================
                     SUM   03:TOTAL         14.170     2.038    6.067    58.163    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
```

```
-------------------------------------------------------------------------------------------
R0004:C00006-------------------------------------------------------------------------------
* SITE
* To account for the existing packed gravel surfaces on-site, the TIMP value
* was calibrated (see design calcs)
--------------------------
| CALIB STANDHYD         |   Area    (ha)=    1.40
| 04:PRE2       DT= 1.00 |   Total Imp(%)=   24.00   Dir. Conn.(%)=    1.00
--------------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .34         1.06
     Dep. Storage     (mm)=       2.00         8.00
     Average Slope     (%)=       3.50        13.00
     Length            (m)=      45.00        70.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      87.66        91.47
                over (min)        1.00         7.00
     Storage Coeff.  (min)=       1.15 (ii)    6.98 (ii)
     Unit Hyd. Tpeak (min)=       1.00         7.00
     Unit Hyd. peak  (cms)=        .99          .16
                                                           *TOTALS*
     PEAK FLOW       (cms)=        .00          .25          .252 (iii)
     TIME TO PEAK    (hrs)=       5.83         6.00         6.000
     RUNOFF VOLUME    (mm)=      95.31        60.79        61.136
     TOTAL RAINFALL   (mm)=      97.40        97.40        97.400
     RUNOFF COEFFICIENT   =        .98          .62          .628

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  81.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------------------
R0004:C00007-------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------
R0004:C00002-------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------
R0004:C00002-------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------
R0004:C00002-------------------------------------------------------------------------------
  ** END OF RUN :    3

*******************************************************************************************





--------------------
| START            | Project  dir.:C:\Temp\15-319\EX\12-hour_SCS\
-------------------- Rainfall dir.:C:\Temp\15-319\EX\12-hour_SCS\
    TZERO =   .00 hrs on        0
```

```
    METOUT=   2 (output = METRIC)
    NRUN  = 0005
    NSTORM=   1
           #  1=12regtim.o89
-------------------------------------------------------------------------------------------
R0005:C00002-------------------------------------------------------------------------------
*#******************************************************************************
*#  Project Name: [Mansfield Ski Club]    Project Number: [15-319]
*#  Date        : 07-31-2017
*#  Modeller    : [J. Lightheart]
*#  Company     : WMI & Associates Ltd.
*#  License #   :  2880720
*#******************************************************************************
*
* Pre-Development Condition - Mansfield Ski Club
*
-------------------------------------------------------------------------------------------
R0005:C00002-------------------------------------------------------------------------------
--------------------
| READ STORM       |  Filename: C:\Temp\15-319\EX\12-hour_SCS\12regtim.o89
| Ptotal= 193.00 mm|  Comments: TIMMINS REGIONAL STORM (12-hour)
--------------------
      TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME
     hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm
      1:00  15.000|   3:00  10.000|   5:00   5.000|   7:00  43.000|   9:00  23.000|  11:00
      2:00  20.000|   4:00   3.000|   6:00  20.000|   8:00  20.000|  10:00  13.000|  12:00

-------------------------------------------------------------------------------------------
R0005:C00003-------------------------------------------------------------------------------
* SITE
* To account for the existing packed gravel surfaces on-site, the TIMP value
* was calibrated (see design calcs)
--------------------------
| CALIB STANDHYD         |   Area    (ha)=    2.46
| 01:PRE1       DT= 1.00 |   Total Imp(%)=   24.00   Dir. Conn.(%)=    1.00
--------------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .59         1.87
     Dep. Storage     (mm)=       2.00         8.10
     Average Slope     (%)=       2.00        10.00
     Length            (m)=     100.00        80.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      43.00        50.88
                over (min)        3.00        12.00
     Storage Coeff.  (min)=       2.91 (ii)   11.56 (ii)
     Unit Hyd. Tpeak (min)=       3.00        12.00
     Unit Hyd. peak  (cms)=        .39          .10
                                                        *TOTALS*
     PEAK FLOW       (cms)=        .00          .26           .262 (iii)
     TIME TO PEAK    (hrs)=       6.95         7.00          7.000
     RUNOFF VOLUME    (mm)=     191.00       150.04        150.449
     TOTAL RAINFALL   (mm)=     193.00       193.00        193.000
```

```
     RUNOFF COEFFICIENT   =        .99          .78           .780

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  81.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------------------
R0005:C00004-------------------------------------------------------------------------------
* EXTERNAL
--------------------------
| CALIB NASHYD           |   Area    (ha)=   11.710   Curve Number   (CN)= 83.00
| 02:EXT        DT= 1.00 |   Ia      (mm)=    6.800   # of Linear Res.(N)=  3.00
--------------------------   U.H. Tp(hrs)=     .240

     Unit Hyd Qpeak  (cms)=    1.864

     PEAK FLOW       (cms)=    1.215 (i)
     TIME TO PEAK    (hrs)=    7.017
     DURATION        (hrs)=   13.667, (dddd|hh:mm:)=   0|13:40
     AVERAGE FLOW    (cms)=     .346
     RUNOFF VOLUME    (mm)=  145.537
     TOTAL RAINFALL   (mm)=  193.000
     RUNOFF COEFFICIENT   =     .754

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

-------------------------------------------------------------------------------------------
R0005:C00005-------------------------------------------------------------------------------
* TOTAL
------------------------
| ADD HYD              |
| 03:TOTAL             |   ID:NHYD           AREA     QPEAK    TPEAK      R.V.     DWF
------------------------                     (ha)     (cms)    (hrs)      (mm)   (cms)
                      ID 1 01:PRE1          2.460      .262    7.000   150.449    .000
                     +ID 2 02:EXT          11.710     1.215    7.017   145.537    .000
                     ==============================================================
                     SUM   03:TOTAL        14.170     1.477    7.017   146.390    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------------------
R0005:C00006-------------------------------------------------------------------------------
* SITE
* To account for the existing packed gravel surfaces on-site, the TIMP value
* was calibrated (see design calcs)
--------------------------
| CALIB STANDHYD         |   Area    (ha)=    1.40
| 04:PRE2       DT= 1.00 |   Total Imp(%)=   24.00   Dir. Conn.(%)=    1.00
--------------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .34         1.06
     Dep. Storage     (mm)=       2.00         8.00
```

```
          Average Slope     (%)=       3.50        13.00
          Length            (m)=      45.00        70.00
          Mannings n           =       .013         .250

          Max.eff.Inten.(mm/hr)=      43.00        50.96
                     over (min)        2.00         9.00
          Storage Coeff.  (min)=       1.52 (ii)    8.90 (ii)
          Unit Hyd. Tpeak (min)=       2.00         9.00
          Unit Hyd. peak  (cms)=        .66          .13
                                                                *TOTALS*
          PEAK FLOW       (cms)=        .00          .15           .151 (iii)
          TIME TO PEAK    (hrs)=       6.87         7.00          7.000
          RUNOFF VOLUME    (mm)=     191.00       150.11        150.522
          TOTAL RAINFALL   (mm)=     193.00       193.00        193.000
          RUNOFF COEFFICIENT   =        .99          .78           .780

            (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
                CN* =  81.0    Ia = Dep. Storage  (Above)
           (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
          (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

     ------------------------------------------------------------------------------------------
     R0005:C00007------------------------------------------------------------------------------
     ------------------------------------------------------------------------------------------
     R0005:C00002------------------------------------------------------------------------------
     ------------------------------------------------------------------------------------------
     R0005:C00002------------------------------------------------------------------------------
     ------------------------------------------------------------------------------------------
     R0005:C00002------------------------------------------------------------------------------
     ------------------------------------------------------------------------------------------
     R0005:C00002------------------------------------------------------------------------------
     --------------------
     | FINISH           |
     --------------------
     ------------------------------------------------------------------------------------------
     ******************************************************************************************
          WARNINGS / ERRORS / NOTES
          -------------------------
        Simulation ended on 2020-11-16     at 11:20:26
     ==========================================================================================
```

Pre-Development Condition
6-hour SCS Type-II Storm Distribution

```
2     Metric units
*#******************************************************************************
*#  Project Name: [Mansfield Ski Club]    Project Number: [15-319]
*#  Date        : 07-31-2017
*#  Modeller    : [J. Lightheart]
*#  Company     : WMI & Associates Ltd.
*#  License #   :  2880720
*#******************************************************************************
*
* Pre-Development Condition - Mansfield Ski Club
*
*% 2-year SCS Type-II Storm Dist. based on Mansfield, ON. rainfall (6-hr)
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[1]
*%                   ["2SCS6.stm"] <--storm filename
*%-----------------|-----------------------------------------------------------|
READ STORM          STORM_FILENAME=["STORM.001"]
*%-----------------|-----------------------------------------------------------|
* SITE
* To account for the existing packed gravel surfaces on-site, the TIMP value
* was calibrated (see design calcs)
CALIB STANDHYD      ID=[1], NHYD=["PRE1"], DT=[1](min), AREA=[2.46](ha),
                    XIMP=[0.01], TIMP=[0.24], DWF=[0](cms), LOSS=[2],
                    SCS curve number CN=[81],
                    Pervious   surfaces: IAper=[8.1](mm), SLPP=[10](%),
                                         LGP=[80](m), MNP=[0.25], SCP=[0](min),
                    Impervious surfaces: IAimp=[2.0](mm), SLPI=[2.0](%),
                                         LGI=[100](m), MNI=[0.013], SCI=[0](min),
                    RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
*%-----------------|-----------------------------------------------------------|
* EXTERNAL
CALIB NASHYD        ID=[2], NHYD=["EXT"], DT=[1]min, AREA=[11.71](ha),
                    DWF=[0](cms),  CN/C=[83], IA=[6.8](mm),
                    N=[3], TP=[0.24]hrs,
                    RAINFALL=[ ,  ,  ,  , ](mm/hr),  END=-1
*%-----------------|-----------------------------------------------------------|
* TOTAL
ADD HYD             IDsum=[3], NHYD=["TOTAL"], IDs to add=[1+2]
*%-----------------|-----------------------------------------------------------|
* SITE
* To account for the existing packed gravel surfaces on-site, the TIMP value
* was calibrated (see design calcs)
CALIB STANDHYD      ID=[4], NHYD=["PRE2"], DT=[1](min), AREA=[1.40](ha),
                    XIMP=[0.01], TIMP=[0.24], DWF=[0](cms), LOSS=[2],
                    SCS curve number CN=[81],
                    Pervious   surfaces: IAper=[8.0](mm), SLPP=[13](%),
                                         LGP=[70](m), MNP=[0.25], SCP=[0](min),
                    Impervious surfaces: IAimp=[2.0](mm), SLPI=[3.5](%),
                                         LGI=[45](m), MNI=[0.013], SCI=[0](min),
                    RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
*%-----------------|-----------------------------------------------------------|
*% 5-year SCS Type-II Storm Dist. based on Mansfield, ON. rainfall (6-hr)
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[2]
*%                   ["5SCS6.stm"] <--storm filename
```

```
*%-----------------|-----------------------------------------------------------|
*% 25-year SCS Type-II Storm Dist. based on Mansfield, ON. rainfall (6-hr)
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[3]
*%                   ["25SCS6.stm"] <--storm filename
*%-----------------|-----------------------------------------------------------|
*% 100-year SCS Type-II Storm Dist. based on Mansfield, ON. rainfall (6-hr)
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[4]
*%                   ["100SCS6.stm"] <--storm filename
*%-----------------|-----------------------------------------------------------|
*% Timmins Regional Storm (12-hr)
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[5]
*%                   ["12regtim.o89"] <--storm filename
*%-----------------|-----------------------------------------------------------|
FINISH
```

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

 SSSSS   W   W   M   M   H   H   Y   Y   M   M    OOO          222     000    11   77777 ==
 S       W W W   MM MM   H   H    Y Y    MM MM   O   O           2    0   0   11   7   7
 SSSSS   W W W   M M M   HHHHH     Y     M M M   O   O           2    0   0   11       7
     S    W W    M   M   H   H     Y     M   M   O   O        222     0   0   11      7
 SSSSS    W W    M   M   H   H     Y     M   M    OOO         2       0   0   11     7   ==
                                                              2       0   0   11    7    #
       StormWater Management HYdrologic Model                  222     000    11    7    ==

 ******************************************************************************************
 **************************************  SWMHYMO Ver4.05.0  *******************************
 ******************  A single event and continuous hydrologic simulation model  ***********
 ******************     based on the principles of HYMO and its successors      ***********
 ******************                 OTTHYMO-83 and OTTHYMO-89.                  ***********
 ******************************************************************************************
 ****************** Distributed by:  J.F. Sabourin and Associates Inc.          ***********
 ******************                 Ottawa,  Ontario: (613) 836-3884           ***********
 ******************                 Gatineau, Quebec: (819) 243-6858           ***********
 ******************                 E-Mail: swmhymo@jfsa.com                   ***********
 ******************************************************************************************

 ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
 ++++++++++++++++++ Licensed user: WMI & Associates Ltd.                        +++++++++++
 ++++++++++++++++++               Barrie                SERIAL#:2880720        +++++++++++
 ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

 ******************************************************************************************
 ******************           ++++++ PROGRAM ARRAY DIMENSIONS ++++++            ***********
 ******************           Maximum value for ID numbers  :     11            ***********
 ******************           Max. number of rainfall points: 105408            ***********
 ******************           Max. number of flow points    : 105408            ***********
 ******************************************************************************************


 *******************************   D E T A I L E D   O U T P U T   ************************
 ******************************************************************************************
 *                 RUN DATE: 2020-11-16     TIME: 11:20:36     RUN COUNTER: 000005
 ******************************************************************************************
 * Input   file: C:\Temp\15-319\EX\6-hour_SCS\2-CYRSCS.dat
 * Output  file: C:\Temp\15-319\EX\6-hour_SCS\2-CYRSCS.out
 * Summary file: C:\Temp\15-319\EX\6-hour_SCS\2-CYRSCS.sum
 * User comments:
 * 1:______________________________________________________________________________________
 * 2:______________________________________________________________________________________
 * 3:______________________________________________________________________________________
 ******************************************************************************************

-------------------------------------------------------------------------------------------
R0001:C00001-------------------------------------------------------------------------------
*#******************************************************************************
*#  Project Name: [Mansfield Ski Club]    Project Number: [15-319]
*#  Date        : 07-31-2017
```

```
*#  Modeller    : [J. Lightheart]
*#  Company     : WMI & Associates Ltd.
*#  License #   :  2880720
*#******************************************************************************
*
* Pre-Development Condition - Mansfield Ski Club
*
--------------------
| START            | Project  dir.:C:\Temp\15-319\EX\6-hour_SCS\
-------------------- Rainfall dir.:C:\Temp\15-319\EX\6-hour_SCS\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 0001
    NSTORM=   1
           #  1=2SCS6.stm
-------------------------------------------------------------------------------------------
R0001:C00002-------------------------------------------------------------------------------
--------------------
| READ STORM       |  Filename: C:\Temp\15-319\EX\6-hour_SCS\2SCS6.stm
| Ptotal=  36.00 mm|  Comments: 2-Year SCS Type-II Storm Distribution (6-hour) Mansfield,
--------------------
      TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME
     hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm
      0:30   1.440|   1:30   2.880|   2:30   5.040|   3:30   9.360|   4:30   2.880|   5:30
      1:00   1.440|   2:00   2.880|   3:00  36.720|   4:00   4.320|   5:00   2.160|   6:00

-------------------------------------------------------------------------------------------
R0001:C00003-------------------------------------------------------------------------------
* SITE
* To account for the existing packed gravel surfaces on-site, the TIMP value
* was calibrated (see design calcs)
--------------------------
| CALIB STANDHYD         |   Area    (ha)=    2.46
| 01:PRE1      DT= 1.00  |   Total Imp(%)=   24.00   Dir. Conn.(%)=    1.00
--------------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .59         1.87
     Dep. Storage     (mm)=       2.00         8.10
     Average Slope     (%)=       2.00        10.00
     Length            (m)=     100.00        80.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      36.72        19.68
                over (min)        3.00        16.00
     Storage Coeff.  (min)=       3.10 (ii)   15.74 (ii)
     Unit Hyd. Tpeak (min)=       3.00        16.00
     Unit Hyd. peak  (cms)=        .37          .07
                                                           *TOTALS*
     PEAK FLOW       (cms)=        .00          .07          .069 (iii)
     TIME TO PEAK    (hrs)=       2.77         3.17         3.167
     RUNOFF VOLUME    (mm)=      34.00        11.74        11.967
     TOTAL RAINFALL   (mm)=      36.00        36.00        36.000
     RUNOFF COEFFICIENT   =        .94          .33          .332
```

```
       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  81.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

---------------------------------------------------------------------------------------------
R0001:C00004---------------------------------------------------------------------------------
* EXTERNAL
-------------------------
| CALIB NASHYD           |   Area    (ha)=   11.710   Curve Number   (CN)= 83.00
| 02:EXT        DT= 1.00 |   Ia      (mm)=    6.800   # of Linear Res.(N)=  3.00
-------------------------    U.H. Tp(hrs)=     .240

     Unit Hyd Qpeak  (cms)=    1.864

     PEAK FLOW       (cms)=     .304 (i)
     TIME TO PEAK    (hrs)=    3.150
     DURATION        (hrs)=    7.667, (dddd|hh:mm:)=   0|07:40
     AVERAGE FLOW    (cms)=     .045
     RUNOFF VOLUME    (mm)=   10.497
     TOTAL RAINFALL   (mm)=   36.000
     RUNOFF COEFFICIENT   =     .292

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

---------------------------------------------------------------------------------------------
R0001:C00005---------------------------------------------------------------------------------
* TOTAL
------------------------
| ADD HYD                |
| 03:TOTAL               |   ID:NHYD           AREA     QPEAK    TPEAK      R.V.     DWF
------------------------                       (ha)     (cms)    (hrs)      (mm)   (cms)
                      ID 1 01:PRE1           2.460      .069    3.167    11.967    .000
                     +ID 2 02:EXT           11.710      .304    3.150    10.497    .000
                     ==========================================================
                     SUM   03:TOTAL         14.170      .373    3.150    10.752    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

---------------------------------------------------------------------------------------------
R0001:C00006---------------------------------------------------------------------------------
* SITE
* To account for the existing packed gravel surfaces on-site, the TIMP value
* was calibrated (see design calcs)
-------------------------
| CALIB STANDHYD         |   Area    (ha)=    1.40
| 04:PRE2       DT= 1.00 |   Total Imp(%)=   24.00   Dir. Conn.(%)=    1.00
-------------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .34         1.06
     Dep. Storage     (mm)=       2.00         8.00
     Average Slope     (%)=       3.50        13.00
```

```
     Length            (m)=      45.00        70.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      36.72        20.95
                over (min)        2.00        12.00
     Storage Coeff.  (min)=       1.62 (ii)   12.14 (ii)
     Unit Hyd. Tpeak (min)=       2.00        12.00
     Unit Hyd. peak  (cms)=        .64          .09
                                                           *TOTALS*
     PEAK FLOW       (cms)=        .00          .04           .045 (iii)
     TIME TO PEAK    (hrs)=       2.72         3.10          3.100
     RUNOFF VOLUME    (mm)=      34.00        11.79         12.015
     TOTAL RAINFALL   (mm)=      36.00        36.00         36.000
     RUNOFF COEFFICIENT   =        .94          .33           .334

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  81.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

---------------------------------------------------------------------------------------------
R0001:C00007---------------------------------------------------------------------------------
  ** END OF RUN :    0

*********************************************************************************************





--------------------
| START            | Project  dir.:C:\Temp\15-319\EX\6-hour_SCS\
-------------------- Rainfall dir.:C:\Temp\15-319\EX\6-hour_SCS\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 0002
    NSTORM=   1
           #  1=5SCS6.stm
---------------------------------------------------------------------------------------------
R0002:C00002---------------------------------------------------------------------------------
*#*******************************************************************************
*#  Project Name: [Mansfield Ski Club]    Project Number: [15-319]
*#  Date        : 07-31-2017
*#  Modeller    : [J. Lightheart]
*#  Company     : WMI & Associates Ltd.
*#  License #   :  2880720
*#*******************************************************************************
*
* Pre-Development Condition - Mansfield Ski Club
*
---------------------------------------------------------------------------------------------
R0002:C00002---------------------------------------------------------------------------------
--------------------
```

```
| READ STORM       |  Filename: C:\Temp\15-319\EX\6-hour_SCS\5SCS6.stm
| Ptotal=  47.50 mm|  Comments: 5-Year SCS Type-II Storm Distribution (6-hour) Mansfield,
--------------------
      TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME
     hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm
      0:30   1.900|   1:30   3.800|   2:30   6.650|   3:30  12.350|   4:30   3.800|   5:30
      1:00   1.900|   2:00   3.800|   3:00  48.450|   4:00   5.700|   5:00   2.850|   6:00

-------------------------------------------------------------------------------------------
R0002:C00003-------------------------------------------------------------------------------
* SITE
* To account for the existing packed gravel surfaces on-site, the TIMP value
* was calibrated (see design calcs)
--------------------------
| CALIB STANDHYD         |   Area    (ha)=    2.46
| 01:PRE1       DT= 1.00 |   Total Imp(%)=   24.00   Dir. Conn.(%)=    1.00
--------------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .59         1.87
     Dep. Storage     (mm)=       2.00         8.10
     Average Slope     (%)=       2.00        10.00
     Length            (m)=     100.00        80.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      48.45        33.98
                over (min)       3.00        13.00
     Storage Coeff.  (min)=       2.77 (ii)   12.94 (ii)
     Unit Hyd. Tpeak (min)=       3.00        13.00
     Unit Hyd. peak  (cms)=        .40          .09
                                                          *TOTALS*
     PEAK FLOW       (cms)=        .00          .13           .130 (iii)
     TIME TO PEAK    (hrs)=       2.92         3.10          3.100
     RUNOFF VOLUME    (mm)=      45.50        19.58         19.843
     TOTAL RAINFALL   (mm)=      47.50        47.50         47.500
     RUNOFF COEFFICIENT   =        .96          .41           .418

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  81.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------------------
R0002:C00004-------------------------------------------------------------------------------
* EXTERNAL
--------------------------
| CALIB NASHYD           |   Area    (ha)=   11.710   Curve Number   (CN)= 83.00
| 02:EXT        DT= 1.00 |   Ia      (mm)=    6.800   # of Linear Res.(N)=  3.00
--------------------------   U.H. Tp(hrs)=     .240

     Unit Hyd Qpeak  (cms)=    1.864

     PEAK FLOW       (cms)=     .537 (i)
     TIME TO PEAK    (hrs)=    3.133
```

```
     DURATION        (hrs)=    7.667, (dddd|hh:mm:)=   0|07:40
     AVERAGE FLOW    (cms)=     .076
     RUNOFF VOLUME    (mm)=   17.865
     TOTAL RAINFALL   (mm)=   47.500
     RUNOFF COEFFICIENT   =     .376

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

-------------------------------------------------------------------------------------------
R0002:C00005-------------------------------------------------------------------------------
* TOTAL
------------------------
| ADD HYD              |
| 03:TOTAL             |   ID:NHYD            AREA     QPEAK    TPEAK      R.V.     DWF
------------------------                      (ha)     (cms)    (hrs)      (mm)   (cms)
                      ID 1 01:PRE1           2.460      .130    3.100    19.843    .000
                     +ID 2 02:EXT           11.710      .537    3.133    17.865    .000
                     ==============================================================
                     SUM   03:TOTAL         14.170      .665    3.117    18.208    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------------------
R0002:C00006-------------------------------------------------------------------------------
* SITE
* To account for the existing packed gravel surfaces on-site, the TIMP value
* was calibrated (see design calcs)
--------------------------
| CALIB STANDHYD         |   Area    (ha)=    1.40
| 04:PRE2       DT= 1.00 |   Total Imp(%)=   24.00   Dir. Conn.(%)=    1.00
--------------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .34         1.06
     Dep. Storage     (mm)=       2.00         8.00
     Average Slope     (%)=       3.50        13.00
     Length            (m)=      45.00        70.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      48.45        35.13
                over (min)       1.00        10.00
     Storage Coeff.  (min)=       1.45 (ii)   10.01 (ii)
     Unit Hyd. Tpeak (min)=       1.00        10.00
     Unit Hyd. peak  (cms)=        .85          .11
                                                          *TOTALS*
     PEAK FLOW       (cms)=        .00          .08           .082 (iii)
     TIME TO PEAK    (hrs)=       2.88         3.07          3.050
     RUNOFF VOLUME    (mm)=      45.32        19.64         19.896
     TOTAL RAINFALL   (mm)=      47.50        47.50         47.500
     RUNOFF COEFFICIENT   =        .95          .41           .419

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  81.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
```

```
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------------------
R0002:C00007--------------------------------------------------------------------------------
--------------------------------------------------------------------------------------------
R0002:C00002--------------------------------------------------------------------------------
  ** END OF RUN :    1

********************************************************************************************





--------------------
| START            | Project  dir.:C:\Temp\15-319\EX\6-hour_SCS\
-------------------- Rainfall dir.:C:\Temp\15-319\EX\6-hour_SCS\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 0003
    NSTORM=   1
           #  1=25SCS6.stm
--------------------------------------------------------------------------------------------
R0003:C00002--------------------------------------------------------------------------------
*#******************************************************************************
*#  Project Name: [Mansfield Ski Club]    Project Number: [15-319]
*#  Date        : 07-31-2017
*#  Modeller    : [J. Lightheart]
*#  Company     : WMI & Associates Ltd.
*#  License #   :  2880720
*#******************************************************************************
*
* Pre-Development Condition - Mansfield Ski Club
*
--------------------------------------------------------------------------------------------
R0003:C00002--------------------------------------------------------------------------------
--------------------
| READ STORM       |  Filename: C:\Temp\15-319\EX\6-hour_SCS\25SCS6.stm
| Ptotal=  64.80 mm|  Comments: 25-Year SCS Type-II Storm Distribution (6-hour) Mansfield,
--------------------
      TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME
     hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm
      0:30   2.592|   1:30   5.184|   2:30   9.072|   3:30  16.848|   4:30   5.184|   5:30
      1:00   2.592|   2:00   5.184|   3:00  66.096|   4:00   7.776|   5:00   3.888|   6:00

--------------------------------------------------------------------------------------------
R0003:C00003--------------------------------------------------------------------------------
* SITE
* To account for the existing packed gravel surfaces on-site, the TIMP value
* was calibrated (see design calcs)
--------------------------
| CALIB STANDHYD         |   Area    (ha)=    2.46
| 01:PRE1       DT= 1.00 |   Total Imp(%)=   24.00   Dir. Conn.(%)=    1.00
```

```
--------------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .59         1.87
     Dep. Storage     (mm)=       2.00         8.10
     Average Slope     (%)=       2.00        10.00
     Length            (m)=     100.00        80.00
     Mannings n          =       .013         .250

     Max.eff.Inten.(mm/hr)=      66.10        56.93
                over (min)       2.00        11.00
     Storage Coeff.  (min)=       2.45 (ii)   10.72 (ii)
     Unit Hyd. Tpeak (min)=       2.00        11.00
     Unit Hyd. peak  (cms)=        .49          .10
                                                           *TOTALS*
     PEAK FLOW       (cms)=        .00          .24           .237 (iii)
     TIME TO PEAK    (hrs)=       2.87         3.07          3.067
     RUNOFF VOLUME    (mm)=      62.80        32.90         33.196
     TOTAL RAINFALL   (mm)=      64.80        64.80         64.800
     RUNOFF COEFFICIENT   =        .97          .51           .512

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  81.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------------------
R0003:C00004--------------------------------------------------------------------------------
* EXTERNAL
--------------------------
| CALIB NASHYD           |   Area    (ha)=   11.710   Curve Number   (CN)= 83.00
| 02:EXT        DT= 1.00 |   Ia      (mm)=    6.800   # of Linear Res.(N)=  3.00
--------------------------   U.H. Tp(hrs)=     .240

     Unit Hyd Qpeak  (cms)=    1.864

     PEAK FLOW       (cms)=     .942 (i)
     TIME TO PEAK    (hrs)=    3.117
     DURATION        (hrs)=    7.667, (dddd|hh:mm:)=   0|07:40
     AVERAGE FLOW    (cms)=     .130
     RUNOFF VOLUME    (mm)=   30.575
     TOTAL RAINFALL   (mm)=   64.800
     RUNOFF COEFFICIENT   =     .472

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

--------------------------------------------------------------------------------------------
R0003:C00005--------------------------------------------------------------------------------
* TOTAL
------------------------
| ADD HYD              |
| 03:TOTAL             |   ID:NHYD            AREA     QPEAK    TPEAK      R.V.     DWF
------------------------                      (ha)     (cms)    (hrs)      (mm)   (cms)
                      ID 1 01:PRE1           2.460      .237    3.067    33.196    .000
```

```
                     +ID 2 02:EXT           11.710      .942    3.117    30.575    .000
                     ==================================================================
                     SUM   03:TOTAL         14.170     1.172    3.100    31.030    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

 ------------------------------------------------------------------------------------------
 R0003:C00006------------------------------------------------------------------------------
 * SITE
 * To account for the existing packed gravel surfaces on-site, the TIMP value
 * was calibrated (see design calcs)
 -------------------------
 | CALIB STANDHYD         |   Area    (ha)=    1.40
 | 04:PRE2       DT= 1.00 |   Total Imp(%)=   24.00   Dir. Conn.(%)=    1.00
 -------------------------
                               IMPERVIOUS    PERVIOUS (i)
      Surface Area     (ha)=        .34         1.06
      Dep. Storage     (mm)=       2.00         8.00
      Average Slope     (%)=       3.50        13.00
      Length            (m)=      45.00        70.00
      Mannings n          =        .013         .250

      Max.eff.Inten.(mm/hr)=      66.10        58.26
                 over (min)        1.00         8.00
      Storage Coeff.  (min)=       1.28 (ii)    8.27 (ii)
      Unit Hyd. Tpeak (min)=       1.00         8.00
      Unit Hyd. peak  (cms)=        .92          .14
                                                            *TOTALS*
      PEAK FLOW       (cms)=        .00          .15           .148 (iii)
      TIME TO PEAK    (hrs)=       2.83         3.03          3.017
      RUNOFF VOLUME    (mm)=      62.68        32.96         33.256
      TOTAL RAINFALL   (mm)=      64.80        64.80         64.800
      RUNOFF COEFFICIENT   =        .97          .51           .513

        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN* =  81.0    Ia = Dep. Storage  (Above)
       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

 ------------------------------------------------------------------------------------------
 R0003:C00007------------------------------------------------------------------------------
 ------------------------------------------------------------------------------------------
 R0003:C00002------------------------------------------------------------------------------
 ------------------------------------------------------------------------------------------
 R0003:C00002------------------------------------------------------------------------------
   ** END OF RUN :    2

 ******************************************************************************************
```

```
 --------------------
 | START            | Project  dir.:C:\Temp\15-319\EX\6-hour_SCS\
 -------------------- Rainfall dir.:C:\Temp\15-319\EX\6-hour_SCS\
     TZERO =   .00 hrs on        0
     METOUT=   2 (output = METRIC)
     NRUN  = 0004
     NSTORM=   1
            #  1=100SCS6.stm
 ------------------------------------------------------------------------------------------
 R0004:C00002------------------------------------------------------------------------------
 *#*******************************************************************************
 *#  Project Name: [Mansfield Ski Club]    Project Number: [15-319]
 *#  Date        : 07-31-2017
 *#  Modeller    : [J. Lightheart]
 *#  Company     : WMI & Associates Ltd.
 *#  License #   :  2880720
 *#*******************************************************************************
 *
 * Pre-Development Condition - Mansfield Ski Club
 *
 ------------------------------------------------------------------------------------------
 R0004:C00002------------------------------------------------------------------------------
 --------------------
 | READ STORM       |  Filename: C:\Temp\15-319\EX\6-hour_SCS\100SCS6.stm
 | Ptotal=  79.10 mm|  Comments: 100-Year SCS Type-II Storm Distribution (6-hour) Mansfield,
 --------------------
       TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME
      hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm
       0:30   3.164|   1:30   6.328|   2:30  11.074|   3:30  20.566|   4:30   6.328|   5:30
       1:00   3.164|   2:00   6.328|   3:00  80.682|   4:00   9.492|   5:00   4.746|   6:00

 ------------------------------------------------------------------------------------------
 R0004:C00003------------------------------------------------------------------------------
 * SITE
 * To account for the existing packed gravel surfaces on-site, the TIMP value
 * was calibrated (see design calcs)
 -------------------------
 | CALIB STANDHYD         |   Area    (ha)=    2.46
 | 01:PRE1       DT= 1.00 |   Total Imp(%)=   24.00   Dir. Conn.(%)=    1.00
 -------------------------
                               IMPERVIOUS    PERVIOUS (i)
      Surface Area     (ha)=        .59         1.87
      Dep. Storage     (mm)=       2.00         8.10
      Average Slope     (%)=       2.00        10.00
      Length            (m)=     100.00        80.00
      Mannings n          =        .013         .250

      Max.eff.Inten.(mm/hr)=      80.68        76.65
                 over (min)        2.00        10.00
      Storage Coeff.  (min)=       2.26 (ii)    9.60 (ii)
      Unit Hyd. Tpeak (min)=       2.00        10.00
      Unit Hyd. peak  (cms)=        .52          .12
                                                            *TOTALS*
```

```
     PEAK FLOW       (cms)=        .01          .33           .336 (iii)
     TIME TO PEAK    (hrs)=       2.73         3.05          3.033
     RUNOFF VOLUME    (mm)=      77.10        44.78         45.103
     TOTAL RAINFALL   (mm)=      79.10        79.10         79.100
     RUNOFF COEFFICIENT   =        .97          .57           .570

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  81.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------------------
R0004:C00004-------------------------------------------------------------------------------
* EXTERNAL
--------------------------
| CALIB NASHYD            |   Area    (ha)=   11.710   Curve Number   (CN)= 83.00
| 02:EXT        DT= 1.00  |   Ia      (mm)=    6.800   # of Linear Res.(N)=  3.00
--------------------------    U.H. Tp(hrs)=     .240

     Unit Hyd Qpeak  (cms)=    1.864

     PEAK FLOW       (cms)=    1.307 (i)
     TIME TO PEAK    (hrs)=    3.117
     DURATION        (hrs)=    7.667, (dddd|hh:mm:)=   0|07:40
     AVERAGE FLOW    (cms)=     .178
     RUNOFF VOLUME    (mm)=   42.046
     TOTAL RAINFALL   (mm)=   79.100
     RUNOFF COEFFICIENT   =     .532

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

-------------------------------------------------------------------------------------------
R0004:C00005-------------------------------------------------------------------------------
* TOTAL
------------------------
| ADD HYD               |
| 03:TOTAL              |   ID:NHYD            AREA     QPEAK    TPEAK      R.V.     DWF
------------------------                       (ha)     (cms)    (hrs)      (mm)   (cms)
                       ID 1 01:PRE1          2.460      .336    3.033    45.103    .000
                      +ID 2 02:EXT          11.710     1.307    3.117    42.046    .000
                      ===================================================================
                      SUM   03:TOTAL        14.170     1.627    3.100    42.577    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------------------
R0004:C00006-------------------------------------------------------------------------------
* SITE
* To account for the existing packed gravel surfaces on-site, the TIMP value
* was calibrated (see design calcs)
--------------------------
| CALIB STANDHYD          |   Area    (ha)=    1.40
| 04:PRE2       DT= 1.00  |   Total Imp(%)=   24.00   Dir. Conn.(%)=    1.00
```

```
--------------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .34         1.06
     Dep. Storage     (mm)=       2.00         8.00
     Average Slope     (%)=       3.50        13.00
     Length            (m)=      45.00        70.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      80.68        78.04
                over (min)       1.00         7.00
     Storage Coeff.  (min)=       1.18 (ii)    7.40 (ii)
     Unit Hyd. Tpeak (min)=       1.00         7.00
     Unit Hyd. peak  (cms)=        .97          .16
                                                           *TOTALS*
     PEAK FLOW       (cms)=        .00          .20           .207 (iii)
     TIME TO PEAK    (hrs)=       2.63         3.02          3.000
     RUNOFF VOLUME    (mm)=      77.01        44.84         45.166
     TOTAL RAINFALL   (mm)=      79.10        79.10         79.100
     RUNOFF COEFFICIENT   =        .97          .57           .571

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  81.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------------------
R0004:C00007-------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------
R0004:C00002-------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------
R0004:C00002-------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------
R0004:C00002-------------------------------------------------------------------------------
  ** END OF RUN :    3

*******************************************************************************************




--------------------
| START            | Project  dir.:C:\Temp\15-319\EX\6-hour_SCS\
-------------------- Rainfall dir.:C:\Temp\15-319\EX\6-hour_SCS\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 0005
    NSTORM=   1
           #  1=12regtim.o89
-------------------------------------------------------------------------------------------
R0005:C00002-------------------------------------------------------------------------------
*#********************************************************************************
*#  Project Name: [Mansfield Ski Club]    Project Number: [15-319]
```

```
*#  Date        : 07-31-2017
*#  Modeller    : [J. Lightheart]
*#  Company     : WMI & Associates Ltd.
*#  License #   :  2880720
*#*****************************************************************************
*
* Pre-Development Condition - Mansfield Ski Club
*
---------------------------------------------------------------------------------------------
R0005:C00002---------------------------------------------------------------------------------
--------------------
| READ STORM       |  Filename: C:\Temp\15-319\EX\6-hour_SCS\12regtim.o89
| Ptotal= 193.00 mm|  Comments: TIMMINS REGIONAL STORM (12-hour)
--------------------
      TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME
     hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm
      1:00  15.000|   3:00  10.000|   5:00   5.000|   7:00  43.000|   9:00  23.000|  11:00
      2:00  20.000|   4:00   3.000|   6:00  20.000|   8:00  20.000|  10:00  13.000|  12:00

---------------------------------------------------------------------------------------------
R0005:C00003---------------------------------------------------------------------------------
* SITE
* To account for the existing packed gravel surfaces on-site, the TIMP value
* was calibrated (see design calcs)
--------------------------
| CALIB STANDHYD         |   Area    (ha)=    2.46
| 01:PRE1       DT= 1.00 |   Total Imp(%)=   24.00   Dir. Conn.(%)=    1.00
--------------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .59         1.87
     Dep. Storage     (mm)=       2.00         8.10
     Average Slope     (%)=       2.00        10.00
     Length            (m)=     100.00        80.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      43.00        50.88
                over (min)       3.00        12.00
     Storage Coeff.  (min)=       2.91 (ii)   11.56 (ii)
     Unit Hyd. Tpeak (min)=       3.00        12.00
     Unit Hyd. peak  (cms)=        .39          .10
                                                          *TOTALS*
     PEAK FLOW       (cms)=        .00          .26           .262 (iii)
     TIME TO PEAK    (hrs)=       6.95         7.00          7.000
     RUNOFF VOLUME    (mm)=     191.00       150.04        150.449
     TOTAL RAINFALL   (mm)=     193.00       193.00        193.000
     RUNOFF COEFFICIENT   =        .99          .78           .780

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  81.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

---------------------------------------------------------------------------------------------
```

```
R0005:C00004---------------------------------------------------------------------------------
* EXTERNAL
--------------------------
| CALIB NASHYD           |   Area    (ha)=   11.710   Curve Number   (CN)= 83.00
| 02:EXT        DT= 1.00 |   Ia      (mm)=    6.800   # of Linear Res.(N)=  3.00
--------------------------   U.H. Tp(hrs)=     .240

     Unit Hyd Qpeak  (cms)=    1.864

     PEAK FLOW       (cms)=    1.215 (i)
     TIME TO PEAK    (hrs)=    7.017
     DURATION        (hrs)=   13.667, (dddd|hh:mm:)=   0|13:40
     AVERAGE FLOW    (cms)=     .346
     RUNOFF VOLUME    (mm)=  145.537
     TOTAL RAINFALL   (mm)=  193.000
     RUNOFF COEFFICIENT   =     .754

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

---------------------------------------------------------------------------------------------
R0005:C00005---------------------------------------------------------------------------------
* TOTAL
------------------------
| ADD HYD              |
| 03:TOTAL             |   ID:NHYD            AREA     QPEAK    TPEAK      R.V.     DWF
------------------------                      (ha)     (cms)    (hrs)      (mm)   (cms)
                     ID 1 01:PRE1          2.460      .262    7.000   150.449    .000
                    +ID 2 02:EXT          11.710     1.215    7.017   145.537    .000
                    ==============================================================
                    SUM   03:TOTAL        14.170     1.477    7.017   146.390    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

---------------------------------------------------------------------------------------------
R0005:C00006---------------------------------------------------------------------------------
* SITE
* To account for the existing packed gravel surfaces on-site, the TIMP value
* was calibrated (see design calcs)
--------------------------
| CALIB STANDHYD         |   Area    (ha)=    1.40
| 04:PRE2       DT= 1.00 |   Total Imp(%)=   24.00   Dir. Conn.(%)=    1.00
--------------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .34         1.06
     Dep. Storage     (mm)=       2.00         8.00
     Average Slope     (%)=       3.50        13.00
     Length            (m)=      45.00        70.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      43.00        50.96
                over (min)       2.00         9.00
     Storage Coeff.  (min)=       1.52 (ii)    8.90 (ii)
     Unit Hyd. Tpeak (min)=       2.00         9.00
```

```
     Unit Hyd. peak  (cms)=        .66          .13
                                                         *TOTALS*
     PEAK FLOW       (cms)=        .00          .15           .151 (iii)
     TIME TO PEAK    (hrs)=       6.87         7.00          7.000
     RUNOFF VOLUME    (mm)=     191.00       150.11        150.522
     TOTAL RAINFALL   (mm)=     193.00       193.00        193.000
     RUNOFF COEFFICIENT   =        .99          .78           .780

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  81.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

------------------------------------------------------------------------------------------
R0005:C00007------------------------------------------------------------------------------
------------------------------------------------------------------------------------------
R0005:C00002------------------------------------------------------------------------------
------------------------------------------------------------------------------------------
R0005:C00002------------------------------------------------------------------------------
------------------------------------------------------------------------------------------
R0005:C00002------------------------------------------------------------------------------
------------------------------------------------------------------------------------------
R0005:C00002------------------------------------------------------------------------------
--------------------
| FINISH           |
--------------------
------------------------------------------------------------------------------------------
******************************************************************************************
     WARNINGS / ERRORS / NOTES
     -------------------------
   Simulation ended on 2020-11-16     at 11:20:36
==========================================================================================
```

Pre-Development Condition
4-hour Chicago Storm Distribution

```
2     Metric units
*#******************************************************************************
*#  Project Name: [Mansfield Ski Club]    Project Number: [15-319]
*#  Date        : 07-31-2017
*#  Modeller    : [J. Lightheart]
*#  Company     : WMI & Associates Ltd.
*#  License #   :  2880720
*#******************************************************************************
*
* Pre-Development Condition - Mansfield Ski Club
*
*% 2-year Chicago Storm Dist. based on Mansfield, ON. rainfall (4-hr)
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[1]
*%                   ["2CHI4.stm"] <--storm filename
*%-----------------|-----------------------------------------------------------|
READ STORM          STORM_FILENAME=["STORM.001"]
*%-----------------|-----------------------------------------------------------|
* SITE
* To account for the existing packed gravel surfaces on-site, the TIMP value
* was calibrated (see design calcs)
CALIB STANDHYD      ID=[1], NHYD=["PRE1"], DT=[1](min), AREA=[2.46](ha),
                    XIMP=[0.01], TIMP=[0.24], DWF=[0](cms), LOSS=[2],
                    SCS curve number CN=[81],
                    Pervious   surfaces: IAper=[8.1](mm), SLPP=[10](%),
                                         LGP=[80](m), MNP=[0.25], SCP=[0](min),
                    Impervious surfaces: IAimp=[2.0](mm), SLPI=[2.0](%),
                                         LGI=[100](m), MNI=[0.013], SCI=[0](min),
                    RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
*%-----------------|-----------------------------------------------------------|
* EXTERNAL
CALIB NASHYD        ID=[2], NHYD=["EXT"], DT=[1]min, AREA=[11.71](ha),
                    DWF=[0](cms),  CN/C=[83], IA=[6.8](mm),
                    N=[3], TP=[0.24]hrs,
                    RAINFALL=[ ,  ,  ,  , ](mm/hr),  END=-1
*%-----------------|-----------------------------------------------------------|
* TOTAL
ADD HYD             IDsum=[3], NHYD=["TOTAL"], IDs to add=[1+2]
*%-----------------|-----------------------------------------------------------|
* SITE
* To account for the existing packed gravel surfaces on-site, the TIMP value
* was calibrated (see design calcs)
CALIB STANDHYD      ID=[4], NHYD=["PRE2"], DT=[1](min), AREA=[1.40](ha),
                    XIMP=[0.01], TIMP=[0.24], DWF=[0](cms), LOSS=[2],
                    SCS curve number CN=[81],
                    Pervious   surfaces: IAper=[8.0](mm), SLPP=[13](%),
                                         LGP=[70](m), MNP=[0.25], SCP=[0](min),
                    Impervious surfaces: IAimp=[2.0](mm), SLPI=[3.5](%),
                                         LGI=[45](m), MNI=[0.013], SCI=[0](min),
                    RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
*%-----------------|-----------------------------------------------------------|
*% 5-year Chicago Storm Dist. based on Mansfield, ON. rainfall (4-hr)
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[2]
*%                   ["5CHI4.stm"] <--storm filename
```

```
*%-----------------|-----------------------------------------------------------|
*% 25-year Chicago Storm Dist. based on Mansfield, ON. rainfall (4-hr)
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[3]
*%                   ["25CHI4.stm"] <--storm filename
*%-----------------|-----------------------------------------------------------|
*% 100-year Chicago Storm Dist. based on Mansfield, ON. rainfall (4-hr)
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[4]
*%                   ["100CHI4.stm"] <--storm filename
*%-----------------|-----------------------------------------------------------|
*% Timmins Regional Storm (12-hr)
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[5]
*%                   ["12regtim.o89"] <--storm filename
*%-----------------|-----------------------------------------------------------|
FINISH
```

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

 SSSSS   W   W   M   M   H   H   Y   Y   M   M    OOO          222     000    11   77777 ==
 S       W W W   MM MM   H   H    Y Y    MM MM   O   O           2    0   0   11   7   7
 SSSSS   W W W   M M M   HHHHH     Y     M M M   O   O           2    0   0   11       7
     S    W W    M   M   H   H     Y     M   M   O   O        222     0   0   11      7
 SSSSS    W W    M   M   H   H     Y     M   M    OOO         2       0   0   11     7   ==
                                                              2       0   0   11    7    #
       StormWater Management HYdrologic Model                  222     000    11    7    ==

 ******************************************************************************************
 **************************************  SWMHYMO Ver4.05.0  ********************************
 ******************  A single event and continuous hydrologic simulation model  ***********
 ******************     based on the principles of HYMO and its successors      ***********
 ******************                 OTTHYMO-83 and OTTHYMO-89.                  ***********
 ******************************************************************************************
 ****************** Distributed by:  J.F. Sabourin and Associates Inc.          ***********
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 ******************                  E-Mail: swmhymo@jfsa.com                   ***********
 ******************************************************************************************

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 +++++++++++++++++ Licensed user: WMI & Associates Ltd.                        +++++++++++
 ++++++++++++++++++               Barrie                SERIAL#:2880720        +++++++++++
 ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

 ******************************************************************************************
 ******************            ++++++ PROGRAM ARRAY DIMENSIONS ++++++          ***********
 ******************            Maximum value for ID numbers  :     11          ***********
 ******************            Max. number of rainfall points: 105408          ***********
 ******************            Max. number of flow points    : 105408          ***********
 ******************************************************************************************


 *******************************   D E T A I L E D   O U T P U T   ***********************
 ******************************************************************************************
 *                 RUN DATE: 2020-11-16     TIME: 11:21:02     RUN COUNTER: 000006
 ******************************************************************************************
 * Input   file: C:\Temp\15-319\EX\4-hour_Chic\2-CYRCHI.dat
 * Output  file: C:\Temp\15-319\EX\4-hour_Chic\2-CYRCHI.out
 * Summary file: C:\Temp\15-319\EX\4-hour_Chic\2-CYRCHI.sum
 * User comments:
 * 1:_______________________________________________________________________________________
 * 2:_______________________________________________________________________________________
 * 3:_______________________________________________________________________________________
 ******************************************************************************************

-------------------------------------------------------------------------------------------
R0001:C00001-------------------------------------------------------------------------------
*#*****************************************************************************
*#  Project Name: [Mansfield Ski Club]    Project Number: [15-319]
*#  Date        : 07-31-2017
```

```
*#  Modeller    : [J. Lightheart]
*#  Company     : WMI & Associates Ltd.
*#  License #   :  2880720
*#*****************************************************************************
*
* Pre-Development Condition - Mansfield Ski Club
*
--------------------
| START            | Project  dir.:C:\Temp\15-319\EX\4-hour_Chic\
-------------------- Rainfall dir.:C:\Temp\15-319\EX\4-hour_Chic\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 0001
    NSTORM=   1
           #  1=2CHI4.stm
------------------------------------------------------------------------------------------
R0001:C00002------------------------------------------------------------------------------
--------------------
| READ STORM       |  Filename: C:\Temp\15-319\EX\4-hour_Chic\2CHI4.stm
| Ptotal=  32.37 mm|  Comments: 2-Year Chicago Storm Distribution (4-hour) Mansfield, ON.
--------------------
      TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME
     hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm
      0:10   2.552|   0:50   4.945|   1:30  17.908|   2:10   5.281|   2:50   3.431|   3:30
      0:20   2.869|   1:00   6.961|   1:40  10.450|   2:20   4.618|   3:00   3.177|   3:40
      0:30   3.301|   1:10  14.171|   1:50   7.709|   2:30   4.124|   3:10   2.963|   3:50
      0:40   3.928|   1:20  73.380|   2:00   6.227|   2:40   3.740|   3:20   2.781|   4:00

------------------------------------------------------------------------------------------
R0001:C00003------------------------------------------------------------------------------
* SITE
* To account for the existing packed gravel surfaces on-site, the TIMP value
* was calibrated (see design calcs)
--------------------------
| CALIB STANDHYD          |   Area    (ha)=    2.46
| 01:PRE1       DT= 1.00 |   Total Imp(%)=   24.00   Dir. Conn.(%)=    1.00
--------------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .59         1.87
     Dep. Storage     (mm)=       2.00         8.10
     Average Slope     (%)=       2.00        10.00
     Length            (m)=     100.00        80.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      73.38        17.06
                over (min)       2.00        16.00
     Storage Coeff.  (min)=       2.35 (ii)   15.74 (ii)
     Unit Hyd. Tpeak (min)=       2.00        16.00
     Unit Hyd. peak  (cms)=        .50          .07
                                                                *TOTALS*
     PEAK FLOW       (cms)=        .00          .05            .054 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.58           1.583
     RUNOFF VOLUME    (mm)=      30.37         9.52           9.724
```

```
     TOTAL RAINFALL   (mm)=      32.37        32.37         32.374
     RUNOFF COEFFICIENT   =        .94          .29           .300

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  81.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------------------
R0001:C00004-------------------------------------------------------------------------------
* EXTERNAL
--------------------------
| CALIB NASHYD           |   Area    (ha)=   11.710   Curve Number   (CN)= 83.00
| 02:EXT        DT= 1.00 |   Ia      (mm)=    6.800   # of Linear Res.(N)=  3.00
--------------------------   U.H. Tp(hrs)=     .240

     Unit Hyd Qpeak  (cms)=    1.864

     PEAK FLOW       (cms)=     .224 (i)
     TIME TO PEAK    (hrs)=    1.617
     DURATION        (hrs)=    5.667, (dddd|hh:mm:)=   0|05:40
     AVERAGE FLOW    (cms)=     .048
     RUNOFF VOLUME    (mm)=    8.428
     TOTAL RAINFALL   (mm)=   32.374
     RUNOFF COEFFICIENT   =     .260

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

-------------------------------------------------------------------------------------------
R0001:C00005-------------------------------------------------------------------------------
* TOTAL
------------------------
| ADD HYD              |
| 03:TOTAL             |   ID:NHYD            AREA     QPEAK    TPEAK      R.V.     DWF
------------------------                      (ha)     (cms)    (hrs)      (mm)   (cms)
                     ID 1 01:PRE1            2.460      .054    1.583     9.724    .000
                    +ID 2 02:EXT            11.710      .224    1.617     8.428    .000
                    ==================================================================
                    SUM   03:TOTAL          14.170      .277    1.617     8.653    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------------------
R0001:C00006-------------------------------------------------------------------------------
* SITE
* To account for the existing packed gravel surfaces on-site, the TIMP value
* was calibrated (see design calcs)
--------------------------
| CALIB STANDHYD         |   Area    (ha)=    1.40
| 04:PRE2       DT= 1.00 |   Total Imp(%)=   24.00   Dir. Conn.(%)=    1.00
--------------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .34         1.06
```

```
     Dep. Storage     (mm)=       2.00         8.00
     Average Slope     (%)=       3.50        13.00
     Length            (m)=      45.00        70.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      73.38        19.64
                over (min)        1.00        12.00
     Storage Coeff.  (min)=       1.23 (ii)   12.03 (ii)
     Unit Hyd. Tpeak (min)=       1.00        12.00
     Unit Hyd. peak  (cms)=        .95          .09
                                                            *TOTALS*
     PEAK FLOW       (cms)=        .00          .04           .036 (iii)
     TIME TO PEAK    (hrs)=       1.30         1.52          1.500
     RUNOFF VOLUME    (mm)=      30.33         9.56          9.769
     TOTAL RAINFALL   (mm)=      32.37        32.37         32.374
     RUNOFF COEFFICIENT   =        .94          .30           .302

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  81.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------------------
R0001:C00007-------------------------------------------------------------------------------
  ** END OF RUN :    0

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--------------------
| START            | Project  dir.:C:\Temp\15-319\EX\4-hour_Chic\
-------------------- Rainfall dir.:C:\Temp\15-319\EX\4-hour_Chic\
    TZERO =   .00 hrs on       0
    METOUT=   2 (output = METRIC)
    NRUN  = 0002
    NSTORM=   1
           #  1=5CHI4.stm
-------------------------------------------------------------------------------------------
R0002:C00002-------------------------------------------------------------------------------
*#****************************************************************************
*#  Project Name: [Mansfield Ski Club]    Project Number: [15-319]
*#  Date        : 07-31-2017
*#  Modeller    : [J. Lightheart]
*#  Company     : WMI & Associates Ltd.
*#  License #   :  2880720
*#****************************************************************************
*
* Pre-Development Condition - Mansfield Ski Club
*
-------------------------------------------------------------------------------------------
```

```
R0002:C00002------------------------------------------------------------------------------
--------------------
| READ STORM       |  Filename: C:\Temp\15-319\EX\4-hour_Chic\5CHI4.stm
| Ptotal=  42.60 mm|  Comments: 5-Year Chicago Storm Distribution (4-hour) Mansfield, ON.
--------------------
      TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME
     hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm
      0:10   3.347|   0:50   6.492|   1:30  23.565|   2:10   6.934|   2:50   4.502|   3:30
      0:20   3.764|   1:00   9.144|   1:40  13.736|   2:20   6.062|   3:00   4.168|   3:40
      0:30   4.331|   1:10  18.640|   1:50  10.128|   2:30   5.413|   3:10   3.887|   3:50
      0:40   5.155|   1:20  96.860|   2:00   8.178|   2:40   4.908|   3:20   3.648|   4:00

------------------------------------------------------------------------------------------
R0002:C00003------------------------------------------------------------------------------
* SITE
* To account for the existing packed gravel surfaces on-site, the TIMP value
* was calibrated (see design calcs)
--------------------------
| CALIB STANDHYD         |   Area    (ha)=    2.46
| 01:PRE1       DT= 1.00 |   Total Imp(%)=   24.00   Dir. Conn.(%)=    1.00
--------------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .59         1.87
     Dep. Storage     (mm)=       2.00         8.10
     Average Slope     (%)=       2.00        10.00
     Length            (m)=     100.00        80.00
     Mannings n          =        .013         .250

     Max.eff.Inten.(mm/hr)=      96.86        36.26
                over (min)       2.00        12.00
     Storage Coeff.  (min)=       2.10 (ii)   12.01 (ii)
     Unit Hyd. Tpeak (min)=       2.00        12.00
     Unit Hyd. peak  (cms)=        .54          .09
                                                          *TOTALS*
     PEAK FLOW       (cms)=        .01          .12           .118 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.50          1.500
     RUNOFF VOLUME    (mm)=      40.60        16.12         16.365
     TOTAL RAINFALL   (mm)=      42.60        42.60         42.603
     RUNOFF COEFFICIENT   =        .95          .38           .384

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  81.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

------------------------------------------------------------------------------------------
R0002:C00004------------------------------------------------------------------------------
* EXTERNAL
--------------------------
| CALIB NASHYD           |   Area    (ha)=   11.710   Curve Number   (CN)= 83.00
| 02:EXT        DT= 1.00 |   Ia      (mm)=    6.800   # of Linear Res.(N)=  3.00
--------------------------   U.H. Tp(hrs)=     .240
```

```
     Unit Hyd Qpeak  (cms)=    1.864

     PEAK FLOW       (cms)=     .424 (i)
     TIME TO PEAK    (hrs)=    1.600
     DURATION        (hrs)=    5.667, (dddd|hh:mm:)=   0|05:40
     AVERAGE FLOW    (cms)=     .084
     RUNOFF VOLUME    (mm)=   14.595
     TOTAL RAINFALL   (mm)=   42.603
     RUNOFF COEFFICIENT   =     .343

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

------------------------------------------------------------------------------------------
R0002:C00005------------------------------------------------------------------------------
* TOTAL
------------------------
| ADD HYD               |
| 03:TOTAL              |   ID:NHYD           AREA     QPEAK    TPEAK      R.V.     DWF
------------------------                      (ha)     (cms)    (hrs)      (mm)   (cms)
                      ID 1 01:PRE1           2.460      .118    1.500    16.365    .000
                     +ID 2 02:EXT           11.710      .424    1.600    14.595    .000
                     ============================================================
                     SUM   03:TOTAL         14.170      .529    1.567    14.903    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

------------------------------------------------------------------------------------------
R0002:C00006------------------------------------------------------------------------------
* SITE
* To account for the existing packed gravel surfaces on-site, the TIMP value
* was calibrated (see design calcs)
--------------------------
| CALIB STANDHYD         |   Area    (ha)=    1.40
| 04:PRE2       DT= 1.00 |   Total Imp(%)=   24.00   Dir. Conn.(%)=    1.00
--------------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .34         1.06
     Dep. Storage     (mm)=       2.00         8.00
     Average Slope     (%)=       3.50        13.00
     Length            (m)=      45.00        70.00
     Mannings n          =        .013         .250

     Max.eff.Inten.(mm/hr)=      96.86        43.46
                over (min)       1.00         9.00
     Storage Coeff.  (min)=       1.10 (ii)    8.96 (ii)
     Unit Hyd. Tpeak (min)=       1.00         9.00
     Unit Hyd. peak  (cms)=       1.01          .13
                                                          *TOTALS*
     PEAK FLOW       (cms)=        .00          .08           .080 (iii)
     TIME TO PEAK    (hrs)=       1.28         1.45          1.450
     RUNOFF VOLUME    (mm)=      40.53        16.17         16.417
     TOTAL RAINFALL   (mm)=      42.60        42.60         42.603
     RUNOFF COEFFICIENT   =        .95          .38           .385
```

```
       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  81.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------------------
R0002:C00007-------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------
R0002:C00002-------------------------------------------------------------------------------
  ** END OF RUN :    1

*******************************************************************************************





--------------------
| START            | Project  dir.:C:\Temp\15-319\EX\4-hour_Chic\
-------------------- Rainfall dir.:C:\Temp\15-319\EX\4-hour_Chic\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 0003
    NSTORM=   1
           #  1=25CHI4.stm
-------------------------------------------------------------------------------------------
R0003:C00002-------------------------------------------------------------------------------
*#******************************************************************************
*#  Project Name: [Mansfield Ski Club]    Project Number: [15-319]
*#  Date        : 07-31-2017
*#  Modeller    : [J. Lightheart]
*#  Company     : WMI & Associates Ltd.
*#  License #   :  2880720
*#******************************************************************************
*
* Pre-Development Condition - Mansfield Ski Club
*
-------------------------------------------------------------------------------------------
R0003:C00002-------------------------------------------------------------------------------
--------------------
| READ STORM       |  Filename: C:\Temp\15-319\EX\4-hour_Chic\25CHI4.stm
| Ptotal=  58.08 mm|  Comments: 25-Year Chicago Storm Distribution (4-hour) Mansfield, ON.
--------------------
      TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME
     hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm
      0:10   4.562|   0:50   8.850|   1:30  32.125|   2:10   9.453|   2:50   6.138|   3:30
      0:20   5.131|   1:00  12.466|   1:40  18.726|   2:20   8.265|   3:00   5.682|   3:40
      0:30   5.904|   1:10  25.411|   1:50  13.807|   2:30   7.379|   3:10   5.299|   3:50
      0:40   7.028|   1:20 132.047|   2:00  11.148|   2:40   6.691|   3:20   4.973|   4:00

-------------------------------------------------------------------------------------------
R0003:C00003-------------------------------------------------------------------------------
```

```
* SITE
* To account for the existing packed gravel surfaces on-site, the TIMP value
* was calibrated (see design calcs)
--------------------------
| CALIB STANDHYD         |   Area    (ha)=    2.46
| 01:PRE1       DT= 1.00 |   Total Imp(%)=   24.00   Dir. Conn.(%)=    1.00
--------------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .59        1.87
     Dep. Storage     (mm)=       2.00        8.10
     Average Slope     (%)=       2.00       10.00
     Length            (m)=     100.00       80.00
     Mannings n           =       .013        .250

     Max.eff.Inten.(mm/hr)=     132.05       79.60
                over (min)        2.00        9.00
     Storage Coeff.  (min)=       1.86 (ii)    9.09 (ii)
     Unit Hyd. Tpeak (min)=       2.00        9.00
     Unit Hyd. peak  (cms)=        .59         .12
                                                          *TOTALS*
     PEAK FLOW       (cms)=        .01         .25          .252 (iii)
     TIME TO PEAK    (hrs)=       1.33        1.43         1.433
     RUNOFF VOLUME    (mm)=      56.08       27.56        27.843
     TOTAL RAINFALL   (mm)=      58.08       58.08        58.079
     RUNOFF COEFFICIENT   =        .97         .47          .479

        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN* =  81.0    Ia = Dep. Storage  (Above)
       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------------------
R0003:C00004-------------------------------------------------------------------------------
* EXTERNAL
--------------------------
| CALIB NASHYD           |   Area    (ha)=   11.710   Curve Number   (CN)= 83.00
| 02:EXT        DT= 1.00 |   Ia      (mm)=    6.800   # of Linear Res.(N)=  3.00
--------------------------   U.H. Tp(hrs)=     .240

     Unit Hyd Qpeak  (cms)=    1.864

     PEAK FLOW       (cms)=     .795 (i)
     TIME TO PEAK    (hrs)=    1.583
     DURATION        (hrs)=    5.667, (dddd|hh:mm:)=   0|05:40
     AVERAGE FLOW    (cms)=     .146
     RUNOFF VOLUME    (mm)=   25.455
     TOTAL RAINFALL   (mm)=   58.079
     RUNOFF COEFFICIENT   =     .438

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

-------------------------------------------------------------------------------------------
R0003:C00005-------------------------------------------------------------------------------
```

```
* TOTAL
------------------------
| ADD HYD              |
| 03:TOTAL             |   ID:NHYD             AREA     QPEAK    TPEAK      R.V.     DWF
------------------------                       (ha)     (cms)    (hrs)      (mm)   (cms)
                      ID 1 01:PRE1            2.460      .252    1.433    27.843    .000
                     +ID 2 02:EXT            11.710      .795    1.583    25.455    .000
                     ===================================================================
                     SUM   03:TOTAL          14.170      .988    1.550    25.869    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------------------
R0003:C00006-------------------------------------------------------------------------------
* SITE
* To account for the existing packed gravel surfaces on-site, the TIMP value
* was calibrated (see design calcs)
--------------------------
| CALIB STANDHYD         |   Area    (ha)=    1.40
| 04:PRE2       DT= 1.00 |   Total Imp(%)=   24.00   Dir. Conn.(%)=    1.00
--------------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .34         1.06
     Dep. Storage     (mm)=       2.00         8.00
     Average Slope     (%)=       3.50        13.00
     Length            (m)=      45.00        70.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=     132.05        86.85
                over (min)       1.00         7.00
     Storage Coeff.  (min)=        .97 (ii)    6.93 (ii)
     Unit Hyd. Tpeak (min)=       1.00         7.00
     Unit Hyd. peak  (cms)=       1.09          .16
                                                            *TOTALS*
     PEAK FLOW       (cms)=        .01          .17           .167 (iii)
     TIME TO PEAK    (hrs)=       1.28         1.40          1.400
     RUNOFF VOLUME    (mm)=      56.04        27.62         27.901
     TOTAL RAINFALL   (mm)=      58.08        58.08         58.079
     RUNOFF COEFFICIENT   =        .96          .48           .480

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
             CN* =  81.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------------------
R0003:C00007-------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------
R0003:C00002-------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------
R0003:C00002-------------------------------------------------------------------------------
  ** END OF RUN :    2
```

```
*******************************************************************************************




--------------------
| START            | Project  dir.:C:\Temp\15-319\EX\4-hour_Chic\
-------------------- Rainfall dir.:C:\Temp\15-319\EX\4-hour_Chic\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 0004
    NSTORM=   1
           #  1=100CHI4.stm
-------------------------------------------------------------------------------------------
R0004:C00002-------------------------------------------------------------------------------
*#****************************************************************************
*#  Project Name: [Mansfield Ski Club]    Project Number: [15-319]
*#  Date        : 07-31-2017
*#  Modeller    : [J. Lightheart]
*#  Company     : WMI & Associates Ltd.
*#  License #   :  2880720
*#****************************************************************************
*
* Pre-Development Condition - Mansfield Ski Club
*
-------------------------------------------------------------------------------------------
R0004:C00002-------------------------------------------------------------------------------
--------------------
| READ STORM       |  Filename: C:\Temp\15-319\EX\4-hour_Chic\100CHI4.stm
| Ptotal=  70.93 mm|  Comments: 100-Year Chicago Storm Distribution (4-hour) Mansfield, ON.
--------------------
      TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME
     hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm
      0:10   5.571|   0:50  10.808|   1:30  39.231|   2:10  11.544|   2:50   7.495|   3:30
      0:20   6.266|   1:00  15.223|   1:40  22.869|   2:20  10.093|   3:00   6.939|   3:40
      0:30   7.210|   1:10  31.032|   1:50  16.861|   2:30   9.012|   3:10   6.472|   3:50
      0:40   8.582|   1:20 161.254|   2:00  13.614|   2:40   8.171|   3:20   6.073|   4:00

-------------------------------------------------------------------------------------------
R0004:C00003-------------------------------------------------------------------------------
* SITE
* To account for the existing packed gravel surfaces on-site, the TIMP value
* was calibrated (see design calcs)
--------------------------
| CALIB STANDHYD         |   Area    (ha)=    2.46
| 01:PRE1       DT= 1.00 |   Total Imp(%)=   24.00   Dir. Conn.(%)=    1.00
--------------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .59         1.87
     Dep. Storage     (mm)=       2.00         8.10
     Average Slope     (%)=       2.00        10.00
     Length            (m)=     100.00        80.00
```

```
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=     161.25       117.56
                over (min)        2.00         8.00
     Storage Coeff.  (min)=       1.71 (ii)    7.90 (ii)
     Unit Hyd. Tpeak (min)=       2.00         8.00
     Unit Hyd. peak  (cms)=        .62          .14
                                                        *TOTALS*
     PEAK FLOW       (cms)=        .01          .38           .387 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.42          1.417
     RUNOFF VOLUME    (mm)=      68.93        37.91         38.221
     TOTAL RAINFALL   (mm)=      70.93        70.93         70.926
     RUNOFF COEFFICIENT   =        .97          .53           .539

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  81.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------------------
R0004:C00004-------------------------------------------------------------------------------
* EXTERNAL
----------------------------
| CALIB NASHYD           |   Area    (ha)=   11.710   Curve Number   (CN)= 83.00
| 02:EXT        DT= 1.00 |   Ia      (mm)=    6.800   # of Linear Res.(N)=  3.00
-------------------------    U.H. Tp(hrs)=     .240

     Unit Hyd Qpeak  (cms)=    1.864

     PEAK FLOW       (cms)=    1.146 (i)
     TIME TO PEAK    (hrs)=    1.567
     DURATION        (hrs)=    5.667, (dddd|hh:mm:)=   0|05:40
     AVERAGE FLOW    (cms)=     .203
     RUNOFF VOLUME    (mm)=   35.404
     TOTAL RAINFALL   (mm)=   70.926
     RUNOFF COEFFICIENT   =     .499

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

-------------------------------------------------------------------------------------------
R0004:C00005-------------------------------------------------------------------------------
* TOTAL
------------------------
| ADD HYD              |
| 03:TOTAL             |   ID:NHYD            AREA     QPEAK    TPEAK      R.V.     DWF
------------------------                      (ha)     (cms)    (hrs)      (mm)   (cms)
                     ID 1 01:PRE1          2.460      .387    1.417    38.221    .000
                    +ID 2 02:EXT          11.710     1.146    1.567    35.404    .000
                    ==============================================================
                    SUM   03:TOTAL        14.170     1.415    1.533    35.893    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
```

```
-------------------------------------------------------------------------------------------
R0004:C00006-------------------------------------------------------------------------------
* SITE
* To account for the existing packed gravel surfaces on-site, the TIMP value
* was calibrated (see design calcs)
--------------------------
| CALIB STANDHYD         |   Area    (ha)=    1.40
| 04:PRE2       DT= 1.00 |   Total Imp(%)=   24.00   Dir. Conn.(%)=    1.00
--------------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .34         1.06
     Dep. Storage     (mm)=       2.00         8.00
     Average Slope     (%)=       3.50        13.00
     Length            (m)=      45.00        70.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=     161.25       125.47
                over (min)        1.00         6.00
     Storage Coeff.  (min)=        .90 (ii)    6.04 (ii)
     Unit Hyd. Tpeak (min)=       1.00         6.00
     Unit Hyd. peak  (cms)=       1.14          .19
                                                        *TOTALS*
     PEAK FLOW       (cms)=        .01          .25           .255 (iii)
     TIME TO PEAK    (hrs)=       1.28         1.38          1.383
     RUNOFF VOLUME    (mm)=      68.90        37.97         38.284
     TOTAL RAINFALL   (mm)=      70.93        70.93         70.926
     RUNOFF COEFFICIENT   =        .97          .54           .540

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  81.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------------------
R0004:C00007-------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------
R0004:C00002-------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------
R0004:C00002-------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------
R0004:C00002-------------------------------------------------------------------------------
  ** END OF RUN :    3

*******************************************************************************************




--------------------
| START            | Project  dir.:C:\Temp\15-319\EX\4-hour_Chic\
-------------------- Rainfall dir.:C:\Temp\15-319\EX\4-hour_Chic\
    TZERO =   .00 hrs on        0
```

```
    METOUT=   2 (output = METRIC)
    NRUN  = 0005
    NSTORM=   1
           #  1=12regtim.o89
--------------------------------------------------------------------------------------------
R0005:C00002--------------------------------------------------------------------------------
*#*****************************************************************************
*#  Project Name: [Mansfield Ski Club]    Project Number: [15-319]
*#  Date        : 07-31-2017
*#  Modeller    : [J. Lightheart]
*#  Company     : WMI & Associates Ltd.
*#  License #   :  2880720
*#*****************************************************************************
*
* Pre-Development Condition - Mansfield Ski Club
*
--------------------------------------------------------------------------------------------
R0005:C00002--------------------------------------------------------------------------------
--------------------
| READ STORM       |  Filename: C:\Temp\15-319\EX\4-hour_Chic\12regtim.o89
| Ptotal= 193.00 mm|  Comments: TIMMINS REGIONAL STORM (12-hour)
--------------------
      TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME
     hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm
      1:00  15.000|   3:00  10.000|   5:00   5.000|   7:00  43.000|   9:00  23.000|  11:00
      2:00  20.000|   4:00   3.000|   6:00  20.000|   8:00  20.000|  10:00  13.000|  12:00

--------------------------------------------------------------------------------------------
R0005:C00003--------------------------------------------------------------------------------
* SITE
* To account for the existing packed gravel surfaces on-site, the TIMP value
* was calibrated (see design calcs)
--------------------------
| CALIB STANDHYD         |   Area    (ha)=    2.46
| 01:PRE1       DT= 1.00 |   Total Imp(%)=   24.00   Dir. Conn.(%)=    1.00
--------------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .59         1.87
     Dep. Storage     (mm)=       2.00         8.10
     Average Slope     (%)=       2.00        10.00
     Length            (m)=     100.00        80.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      43.00        50.88
                over (min)       3.00        12.00
     Storage Coeff.  (min)=       2.91 (ii)   11.56 (ii)
     Unit Hyd. Tpeak (min)=       3.00        12.00
     Unit Hyd. peak  (cms)=        .39          .10
                                                            *TOTALS*
     PEAK FLOW       (cms)=        .00          .26           .262 (iii)
     TIME TO PEAK    (hrs)=       6.95         7.00          7.000
     RUNOFF VOLUME    (mm)=     191.00       150.04        150.449
     TOTAL RAINFALL   (mm)=     193.00       193.00        193.000
```

```
     RUNOFF COEFFICIENT   =        .99          .78           .780

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  81.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------------------
R0005:C00004--------------------------------------------------------------------------------
* EXTERNAL
--------------------------
| CALIB NASHYD           |   Area    (ha)=   11.710   Curve Number   (CN)= 83.00
| 02:EXT        DT= 1.00 |   Ia      (mm)=    6.800   # of Linear Res.(N)=  3.00
--------------------------   U.H. Tp(hrs)=     .240

     Unit Hyd Qpeak  (cms)=    1.864

     PEAK FLOW       (cms)=    1.215 (i)
     TIME TO PEAK    (hrs)=    7.017
     DURATION        (hrs)=   13.667, (dddd|hh:mm:)=   0|13:40
     AVERAGE FLOW    (cms)=     .346
     RUNOFF VOLUME    (mm)=  145.537
     TOTAL RAINFALL   (mm)=  193.000
     RUNOFF COEFFICIENT   =     .754

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

--------------------------------------------------------------------------------------------
R0005:C00005--------------------------------------------------------------------------------
* TOTAL
------------------------
| ADD HYD              |
| 03:TOTAL             |   ID:NHYD            AREA     QPEAK    TPEAK      R.V.     DWF
------------------------                      (ha)     (cms)    (hrs)      (mm)   (cms)
                      ID 1 01:PRE1           2.460      .262    7.000   150.449    .000
                     +ID 2 02:EXT           11.710     1.215    7.017   145.537    .000
                     ==================================================================
                     SUM   03:TOTAL         14.170     1.477    7.017   146.390    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------------------
R0005:C00006--------------------------------------------------------------------------------
* SITE
* To account for the existing packed gravel surfaces on-site, the TIMP value
* was calibrated (see design calcs)
--------------------------
| CALIB STANDHYD         |   Area    (ha)=    1.40
| 04:PRE2       DT= 1.00 |   Total Imp(%)=   24.00   Dir. Conn.(%)=    1.00
--------------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .34         1.06
     Dep. Storage     (mm)=       2.00         8.00
```

```
           Average Slope     (%)=       3.50        13.00
           Length            (m)=      45.00        70.00
           Mannings n           =       .013         .250

           Max.eff.Inten.(mm/hr)=      43.00        50.96
                      over (min)        2.00         9.00
           Storage Coeff.  (min)=       1.52 (ii)    8.90 (ii)
           Unit Hyd. Tpeak (min)=       2.00         9.00
           Unit Hyd. peak  (cms)=        .66          .13
                                                                 *TOTALS*
           PEAK FLOW       (cms)=        .00          .15           .151 (iii)
           TIME TO PEAK    (hrs)=       6.87         7.00          7.000
           RUNOFF VOLUME    (mm)=     191.00       150.11        150.522
           TOTAL RAINFALL   (mm)=     193.00       193.00        193.000
           RUNOFF COEFFICIENT   =        .99          .78           .780

             (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
                 CN* =  81.0    Ia = Dep. Storage  (Above)
            (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
           (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

      -------------------------------------------------------------------------------------------
      R0005:C00007-------------------------------------------------------------------------------
      -------------------------------------------------------------------------------------------
      R0005:C00002-------------------------------------------------------------------------------
      -------------------------------------------------------------------------------------------
      R0005:C00002-------------------------------------------------------------------------------
      -------------------------------------------------------------------------------------------
      R0005:C00002-------------------------------------------------------------------------------
      -------------------------------------------------------------------------------------------
      R0005:C00002-------------------------------------------------------------------------------
      --------------------
      | FINISH           |
      --------------------
      -------------------------------------------------------------------------------------------
      *******************************************************************************************
           WARNINGS / ERRORS / NOTES
           -------------------------
         Simulation ended on 2020-11-16     at 11:21:02
      ===========================================================================================
```

Post-Development Condition
24-hour SCS Type-II Storm Distribution

```
2     Metric units
*#******************************************************************************
*#  Project Name: [Mansfield Ski Club]    Project Number: [15-319]
*#  Date        : 07-31-2017
*#  Modeller    : [J. Lightheart]
*#  Company     : WMI & Associates Ltd.
*#  License #   :  2880720
*#******************************************************************************
*
* Post-Development Condition - Mansfield Ski Club
*
*% 25mm Chicago Storm Dist. based on Mansfield, ON. rainfall (4-hr)
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[1]
*%                   ["25mm4hr.stm"] <--storm filename
*%-----------------|-----------------------------------------------------------|
READ STORM          STORM_FILENAME=["STORM.001"]
*%-----------------|-----------------------------------------------------------|
* SITE (POST1 - Controlled Area)
CALIB STANDHYD      ID=[1], NHYD=["POST1"], DT=[1](min), AREA=[2.74](ha),
                    XIMP=[0.59], TIMP=[0.69], DWF=[0](cms), LOSS=[2],
                    SCS curve number CN=[84],
                    Pervious   surfaces: IAper=[5.0](mm), SLPP=[33.3](%),
                                         LGP=[6](m), MNP=[0.25], SCP=[0](min),
                    Impervious surfaces: IAimp=[2.0](mm), SLPI=[3.5](%),
                                         LGI=[300](m), MNI=[0.013], SCI=[0](min),
                    RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
*%-----------------|-----------------------------------------------------------|
* EXTERNAL (Routed through SWM Facility)
CALIB NASHYD        ID=[2], NHYD=["EXT"], DT=[1]min, AREA=[11.94](ha),
                    DWF=[0](cms),  CN/C=[83], IA=[6.8](mm),
                    N=[3], TP=[0.24]hrs,
                    RAINFALL=[ ,  ,  ,  , ](mm/hr),  END=-1
*%-----------------|-----------------------------------------------------------|
* TOTAL FLOW TO SIDEROAD 15 CROSS CULVERT (POST1 CONTROLLED + EXT)
ADD HYD             IDsum=[3], NHYD=["POST1+EXT"], IDs to add=[1+2]
*%-----------------|-----------------------------------------------------------|
* SWM Facility
ROUTE RESERVOIR     IDout=[4], NHYD=["SWM Facility"], IDin=[3], RDT=[1](min),
                         TABLE of ( OUTFLOW-STORAGE ) values
                                   (cms) - (ha-m)
                                 [0.0000 , 0.00000]
                                 [0.0015 , 0.00063]
                                 [0.0031 , 0.00131]
                                 [0.0041 , 0.00205]
                                 [0.0050 , 0.00284]
                                 [0.0057 , 0.00368]
                                 [0.0063 , 0.00459]
                                 [0.0069 , 0.00557]
                                 [0.0074 , 0.00661]
                                 [0.0079 , 0.00772]
                                 [0.0084 , 0.00891]
                                 [0.0088 , 0.01017]
                                 [0.0092 , 0.01150]
```

```
                                 [0.0096 , 0.01292]
                                 [0.0100 , 0.01442]
                                 [0.0104 , 0.01601]
                                 [0.0108 , 0.01769]
                                 [0.0111 , 0.01946]
                                 [0.0114 , 0.02133]
                                 [0.0118 , 0.02329]
                                 [0.0121 , 0.02535]
                                 [0.0124 , 0.02777]
                                 [0.0127 , 0.03027]
                                 [0.0130 , 0.03287]
                                 [0.0133 , 0.03557]
                                 [0.0317 , 0.03837]
                                 [0.0651 , 0.04128]
                                 [0.1082 , 0.04430]
                                 [0.1593 , 0.04743]
                                 [0.2172 , 0.05067]
                                 [0.2811 , 0.05403]
                                 [0.3506 , 0.05751]
                                 [0.4252 , 0.06112]
                                 [0.5047 , 0.06486]
                                 [0.5887 , 0.06872]
                                 [0.6769 , 0.07272]
                                 [0.7693 , 0.07686]
                                 [0.8656 , 0.08113]
                                 [0.9656 , 0.08555]
                                 [1.0706 , 0.09011]
                                 [1.1842 , 0.09483]
                                 [1.3084 , 0.09970]
                                 [1.4447 , 0.10472]
                                 [1.5945 , 0.10990]
                                 [1.7589 , 0.11524]
                                 [2.0195 , 0.12075]
                                 [2.3829 , 0.14300]
                                 [2.8396 , 0.14870]
                                 [3.3911 , 0.15454]
                                 [4.0406 , 0.16053]
                                 [4.7921 , 0.16666]
                                 [5.6495 , 0.17293]
                                 [   -1  ,  -1  ]  (maximum one hundred pairs of points)
                                 IDovf=[   ], NHYDovf=["      "],
*%-----------------|-------------------------------------------------------------------------
* SITE (POST2 - Uncontrolled Area)
CALIB STANDHYD      ID=[5], NHYD=["POST2"], DT=[1](min), AREA=[0.89](ha),
                    XIMP=[0.105], TIMP=[0.21], DWF=[0](cms), LOSS=[2],
                    SCS curve number CN=[84],
                    Pervious   surfaces: IAper=[5.0](mm), SLPP=[11.1](%),
                                         LGP=[50](m), MNP=[0.25], SCP=[0](min),
                    Impervious surfaces: IAimp=[2.0](mm), SLPI=[6.0](%),
                                         LGI=[120](m), MNI=[0.013], SCI=[0](min),
                    RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
*%-----------------|-----------------------------------------------------------|
*% 2-year SCS Type-II Storm Dist. based on Mansfield, ON. rainfall (24-hr)
```

```
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[2]
*%                   ["2SCS24.stm"] <--storm filename
*%-----------------|------------------------------------------------------------|
*% 5-year SCS Type-II Storm Dist. based on Mansfield, ON. rainfall (24-hr)
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[3]
*%                   ["5SCS24.stm"] <--storm filename
*%-----------------|------------------------------------------------------------|
*% 25-year SCS Type-II Storm Dist. based on Mansfield, ON. rainfall (24-hr)
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[4]
*%                   ["25SCS24.stm"] <--storm filename
*%-----------------|------------------------------------------------------------|
*% 100-year SCS Type-II Storm Dist. based on Mansfield, ON. rainfall (24-hr)
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[5]
*%                   ["100SCS24.stm"] <--storm filename
*%-----------------|------------------------------------------------------------|
*% Timmins Regional Storm (12-hr)
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[6]
*%                   ["12regtim.o89"] <--storm filename
*%-----------------|------------------------------------------------------------|
FINISH
```

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

 SSSSS   W   W   M   M   H   H   Y   Y   M   M    OOO         222     000    11   77777 ==
 S       W W W   MM MM   H   H    Y Y    MM MM   O   O          2    0   0   11   7   7
 SSSSS   W W W   M M M   HHHHH     Y     M M M   O   O          2    0   0   11       7
     S    W W    M   M   H   H     Y     M   M   O   O        222    0   0   11      7
 SSSSS    W W    M   M   H   H     Y     M   M    OOO         2      0   0   11     7   ==
                                                              2      0   0   11    7    #
       StormWater Management HYdrologic Model                  222     000    11    7    ==

 ******************************************************************************************
 **************************************  SWMHYMO Ver4.05.0  ******************************
 ******************  A single event and continuous hydrologic simulation model  ***********
 ******************     based on the principles of HYMO and its successors      ***********
 ******************                 OTTHYMO-83 and OTTHYMO-89.                   ***********
 ******************************************************************************************
 ****************** Distributed by:  J.F. Sabourin and Associates Inc.          ***********
 ******************                  Ottawa,  Ontario: (613) 836-3884           ***********
 ******************                  Gatineau, Quebec: (819) 243-6858           ***********
 ******************                  E-Mail: swmhymo@jfsa.com                   ***********
 ******************************************************************************************

 ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
 +++++++++++++++++ Licensed user: WMI & Associates Ltd.                        +++++++++++
 ++++++++++++++++++              Barrie                SERIAL#:2880720        +++++++++++
 ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

 ******************************************************************************************
 ******************           ++++++ PROGRAM ARRAY DIMENSIONS ++++++           ***********
 ******************           Maximum value for ID numbers  :     11           ***********
 ******************           Max. number of rainfall points: 105408           ***********
 ******************           Max. number of flow points    : 105408           ***********
 ******************************************************************************************


 *******************************   D E T A I L E D   O U T P U T   ***********************
 ******************************************************************************************
 *                 RUN DATE: 2020-12-09     TIME: 16:07:39     RUN COUNTER: 000004
 ******************************************************************************************
 * Input   file: C:\Temp\15-319\PR\24-hour_SCS\2-CYRSCS.dat
 * Output  file: C:\Temp\15-319\PR\24-hour_SCS\2-CYRSCS.out
 * Summary file: C:\Temp\15-319\PR\24-hour_SCS\2-CYRSCS.sum
 * User comments:
 * 1:_____________________________________________________________________________________
 * 2:_____________________________________________________________________________________
 * 3:_____________________________________________________________________________________
 ******************************************************************************************

-------------------------------------------------------------------------------------------
R0001:C00001-------------------------------------------------------------------------------
*#*****************************************************************************
*#  Project Name: [Mansfield Ski Club]    Project Number: [15-319]
*#  Date        : 07-31-2017
```

```
*#  Modeller    : [J. Lightheart]
*#  Company     : WMI & Associates Ltd.
*#  License #   :  2880720
*#*****************************************************************************
*
* Post-Development Condition - Mansfield Ski Club
*
--------------------
| START            | Project  dir.:C:\Temp\15-319\PR\24-hour_SCS\
-------------------- Rainfall dir.:C:\Temp\15-319\PR\24-hour_SCS\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 0001
    NSTORM=   1
           #  1=25mm4hr.stm
-------------------------------------------------------------------------------------------
R0001:C00002-------------------------------------------------------------------------------
--------------------
| READ STORM       |  Filename: C:\Temp\15-319\PR\24-hour_SCS\25mm4hr.stm
| Ptotal=  25.00 mm|  Comments: 25mm Chicago Storm Distribution (4-hour) Mansfield, ON.
--------------------
       TIME    RAIN|  TIME    RAIN|  TIME    RAIN|  TIME    RAIN|  TIME    RAIN|  TIME
      hh:mm   mm/hr| hh:mm   mm/hr| hh:mm   mm/hr| hh:mm   mm/hr| hh:mm   mm/hr| hh:mm
       0:10   1.970|  0:50   3.820|  1:30  13.830|  2:10   4.080|  2:50   2.650|  3:30
       0:20   2.220|  1:00   5.380|  1:40   8.070|  2:20   3.570|  3:00   2.450|  3:40
       0:30   2.550|  1:10  10.940|  1:50   5.950|  2:30   3.190|  3:10   2.290|  3:50
       0:40   3.030|  1:20  56.670|  2:00   4.810|  2:40   2.890|  3:20   2.150|  4:00

-------------------------------------------------------------------------------------------
R0001:C00003-------------------------------------------------------------------------------
* SITE (POST1 - Controlled Area)
--------------------------
| CALIB STANDHYD         |   Area    (ha)=    2.74
| 01:POST1      DT= 1.00 |   Total Imp(%)=   69.00   Dir. Conn.(%)=   59.00
--------------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.89          .85
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       3.50        33.30
     Length            (m)=     300.00         6.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      56.67        23.86
                over (min)        4.00         6.00
     Storage Coeff.  (min)=       4.26 (ii)    5.98 (ii)
     Unit Hyd. Tpeak (min)=       4.00         6.00
     Unit Hyd. peak  (cms)=        .27          .19
                                                          *TOTALS*
     PEAK FLOW       (cms)=        .22          .04          .255 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.40         1.350
     RUNOFF VOLUME    (mm)=      23.01         7.79        16.768
     TOTAL RAINFALL   (mm)=      25.01        25.01        25.005
     RUNOFF COEFFICIENT   =        .92          .31          .671
```

```
       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  84.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

   ---------------------------------------------------------------------------------------------
   R0001:C00004-------------------------------------------------------------------------------
   * EXTERNAL (Routed through SWM Facility)
   --------------------------
   | CALIB NASHYD           |   Area    (ha)=   11.940   Curve Number   (CN)= 83.00
   | 02:EXT        DT= 1.00 |   Ia      (mm)=    6.800   # of Linear Res.(N)=  3.00
   --------------------------   U.H. Tp(hrs)=     .240

        Unit Hyd Qpeak  (cms)=    1.900

        PEAK FLOW       (cms)=     .115 (i)
        TIME TO PEAK    (hrs)=    1.650
        DURATION        (hrs)=    5.667, (dddd|hh:mm:)=   0|05:40
        AVERAGE FLOW    (cms)=     .028
        RUNOFF VOLUME    (mm)=    4.719
        TOTAL RAINFALL   (mm)=   25.005
        RUNOFF COEFFICIENT   =     .189

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

   ---------------------------------------------------------------------------------------------
   R0001:C00005-------------------------------------------------------------------------------
   * TOTAL FLOW TO SIDEROAD 15 CROSS CULVERT (POST1 CONTROLLED + EXT)
   ------------------------
   | ADD HYD                |
   | 03:POST1+EXT           |   ID:NHYD           AREA     QPEAK    TPEAK      R.V.     DWF
   ------------------------                        (ha)     (cms)    (hrs)      (mm)   (cms)
                          ID 1 01:POST1          2.740      .255    1.350    16.768    .000
                         +ID 2 02:EXT           11.940      .115    1.650     4.719    .000
                         =============================================================
                         SUM   03:POST1+EXT     14.680      .282    1.367     6.968    .000

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

   ---------------------------------------------------------------------------------------------
   R0001:C00006-------------------------------------------------------------------------------
   * SWM Facility
   -----------------------
   |  ROUTE RESERVOIR -> |    Requested routing time step =  1.0 min.
   |  IN>03:POST1+EXT    |
   | OUT<04:SWM Facili   | =========================  OUTLFOW STORAGE TABLE  ================
   ---------------------- OUTFLOW   STORAGE| OUTFLOW   STORAGE| OUTFLOW   STORAGE| OUTFLOW
                           (cms)   (ha.m.)|   (cms)   (ha.m.)|   (cms)   (ha.m.)|   (cms)
                            .000 .0000E+00|    .010 .1292E-01|    .065 .4128E-01|   1.071 .
                            .002 .6300E-03|    .010 .1442E-01|    .108 .4430E-01|   1.184 .
                            .003 .1310E-02|    .010 .1601E-01|    .159 .4743E-01|   1.308 .
                            .004 .2050E-02|    .011 .1769E-01|    .217 .5067E-01|   1.445 .
```

```
                            .005 .2840E-02|    .011 .1946E-01|    .281 .5403E-01|   1.594 .
                            .006 .3680E-02|    .011 .2133E-01|    .351 .5751E-01|   1.759 .
                            .006 .4590E-02|    .012 .2329E-01|    .425 .6112E-01|   2.020 .
                            .007 .5570E-02|    .012 .2535E-01|    .505 .6486E-01|   2.383 .
                            .007 .6610E-02|    .012 .2777E-01|    .589 .6872E-01|   2.840 .
                            .008 .7720E-02|    .013 .3027E-01|    .677 .7272E-01|   3.391 .
                            .008 .8910E-02|    .013 .3287E-01|    .769 .7686E-01|   4.041 .
                            .009 .1017E-01|    .013 .3557E-01|    .866 .8113E-01|   4.792 .
                            .009 .1150E-01|    .032 .3837E-01|    .966 .8555E-01|   5.649 .

        ROUTING RESULTS             AREA     QPEAK     TPEAK       R.V.
        ---------------------       (ha)     (cms)     (hrs)       (mm)
        INFLOW > 03:POST1+EXT     14.680      .282     1.367      6.968
       OUTFLOW < 04:SWM Facili    14.680      .108     2.033      6.968

                      PEAK   FLOW   REDUCTION [Qout/Qin](%)=   38.291
                      TIME SHIFT OF PEAK FLOW         (min)=    40.00
                      MAXIMUM  STORAGE   USED       (ha.m.)=.4429E-01

   ---------------------------------------------------------------------------------------------
   R0001:C00007-------------------------------------------------------------------------------
   * SITE (POST2 - Uncontrolled Area)
   --------------------------
   | CALIB STANDHYD         |   Area    (ha)=     .89
   | 05:POST2      DT= 1.00 |   Total Imp(%)=   21.00   Dir. Conn.(%)=   10.50
   --------------------------
                                 IMPERVIOUS    PERVIOUS (i)
        Surface Area     (ha)=        .19          .70
        Dep. Storage     (mm)=       2.00         5.00
        Average Slope     (%)=       6.00        11.10
        Length            (m)=     120.00        50.00
        Mannings n          =        .013         .250

        Max.eff.Inten.(mm/hr)=      56.67        11.01
                   over (min)       2.00        14.00
        Storage Coeff.  (min)=       2.09 (ii)   13.75 (ii)
        Unit Hyd. Tpeak (min)=       2.00        14.00
        Unit Hyd. peak  (cms)=        .54          .08
                                                               *TOTALS*
        PEAK FLOW       (cms)=        .01          .01           .018 (iii)
        TIME TO PEAK    (hrs)=       1.33         1.55          1.333
        RUNOFF VOLUME    (mm)=      23.00         6.70          8.411
        TOTAL RAINFALL   (mm)=      25.01        25.01         25.005
        RUNOFF COEFFICIENT   =        .92          .27           .336

          (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
              CN* =  84.0    Ia = Dep. Storage  (Above)
         (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
        (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

   ---------------------------------------------------------------------------------------------
   R0001:C00008-------------------------------------------------------------------------------
     ** END OF RUN :    0
```

```
*******************************************************************************************




--------------------
| START            | Project  dir.:C:\Temp\15-319\PR\24-hour_SCS\
-------------------- Rainfall dir.:C:\Temp\15-319\PR\24-hour_SCS\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 0002
    NSTORM=   1
           #  1=2SCS24.stm
-------------------------------------------------------------------------------------------
R0002:C00002-------------------------------------------------------------------------------
*#******************************************************************************
*#  Project Name: [Mansfield Ski Club]    Project Number: [15-319]
*#  Date        : 07-31-2017
*#  Modeller    : [J. Lightheart]
*#  Company     : WMI & Associates Ltd.
*#  License #   :  2880720
*#******************************************************************************
*
* Post-Development Condition - Mansfield Ski Club
*
-------------------------------------------------------------------------------------------
R0002:C00002-------------------------------------------------------------------------------
--------------------
| READ STORM       |  Filename: C:\Temp\15-319\PR\24-hour_SCS\2SCS24.stm
| Ptotal=  54.70 mm|  Comments: 2-Year SCS Type-II Storm Distribution (24-hour) Mansfield,
--------------------
      TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME
     hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm
      0:12    .547|   4:12   1.094|   8:12   1.641|  12:12  10.940|  16:12   1.368|  20:12
      0:24    .547|   4:24   1.094|   8:24   1.641|  12:24   6.838|  16:24   1.367|  20:24
      0:36    .547|   4:36   1.094|   8:36   1.641|  12:36   4.923|  16:36   1.367|  20:36
      0:48    .547|   4:48   1.094|   8:48   1.641|  12:48   4.650|  16:48   1.367|  20:48
      1:00    .547|   5:00   1.094|   9:00   1.641|  13:00   3.282|  17:00    .820|  21:00
      1:12    .547|   5:12   1.094|   9:12   1.641|  13:12   2.735|  17:12    .821|  21:12
      1:24    .547|   5:24   1.094|   9:24   1.641|  13:24   2.735|  17:24   1.094|  21:24
      1:36    .547|   5:36   1.094|   9:36   1.641|  13:36   2.735|  17:36    .821|  21:36
      1:48    .547|   5:48   1.094|   9:48   1.641|  13:48   2.735|  17:48   1.094|  21:48
      2:00    .547|   6:00   1.094|  10:00   1.641|  14:00   2.735|  18:00    .821|  22:00
      2:12    .547|   6:12   1.094|  10:12   3.008|  14:12   1.641|  18:12    .821|  22:12
      2:24    .547|   6:24   1.094|  10:24   3.009|  14:24   1.641|  18:24    .820|  22:24
      2:36    .547|   6:36   1.094|  10:36   3.008|  14:36   1.641|  18:36   1.094|  22:36
      2:48    .547|   6:48   1.094|  10:48   3.009|  14:48   1.641|  18:48    .821|  22:48
      3:00    .547|   7:00   1.094|  11:00   3.008|  15:00   1.641|  19:00    .821|  23:00
      3:12    .547|   7:12   1.094|  11:12   4.102|  15:12   1.367|  19:12   1.094|  23:12
      3:24    .547|   7:24   1.094|  11:24   6.017|  15:24   1.367|  19:24    .821|  23:24
      3:36    .547|   7:36   1.094|  11:36  14.495|  15:36   1.367|  19:36   1.094|  23:36
```

```
      3:48    .547|   7:48   1.094|  11:48  30.085|  15:48   1.367|  19:48    .821|  23:48
      4:00    .547|   8:00   1.094|  12:00  61.538|  16:00   1.367|  20:00   1.094|  24:00

-------------------------------------------------------------------------------------------
R0002:C00003-------------------------------------------------------------------------------
* SITE (POST1 - Controlled Area)
--------------------------
| CALIB STANDHYD         |   Area    (ha)=    2.74
| 01:POST1      DT= 1.00 |   Total Imp(%)=   69.00   Dir. Conn.(%)=   59.00
--------------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.89          .85
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       3.50        33.30
     Length            (m)=     300.00         6.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      61.54        56.60
                over (min)       4.00         5.00
     Storage Coeff.  (min)=       4.12 (ii)    5.34 (ii)
     Unit Hyd. Tpeak (min)=       4.00         5.00
     Unit Hyd. peak  (cms)=        .28          .22
                                                           *TOTALS*
     PEAK FLOW       (cms)=        .26          .11           .378 (iii)
     TIME TO PEAK    (hrs)=      12.00        12.02         12.000
     RUNOFF VOLUME    (mm)=      52.70        29.63         43.242
     TOTAL RAINFALL   (mm)=      54.70        54.70         54.700
     RUNOFF COEFFICIENT   =        .96          .54           .791

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  84.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------------------
R0002:C00004-------------------------------------------------------------------------------
* EXTERNAL (Routed through SWM Facility)
--------------------------
| CALIB NASHYD           |   Area    (ha)=   11.940   Curve Number   (CN)= 83.00
| 02:EXT        DT= 1.00 |   Ia      (mm)=    6.800   # of Linear Res.(N)=  3.00
--------------------------   U.H. Tp(hrs)=     .240

     Unit Hyd Qpeak  (cms)=    1.900

     PEAK FLOW       (cms)=     .604 (i)
     TIME TO PEAK    (hrs)=   12.150
     DURATION        (hrs)=   25.667, (dddd|hh:mm:)=   1|01:40
     AVERAGE FLOW    (cms)=     .030
     RUNOFF VOLUME    (mm)=   22.962
     TOTAL RAINFALL   (mm)=   54.700
     RUNOFF COEFFICIENT   =     .420

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

```
-------------------------------------------------------------------------------------------
R0002:C00005-------------------------------------------------------------------------------
* TOTAL FLOW TO SIDEROAD 15 CROSS CULVERT (POST1 CONTROLLED + EXT)
------------------------
| ADD HYD              |
| 03:POST1+EXT         |   ID:NHYD            AREA     QPEAK    TPEAK      R.V.     DWF
------------------------                      (ha)     (cms)    (hrs)      (mm)   (cms)
                      ID 1 01:POST1          2.740      .378   12.000    43.242    .000
                     +ID 2 02:EXT           11.940      .604   12.150    22.962    .000
                     ==================================================================
                     SUM   03:POST1+EXT     14.680      .861   12.033    26.747    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------------------
R0002:C00006-------------------------------------------------------------------------------
* SWM Facility
-----------------------
|  ROUTE RESERVOIR -> |    Requested routing time step =  1.0 min.
|  IN>03:POST1+EXT    |
| OUT<04:SWM Facili   | =========================  OUTLFOW STORAGE TABLE  =================
----------------------- OUTFLOW   STORAGE| OUTFLOW   STORAGE| OUTFLOW   STORAGE| OUTFLOW
                          (cms)   (ha.m.)|   (cms)   (ha.m.)|   (cms)   (ha.m.)|   (cms)
                           .000 .0000E+00|    .010 .1292E-01|    .065 .4128E-01|   1.071 .
                           .002 .6300E-03|    .010 .1442E-01|    .108 .4430E-01|   1.184 .
                           .003 .1310E-02|    .010 .1601E-01|    .159 .4743E-01|   1.308 .
                           .004 .2050E-02|    .011 .1769E-01|    .217 .5067E-01|   1.445 .
                           .005 .2840E-02|    .011 .1946E-01|    .281 .5403E-01|   1.594 .
                           .006 .3680E-02|    .011 .2133E-01|    .351 .5751E-01|   1.759 .
                           .006 .4590E-02|    .012 .2329E-01|    .425 .6112E-01|   2.020 .
                           .007 .5570E-02|    .012 .2535E-01|    .505 .6486E-01|   2.383 .
                           .007 .6610E-02|    .012 .2777E-01|    .589 .6872E-01|   2.840 .
                           .008 .7720E-02|    .013 .3027E-01|    .677 .7272E-01|   3.391 .
                           .008 .8910E-02|    .013 .3287E-01|    .769 .7686E-01|   4.041 .
                           .009 .1017E-01|    .013 .3557E-01|    .866 .8113E-01|   4.792 .
                           .009 .1150E-01|    .032 .3837E-01|    .966 .8555E-01|   5.649 .

     ROUTING RESULTS             AREA     QPEAK     TPEAK       R.V.
     ----------------------      (ha)     (cms)     (hrs)       (mm)
     INFLOW > 03:POST1+EXT     14.680      .861    12.033     26.747
    OUTFLOW < 04:SWM Facili    14.680      .709    12.183     26.747

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=   82.385
                   TIME SHIFT OF PEAK FLOW         (min)=     9.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=.7419E-01

-------------------------------------------------------------------------------------------
R0002:C00007-------------------------------------------------------------------------------
* SITE (POST2 - Uncontrolled Area)
--------------------------
| CALIB STANDHYD         |   Area    (ha)=     .89
| 05:POST2      DT= 1.00 |   Total Imp(%)=   21.00   Dir. Conn.(%)=   10.50
```

```
--------------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .19          .70
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       6.00        11.10
     Length            (m)=     120.00        50.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      61.54        43.49
                over (min)        2.00         9.00
     Storage Coeff.  (min)=       2.02 (ii)    8.75 (ii)
     Unit Hyd. Tpeak (min)=       2.00         9.00
     Unit Hyd. peak  (cms)=        .56          .13
                                                           *TOTALS*
     PEAK FLOW       (cms)=        .02          .06           .073 (iii)
     TIME TO PEAK    (hrs)=      12.00        12.07         12.017
     RUNOFF VOLUME    (mm)=      52.70        27.19         29.872
     TOTAL RAINFALL   (mm)=      54.70        54.70         54.700
     RUNOFF COEFFICIENT   =        .96          .50           .546

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  84.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------------------
R0002:C00008-------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------
R0002:C00002-------------------------------------------------------------------------------
  ** END OF RUN :    1

*******************************************************************************************




--------------------
| START            | Project  dir.:C:\Temp\15-319\PR\24-hour_SCS\
-------------------- Rainfall dir.:C:\Temp\15-319\PR\24-hour_SCS\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 0003
    NSTORM=   1
           #  1=5SCS24.stm
-------------------------------------------------------------------------------------------
R0003:C00002-------------------------------------------------------------------------------
*#******************************************************************************
*#  Project Name: [Mansfield Ski Club]    Project Number: [15-319]
*#  Date        : 07-31-2017
*#  Modeller    : [J. Lightheart]
*#  Company     : WMI & Associates Ltd.
*#  License #   :  2880720
```

```
*#******************************************************************************
*
* Post-Development Condition - Mansfield Ski Club
*
-------------------------------------------------------------------------------------------
R0003:C00002-------------------------------------------------------------------------------
--------------------
| READ STORM       |  Filename: C:\Temp\15-319\PR\24-hour_SCS\5SCS24.stm
| Ptotal=  72.10 mm|  Comments: 5-Year SCS Type-II Storm Distribution (24-hour) Mansfield,
--------------------
      TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME
     hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm
      0:12    .721|   4:12   1.442|   8:12   2.163|  12:12  14.420|  16:12   1.803|  20:12
      0:24    .721|   4:24   1.442|   8:24   2.163|  12:24   9.013|  16:24   1.802|  20:24
      0:36    .721|   4:36   1.442|   8:36   2.163|  12:36   6.489|  16:36   1.802|  20:36
      0:48    .721|   4:48   1.442|   8:48   2.163|  12:48   6.129|  16:48   1.802|  20:48
      1:00    .721|   5:00   1.442|   9:00   2.163|  13:00   4.326|  17:00   1.081|  21:00
      1:12    .721|   5:12   1.442|   9:12   2.163|  13:12   3.605|  17:12   1.082|  21:12
      1:24    .721|   5:24   1.442|   9:24   2.163|  13:24   3.605|  17:24   1.442|  21:24
      1:36    .721|   5:36   1.442|   9:36   2.163|  13:36   3.605|  17:36   1.082|  21:36
      1:48    .721|   5:48   1.442|   9:48   2.163|  13:48   3.605|  17:48   1.442|  21:48
      2:00    .721|   6:00   1.442|  10:00   2.163|  14:00   3.605|  18:00   1.082|  22:00
      2:12    .721|   6:12   1.442|  10:12   3.965|  14:12   2.163|  18:12   1.082|  22:12
      2:24    .721|   6:24   1.442|  10:24   3.966|  14:24   2.163|  18:24   1.081|  22:24
      2:36    .721|   6:36   1.442|  10:36   3.965|  14:36   2.163|  18:36   1.442|  22:36
      2:48    .721|   6:48   1.442|  10:48   3.966|  14:48   2.163|  18:48   1.082|  22:48
      3:00    .721|   7:00   1.442|  11:00   3.965|  15:00   2.163|  19:00   1.082|  23:00
      3:12    .721|   7:12   1.442|  11:12   5.408|  15:12   1.802|  19:12   1.442|  23:12
      3:24    .721|   7:24   1.442|  11:24   7.931|  15:24   1.802|  19:24   1.082|  23:24
      3:36    .721|   7:36   1.442|  11:36  19.106|  15:36   1.802|  19:36   1.442|  23:36
      3:48    .721|   7:48   1.442|  11:48  39.655|  15:48   1.802|  19:48   1.082|  23:48
      4:00    .721|   8:00   1.442|  12:00  81.113|  16:00   1.802|  20:00   1.442|  24:00

-------------------------------------------------------------------------------------------
R0003:C00003-------------------------------------------------------------------------------
* SITE (POST1 - Controlled Area)
--------------------------
| CALIB STANDHYD         |   Area    (ha)=    2.74
| 01:POST1      DT= 1.00 |   Total Imp(%)=   69.00   Dir. Conn.(%)=   59.00
--------------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.89          .85
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       3.50        33.30
     Length            (m)=     300.00         6.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      81.11        83.02
                over (min)        4.00         5.00
     Storage Coeff.  (min)=       3.69 (ii)    4.74 (ii)
     Unit Hyd. Tpeak (min)=       4.00         5.00
     Unit Hyd. peak  (cms)=        .30          .23
                                                             *TOTALS*
```

```
     PEAK FLOW       (cms)=        .35          .17           .526 (iii)
     TIME TO PEAK    (hrs)=      12.00        12.00         12.000
     RUNOFF VOLUME    (mm)=      70.09        44.49         59.602
     TOTAL RAINFALL   (mm)=      72.10        72.10         72.101
     RUNOFF COEFFICIENT   =        .97          .62           .827

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  84.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------------------
R0003:C00004-------------------------------------------------------------------------------
* EXTERNAL (Routed through SWM Facility)
--------------------------
| CALIB NASHYD           |   Area    (ha)=   11.940   Curve Number   (CN)= 83.00
| 02:EXT        DT= 1.00 |   Ia      (mm)=    6.800   # of Linear Res.(N)=  3.00
--------------------------   U.H. Tp(hrs)=     .240

     Unit Hyd Qpeak  (cms)=    1.900

     PEAK FLOW       (cms)=     .966 (i)
     TIME TO PEAK    (hrs)=   12.133
     DURATION        (hrs)=   25.667, (dddd|hh:mm:)=   1|01:40
     AVERAGE FLOW    (cms)=     .047
     RUNOFF VOLUME    (mm)=   36.345
     TOTAL RAINFALL   (mm)=   72.101
     RUNOFF COEFFICIENT   =     .504

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

-------------------------------------------------------------------------------------------
R0003:C00005-------------------------------------------------------------------------------
* TOTAL FLOW TO SIDEROAD 15 CROSS CULVERT (POST1 CONTROLLED + EXT)
------------------------
| ADD HYD              |
| 03:POST1+EXT         |   ID:NHYD            AREA     QPEAK    TPEAK      R.V.     DWF
------------------------                      (ha)     (cms)    (hrs)      (mm)   (cms)
                     ID 1 01:POST1         2.740      .526   12.000    59.602    .000
                    +ID 2 02:EXT          11.940      .966   12.133    36.345    .000
                    ==================================================================
                    SUM   03:POST1+EXT    14.680     1.315   12.033    40.686    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------------------
R0003:C00006-------------------------------------------------------------------------------
* SWM Facility
-----------------------
|  ROUTE RESERVOIR -> |    Requested routing time step =  1.0 min.
|  IN>03:POST1+EXT    |
| OUT<04:SWM Facili   | =========================  OUTFLOW STORAGE TABLE  =================
----------------------- OUTFLOW   STORAGE| OUTFLOW   STORAGE| OUTFLOW   STORAGE| OUTFLOW
```

```
                                (cms)   (ha.m.)|   (cms)   (ha.m.)|   (cms)   (ha.m.)|   (cms)
                                 .000 .0000E+00|    .010 .1292E-01|    .065 .4128E-01|   1.071 .
                                 .002 .6300E-03|    .010 .1442E-01|    .108 .4430E-01|   1.184 .
                                 .003 .1310E-02|    .010 .1601E-01|    .159 .4743E-01|   1.308 .
                                 .004 .2050E-02|    .011 .1769E-01|    .217 .5067E-01|   1.445 .
                                 .005 .2840E-02|    .011 .1946E-01|    .281 .5403E-01|   1.594 .
                                 .006 .3680E-02|    .011 .2133E-01|    .351 .5751E-01|   1.759 .
                                 .006 .4590E-02|    .012 .2329E-01|    .425 .6112E-01|   2.020 .
                                 .007 .5570E-02|    .012 .2535E-01|    .505 .6486E-01|   2.383 .
                                 .007 .6610E-02|    .012 .2777E-01|    .589 .6872E-01|   2.840 .
                                 .008 .7720E-02|    .013 .3027E-01|    .677 .7272E-01|   3.391 .
                                 .008 .8910E-02|    .013 .3287E-01|    .769 .7686E-01|   4.041 .
                                 .009 .1017E-01|    .013 .3557E-01|    .866 .8113E-01|   4.792 .
                                 .009 .1150E-01|    .032 .3837E-01|    .966 .8555E-01|   5.649 .

          ROUTING RESULTS             AREA     QPEAK     TPEAK       R.V.
          ----------------------      (ha)     (cms)     (hrs)       (mm)
          INFLOW > 03:POST1+EXT     14.680     1.315    12.033     40.686
         OUTFLOW < 04:SWM Facili    14.680     1.120    12.167     40.686

                        PEAK   FLOW   REDUCTION [Qout/Qin](%)=   85.197
                        TIME SHIFT OF PEAK FLOW         (min)=     8.00
                        MAXIMUM  STORAGE   USED       (ha.m.)=.9218E-01

     ------------------------------------------------------------------------------------------
     R0003:C00007------------------------------------------------------------------------------
     * SITE (POST2 - Uncontrolled Area)
     --------------------------
     | CALIB STANDHYD         |   Area    (ha)=     .89
     | 05:POST2      DT= 1.00 |   Total Imp(%)=   21.00   Dir. Conn.(%)=   10.50
     --------------------------
                                  IMPERVIOUS    PERVIOUS (i)
          Surface Area     (ha)=        .19          .70
          Dep. Storage     (mm)=       2.00         5.00
          Average Slope     (%)=       6.00        11.10
          Length            (m)=     120.00        50.00
          Mannings n           =       .013         .250

          Max.eff.Inten.(mm/hr)=      81.11        65.90
                     over (min)        2.00         8.00
          Storage Coeff.  (min)=       1.81 (ii)    7.51 (ii)
          Unit Hyd. Tpeak (min)=       2.00         8.00
          Unit Hyd. peak  (cms)=        .60          .15
                                                                *TOTALS*
          PEAK FLOW       (cms)=        .02          .10           .116 (iii)
          TIME TO PEAK    (hrs)=      12.00        12.03         12.017
          RUNOFF VOLUME    (mm)=      70.10        41.50         44.506
          TOTAL RAINFALL   (mm)=      72.10        72.10         72.101
          RUNOFF COEFFICIENT   =        .97          .58           .617

            (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
                CN* =  84.0    Ia = Dep. Storage  (Above)
           (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
```

```
          (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

     ------------------------------------------------------------------------------------------
     R0003:C00008------------------------------------------------------------------------------
     ------------------------------------------------------------------------------------------
     R0003:C00002------------------------------------------------------------------------------
     ------------------------------------------------------------------------------------------
     R0003:C00002------------------------------------------------------------------------------
       ** END OF RUN :    2

     ******************************************************************************************






     --------------------
     | START            | Project  dir.:C:\Temp\15-319\PR\24-hour_SCS\
     -------------------- Rainfall dir.:C:\Temp\15-319\PR\24-hour_SCS\
         TZERO =   .00 hrs on        0
         METOUT=   2 (output = METRIC)
         NRUN  = 0004
         NSTORM=   1
                #  1=25SCS24.stm
     ------------------------------------------------------------------------------------------
     R0004:C00002------------------------------------------------------------------------------
     *#*******************************************************************************
     *#  Project Name: [Mansfield Ski Club]    Project Number: [15-319]
     *#  Date        : 07-31-2017
     *#  Modeller    : [J. Lightheart]
     *#  Company     : WMI & Associates Ltd.
     *#  License #   :  2880720
     *#*******************************************************************************
     *
     * Post-Development Condition - Mansfield Ski Club
     *
     ------------------------------------------------------------------------------------------
     R0004:C00002------------------------------------------------------------------------------
     --------------------
     | READ STORM       |  Filename: C:\Temp\15-319\PR\24-hour_SCS\25SCS24.stm
     | Ptotal=  98.40 mm|  Comments: 25-Year SCS Type-II Storm Distribution (24-hour) Mansfield,
     --------------------
          TIME    RAIN|  TIME    RAIN|  TIME    RAIN|  TIME    RAIN|  TIME    RAIN|  TIME
         hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm
          0:12    .984|  4:12   1.968|  8:12   2.952| 12:12  19.680| 16:12   2.460| 20:12
          0:24    .984|  4:24   1.968|  8:24   2.952| 12:24  12.300| 16:24   2.460| 20:24
          0:36    .984|  4:36   1.968|  8:36   2.952| 12:36   8.856| 16:36   2.460| 20:36
          0:48    .984|  4:48   1.968|  8:48   2.952| 12:48   8.364| 16:48   2.460| 20:48
          1:00    .984|  5:00   1.968|  9:00   2.952| 13:00   5.904| 17:00   1.476| 21:00
          1:12    .984|  5:12   1.968|  9:12   2.952| 13:12   4.920| 17:12   1.476| 21:12
          1:24    .984|  5:24   1.968|  9:24   2.952| 13:24   4.920| 17:24   1.968| 21:24
          1:36    .984|  5:36   1.968|  9:36   2.952| 13:36   4.920| 17:36   1.476| 21:36
          1:48    .984|  5:48   1.968|  9:48   2.952| 13:48   4.920| 17:48   1.968| 21:48
```

```
      2:00    .984|   6:00   1.968|  10:00   2.952|  14:00   4.920|  18:00   1.476|  22:00
      2:12    .984|   6:12   1.968|  10:12   5.412|  14:12   2.952|  18:12   1.476|  22:12
      2:24    .984|   6:24   1.968|  10:24   5.412|  14:24   2.952|  18:24   1.476|  22:24
      2:36    .984|   6:36   1.968|  10:36   5.412|  14:36   2.952|  18:36   1.968|  22:36
      2:48    .984|   6:48   1.968|  10:48   5.412|  14:48   2.952|  18:48   1.476|  22:48
      3:00    .984|   7:00   1.968|  11:00   5.412|  15:00   2.952|  19:00   1.476|  23:00
      3:12    .984|   7:12   1.968|  11:12   7.380|  15:12   2.460|  19:12   1.968|  23:12
      3:24    .984|   7:24   1.968|  11:24  10.824|  15:24   2.460|  19:24   1.476|  23:24
      3:36    .984|   7:36   1.968|  11:36  26.076|  15:36   2.460|  19:36   1.968|  23:36
      3:48    .984|   7:48   1.968|  11:48  54.120|  15:48   2.460|  19:48   1.476|  23:48
      4:00    .984|   8:00   1.968|  12:00 110.700|  16:00   2.460|  20:00   1.968|  24:00

---------------------------------------------------------------------------------------------
R0004:C00003---------------------------------------------------------------------------------
* SITE (POST1 - Controlled Area)
--------------------------
| CALIB STANDHYD         |   Area    (ha)=    2.74
| 01:POST1      DT= 1.00 |   Total Imp(%)=   69.00   Dir. Conn.(%)=   59.00
--------------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.89          .85
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       3.50        33.30
     Length            (m)=     300.00         6.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=     110.70       124.23
                over (min)        3.00         4.00
     Storage Coeff.  (min)=       3.26 (ii)    4.15 (ii)
     Unit Hyd. Tpeak (min)=       3.00         4.00
     Unit Hyd. peak  (cms)=        .36          .28
                                                           *TOTALS*
     PEAK FLOW       (cms)=        .49          .27           .760 (iii)
     TIME TO PEAK    (hrs)=      12.00        12.00         12.000
     RUNOFF VOLUME    (mm)=      96.40        68.23         84.853
     TOTAL RAINFALL   (mm)=      98.40        98.40         98.399
     RUNOFF COEFFICIENT   =        .98          .69           .862

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
             CN* =  84.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

---------------------------------------------------------------------------------------------
R0004:C00004---------------------------------------------------------------------------------
* EXTERNAL (Routed through SWM Facility)
--------------------------
| CALIB NASHYD           |   Area    (ha)=   11.940   Curve Number   (CN)= 83.00
| 02:EXT        DT= 1.00 |   Ia      (mm)=    6.800   # of Linear Res.(N)=  3.00
--------------------------   U.H. Tp(hrs)=     .240

     Unit Hyd Qpeak  (cms)=    1.900
```

```
     PEAK FLOW       (cms)=    1.559 (i)
     TIME TO PEAK    (hrs)=   12.133
     DURATION        (hrs)=   25.667, (dddd|hh:mm:)=   1|01:40
     AVERAGE FLOW    (cms)=     .075
     RUNOFF VOLUME    (mm)=   58.420
     TOTAL RAINFALL   (mm)=   98.399
     RUNOFF COEFFICIENT   =     .594

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

---------------------------------------------------------------------------------------------
R0004:C00005---------------------------------------------------------------------------------
* TOTAL FLOW TO SIDEROAD 15 CROSS CULVERT (POST1 CONTROLLED + EXT)
------------------------
| ADD HYD                |
| 03:POST1+EXT           |   ID:NHYD           AREA     QPEAK    TPEAK      R.V.     DWF
------------------------                       (ha)     (cms)    (hrs)      (mm)   (cms)
                     ID 1 01:POST1         2.740      .760   12.000    84.853    .000
                    +ID 2 02:EXT          11.940     1.559   12.133    58.420    .000
                    ==============================================================
                    SUM   03:POST1+EXT    14.680     2.015   12.033    63.353    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

---------------------------------------------------------------------------------------------
R0004:C00006---------------------------------------------------------------------------------
* SWM Facility
-----------------------
|  ROUTE RESERVOIR -> |    Requested routing time step =  1.0 min.
|  IN>03:POST1+EXT    |
| OUT<04:SWM Facili   | =========================  OUTLFOW STORAGE TABLE  =================
----------------------- OUTFLOW   STORAGE| OUTFLOW   STORAGE| OUTFLOW   STORAGE| OUTFLOW
                          (cms)   (ha.m.)|   (cms)   (ha.m.)|   (cms)   (ha.m.)|   (cms)
                           .000 .0000E+00|    .010 .1292E-01|    .065 .4128E-01|   1.071 .
                           .002 .6300E-03|    .010 .1442E-01|    .108 .4430E-01|   1.184 .
                           .003 .1310E-02|    .010 .1601E-01|    .159 .4743E-01|   1.308 .
                           .004 .2050E-02|    .011 .1769E-01|    .217 .5067E-01|   1.445 .
                           .005 .2840E-02|    .011 .1946E-01|    .281 .5403E-01|   1.594 .
                           .006 .3680E-02|    .011 .2133E-01|    .351 .5751E-01|   1.759 .
                           .006 .4590E-02|    .012 .2329E-01|    .425 .6112E-01|   2.020 .
                           .007 .5570E-02|    .012 .2535E-01|    .505 .6486E-01|   2.383 .
                           .007 .6610E-02|    .012 .2777E-01|    .589 .6872E-01|   2.840 .
                           .008 .7720E-02|    .013 .3027E-01|    .677 .7272E-01|   3.391 .
                           .008 .8910E-02|    .013 .3287E-01|    .769 .7686E-01|   4.041 .
                           .009 .1017E-01|    .013 .3557E-01|    .866 .8113E-01|   4.792 .
                           .009 .1150E-01|    .032 .3837E-01|    .966 .8555E-01|   5.649 .

     ROUTING RESULTS             AREA     QPEAK     TPEAK       R.V.
     ----------------------      (ha)     (cms)     (hrs)       (mm)
     INFLOW > 03:POST1+EXT     14.680     2.015    12.033     63.353
    OUTFLOW < 04:SWM Facili    14.680     1.784    12.150     63.353

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=   88.516
```

```
                   TIME SHIFT OF PEAK FLOW         (min)=     7.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=.1158E+00

-------------------------------------------------------------------------------------------
R0004:C00007-------------------------------------------------------------------------------
* SITE (POST2 - Uncontrolled Area)
--------------------------
| CALIB STANDHYD         |   Area    (ha)=     .89
| 05:POST2      DT= 1.00 |   Total Imp(%)=   21.00   Dir. Conn.(%)=   10.50
--------------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .19          .70
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       6.00        11.10
     Length            (m)=     120.00        50.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=     110.70       101.37
                over (min)        2.00         6.00
     Storage Coeff.  (min)=       1.60 (ii)    6.40 (ii)
     Unit Hyd. Tpeak (min)=       2.00         6.00
     Unit Hyd. peak  (cms)=        .64          .18
                                                           *TOTALS*
     PEAK FLOW       (cms)=        .03          .17           .192 (iii)
     TIME TO PEAK    (hrs)=      12.00        12.02         12.000
     RUNOFF VOLUME    (mm)=      96.40        64.62         67.960
     TOTAL RAINFALL   (mm)=      98.40        98.40         98.399
     RUNOFF COEFFICIENT   =        .98          .66           .691

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  84.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------------------
R0004:C00008-------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------
R0004:C00002-------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------
R0004:C00002-------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------
R0004:C00002-------------------------------------------------------------------------------
  ** END OF RUN :    3

*******************************************************************************************




--------------------
| START            | Project  dir.:C:\Temp\15-319\PR\24-hour_SCS\
-------------------- Rainfall dir.:C:\Temp\15-319\PR\24-hour_SCS\
```

```
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 0005
    NSTORM=   1
           #  1=100SCS24.stm
-------------------------------------------------------------------------------------------
R0005:C00002-------------------------------------------------------------------------------
*#******************************************************************************
*#  Project Name: [Mansfield Ski Club]    Project Number: [15-319]
*#  Date        : 07-31-2017
*#  Modeller    : [J. Lightheart]
*#  Company     : WMI & Associates Ltd.
*#  License #   :  2880720
*#******************************************************************************
*
* Post-Development Condition - Mansfield Ski Club
*
-------------------------------------------------------------------------------------------
R0005:C00002-------------------------------------------------------------------------------
--------------------
| READ STORM       |  Filename: C:\Temp\15-319\PR\24-hour_SCS\100SCS24.stm
| Ptotal= 120.00 mm|  Comments: 100-Year SCS Type-II Storm Distribution (24-hour)
--------------------
      TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME
     hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm
      0:12   1.200|   4:12   2.400|   8:12   3.600|  12:12  24.000|  16:12   3.000|  20:12
      0:24   1.200|   4:24   2.400|   8:24   3.600|  12:24  15.000|  16:24   3.000|  20:24
      0:36   1.200|   4:36   2.400|   8:36   3.600|  12:36  10.800|  16:36   3.000|  20:36
      0:48   1.200|   4:48   2.400|   8:48   3.600|  12:48  10.200|  16:48   3.000|  20:48
      1:00   1.200|   5:00   2.400|   9:00   3.600|  13:00   7.200|  17:00   1.800|  21:00
      1:12   1.200|   5:12   2.400|   9:12   3.600|  13:12   6.000|  17:12   1.800|  21:12
      1:24   1.200|   5:24   2.400|   9:24   3.600|  13:24   6.000|  17:24   2.400|  21:24
      1:36   1.200|   5:36   2.400|   9:36   3.600|  13:36   6.000|  17:36   1.800|  21:36
      1:48   1.200|   5:48   2.400|   9:48   3.600|  13:48   6.000|  17:48   2.400|  21:48
      2:00   1.200|   6:00   2.400|  10:00   3.600|  14:00   6.000|  18:00   1.800|  22:00
      2:12   1.200|   6:12   2.400|  10:12   6.600|  14:12   3.600|  18:12   1.800|  22:12
      2:24   1.200|   6:24   2.400|  10:24   6.600|  14:24   3.600|  18:24   1.800|  22:24
      2:36   1.200|   6:36   2.400|  10:36   6.600|  14:36   3.600|  18:36   2.400|  22:36
      2:48   1.200|   6:48   2.400|  10:48   6.600|  14:48   3.600|  18:48   1.800|  22:48
      3:00   1.200|   7:00   2.400|  11:00   6.600|  15:00   3.600|  19:00   1.800|  23:00
      3:12   1.200|   7:12   2.400|  11:12   9.000|  15:12   3.000|  19:12   2.400|  23:12
      3:24   1.200|   7:24   2.400|  11:24  13.200|  15:24   3.000|  19:24   1.800|  23:24
      3:36   1.200|   7:36   2.400|  11:36  31.800|  15:36   3.000|  19:36   2.400|  23:36
      3:48   1.200|   7:48   2.400|  11:48  66.000|  15:48   3.000|  19:48   1.800|  23:48
      4:00   1.200|   8:00   2.400|  12:00 135.000|  16:00   3.000|  20:00   2.400|  24:00

-------------------------------------------------------------------------------------------
R0005:C00003-------------------------------------------------------------------------------
* SITE (POST1 - Controlled Area)
--------------------------
| CALIB STANDHYD         |   Area    (ha)=    2.74
| 01:POST1      DT= 1.00 |   Total Imp(%)=   69.00   Dir. Conn.(%)=   59.00
--------------------------
```

```
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.89          .85
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       3.50        33.30
     Length            (m)=     300.00         6.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=     135.00       157.84
                over (min)       3.00         4.00
     Storage Coeff.  (min)=       3.01 (ii)    3.82 (ii)
     Unit Hyd. Tpeak (min)=       3.00         4.00
     Unit Hyd. peak  (cms)=        .37          .29
                                                           *TOTALS*
     PEAK FLOW       (cms)=        .60          .35            .949 (iii)
     TIME TO PEAK    (hrs)=      12.00        12.00          12.000
     RUNOFF VOLUME    (mm)=     118.00        88.39         105.863
     TOTAL RAINFALL   (mm)=     120.00       120.00         120.000
     RUNOFF COEFFICIENT   =        .98          .74            .882

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  84.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------------------
R0005:C00004-------------------------------------------------------------------------------
* EXTERNAL (Routed through SWM Facility)
--------------------------
| CALIB NASHYD           |   Area    (ha)=   11.940   Curve Number   (CN)= 83.00
| 02:EXT       DT= 1.00 |   Ia      (mm)=    6.800   # of Linear Res.(N)=  3.00
--------------------------   U.H. Tp(hrs)=     .240

     Unit Hyd Qpeak  (cms)=    1.900

     PEAK FLOW       (cms)=    2.065 (i)
     TIME TO PEAK    (hrs)=   12.133
     DURATION        (hrs)=   25.667, (dddd|hh:mm:)=   1|01:40
     AVERAGE FLOW    (cms)=     .100
     RUNOFF VOLUME    (mm)=   77.557
     TOTAL RAINFALL   (mm)=  120.000
     RUNOFF COEFFICIENT   =     .646

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

-------------------------------------------------------------------------------------------
R0005:C00005-------------------------------------------------------------------------------
* TOTAL FLOW TO SIDEROAD 15 CROSS CULVERT (POST1 CONTROLLED + EXT)
------------------------
| ADD HYD               |
| 03:POST1+EXT         |   ID:NHYD            AREA     QPEAK    TPEAK      R.V.     DWF
------------------------                      (ha)     (cms)    (hrs)      (mm)   (cms)
                      ID 1 01:POST1          2.740      .949   12.000   105.863    .000
                     +ID 2 02:EXT           11.940     2.065   12.133    77.557    .000
```

```
                     ===================================================================
                     SUM   03:POST1+EXT     14.680     2.628   12.017    82.840    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------------------
R0005:C00006-------------------------------------------------------------------------------
* SWM Facility
-----------------------
|  ROUTE RESERVOIR -> |    Requested routing time step =  1.0 min.
|  IN>03:POST1+EXT    |
| OUT<04:SWM Facili   | ========================  OUTLFOW STORAGE TABLE  =================
----------------------- OUTFLOW   STORAGE| OUTFLOW   STORAGE| OUTFLOW   STORAGE| OUTFLOW
                          (cms)   (ha.m.)|   (cms)   (ha.m.)|   (cms)   (ha.m.)|   (cms)
                           .000 .0000E+00|    .010 .1292E-01|    .065 .4128E-01|   1.071 .
                           .002 .6300E-03|    .010 .1442E-01|    .108 .4430E-01|   1.184 .
                           .003 .1310E-02|    .010 .1601E-01|    .159 .4743E-01|   1.308 .
                           .004 .2050E-02|    .011 .1769E-01|    .217 .5067E-01|   1.445 .
                           .005 .2840E-02|    .011 .1946E-01|    .281 .5403E-01|   1.594 .
                           .006 .3680E-02|    .011 .2133E-01|    .351 .5751E-01|   1.759 .
                           .006 .4590E-02|    .012 .2329E-01|    .425 .6112E-01|   2.020 .
                           .007 .5570E-02|    .012 .2535E-01|    .505 .6486E-01|   2.383 .
                           .007 .6610E-02|    .012 .2777E-01|    .589 .6872E-01|   2.840 .
                           .008 .7720E-02|    .013 .3027E-01|    .677 .7272E-01|   3.391 .
                           .008 .8910E-02|    .013 .3287E-01|    .769 .7686E-01|   4.041 .
                           .009 .1017E-01|    .013 .3557E-01|    .866 .8113E-01|   4.792 .
                           .009 .1150E-01|    .032 .3837E-01|    .966 .8555E-01|   5.649 .

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     ----------------------     (ha)     (cms)     (hrs)       (mm)
     INFLOW > 03:POST1+EXT     14.680     2.628    12.017     82.840
    OUTFLOW < 04:SWM Facili    14.680     2.275    12.167     82.840

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=   86.558
                   TIME SHIFT OF PEAK FLOW         (min)=     9.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=.1364E+00

-------------------------------------------------------------------------------------------
R0005:C00007-------------------------------------------------------------------------------
* SITE (POST2 - Uncontrolled Area)
--------------------------
| CALIB STANDHYD        |   Area    (ha)=     .89
| 05:POST2      DT= 1.00 |   Total Imp(%)=   21.00   Dir. Conn.(%)=   10.50
--------------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .19          .70
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       6.00        11.10
     Length            (m)=     120.00        50.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=     135.00       130.11
                over (min)       1.00         6.00
```

```
           Storage Coeff.  (min)=       1.48 (ii)    5.82 (ii)
           Unit Hyd. Tpeak (min)=       1.00         6.00
           Unit Hyd. peak  (cms)=        .84          .19
                                                                 *TOTALS*
           PEAK FLOW       (cms)=        .04          .22           .251 (iii)
           TIME TO PEAK    (hrs)=      12.00        12.02         12.000
           RUNOFF VOLUME    (mm)=     117.98        84.40         87.928
           TOTAL RAINFALL   (mm)=     120.00       120.00        120.000
           RUNOFF COEFFICIENT   =        .98          .70           .733

             (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
                 CN* =  84.0    Ia = Dep. Storage  (Above)
            (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
           (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

      ------------------------------------------------------------------------------------------
      R0005:C00008------------------------------------------------------------------------------
      ------------------------------------------------------------------------------------------
      R0005:C00002------------------------------------------------------------------------------
      ------------------------------------------------------------------------------------------
      R0005:C00002------------------------------------------------------------------------------
      ------------------------------------------------------------------------------------------
      R0005:C00002------------------------------------------------------------------------------
      ------------------------------------------------------------------------------------------
      R0005:C00002------------------------------------------------------------------------------
        ** END OF RUN :    4

      ******************************************************************************************




      --------------------
      | START            | Project  dir.:C:\Temp\15-319\PR\24-hour_SCS\
      -------------------- Rainfall dir.:C:\Temp\15-319\PR\24-hour_SCS\
          TZERO =   .00 hrs on        0
          METOUT=   2 (output = METRIC)
          NRUN  = 0006
          NSTORM=   1
                 #  1=12regtim.o89
      ------------------------------------------------------------------------------------------
      R0006:C00002------------------------------------------------------------------------------
      *#*****************************************************************************
      *#  Project Name: [Mansfield Ski Club]    Project Number: [15-319]
      *#  Date        : 07-31-2017
      *#  Modeller    : [J. Lightheart]
      *#  Company     : WMI & Associates Ltd.
      *#  License #   :  2880720
      *#*****************************************************************************
      *
      * Post-Development Condition - Mansfield Ski Club
      *
```

```
      ------------------------------------------------------------------------------------------
      R0006:C00002------------------------------------------------------------------------------
      --------------------
      | READ STORM       |  Filename: C:\Temp\15-319\PR\24-hour_SCS\12regtim.o89
      | Ptotal= 193.00 mm|  Comments: TIMMINS REGIONAL STORM (12-hour)
      --------------------
            TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME
           hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm
            1:00  15.000|   3:00  10.000|   5:00   5.000|   7:00  43.000|   9:00  23.000|  11:00
            2:00  20.000|   4:00   3.000|   6:00  20.000|   8:00  20.000|  10:00  13.000|  12:00

      ------------------------------------------------------------------------------------------
      R0006:C00003------------------------------------------------------------------------------
      * SITE (POST1 - Controlled Area)
      --------------------------
      | CALIB STANDHYD         |   Area    (ha)=    2.74
      | 01:POST1      DT= 1.00 |   Total Imp(%)=   69.00   Dir. Conn.(%)=   59.00
      --------------------------
                                    IMPERVIOUS    PERVIOUS (i)
           Surface Area     (ha)=       1.89          .85
           Dep. Storage     (mm)=       2.00         5.00
           Average Slope     (%)=       3.50        33.30
           Length            (m)=     300.00         6.00
           Mannings n           =       .013         .250

           Max.eff.Inten.(mm/hr)=      43.00        53.33
                      over (min)       5.00         6.00
           Storage Coeff.  (min)=       4.75 (ii)    6.00 (ii)
           Unit Hyd. Tpeak (min)=       5.00         6.00
           Unit Hyd. peak  (cms)=        .23          .19
                                                                 *TOTALS*
           PEAK FLOW       (cms)=        .19          .13           .318 (iii)
           TIME TO PEAK    (hrs)=       7.00         7.00          7.000
           RUNOFF VOLUME    (mm)=     190.99       158.56        177.702
           TOTAL RAINFALL   (mm)=     193.00       193.00        193.000
           RUNOFF COEFFICIENT   =        .99          .82           .921

             (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
                 CN* =  84.0    Ia = Dep. Storage  (Above)
            (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
           (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

      ------------------------------------------------------------------------------------------
      R0006:C00004------------------------------------------------------------------------------
      * EXTERNAL (Routed through SWM Facility)
      --------------------------
      | CALIB NASHYD           |   Area    (ha)=   11.940   Curve Number   (CN)= 83.00
      | 02:EXT        DT= 1.00 |   Ia      (mm)=    6.800   # of Linear Res.(N)=  3.00
      --------------------------   U.H. Tp(hrs)=     .240

           Unit Hyd Qpeak  (cms)=    1.900

           PEAK FLOW       (cms)=    1.239 (i)
```

```
     TIME TO PEAK    (hrs)=    7.017
     DURATION        (hrs)=   13.667, (dddd|hh:mm:)=   0|13:40
     AVERAGE FLOW    (cms)=     .353
     RUNOFF VOLUME    (mm)=  145.537
     TOTAL RAINFALL   (mm)=  193.000
     RUNOFF COEFFICIENT   =     .754

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

-------------------------------------------------------------------------------------------
R0006:C00005-------------------------------------------------------------------------------
* TOTAL FLOW TO SIDEROAD 15 CROSS CULVERT (POST1 CONTROLLED + EXT)
------------------------
| ADD HYD              |
| 03:POST1+EXT         |   ID:NHYD           AREA     QPEAK    TPEAK      R.V.     DWF
------------------------                     (ha)     (cms)    (hrs)      (mm)   (cms)
                      ID 1 01:POST1         2.740      .318    7.000   177.702    .000
                     +ID 2 02:EXT          11.940     1.239    7.017   145.537    .000
                     ==================================================================
                     SUM   03:POST1+EXT    14.680     1.556    7.000   151.541    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------------------
R0006:C00006-------------------------------------------------------------------------------
* SWM Facility
-----------------------
|  ROUTE RESERVOIR -> |    Requested routing time step =  1.0 min.
|  IN>03:POST1+EXT    |
| OUT<04:SWM Facili   | =========================  OUTFLOW STORAGE TABLE  =================
---------------------- OUTFLOW   STORAGE| OUTFLOW   STORAGE| OUTFLOW   STORAGE| OUTFLOW
                         (cms)   (ha.m.)|   (cms)   (ha.m.)|   (cms)   (ha.m.)|   (cms)
                          .000 .0000E+00|    .010 .1292E-01|    .065 .4128E-01|   1.071 .
                          .002 .6300E-03|    .010 .1442E-01|    .108 .4430E-01|   1.184 .
                          .003 .1310E-02|    .010 .1601E-01|    .159 .4743E-01|   1.308 .
                          .004 .2050E-02|    .011 .1769E-01|    .217 .5067E-01|   1.445 .
                          .005 .2840E-02|    .011 .1946E-01|    .281 .5403E-01|   1.594 .
                          .006 .3680E-02|    .011 .2133E-01|    .351 .5751E-01|   1.759 .
                          .006 .4590E-02|    .012 .2329E-01|    .425 .6112E-01|   2.020 .
                          .007 .5570E-02|    .012 .2535E-01|    .505 .6486E-01|   2.383 .
                          .007 .6610E-02|    .012 .2777E-01|    .589 .6872E-01|   2.840 .
                          .008 .7720E-02|    .013 .3027E-01|    .677 .7272E-01|   3.391 .
                          .008 .8910E-02|    .013 .3287E-01|    .769 .7686E-01|   4.041 .
                          .009 .1017E-01|    .013 .3557E-01|    .866 .8113E-01|   4.792 .
                          .009 .1150E-01|    .032 .3837E-01|    .966 .8555E-01|   5.649 .

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     ----------------------      (ha)     (cms)     (hrs)       (mm)
     INFLOW > 03:POST1+EXT     14.680     1.556     7.000    151.541
    OUTFLOW < 04:SWM Facili    14.680     1.540     7.033    151.540

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=   98.975
                   TIME SHIFT OF PEAK FLOW         (min)=     2.00
```

```
                   MAXIMUM  STORAGE   USED       (ha.m.)=.1080E+00

-------------------------------------------------------------------------------------------
R0006:C00007-------------------------------------------------------------------------------
* SITE (POST2 - Uncontrolled Area)
--------------------------
| CALIB STANDHYD         |   Area    (ha)=     .89
| 05:POST2      DT= 1.00 |   Total Imp(%)=   21.00   Dir. Conn.(%)=   10.50
--------------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .19          .70
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       6.00        11.10
     Length            (m)=     120.00        50.00
     Mannings n          =        .013         .250

     Max.eff.Inten.(mm/hr)=      43.00        44.82
                over (min)        2.00         9.00
     Storage Coeff.  (min)=       2.33 (ii)    8.99 (ii)
     Unit Hyd. Tpeak (min)=       2.00         9.00
     Unit Hyd. peak  (cms)=        .50          .13
                                                           *TOTALS*
     PEAK FLOW       (cms)=        .01          .09           .098 (iii)
     TIME TO PEAK    (hrs)=       6.98         7.00          7.000
     RUNOFF VOLUME    (mm)=     191.00       153.77        157.677
     TOTAL RAINFALL   (mm)=     193.00       193.00        193.000
     RUNOFF COEFFICIENT   =        .99          .80           .817

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  84.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------------------
R0006:C00008-------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------
R0006:C00002-------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------
R0006:C00002-------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------
R0006:C00002-------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------
R0006:C00002-------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------
R0006:C00002-------------------------------------------------------------------------------
--------------------
| FINISH           |
--------------------
-------------------------------------------------------------------------------------------
*******************************************************************************************
     WARNINGS / ERRORS / NOTES
     -------------------------
   Simulation ended on 2020-12-09     at 16:07:39
```

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

Post-Development Condition
12-hour SCS Type-II Storm Distribution

```
2     Metric units
*#******************************************************************************
*#  Project Name: [Mansfield Ski Club]    Project Number: [15-319]
*#  Date        : 07-31-2017
*#  Modeller    : [J. Lightheart]
*#  Company     : WMI & Associates Ltd.
*#  License #   :  2880720
*#******************************************************************************
*
* Post-Development Condition - Mansfield Ski Club
*
*% 25mm Chicago Storm Dist. based on Mansfield, ON. rainfall (4-hr)
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[1]
*%                   ["25mm4hr.stm"] <--storm filename
*%-----------------|-----------------------------------------------------------|
READ STORM          STORM_FILENAME=["STORM.001"]
*%-----------------|-----------------------------------------------------------|
* SITE (POST1 - Controlled Area)
CALIB STANDHYD      ID=[1], NHYD=["POST1"], DT=[1](min), AREA=[2.74](ha),
                    XIMP=[0.59], TIMP=[0.69], DWF=[0](cms), LOSS=[2],
                    SCS curve number CN=[84],
                    Pervious   surfaces: IAper=[5.0](mm), SLPP=[33.3](%),
                                         LGP=[6](m), MNP=[0.25], SCP=[0](min),
                    Impervious surfaces: IAimp=[2.0](mm), SLPI=[3.5](%),
                                         LGI=[300](m), MNI=[0.013], SCI=[0](min),
                    RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
*%-----------------|-----------------------------------------------------------|
* EXTERNAL (Routed through SWM Facility)
CALIB NASHYD        ID=[2], NHYD=["EXT"], DT=[1]min, AREA=[11.94](ha),
                    DWF=[0](cms),  CN/C=[83], IA=[6.8](mm),
                    N=[3], TP=[0.24]hrs,
                    RAINFALL=[ ,  ,  ,  , ](mm/hr),  END=-1
*%-----------------|-----------------------------------------------------------|
* TOTAL FLOW TO SIDEROAD 15 CROSS CULVERT (POST1 CONTROLLED + EXT)
ADD HYD             IDsum=[3], NHYD=["POST1+EXT"], IDs to add=[1+2]
*%-----------------|-----------------------------------------------------------|
* SWM Facility
ROUTE RESERVOIR     IDout=[4], NHYD=["SWM Facility"], IDin=[3], RDT=[1](min),
                         TABLE of ( OUTFLOW-STORAGE ) values
                                   (cms) - (ha-m)
                                 [0.0000 , 0.00000]
                                 [0.0015 , 0.00063]
                                 [0.0031 , 0.00131]
                                 [0.0041 , 0.00205]
                                 [0.0050 , 0.00284]
                                 [0.0057 , 0.00368]
                                 [0.0063 , 0.00459]
                                 [0.0069 , 0.00557]
                                 [0.0074 , 0.00661]
                                 [0.0079 , 0.00772]
                                 [0.0084 , 0.00891]
                                 [0.0088 , 0.01017]
                                 [0.0092 , 0.01150]
```

```
                                 [0.0096 , 0.01292]
                                 [0.0100 , 0.01442]
                                 [0.0104 , 0.01601]
                                 [0.0108 , 0.01769]
                                 [0.0111 , 0.01946]
                                 [0.0114 , 0.02133]
                                 [0.0118 , 0.02329]
                                 [0.0121 , 0.02535]
                                 [0.0124 , 0.02777]
                                 [0.0127 , 0.03027]
                                 [0.0130 , 0.03287]
                                 [0.0133 , 0.03557]
                                 [0.0317 , 0.03837]
                                 [0.0651 , 0.04128]
                                 [0.1082 , 0.04430]
                                 [0.1593 , 0.04743]
                                 [0.2172 , 0.05067]
                                 [0.2811 , 0.05403]
                                 [0.3506 , 0.05751]
                                 [0.4252 , 0.06112]
                                 [0.5047 , 0.06486]
                                 [0.5887 , 0.06872]
                                 [0.6769 , 0.07272]
                                 [0.7693 , 0.07686]
                                 [0.8656 , 0.08113]
                                 [0.9656 , 0.08555]
                                 [1.0706 , 0.09011]
                                 [1.1842 , 0.09483]
                                 [1.3084 , 0.09970]
                                 [1.4447 , 0.10472]
                                 [1.5945 , 0.10990]
                                 [1.7589 , 0.11524]
                                 [2.0195 , 0.12075]
                                 [2.3829 , 0.14300]
                                 [2.8396 , 0.14870]
                                 [3.3911 , 0.15454]
                                 [4.0406 , 0.16053]
                                 [4.7921 , 0.16666]
                                 [5.6495 , 0.17293]
                                 [   -1  ,  -1  ]  (maximum one hundred pairs of points)
                                 IDovf=[   ], NHYDovf=["      "],
*%-----------------|-------------------------------------------------------------------------
* SITE (POST2 - Uncontrolled Area)
CALIB STANDHYD      ID=[5], NHYD=["POST2"], DT=[1](min), AREA=[0.89](ha),
                    XIMP=[0.105], TIMP=[0.21], DWF=[0](cms), LOSS=[2],
                    SCS curve number CN=[84],
                    Pervious   surfaces: IAper=[5.0](mm), SLPP=[11.1](%),
                                         LGP=[50](m), MNP=[0.25], SCP=[0](min),
                    Impervious surfaces: IAimp=[2.0](mm), SLPI=[6.0](%),
                                         LGI=[120](m), MNI=[0.013], SCI=[0](min),
                    RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
*%-----------------|-----------------------------------------------------------|
*% 2-year SCS Type-II Storm Dist. based on Mansfield, ON. rainfall (12-hr)
```

```
START              TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[2]
*%                  ["2SCS12.stm"] <--storm filename
*%-----------------|-----------------------------------------------------------|
*% 5-year SCS Type-II Storm Dist. based on Mansfield, ON. rainfall (12-hr)
START              TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[3]
*%                  ["5SCS12.stm"] <--storm filename
*%-----------------|-----------------------------------------------------------|
*% 25-year SCS Type-II Storm Dist. based on Mansfield, ON. rainfall (12-hr)
START              TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[4]
*%                  ["25SCS12.stm"] <--storm filename
*%-----------------|-----------------------------------------------------------|
*% 100-year SCS Type-II Storm Dist. based on Mansfield, ON. rainfall (12-hr)
START              TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[5]
*%                  ["100SCS12.stm"] <--storm filename
*%-----------------|-----------------------------------------------------------|
*% Timmins Regional Storm (12-hr)
START              TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[6]
*%                  ["12regtim.o89"] <--storm filename
*%-----------------|-----------------------------------------------------------|
FINISH
```

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

 SSSSS   W   W   M   M   H   H   Y   Y   M   M    OOO          222     000    11   77777 ==
 S       W W W   MM MM   H   H    Y Y    MM MM   O   O           2    0   0   11   7   7
 SSSSS   W W W   M M M   HHHHH     Y     M M M   O   O           2    0   0   11       7
     S    W W    M   M   H   H     Y     M   M   O   O        222     0   0   11      7
 SSSSS    W W    M   M   H   H     Y     M   M    OOO         2       0   0   11     7   ==
                                                              2       0   0   11    7    #
       StormWater Management HYdrologic Model                  222     000    11    7    ==

 ******************************************************************************************
 *************************************  SWMHYMO Ver4.05.0  ******************************
 ******************  A single event and continuous hydrologic simulation model  ***********
 ******************     based on the principles of HYMO and its successors      ***********
 ******************                 OTTHYMO-83 and OTTHYMO-89.                  ***********
 ******************************************************************************************
 ****************** Distributed by:  J.F. Sabourin and Associates Inc.          ***********
 ******************                  Ottawa,  Ontario: (613) 836-3884           ***********
 ******************                  Gatineau, Quebec: (819) 243-6858           ***********
 ******************                  E-Mail: swmhymo@jfsa.com                   ***********
 ******************************************************************************************

 ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
 ++++++++++++++++++ Licensed user: WMI & Associates Ltd.                        +++++++++++
 ++++++++++++++++++               Barrie                SERIAL#:2880720         +++++++++++
 ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

 ******************************************************************************************
 ******************           ++++++ PROGRAM ARRAY DIMENSIONS ++++++            ***********
 ******************           Maximum value for ID numbers  :     11            ***********
 ******************           Max. number of rainfall points: 105408            ***********
 ******************           Max. number of flow points    : 105408            ***********
 ******************************************************************************************


 *******************************   D E T A I L E D   O U T P U T   ***********************
 ******************************************************************************************
 *                 RUN DATE: 2020-12-09     TIME: 16:07:01     RUN COUNTER: 000003
 ******************************************************************************************
 * Input   file: C:\Temp\15-319\PR\12-hour_SCS\2-CYRSCS.dat
 * Output  file: C:\Temp\15-319\PR\12-hour_SCS\2-CYRSCS.out
 * Summary file: C:\Temp\15-319\PR\12-hour_SCS\2-CYRSCS.sum
 * User comments:
 * 1:_______________________________________________________________________________________
 * 2:_______________________________________________________________________________________
 * 3:_______________________________________________________________________________________
 ******************************************************************************************

-------------------------------------------------------------------------------------------
R0001:C00001-------------------------------------------------------------------------------
*#******************************************************************************
*#  Project Name: [Mansfield Ski Club]    Project Number: [15-319]
*#  Date        : 07-31-2017
```

```
*#  Modeller    : [J. Lightheart]
*#  Company     : WMI & Associates Ltd.
*#  License #   :  2880720
*#******************************************************************************
*
* Post-Development Condition - Mansfield Ski Club
*
--------------------
| START            | Project  dir.:C:\Temp\15-319\PR\12-hour_SCS\
-------------------- Rainfall dir.:C:\Temp\15-319\PR\12-hour_SCS\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 0001
    NSTORM=   1
           #  1=25mm4hr.stm
-------------------------------------------------------------------------------------------
R0001:C00002-------------------------------------------------------------------------------
--------------------
| READ STORM       |  Filename: C:\Temp\15-319\PR\12-hour_SCS\25mm4hr.stm
| Ptotal=  25.00 mm|  Comments: 25mm Chicago Storm Distribution (4-hour) Mansfield, ON.
--------------------
      TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME
     hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm
      0:10   1.970|   0:50   3.820|   1:30  13.830|   2:10   4.080|   2:50   2.650|   3:30
      0:20   2.220|   1:00   5.380|   1:40   8.070|   2:20   3.570|   3:00   2.450|   3:40
      0:30   2.550|   1:10  10.940|   1:50   5.950|   2:30   3.190|   3:10   2.290|   3:50
      0:40   3.030|   1:20  56.670|   2:00   4.810|   2:40   2.890|   3:20   2.150|   4:00

-------------------------------------------------------------------------------------------
R0001:C00003-------------------------------------------------------------------------------
* SITE (POST1 - Controlled Area)
--------------------------
| CALIB STANDHYD         |   Area    (ha)=    2.74
| 01:POST1      DT= 1.00 |   Total Imp(%)=   69.00   Dir. Conn.(%)=   59.00
--------------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.89          .85
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       3.50        33.30
     Length            (m)=     300.00         6.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      56.67        23.86
                over (min)       4.00         6.00
     Storage Coeff.  (min)=       4.26 (ii)    5.98 (ii)
     Unit Hyd. Tpeak (min)=       4.00         6.00
     Unit Hyd. peak  (cms)=        .27          .19
                                                              *TOTALS*
     PEAK FLOW       (cms)=        .22          .04             .255 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.40            1.350
     RUNOFF VOLUME    (mm)=      23.01         7.79           16.768
     TOTAL RAINFALL   (mm)=      25.01        25.01           25.005
     RUNOFF COEFFICIENT   =        .92          .31             .671
```

```
         (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
                 CN* =  84.0    Ia = Dep. Storage  (Above)
        (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
       (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

      ---------------------------------------------------------------------------------------------
      R0001:C00004-----------------------------------------------------------------------------
      * EXTERNAL (Routed through SWM Facility)
      -------------------------
      | CALIB NASHYD           |   Area    (ha)=   11.940   Curve Number   (CN)= 83.00
      | 02:EXT        DT= 1.00 |   Ia      (mm)=    6.800   # of Linear Res.(N)=  3.00
      -------------------------    U.H. Tp(hrs)=     .240

           Unit Hyd Qpeak  (cms)=    1.900

           PEAK FLOW       (cms)=     .115 (i)
           TIME TO PEAK    (hrs)=    1.650
           DURATION        (hrs)=    5.667, (dddd|hh:mm:)=   0|05:40
           AVERAGE FLOW    (cms)=     .028
           RUNOFF VOLUME    (mm)=    4.719
           TOTAL RAINFALL   (mm)=   25.005
           RUNOFF COEFFICIENT   =     .189

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

      ---------------------------------------------------------------------------------------------
      R0001:C00005-----------------------------------------------------------------------------
      * TOTAL FLOW TO SIDEROAD 15 CROSS CULVERT (POST1 CONTROLLED + EXT)
      ------------------------
      | ADD HYD                |
      | 03:POST1+EXT           |   ID:NHYD           AREA     QPEAK    TPEAK      R.V.     DWF
      ------------------------                       (ha)     (cms)    (hrs)      (mm)   (cms)
                             ID 1 01:POST1          2.740      .255    1.350    16.768    .000
                            +ID 2 02:EXT           11.940      .115    1.650     4.719    .000
                            ================================================================
                            SUM   03:POST1+EXT     14.680      .282    1.367     6.968    .000

         NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

      ---------------------------------------------------------------------------------------------
      R0001:C00006-----------------------------------------------------------------------------
      * SWM Facility
      ----------------------
      |  ROUTE RESERVOIR -> |    Requested routing time step =  1.0 min.
      |  IN>03:POST1+EXT    |
      | OUT<04:SWM Facili   | ========================  OUTFLOW STORAGE TABLE  ================
      ---------------------- OUTFLOW   STORAGE| OUTFLOW   STORAGE| OUTFLOW   STORAGE| OUTFLOW
                               (cms)   (ha.m.)|   (cms)   (ha.m.)|   (cms)   (ha.m.)|   (cms)
                                .000 .0000E+00|    .010 .1292E-01|    .065 .4128E-01|   1.071 .
                                .002 .6300E-03|    .010 .1442E-01|    .108 .4430E-01|   1.184 .
                                .003 .1310E-02|    .010 .1601E-01|    .159 .4743E-01|   1.308 .
                                .004 .2050E-02|    .011 .1769E-01|    .217 .5067E-01|   1.445 .
```

```
                                .005 .2840E-02|    .011 .1946E-01|    .281 .5403E-01|   1.594 .
                                .006 .3680E-02|    .011 .2133E-01|    .351 .5751E-01|   1.759 .
                                .006 .4590E-02|    .012 .2329E-01|    .425 .6112E-01|   2.020 .
                                .007 .5570E-02|    .012 .2535E-01|    .505 .6486E-01|   2.383 .
                                .007 .6610E-02|    .012 .2777E-01|    .589 .6872E-01|   2.840 .
                                .008 .7720E-02|    .013 .3027E-01|    .677 .7272E-01|   3.391 .
                                .008 .8910E-02|    .013 .3287E-01|    .769 .7686E-01|   4.041 .
                                .009 .1017E-01|    .013 .3557E-01|    .866 .8113E-01|   4.792 .
                                .009 .1150E-01|    .032 .3837E-01|    .966 .8555E-01|   5.649 .

           ROUTING RESULTS             AREA     QPEAK     TPEAK       R.V.
           ----------------------      (ha)     (cms)     (hrs)       (mm)
           INFLOW > 03:POST1+EXT     14.680      .282     1.367      6.968
          OUTFLOW < 04:SWM Facili    14.680      .108     2.033      6.968

                          PEAK   FLOW   REDUCTION [Qout/Qin](%)=   38.291
                          TIME SHIFT OF PEAK FLOW         (min)=    40.00
                          MAXIMUM  STORAGE   USED       (ha.m.)=.4429E-01

      ---------------------------------------------------------------------------------------------
      R0001:C00007-----------------------------------------------------------------------------
      * SITE (POST2 - Uncontrolled Area)
      -------------------------
      | CALIB STANDHYD         |   Area    (ha)=     .89
      | 05:POST2      DT= 1.00 |   Total Imp(%)=   21.00   Dir. Conn.(%)=   10.50
      -------------------------
                                  IMPERVIOUS    PERVIOUS (i)
           Surface Area     (ha)=        .19          .70
           Dep. Storage     (mm)=       2.00         5.00
           Average Slope     (%)=       6.00        11.10
           Length            (m)=     120.00        50.00
           Mannings n           =       .013         .250

           Max.eff.Inten.(mm/hr)=      56.67        11.01
                      over (min)        2.00        14.00
           Storage Coeff.  (min)=       2.09 (ii)   13.75 (ii)
           Unit Hyd. Tpeak (min)=       2.00        14.00
           Unit Hyd. peak  (cms)=        .54          .08
                                                                *TOTALS*
           PEAK FLOW       (cms)=        .01          .01           .018 (iii)
           TIME TO PEAK    (hrs)=       1.33         1.55          1.333
           RUNOFF VOLUME    (mm)=      23.00         6.70          8.411
           TOTAL RAINFALL   (mm)=      25.01        25.01         25.005
           RUNOFF COEFFICIENT   =        .92          .27           .336

             (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
                 CN* =  84.0    Ia = Dep. Storage  (Above)
            (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
           (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

      ---------------------------------------------------------------------------------------------
      R0001:C00008-----------------------------------------------------------------------------
        ** END OF RUN :    0
```

```
 ******************************************************************************************




 --------------------
 | START            | Project  dir.:C:\Temp\15-319\PR\12-hour_SCS\
 -------------------- Rainfall dir.:C:\Temp\15-319\PR\12-hour_SCS\
     TZERO =   .00 hrs on        0
     METOUT=   2 (output = METRIC)
     NRUN  = 0002
     NSTORM=   1
            #  1=2SCS12.stm
 ------------------------------------------------------------------------------------------
 R0002:C00002------------------------------------------------------------------------------
 *#***************************************************************************
 *#  Project Name: [Mansfield Ski Club]    Project Number: [15-319]
 *#  Date        : 07-31-2017
 *#  Modeller    : [J. Lightheart]
 *#  Company     : WMI & Associates Ltd.
 *#  License #   :  2880720
 *#***************************************************************************
 *
 * Post-Development Condition - Mansfield Ski Club
 *
 ------------------------------------------------------------------------------------------
 R0002:C00002------------------------------------------------------------------------------
 --------------------
 | READ STORM       |  Filename: C:\Temp\15-319\PR\12-hour_SCS\2SCS12.stm
 | Ptotal=  44.40 mm|  Comments: 2-Year SCS Type-II Storm Distribution (12-hour) Mansfield,
 --------------------
       TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME
      hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm
       0:30    .888|   2:30   1.776|   4:30   2.664|   6:30   7.992|   8:30   1.776|  10:30
       1:00    .888|   3:00   1.776|   5:00   3.552|   7:00   3.552|   9:00   1.776|  11:00
       1:30    .888|   3:30   1.776|   5:30   5.328|   7:30   2.664|   9:30   1.776|  11:30
       2:00    .888|   4:00   1.776|   6:00  39.960|   8:00   2.664|  10:00    .888|  12:00

 ------------------------------------------------------------------------------------------
 R0002:C00003------------------------------------------------------------------------------
 * SITE (POST1 - Controlled Area)
 -------------------------
 | CALIB STANDHYD        |   Area    (ha)=    2.74
 | 01:POST1      DT= 1.00 |   Total Imp(%)=   69.00   Dir. Conn.(%)=   59.00
 -------------------------
                               IMPERVIOUS    PERVIOUS (i)
      Surface Area     (ha)=       1.89          .85
      Dep. Storage     (mm)=       2.00         5.00
      Average Slope     (%)=       3.50        33.30
      Length            (m)=     300.00         6.00
      Mannings n          =       .013         .250
```

```
      Max.eff.Inten.(mm/hr)=      39.96        34.36
                 over (min)        5.00         6.00
      Storage Coeff.  (min)=       4.89 (ii)    6.39 (ii)
      Unit Hyd. Tpeak (min)=       5.00         6.00
      Unit Hyd. peak  (cms)=        .23          .18
                                                            *TOTALS*
      PEAK FLOW       (cms)=        .18          .07           .252 (iii)
      TIME TO PEAK    (hrs)=       6.00         6.02          6.000
      RUNOFF VOLUME    (mm)=      42.40        21.37         33.779
      TOTAL RAINFALL   (mm)=      44.40        44.40         44.400
      RUNOFF COEFFICIENT   =        .95          .48           .761

        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN* =  84.0    Ia = Dep. Storage  (Above)
       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

 ------------------------------------------------------------------------------------------
 R0002:C00004------------------------------------------------------------------------------
 * EXTERNAL (Routed through SWM Facility)
 -------------------------
 | CALIB NASHYD          |   Area    (ha)=   11.940   Curve Number   (CN)= 83.00
 | 02:EXT       DT= 1.00 |   Ia      (mm)=    6.800   # of Linear Res.(N)=  3.00
 -------------------------   U.H. Tp(hrs)=     .240

      Unit Hyd Qpeak  (cms)=    1.900

      PEAK FLOW       (cms)=     .446 (i)
      TIME TO PEAK    (hrs)=    6.117
      DURATION        (hrs)=   13.667, (dddd|hh:mm:)=   0|13:40
      AVERAGE FLOW    (cms)=     .038
      RUNOFF VOLUME    (mm)=   15.774
      TOTAL RAINFALL   (mm)=   44.400
      RUNOFF COEFFICIENT   =     .355

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

 ------------------------------------------------------------------------------------------
 R0002:C00005------------------------------------------------------------------------------
 * TOTAL FLOW TO SIDEROAD 15 CROSS CULVERT (POST1 CONTROLLED + EXT)
 -----------------------
 | ADD HYD               |
 | 03:POST1+EXT          |   ID:NHYD           AREA     QPEAK    TPEAK      R.V.     DWF
 -----------------------                       (ha)     (cms)    (hrs)      (mm)   (cms)
                      ID 1 01:POST1          2.740      .252    6.000    33.779    .000
                     +ID 2 02:EXT           11.940      .446    6.117    15.774    .000
                     ==================================================================
                     SUM   03:POST1+EXT     14.680      .654    6.033    19.135    .000

    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

 ------------------------------------------------------------------------------------------
```

```
R0002:C00006---------------------------------------------------------------------------------
* SWM Facility
----------------------
|  ROUTE RESERVOIR -> |    Requested routing time step =  1.0 min.
|  IN>03:POST1+EXT    |
| OUT<04:SWM Facili   | ========================  OUTLFOW STORAGE TABLE  =================
----------------------- OUTFLOW   STORAGE| OUTFLOW   STORAGE| OUTFLOW   STORAGE| OUTFLOW
                          (cms)   (ha.m.)|   (cms)   (ha.m.)|   (cms)   (ha.m.)|   (cms)
                           .000 .0000E+00|    .010 .1292E-01|    .065 .4128E-01|   1.071 .
                           .002 .6300E-03|    .010 .1442E-01|    .108 .4430E-01|   1.184 .
                           .003 .1310E-02|    .010 .1601E-01|    .159 .4743E-01|   1.308 .
                           .004 .2050E-02|    .011 .1769E-01|    .217 .5067E-01|   1.445 .
                           .005 .2840E-02|    .011 .1946E-01|    .281 .5403E-01|   1.594 .
                           .006 .3680E-02|    .011 .2133E-01|    .351 .5751E-01|   1.759 .
                           .006 .4590E-02|    .012 .2329E-01|    .425 .6112E-01|   2.020 .
                           .007 .5570E-02|    .012 .2535E-01|    .505 .6486E-01|   2.383 .
                           .007 .6610E-02|    .012 .2777E-01|    .589 .6872E-01|   2.840 .
                           .008 .7720E-02|    .013 .3027E-01|    .677 .7272E-01|   3.391 .
                           .008 .8910E-02|    .013 .3287E-01|    .769 .7686E-01|   4.041 .
                           .009 .1017E-01|    .013 .3557E-01|    .866 .8113E-01|   4.792 .
                           .009 .1150E-01|    .032 .3837E-01|    .966 .8555E-01|   5.649 .

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     ----------------------      (ha)     (cms)     (hrs)       (mm)
     INFLOW > 03:POST1+EXT     14.680      .654     6.033     19.135
    OUTFLOW < 04:SWM Facili    14.680      .536     6.167     19.135

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=   81.905
                   TIME SHIFT OF PEAK FLOW         (min)=     8.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=.6630E-01

---------------------------------------------------------------------------------------------
R0002:C00007---------------------------------------------------------------------------------
* SITE (POST2 - Uncontrolled Area)
--------------------------
| CALIB STANDHYD         |   Area    (ha)=     .89
| 05:POST2      DT= 1.00 |   Total Imp(%)=   21.00   Dir. Conn.(%)=   10.50
--------------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .19          .70
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       6.00        11.10
     Length            (m)=     120.00        50.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      39.96        26.09
                over (min)       2.00        11.00
     Storage Coeff.  (min)=       2.40 (ii)   10.66 (ii)
     Unit Hyd. Tpeak (min)=       2.00        11.00
     Unit Hyd. peak  (cms)=        .50          .11
                                                            *TOTALS*
     PEAK FLOW       (cms)=        .01          .04           .050 (iii)
     TIME TO PEAK    (hrs)=       5.77         6.05          6.000
```

```
     RUNOFF VOLUME    (mm)=      42.40        19.34         21.758
     TOTAL RAINFALL   (mm)=      44.40        44.40         44.400
     RUNOFF COEFFICIENT   =        .95          .44           .490

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  84.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

---------------------------------------------------------------------------------------------
R0002:C00008---------------------------------------------------------------------------------
---------------------------------------------------------------------------------------------
R0002:C00002---------------------------------------------------------------------------------
  ** END OF RUN :    1

*********************************************************************************************





--------------------
| START           | Project  dir.:C:\Temp\15-319\PR\12-hour_SCS\
-------------------- Rainfall dir.:C:\Temp\15-319\PR\12-hour_SCS\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 0003
    NSTORM=   1
           #  1=5SCS12.stm
---------------------------------------------------------------------------------------------
R0003:C00002---------------------------------------------------------------------------------
*#****************************************************************************
*#  Project Name: [Mansfield Ski Club]    Project Number: [15-319]
*#  Date        : 07-31-2017
*#  Modeller    : [J. Lightheart]
*#  Company     : WMI & Associates Ltd.
*#  License #   :  2880720
*#****************************************************************************
*
* Post-Development Condition - Mansfield Ski Club
*
---------------------------------------------------------------------------------------------
R0003:C00002---------------------------------------------------------------------------------
--------------------
| READ STORM       |  Filename: C:\Temp\15-319\PR\12-hour_SCS\5SCS12.stm
| Ptotal=  58.50 mm|  Comments: 5-Year SCS Type-II Storm Distribution (12-hour) Mansfield,
--------------------
      TIME    RAIN|  TIME    RAIN|  TIME    RAIN|  TIME    RAIN|  TIME    RAIN|  TIME
     hh:mm   mm/hr| hh:mm   mm/hr| hh:mm   mm/hr| hh:mm   mm/hr| hh:mm   mm/hr| hh:mm
      0:30   1.170|  2:30   2.340|  4:30   3.510|  6:30  10.530|  8:30   2.340| 10:30
      1:00   1.170|  3:00   2.340|  5:00   4.680|  7:00   4.680|  9:00   2.340| 11:00
      1:30   1.170|  3:30   2.340|  5:30   7.020|  7:30   3.510|  9:30   2.340| 11:30
      2:00   1.170|  4:00   2.340|  6:00  52.650|  8:00   3.510| 10:00   1.170| 12:00
```

```
-------------------------------------------------------------------------------------------
R0003:C00003-------------------------------------------------------------------------------
* SITE (POST1 - Controlled Area)
--------------------------
| CALIB STANDHYD         |   Area    (ha)=    2.74
| 01:POST1      DT= 1.00 |   Total Imp(%)=   69.00   Dir. Conn.(%)=   59.00
--------------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.89          .85
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       3.50        33.30
     Length            (m)=     300.00         6.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      52.65        51.19
                over (min)        4.00         6.00
     Storage Coeff.  (min)=       4.38 (ii)    5.65 (ii)
     Unit Hyd. Tpeak (min)=       4.00         6.00
     Unit Hyd. peak  (cms)=        .27          .20
                                                           *TOTALS*
     PEAK FLOW       (cms)=        .24          .11           .349 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.00          6.000
     RUNOFF VOLUME    (mm)=      56.50        32.80         46.781
     TOTAL RAINFALL   (mm)=      58.50        58.50         58.500
     RUNOFF COEFFICIENT   =        .97          .56           .800

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  84.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------------------
R0003:C00004-------------------------------------------------------------------------------
* EXTERNAL (Routed through SWM Facility)
--------------------------
| CALIB NASHYD           |   Area    (ha)=   11.940   Curve Number   (CN)= 83.00
| 02:EXT        DT= 1.00 |   Ia      (mm)=    6.800   # of Linear Res.(N)=  3.00
--------------------------   U.H. Tp(hrs)=     .240

     Unit Hyd Qpeak  (cms)=    1.900

     PEAK FLOW       (cms)=     .742 (i)
     TIME TO PEAK    (hrs)=    6.100
     DURATION        (hrs)=   13.667, (dddd|hh:mm:)=   0|13:40
     AVERAGE FLOW    (cms)=     .063
     RUNOFF VOLUME    (mm)=   25.769
     TOTAL RAINFALL   (mm)=   58.500
     RUNOFF COEFFICIENT   =     .440

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

-------------------------------------------------------------------------------------------
```

```
R0003:C00005-------------------------------------------------------------------------------
* TOTAL FLOW TO SIDEROAD 15 CROSS CULVERT (POST1 CONTROLLED + EXT)
------------------------
| ADD HYD                |
| 03:POST1+EXT           |   ID:NHYD            AREA     QPEAK    TPEAK      R.V.     DWF
------------------------                        (ha)     (cms)    (hrs)      (mm)   (cms)
                      ID 1 01:POST1          2.740      .349    6.000    46.781    .000
                     +ID 2 02:EXT           11.940      .742    6.100    25.769    .000
                     ==============================================================
                     SUM   03:POST1+EXT     14.680     1.026    6.033    29.691    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------------------
R0003:C00006-------------------------------------------------------------------------------
* SWM Facility
-----------------------
|  ROUTE RESERVOIR -> |    Requested routing time step =  1.0 min.
|  IN>03:POST1+EXT    |
| OUT<04:SWM Facili   | =========================  OUTLFOW STORAGE TABLE  =================
----------------------- OUTFLOW   STORAGE| OUTFLOW   STORAGE| OUTFLOW   STORAGE| OUTFLOW
                          (cms)   (ha.m.)|   (cms)   (ha.m.)|   (cms)   (ha.m.)|   (cms)
                           .000 .0000E+00|    .010 .1292E-01|    .065 .4128E-01|   1.071 .
                           .002 .6300E-03|    .010 .1442E-01|    .108 .4430E-01|   1.184 .
                           .003 .1310E-02|    .010 .1601E-01|    .159 .4743E-01|   1.308 .
                           .004 .2050E-02|    .011 .1769E-01|    .217 .5067E-01|   1.445 .
                           .005 .2840E-02|    .011 .1946E-01|    .281 .5403E-01|   1.594 .
                           .006 .3680E-02|    .011 .2133E-01|    .351 .5751E-01|   1.759 .
                           .006 .4590E-02|    .012 .2329E-01|    .425 .6112E-01|   2.020 .
                           .007 .5570E-02|    .012 .2535E-01|    .505 .6486E-01|   2.383 .
                           .007 .6610E-02|    .012 .2777E-01|    .589 .6872E-01|   2.840 .
                           .008 .7720E-02|    .013 .3027E-01|    .677 .7272E-01|   3.391 .
                           .008 .8910E-02|    .013 .3287E-01|    .769 .7686E-01|   4.041 .
                           .009 .1017E-01|    .013 .3557E-01|    .866 .8113E-01|   4.792 .
                           .009 .1150E-01|    .032 .3837E-01|    .966 .8555E-01|   5.649 .

     ROUTING RESULTS             AREA     QPEAK     TPEAK       R.V.
     ----------------------      (ha)     (cms)     (hrs)       (mm)
     INFLOW > 03:POST1+EXT     14.680     1.026     6.033     29.691
    OUTFLOW < 04:SWM Facili    14.680      .892     6.133     29.691

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=   86.998
                   TIME SHIFT OF PEAK FLOW         (min)=     6.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=.8232E-01

-------------------------------------------------------------------------------------------
R0003:C00007-------------------------------------------------------------------------------
* SITE (POST2 - Uncontrolled Area)
--------------------------
| CALIB STANDHYD         |   Area    (ha)=     .89
| 05:POST2      DT= 1.00 |   Total Imp(%)=   21.00   Dir. Conn.(%)=   10.50
--------------------------
                              IMPERVIOUS    PERVIOUS (i)
```

```
     Surface Area     (ha)=        .19          .70
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       6.00        11.10
     Length            (m)=     120.00        50.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      52.65        40.41
                over (min)        2.00         9.00
     Storage Coeff.  (min)=       2.15 (ii)    9.09 (ii)
     Unit Hyd. Tpeak (min)=       2.00         9.00
     Unit Hyd. peak  (cms)=        .53          .13
                                                           *TOTALS*
     PEAK FLOW       (cms)=        .01          .07           .080 (iii)
     TIME TO PEAK    (hrs)=       5.75         6.03          6.000
     RUNOFF VOLUME    (mm)=      56.50        30.22         32.982
     TOTAL RAINFALL   (mm)=      58.50        58.50         58.500
     RUNOFF COEFFICIENT   =        .97          .52           .564

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  84.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------------------
R0003:C00008-------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------
R0003:C00002-------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------
R0003:C00002-------------------------------------------------------------------------------
  ** END OF RUN :    2

*******************************************************************************************





--------------------
| START           | Project  dir.:C:\Temp\15-319\PR\12-hour_SCS\
-------------------- Rainfall dir.:C:\Temp\15-319\PR\12-hour_SCS\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 0004
    NSTORM=   1
           #  1=25SCS12.stm
-------------------------------------------------------------------------------------------
R0004:C00002-------------------------------------------------------------------------------
*#******************************************************************************
*#  Project Name: [Mansfield Ski Club]    Project Number: [15-319]
*#  Date        : 07-31-2017
*#  Modeller    : [J. Lightheart]
*#  Company     : WMI & Associates Ltd.
*#  License #   :  2880720
```

```
*#******************************************************************************
*
* Post-Development Condition - Mansfield Ski Club
*
-------------------------------------------------------------------------------------------
R0004:C00002-------------------------------------------------------------------------------
--------------------
| READ STORM       |  Filename: C:\Temp\15-319\PR\12-hour_SCS\25SCS12.stm
| Ptotal=  79.90 mm|  Comments: 25-Year SCS Type-II Storm Distribution (12-hour) Mansfield,
--------------------
      TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME
     hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm
      0:30   1.598|   2:30   3.196|   4:30   4.794|   6:30  14.382|   8:30   3.196|  10:30
      1:00   1.598|   3:00   3.196|   5:00   6.392|   7:00   6.392|   9:00   3.196|  11:00
      1:30   1.598|   3:30   3.196|   5:30   9.588|   7:30   4.794|   9:30   3.196|  11:30
      2:00   1.598|   4:00   3.196|   6:00  71.910|   8:00   4.794|  10:00   1.598|  12:00

-------------------------------------------------------------------------------------------
R0004:C00003-------------------------------------------------------------------------------
* SITE (POST1 - Controlled Area)
--------------------------
| CALIB STANDHYD         |   Area    (ha)=    2.74
| 01:POST1      DT= 1.00 |   Total Imp(%)=   69.00   Dir. Conn.(%)=   59.00
--------------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.89          .85
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       3.50        33.30
     Length            (m)=     300.00         6.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      71.91        77.77
                over (min)        4.00         5.00
     Storage Coeff.  (min)=       3.87 (ii)    4.95 (ii)
     Unit Hyd. Tpeak (min)=       4.00         5.00
     Unit Hyd. peak  (cms)=        .29          .23
                                                           *TOTALS*
     PEAK FLOW       (cms)=        .32          .18           .499 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.00          6.000
     RUNOFF VOLUME    (mm)=      77.90        51.41         67.040
     TOTAL RAINFALL   (mm)=      79.90        79.90         79.900
     RUNOFF COEFFICIENT   =        .97          .64           .839

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  84.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------------------
R0004:C00004-------------------------------------------------------------------------------
* EXTERNAL (Routed through SWM Facility)
--------------------------
| CALIB NASHYD           |   Area    (ha)=   11.940   Curve Number   (CN)= 83.00
```

```
| 02:EXT        DT= 1.00 |   Ia      (mm)=    6.800   # of Linear Res.(N)=  3.00
-------------------------   U.H. Tp(hrs)=     .240

     Unit Hyd Qpeak  (cms)=    1.900

     PEAK FLOW       (cms)=    1.241 (i)
     TIME TO PEAK    (hrs)=    6.100
     DURATION        (hrs)=   13.667, (dddd|hh:mm:)=   0|13:40
     AVERAGE FLOW    (cms)=     .104
     RUNOFF VOLUME    (mm)=   42.707
     TOTAL RAINFALL   (mm)=   79.900
     RUNOFF COEFFICIENT   =     .535

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

-------------------------------------------------------------------------------------------
R0004:C00005-------------------------------------------------------------------------------
* TOTAL FLOW TO SIDEROAD 15 CROSS CULVERT (POST1 CONTROLLED + EXT)
------------------------
| ADD HYD               |
| 03:POST1+EXT          |   ID:NHYD            AREA     QPEAK    TPEAK      R.V.     DWF
------------------------                       (ha)     (cms)    (hrs)      (mm)   (cms)
                      ID 1 01:POST1          2.740      .499    6.000    67.040    .000
                     +ID 2 02:EXT           11.940     1.241    6.100    42.707    .000
                     ===============================================================
                     SUM   03:POST1+EXT     14.680     1.647    6.033    47.248    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------------------
R0004:C00006-------------------------------------------------------------------------------
* SWM Facility
----------------------
|  ROUTE RESERVOIR -> |    Requested routing time step =  1.0 min.
|  IN>03:POST1+EXT    |
| OUT<04:SWM Facili   | ========================  OUTLFOW STORAGE TABLE  ================
----------------------- OUTFLOW   STORAGE| OUTFLOW   STORAGE| OUTFLOW   STORAGE| OUTFLOW
                          (cms)   (ha.m.)|   (cms)   (ha.m.)|   (cms)   (ha.m.)|   (cms)
                           .000 .0000E+00|    .010 .1292E-01|    .065 .4128E-01|   1.071 .
                           .002 .6300E-03|    .010 .1442E-01|    .108 .4430E-01|   1.184 .
                           .003 .1310E-02|    .010 .1601E-01|    .159 .4743E-01|   1.308 .
                           .004 .2050E-02|    .011 .1769E-01|    .217 .5067E-01|   1.445 .
                           .005 .2840E-02|    .011 .1946E-01|    .281 .5403E-01|   1.594 .
                           .006 .3680E-02|    .011 .2133E-01|    .351 .5751E-01|   1.759 .
                           .006 .4590E-02|    .012 .2329E-01|    .425 .6112E-01|   2.020 .
                           .007 .5570E-02|    .012 .2535E-01|    .505 .6486E-01|   2.383 .
                           .007 .6610E-02|    .012 .2777E-01|    .589 .6872E-01|   2.840 .
                           .008 .7720E-02|    .013 .3027E-01|    .677 .7272E-01|   3.391 .
                           .008 .8910E-02|    .013 .3287E-01|    .769 .7686E-01|   4.041 .
                           .009 .1017E-01|    .013 .3557E-01|    .866 .8113E-01|   4.792 .
                           .009 .1150E-01|    .032 .3837E-01|    .966 .8555E-01|   5.649 .

     ROUTING RESULTS             AREA     QPEAK     TPEAK       R.V.
```

```
     ----------------------      (ha)     (cms)     (hrs)       (mm)
     INFLOW > 03:POST1+EXT     14.680     1.647     6.033     47.248
    OUTFLOW < 04:SWM Facili    14.680     1.483     6.100     47.248

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=   90.036
                   TIME SHIFT OF PEAK FLOW         (min)=     4.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=.1061E+00

-------------------------------------------------------------------------------------------
R0004:C00007-------------------------------------------------------------------------------
* SITE (POST2 - Uncontrolled Area)
--------------------------
| CALIB STANDHYD         |   Area    (ha)=     .89
| 05:POST2      DT= 1.00 |   Total Imp(%)=   21.00   Dir. Conn.(%)=   10.50
--------------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .19          .70
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       6.00        11.10
     Length            (m)=     120.00        50.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      71.91        62.84
                over (min)       2.00         8.00
     Storage Coeff.  (min)=       1.90 (ii)    7.71 (ii)
     Unit Hyd. Tpeak (min)=       2.00         8.00
     Unit Hyd. peak  (cms)=        .58          .15
                                                           *TOTALS*
     PEAK FLOW       (cms)=        .02          .11           .129 (iii)
     TIME TO PEAK    (hrs)=       5.75         6.02          6.000
     RUNOFF VOLUME    (mm)=      77.90        48.21         51.330
     TOTAL RAINFALL   (mm)=      79.90        79.90         79.900
     RUNOFF COEFFICIENT   =        .97          .60           .642

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  84.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------------------
R0004:C00008-------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------
R0004:C00002-------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------
R0004:C00002-------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------
R0004:C00002-------------------------------------------------------------------------------
  ** END OF RUN :    3

*******************************************************************************************
```

```
--------------------
| START            | Project  dir.:C:\Temp\15-319\PR\12-hour_SCS\
-------------------- Rainfall dir.:C:\Temp\15-319\PR\12-hour_SCS\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 0005
    NSTORM=   1
           #  1=100SCS12.stm
-------------------------------------------------------------------------------------------
R0005:C00002-------------------------------------------------------------------------------
*#*****************************************************************************
*#  Project Name: [Mansfield Ski Club]    Project Number: [15-319]
*#  Date        : 07-31-2017
*#  Modeller    : [J. Lightheart]
*#  Company     : WMI & Associates Ltd.
*#  License #   :  2880720
*#*****************************************************************************
*
* Post-Development Condition - Mansfield Ski Club
*
-------------------------------------------------------------------------------------------
R0005:C00002-------------------------------------------------------------------------------
--------------------
| READ STORM       |  Filename: C:\Temp\15-319\PR\12-hour_SCS\100SCS12.stm
| Ptotal=  97.40 mm|  Comments: 100-Year SCS Type-II Storm Distribution (12-hour)
--------------------
      TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME
     hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm
      0:30   1.948|   2:30   3.896|   4:30   5.844|   6:30  17.532|   8:30   3.896|  10:30
      1:00   1.948|   3:00   3.896|   5:00   7.792|   7:00   7.792|   9:00   3.896|  11:00
      1:30   1.948|   3:30   3.896|   5:30  11.688|   7:30   5.844|   9:30   3.896|  11:30
      2:00   1.948|   4:00   3.896|   6:00  87.660|   8:00   5.844|  10:00   1.948|  12:00

-------------------------------------------------------------------------------------------
R0005:C00003-------------------------------------------------------------------------------
* SITE (POST1 - Controlled Area)
--------------------------
| CALIB STANDHYD         |   Area    (ha)=    2.74
| 01:POST1      DT= 1.00 |   Total Imp(%)=   69.00   Dir. Conn.(%)=   59.00
--------------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.89          .85
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       3.50        33.30
     Length            (m)=     300.00         6.00
     Mannings n          =       .013         .250

     Max.eff.Inten.(mm/hr)=      87.66        99.54
                over (min)       4.00         5.00
     Storage Coeff.  (min)=       3.57 (ii)    4.55 (ii)
     Unit Hyd. Tpeak (min)=       4.00         5.00
```

```
     Unit Hyd. peak  (cms)=        .30          .24
                                                           *TOTALS*
     PEAK FLOW       (cms)=        .39          .23           .622 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.00          6.000
     RUNOFF VOLUME    (mm)=      95.40        67.32         83.886
     TOTAL RAINFALL   (mm)=      97.40        97.40         97.400
     RUNOFF COEFFICIENT   =        .98          .69           .861

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  84.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------------------
R0005:C00004-------------------------------------------------------------------------------
* EXTERNAL (Routed through SWM Facility)
--------------------------
| CALIB NASHYD           |   Area    (ha)=   11.940   Curve Number   (CN)= 83.00
| 02:EXT        DT= 1.00 |   Ia      (mm)=    6.800   # of Linear Res.(N)=  3.00
--------------------------   U.H. Tp(hrs)=     .240

     Unit Hyd Qpeak  (cms)=    1.900

     PEAK FLOW       (cms)=    1.674 (i)
     TIME TO PEAK    (hrs)=    6.083
     DURATION        (hrs)=   13.667, (dddd|hh:mm:)=   0|13:40
     AVERAGE FLOW    (cms)=     .140
     RUNOFF VOLUME    (mm)=   57.552
     TOTAL RAINFALL   (mm)=   97.400
     RUNOFF COEFFICIENT   =     .591

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

-------------------------------------------------------------------------------------------
R0005:C00005-------------------------------------------------------------------------------
* TOTAL FLOW TO SIDEROAD 15 CROSS CULVERT (POST1 CONTROLLED + EXT)
-----------------------
| ADD HYD              |
| 03:POST1+EXT         |   ID:NHYD            AREA     QPEAK    TPEAK      R.V.     DWF
-----------------------                        (ha)     (cms)    (hrs)      (mm)   (cms)
                      ID 1 01:POST1          2.740      .622    6.000    83.886    .000
                     +ID 2 02:EXT           11.940     1.674    6.083    57.552    .000
                     ==================================================================
                     SUM   03:POST1+EXT     14.680     2.184    6.033    62.467    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------------------
R0005:C00006-------------------------------------------------------------------------------
* SWM Facility
-----------------------
|  ROUTE RESERVOIR -> |    Requested routing time step =  1.0 min.
|  IN>03:POST1+EXT    |
```

```
| OUT<04:SWM Facili   | =========================  OUTLFOW STORAGE TABLE  =================
----------------------- OUTFLOW   STORAGE| OUTFLOW   STORAGE| OUTFLOW   STORAGE| OUTFLOW
                          (cms)   (ha.m.)|   (cms)   (ha.m.)|   (cms)   (ha.m.)|   (cms)
                           .000 .0000E+00|    .010 .1292E-01|    .065 .4128E-01|   1.071 .
                           .002 .6300E-03|    .010 .1442E-01|    .108 .4430E-01|   1.184 .
                           .003 .1310E-02|    .010 .1601E-01|    .159 .4743E-01|   1.308 .
                           .004 .2050E-02|    .011 .1769E-01|    .217 .5067E-01|   1.445 .
                           .005 .2840E-02|    .011 .1946E-01|    .281 .5403E-01|   1.594 .
                           .006 .3680E-02|    .011 .2133E-01|    .351 .5751E-01|   1.759 .
                           .006 .4590E-02|    .012 .2329E-01|    .425 .6112E-01|   2.020 .
                           .007 .5570E-02|    .012 .2535E-01|    .505 .6486E-01|   2.383 .
                           .007 .6610E-02|    .012 .2777E-01|    .589 .6872E-01|   2.840 .
                           .008 .7720E-02|    .013 .3027E-01|    .677 .7272E-01|   3.391 .
                           .008 .8910E-02|    .013 .3287E-01|    .769 .7686E-01|   4.041 .
                           .009 .1017E-01|    .013 .3557E-01|    .866 .8113E-01|   4.792 .
                           .009 .1150E-01|    .032 .3837E-01|    .966 .8555E-01|   5.649 .

     ROUTING RESULTS             AREA     QPEAK     TPEAK       R.V.
     ----------------------      (ha)     (cms)     (hrs)       (mm)
     INFLOW > 03:POST1+EXT     14.680     2.184     6.033     62.467
    OUTFLOW < 04:SWM Facili    14.680     2.036     6.083     62.467

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=   93.234
                   TIME SHIFT OF PEAK FLOW         (min)=     3.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=.1218E+00

-------------------------------------------------------------------------------------------
R0005:C00007-------------------------------------------------------------------------------
* SITE (POST2 - Uncontrolled Area)
--------------------------
| CALIB STANDHYD         |   Area    (ha)=     .89
| 05:POST2      DT= 1.00 |   Total Imp(%)=   21.00   Dir. Conn.(%)=   10.50
--------------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .19          .70
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       6.00        11.10
     Length            (m)=     120.00        50.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      87.66        81.64
                over (min)        2.00         7.00
     Storage Coeff.  (min)=       1.76 (ii)    6.99 (ii)
     Unit Hyd. Tpeak (min)=       2.00         7.00
     Unit Hyd. peak  (cms)=        .61          .16
                                                           *TOTALS*
     PEAK FLOW       (cms)=        .02          .15           .171 (iii)
     TIME TO PEAK    (hrs)=       5.85         6.00          6.000
     RUNOFF VOLUME    (mm)=      95.40        63.72         67.048
     TOTAL RAINFALL   (mm)=      97.40        97.40         97.400
     RUNOFF COEFFICIENT   =        .98          .65           .688

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
```

```
           CN* =  84.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------------------
R0005:C00008-------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------
R0005:C00002-------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------
R0005:C00002-------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------
R0005:C00002-------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------
R0005:C00002-------------------------------------------------------------------------------
  ** END OF RUN :    4

*******************************************************************************************




--------------------
| START            | Project  dir.:C:\Temp\15-319\PR\12-hour_SCS\
-------------------- Rainfall dir.:C:\Temp\15-319\PR\12-hour_SCS\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 0006
    NSTORM=   1
           #  1=12regtim.o89
-------------------------------------------------------------------------------------------
R0006:C00002-------------------------------------------------------------------------------
*#*****************************************************************************
*#  Project Name: [Mansfield Ski Club]    Project Number: [15-319]
*#  Date        : 07-31-2017
*#  Modeller    : [J. Lightheart]
*#  Company     : WMI & Associates Ltd.
*#  License #   :  2880720
*#*****************************************************************************
*
* Post-Development Condition - Mansfield Ski Club
*
-------------------------------------------------------------------------------------------
R0006:C00002-------------------------------------------------------------------------------
--------------------
| READ STORM       |  Filename: C:\Temp\15-319\PR\12-hour_SCS\12regtim.o89
| Ptotal= 193.00 mm|  Comments: TIMMINS REGIONAL STORM (12-hour)
--------------------
      TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME
     hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm
      1:00  15.000|   3:00  10.000|   5:00   5.000|   7:00  43.000|   9:00  23.000|  11:00
      2:00  20.000|   4:00   3.000|   6:00  20.000|   8:00  20.000|  10:00  13.000|  12:00
```

```
-------------------------------------------------------------------------------------------
R0006:C00003-------------------------------------------------------------------------------
* SITE (POST1 - Controlled Area)
--------------------------
| CALIB STANDHYD         |   Area    (ha)=    2.74
| 01:POST1      DT= 1.00 |   Total Imp(%)=   69.00   Dir. Conn.(%)=   59.00
--------------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.89          .85
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       3.50        33.30
     Length            (m)=     300.00         6.00
     Mannings n          =       .013         .250

     Max.eff.Inten.(mm/hr)=      43.00        53.33
                over (min)        5.00         6.00
     Storage Coeff.  (min)=       4.75 (ii)    6.00 (ii)
     Unit Hyd. Tpeak (min)=       5.00         6.00
     Unit Hyd. peak  (cms)=        .23          .19
                                                       *TOTALS*
     PEAK FLOW       (cms)=        .19          .13           .318 (iii)
     TIME TO PEAK    (hrs)=       7.00         7.00          7.000
     RUNOFF VOLUME    (mm)=     190.99       158.56        177.702
     TOTAL RAINFALL   (mm)=     193.00       193.00        193.000
     RUNOFF COEFFICIENT   =        .99          .82           .921

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  84.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------------------
R0006:C00004-------------------------------------------------------------------------------
* EXTERNAL (Routed through SWM Facility)
--------------------------
| CALIB NASHYD           |   Area    (ha)=   11.940   Curve Number   (CN)= 83.00
| 02:EXT        DT= 1.00 |   Ia      (mm)=    6.800   # of Linear Res.(N)=  3.00
--------------------------   U.H. Tp(hrs)=     .240

     Unit Hyd Qpeak  (cms)=    1.900

     PEAK FLOW       (cms)=    1.239 (i)
     TIME TO PEAK    (hrs)=    7.017
     DURATION        (hrs)=   13.667, (dddd|hh:mm:)=   0|13:40
     AVERAGE FLOW    (cms)=     .353
     RUNOFF VOLUME    (mm)=  145.537
     TOTAL RAINFALL   (mm)=  193.000
     RUNOFF COEFFICIENT   =     .754

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

-------------------------------------------------------------------------------------------
R0006:C00005-------------------------------------------------------------------------------
```

```
* TOTAL FLOW TO SIDEROAD 15 CROSS CULVERT (POST1 CONTROLLED + EXT)
------------------------
| ADD HYD               |
| 03:POST1+EXT          |   ID:NHYD            AREA     QPEAK    TPEAK      R.V.     DWF
------------------------                       (ha)     (cms)    (hrs)      (mm)   (cms)
                      ID 1 01:POST1          2.740      .318    7.000   177.702    .000
                     +ID 2 02:EXT           11.940     1.239    7.017   145.537    .000
                     ===============================================================
                     SUM   03:POST1+EXT     14.680     1.556    7.000   151.541    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------------------
R0006:C00006-------------------------------------------------------------------------------
* SWM Facility
-----------------------
|  ROUTE RESERVOIR -> |    Requested routing time step =  1.0 min.
|  IN>03:POST1+EXT    |
| OUT<04:SWM Facili   | =========================  OUTLFOW STORAGE TABLE  =================
----------------------- OUTFLOW   STORAGE| OUTFLOW   STORAGE| OUTFLOW   STORAGE| OUTFLOW
                          (cms)   (ha.m.)|   (cms)   (ha.m.)|   (cms)   (ha.m.)|   (cms)
                           .000 .0000E+00|    .010 .1292E-01|    .065 .4128E-01|   1.071 .
                           .002 .6300E-03|    .010 .1442E-01|    .108 .4430E-01|   1.184 .
                           .003 .1310E-02|    .010 .1601E-01|    .159 .4743E-01|   1.308 .
                           .004 .2050E-02|    .011 .1769E-01|    .217 .5067E-01|   1.445 .
                           .005 .2840E-02|    .011 .1946E-01|    .281 .5403E-01|   1.594 .
                           .006 .3680E-02|    .011 .2133E-01|    .351 .5751E-01|   1.759 .
                           .006 .4590E-02|    .012 .2329E-01|    .425 .6112E-01|   2.020 .
                           .007 .5570E-02|    .012 .2535E-01|    .505 .6486E-01|   2.383 .
                           .007 .6610E-02|    .012 .2777E-01|    .589 .6872E-01|   2.840 .
                           .008 .7720E-02|    .013 .3027E-01|    .677 .7272E-01|   3.391 .
                           .008 .8910E-02|    .013 .3287E-01|    .769 .7686E-01|   4.041 .
                           .009 .1017E-01|    .013 .3557E-01|    .866 .8113E-01|   4.792 .
                           .009 .1150E-01|    .032 .3837E-01|    .966 .8555E-01|   5.649 .

     ROUTING RESULTS             AREA     QPEAK     TPEAK       R.V.
     ----------------------      (ha)     (cms)     (hrs)       (mm)
     INFLOW > 03:POST1+EXT     14.680     1.556     7.000    151.541
    OUTFLOW < 04:SWM Facili    14.680     1.540     7.033    151.540

                    PEAK   FLOW   REDUCTION [Qout/Qin](%)=   98.975
                    TIME SHIFT OF PEAK FLOW         (min)=     2.00
                    MAXIMUM  STORAGE   USED       (ha.m.)=.1080E+00

-------------------------------------------------------------------------------------------
R0006:C00007-------------------------------------------------------------------------------
* SITE (POST2 - Uncontrolled Area)
--------------------------
| CALIB STANDHYD         |   Area    (ha)=     .89
| 05:POST2      DT= 1.00 |   Total Imp(%)=   21.00   Dir. Conn.(%)=   10.50
--------------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .19          .70
```

```
          Dep. Storage     (mm)=       2.00         5.00
          Average Slope     (%)=       6.00        11.10
          Length            (m)=     120.00        50.00
          Mannings n          =       .013         .250

          Max.eff.Inten.(mm/hr)=      43.00        44.82
                     over (min)       2.00         9.00
          Storage Coeff.  (min)=       2.33 (ii)    8.99 (ii)
          Unit Hyd. Tpeak (min)=       2.00         9.00
          Unit Hyd. peak  (cms)=        .50          .13
                                                                *TOTALS*
          PEAK FLOW       (cms)=        .01          .09           .098 (iii)
          TIME TO PEAK    (hrs)=       6.98         7.00          7.000
          RUNOFF VOLUME    (mm)=     191.00       153.77        157.677
          TOTAL RAINFALL   (mm)=     193.00       193.00        193.000
          RUNOFF COEFFICIENT   =        .99          .80           .817

            (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
                CN* =  84.0    Ia = Dep. Storage  (Above)
           (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
          (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

     -------------------------------------------------------------------------------------------
     R0006:C00008------------------------------------------------------------------------------
     -------------------------------------------------------------------------------------------
     R0006:C00002------------------------------------------------------------------------------
     -------------------------------------------------------------------------------------------
     R0006:C00002------------------------------------------------------------------------------
     -------------------------------------------------------------------------------------------
     R0006:C00002------------------------------------------------------------------------------
     -------------------------------------------------------------------------------------------
     R0006:C00002------------------------------------------------------------------------------
     -------------------------------------------------------------------------------------------
     R0006:C00002------------------------------------------------------------------------------
     --------------------
     | FINISH           |
     --------------------
     -------------------------------------------------------------------------------------------
     *******************************************************************************************
          WARNINGS / ERRORS / NOTES
          -------------------------
        Simulation ended on 2020-12-09     at 16:07:01
     ===========================================================================================
```

Post-Development Condition
6-hour SCS Type-II Storm Distribution

```
2     Metric units
*#******************************************************************************
*#  Project Name: [Mansfield Ski Club]    Project Number: [15-319]
*#  Date        : 07-31-2017
*#  Modeller    : [J. Lightheart]
*#  Company     : WMI & Associates Ltd.
*#  License #   :  2880720
*#******************************************************************************
*
* Post-Development Condition - Mansfield Ski Club
*
*% 25mm Chicago Storm Dist. based on Mansfield, ON. rainfall (4-hr)
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[1]
*%                   ["25mm4hr.stm"] <--storm filename
*%-----------------|-----------------------------------------------------------|
READ STORM          STORM_FILENAME=["STORM.001"]
*%-----------------|-----------------------------------------------------------|
* SITE (POST1 - Controlled Area)
CALIB STANDHYD      ID=[1], NHYD=["POST1"], DT=[1](min), AREA=[2.74](ha),
                    XIMP=[0.59], TIMP=[0.69], DWF=[0](cms), LOSS=[2],
                    SCS curve number CN=[84],
                    Pervious   surfaces: IAper=[5.0](mm), SLPP=[33.3](%),
                                         LGP=[6](m), MNP=[0.25], SCP=[0](min),
                    Impervious surfaces: IAimp=[2.0](mm), SLPI=[3.5](%),
                                         LGI=[300](m), MNI=[0.013], SCI=[0](min),
                    RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
*%-----------------|-----------------------------------------------------------|
* EXTERNAL (Routed through SWM Facility)
CALIB NASHYD        ID=[2], NHYD=["EXT"], DT=[1]min, AREA=[11.94](ha),
                    DWF=[0](cms),  CN/C=[83], IA=[6.8](mm),
                    N=[3], TP=[0.24]hrs,
                    RAINFALL=[ ,  ,  ,  , ](mm/hr),  END=-1
*%-----------------|-----------------------------------------------------------|
* TOTAL FLOW TO SIDEROAD 15 CROSS CULVERT (POST1 CONTROLLED + EXT)
ADD HYD             IDsum=[3], NHYD=["POST1+EXT"], IDs to add=[1+2]
*%-----------------|-----------------------------------------------------------|
* SWM Facility
ROUTE RESERVOIR     IDout=[4], NHYD=["SWM Facility"], IDin=[3], RDT=[1](min),
                         TABLE of ( OUTFLOW-STORAGE ) values
                                   (cms) - (ha-m)
                                 [0.0000 , 0.00000]
                                 [0.0015 , 0.00063]
                                 [0.0031 , 0.00131]
                                 [0.0041 , 0.00205]
                                 [0.0050 , 0.00284]
                                 [0.0057 , 0.00368]
                                 [0.0063 , 0.00459]
                                 [0.0069 , 0.00557]
                                 [0.0074 , 0.00661]
                                 [0.0079 , 0.00772]
                                 [0.0084 , 0.00891]
                                 [0.0088 , 0.01017]
                                 [0.0092 , 0.01150]
```

```
                                 [0.0096 , 0.01292]
                                 [0.0100 , 0.01442]
                                 [0.0104 , 0.01601]
                                 [0.0108 , 0.01769]
                                 [0.0111 , 0.01946]
                                 [0.0114 , 0.02133]
                                 [0.0118 , 0.02329]
                                 [0.0121 , 0.02535]
                                 [0.0124 , 0.02777]
                                 [0.0127 , 0.03027]
                                 [0.0130 , 0.03287]
                                 [0.0133 , 0.03557]
                                 [0.0317 , 0.03837]
                                 [0.0651 , 0.04128]
                                 [0.1082 , 0.04430]
                                 [0.1593 , 0.04743]
                                 [0.2172 , 0.05067]
                                 [0.2811 , 0.05403]
                                 [0.3506 , 0.05751]
                                 [0.4252 , 0.06112]
                                 [0.5047 , 0.06486]
                                 [0.5887 , 0.06872]
                                 [0.6769 , 0.07272]
                                 [0.7693 , 0.07686]
                                 [0.8656 , 0.08113]
                                 [0.9656 , 0.08555]
                                 [1.0706 , 0.09011]
                                 [1.1842 , 0.09483]
                                 [1.3084 , 0.09970]
                                 [1.4447 , 0.10472]
                                 [1.5945 , 0.10990]
                                 [1.7589 , 0.11524]
                                 [2.0195 , 0.12075]
                                 [2.3829 , 0.14300]
                                 [2.8396 , 0.14870]
                                 [3.3911 , 0.15454]
                                 [4.0406 , 0.16053]
                                 [4.7921 , 0.16666]
                                 [5.6495 , 0.17293]
                                 [   -1  ,  -1  ]  (maximum one hundred pairs of points)
                                 IDovf=[   ], NHYDovf=["      "],
*%-----------------|-----------------------------------------------------------------------
* SITE (POST2 - Uncontrolled Area)
CALIB STANDHYD      ID=[5], NHYD=["POST2"], DT=[1](min), AREA=[0.89](ha),
                    XIMP=[0.105], TIMP=[0.21], DWF=[0](cms), LOSS=[2],
                    SCS curve number CN=[84],
                    Pervious   surfaces: IAper=[5.0](mm), SLPP=[11.1](%),
                                         LGP=[50](m), MNP=[0.25], SCP=[0](min),
                    Impervious surfaces: IAimp=[2.0](mm), SLPI=[6.0](%),
                                         LGI=[120](m), MNI=[0.013], SCI=[0](min),
                    RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
*%-----------------|-----------------------------------------------------------|
*% 2-year SCS Type-II Storm Dist. based on Mansfield, ON. rainfall (6-hr)
```

```
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[2]
*%                   ["2SCS6.stm"] <--storm filename
*%-----------------|-----------------------------------------------------------|
*% 5-year SCS Type-II Storm Dist. based on Mansfield, ON. rainfall (6-hr)
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[3]
*%                   ["5SCS6.stm"] <--storm filename
*%-----------------|-----------------------------------------------------------|
*% 25-year SCS Type-II Storm Dist. based on Mansfield, ON. rainfall (6-hr)
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[4]
*%                   ["25SCS6.stm"] <--storm filename
*%-----------------|-----------------------------------------------------------|
*% 100-year SCS Type-II Storm Dist. based on Mansfield, ON. rainfall (6-hr)
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[5]
*%                   ["100SCS6.stm"] <--storm filename
*%-----------------|-----------------------------------------------------------|
*% Timmins Regional Storm (12-hr)
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[6]
*%                   ["12regtim.o89"] <--storm filename
*%-----------------|-----------------------------------------------------------|
FINISH
```

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

 SSSSS   W   W   M   M   H   H   Y   Y   M   M    OOO         222     000    11   77777 ==
 S       W W W   MM MM   H   H    Y Y    MM MM   O   O          2    0   0   11   7   7
 SSSSS   W W W   M M M   HHHHH     Y     M M M   O   O          2    0   0   11       7
     S    W W    M   M   H   H     Y     M   M   O   O        222    0   0   11      7
 SSSSS    W W    M   M   H   H     Y     M   M    OOO         2      0   0   11     7   ==
                                                              2      0   0   11    7    #
       StormWater Management HYdrologic Model                  222     000    11    7    ==

 ******************************************************************************************
 **************************************  SWMHYMO Ver4.05.0  ******************************
 ******************  A single event and continuous hydrologic simulation model  ***********
 ******************     based on the principles of HYMO and its successors      ***********
 ******************                 OTTHYMO-83 and OTTHYMO-89.                  ***********
 ******************************************************************************************
 ****************** Distributed by:  J.F. Sabourin and Associates Inc.          ***********
 ******************                  Ottawa,  Ontario: (613) 836-3884           ***********
 ******************                  Gatineau, Quebec: (819) 243-6858           ***********
 ******************                  E-Mail: swmhymo@jfsa.com                   ***********
 ******************************************************************************************

 ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
 ++++++++++++++++++ Licensed user: WMI & Associates Ltd.                        +++++++++++
 ++++++++++++++++++               Barrie                SERIAL#:2880720         +++++++++++
 ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

 ******************************************************************************************
 ******************           ++++++ PROGRAM ARRAY DIMENSIONS ++++++            ***********
 ******************           Maximum value for ID numbers  :     11            ***********
 ******************           Max. number of rainfall points: 105408            ***********
 ******************           Max. number of flow points    : 105408            ***********
 ******************************************************************************************


 *******************************   D E T A I L E D   O U T P U T   ***********************
 ******************************************************************************************
 *                 RUN DATE: 2020-12-09     TIME: 16:06:26     RUN COUNTER: 000002
 ******************************************************************************************
 * Input   file: C:\Temp\15-319\PR\6-hour_SCS\2-CYRSCS.dat
 * Output  file: C:\Temp\15-319\PR\6-hour_SCS\2-CYRSCS.out
 * Summary file: C:\Temp\15-319\PR\6-hour_SCS\2-CYRSCS.sum
 * User comments:
 * 1:_____________________________________________________________________________________
 * 2:_____________________________________________________________________________________
 * 3:_____________________________________________________________________________________
 ******************************************************************************************

-------------------------------------------------------------------------------------------
R0001:C00001-------------------------------------------------------------------------------
*#*****************************************************************************
*#  Project Name: [Mansfield Ski Club]    Project Number: [15-319]
*#  Date        : 07-31-2017
```

```
*#  Modeller    : [J. Lightheart]
*#  Company     : WMI & Associates Ltd.
*#  License #   :  2880720
*#*****************************************************************************
*
* Post-Development Condition - Mansfield Ski Club
*
--------------------
| START            | Project  dir.:C:\Temp\15-319\PR\6-hour_SCS\
-------------------- Rainfall dir.:C:\Temp\15-319\PR\6-hour_SCS\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 0001
    NSTORM=   1
           #  1=25mm4hr.stm
-------------------------------------------------------------------------------------------
R0001:C00002-------------------------------------------------------------------------------
--------------------
| READ STORM       |  Filename: C:\Temp\15-319\PR\6-hour_SCS\25mm4hr.stm
| Ptotal=  25.00 mm|  Comments: 25mm Chicago Storm Distribution (4-hour) Mansfield, ON.
--------------------
      TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME
     hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm
      0:10   1.970|   0:50   3.820|   1:30  13.830|   2:10   4.080|   2:50   2.650|   3:30
      0:20   2.220|   1:00   5.380|   1:40   8.070|   2:20   3.570|   3:00   2.450|   3:40
      0:30   2.550|   1:10  10.940|   1:50   5.950|   2:30   3.190|   3:10   2.290|   3:50
      0:40   3.030|   1:20  56.670|   2:00   4.810|   2:40   2.890|   3:20   2.150|   4:00

-------------------------------------------------------------------------------------------
R0001:C00003-------------------------------------------------------------------------------
* SITE (POST1 - Controlled Area)
--------------------------
| CALIB STANDHYD         |   Area    (ha)=    2.74
| 01:POST1      DT= 1.00 |   Total Imp(%)=   69.00   Dir. Conn.(%)=   59.00
--------------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.89          .85
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       3.50        33.30
     Length            (m)=     300.00         6.00
     Mannings n          =       .013         .250

     Max.eff.Inten.(mm/hr)=      56.67        23.86
                over (min)       4.00         6.00
     Storage Coeff.  (min)=       4.26 (ii)    5.98 (ii)
     Unit Hyd. Tpeak (min)=       4.00         6.00
     Unit Hyd. peak  (cms)=        .27          .19
                                                            *TOTALS*
     PEAK FLOW       (cms)=        .22          .04           .255 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.40          1.350
     RUNOFF VOLUME    (mm)=      23.01         7.79         16.768
     TOTAL RAINFALL   (mm)=      25.01        25.01         25.005
     RUNOFF COEFFICIENT   =        .92          .31           .671
```

```
         (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
             CN* =  84.0    Ia = Dep. Storage  (Above)
        (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
       (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

  ---------------------------------------------------------------------------------------------
  R0001:C00004---------------------------------------------------------------------------------
  * EXTERNAL (Routed through SWM Facility)
  --------------------------
  | CALIB NASHYD           |   Area    (ha)=   11.940   Curve Number   (CN)= 83.00
  | 02:EXT        DT= 1.00 |   Ia      (mm)=    6.800   # of Linear Res.(N)=  3.00
  --------------------------   U.H. Tp(hrs)=     .240

       Unit Hyd Qpeak  (cms)=    1.900

       PEAK FLOW       (cms)=     .115 (i)
       TIME TO PEAK    (hrs)=    1.650
       DURATION        (hrs)=    5.667, (dddd|hh:mm:)=   0|05:40
       AVERAGE FLOW    (cms)=     .028
       RUNOFF VOLUME    (mm)=    4.719
       TOTAL RAINFALL   (mm)=   25.005
       RUNOFF COEFFICIENT   =     .189

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

  ---------------------------------------------------------------------------------------------
  R0001:C00005---------------------------------------------------------------------------------
  * TOTAL FLOW TO SIDEROAD 15 CROSS CULVERT (POST1 CONTROLLED + EXT)
  ------------------------
  | ADD HYD                |
  | 03:POST1+EXT           |   ID:NHYD           AREA     QPEAK    TPEAK      R.V.     DWF
  ------------------------                       (ha)     (cms)    (hrs)      (mm)   (cms)
                         ID 1 01:POST1          2.740      .255    1.350    16.768    .000
                        +ID 2 02:EXT           11.940      .115    1.650     4.719    .000
                        ==================================================================
                        SUM   03:POST1+EXT     14.680      .282    1.367     6.968    .000

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

  ---------------------------------------------------------------------------------------------
  R0001:C00006---------------------------------------------------------------------------------
  * SWM Facility
  ----------------------
  |  ROUTE RESERVOIR -> |    Requested routing time step =  1.0 min.
  |  IN>03:POST1+EXT    |
  | OUT<04:SWM Facili   | ========================  OUTLFOW STORAGE TABLE  =================
  ---------------------- OUTFLOW   STORAGE| OUTFLOW   STORAGE| OUTFLOW   STORAGE| OUTFLOW
                          (cms)   (ha.m.)|   (cms)   (ha.m.)|   (cms)   (ha.m.)|   (cms)
                           .000 .0000E+00|    .010 .1292E-01|    .065 .4128E-01|   1.071 .
                           .002 .6300E-03|    .010 .1442E-01|    .108 .4430E-01|   1.184 .
                           .003 .1310E-02|    .010 .1601E-01|    .159 .4743E-01|   1.308 .
                           .004 .2050E-02|    .011 .1769E-01|    .217 .5067E-01|   1.445 .
```

```
                                  .005 .2840E-02|    .011 .1946E-01|    .281 .5403E-01|   1.594 .
                                  .006 .3680E-02|    .011 .2133E-01|    .351 .5751E-01|   1.759 .
                                  .006 .4590E-02|    .012 .2329E-01|    .425 .6112E-01|   2.020 .
                                  .007 .5570E-02|    .012 .2535E-01|    .505 .6486E-01|   2.383 .
                                  .007 .6610E-02|    .012 .2777E-01|    .589 .6872E-01|   2.840 .
                                  .008 .7720E-02|    .013 .3027E-01|    .677 .7272E-01|   3.391 .
                                  .008 .8910E-02|    .013 .3287E-01|    .769 .7686E-01|   4.041 .
                                  .009 .1017E-01|    .013 .3557E-01|    .866 .8113E-01|   4.792 .
                                  .009 .1150E-01|    .032 .3837E-01|    .966 .8555E-01|   5.649 .

       ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
       ----------------------     (ha)     (cms)     (hrs)       (mm)
       INFLOW > 03:POST1+EXT     14.680      .282     1.367      6.968
      OUTFLOW < 04:SWM Facili    14.680      .108     2.033      6.968

                     PEAK   FLOW   REDUCTION [Qout/Qin](%)=   38.291
                     TIME SHIFT OF PEAK FLOW         (min)=    40.00
                     MAXIMUM  STORAGE   USED       (ha.m.)=.4429E-01

  ---------------------------------------------------------------------------------------------
  R0001:C00007---------------------------------------------------------------------------------
  * SITE (POST2 - Uncontrolled Area)
  --------------------------
  | CALIB STANDHYD         |   Area    (ha)=     .89
  | 05:POST2      DT= 1.00 |   Total Imp(%)=   21.00   Dir. Conn.(%)=   10.50
  --------------------------
                                IMPERVIOUS    PERVIOUS (i)
       Surface Area     (ha)=        .19          .70
       Dep. Storage     (mm)=       2.00         5.00
       Average Slope     (%)=       6.00        11.10
       Length            (m)=     120.00        50.00
       Mannings n           =       .013         .250

       Max.eff.Inten.(mm/hr)=      56.67        11.01
                  over (min)       2.00        14.00
       Storage Coeff.  (min)=       2.09 (ii)   13.75 (ii)
       Unit Hyd. Tpeak (min)=       2.00        14.00
       Unit Hyd. peak  (cms)=        .54          .08
                                                            *TOTALS*
       PEAK FLOW       (cms)=        .01          .01          .018 (iii)
       TIME TO PEAK    (hrs)=       1.33         1.55         1.333
       RUNOFF VOLUME    (mm)=      23.00         6.70         8.411
       TOTAL RAINFALL   (mm)=      25.01        25.01        25.005
       RUNOFF COEFFICIENT   =        .92          .27          .336

         (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
             CN* =  84.0    Ia = Dep. Storage  (Above)
        (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
       (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

  ---------------------------------------------------------------------------------------------
  R0001:C00008---------------------------------------------------------------------------------
    ** END OF RUN :    0
```

```
 *******************************************************************************************





 --------------------
 | START            | Project  dir.:C:\Temp\15-319\PR\6-hour_SCS\
 -------------------- Rainfall dir.:C:\Temp\15-319\PR\6-hour_SCS\
     TZERO =   .00 hrs on        0
     METOUT=   2 (output = METRIC)
     NRUN  = 0002
     NSTORM=   1
            #  1=2SCS6.stm
 ------------------------------------------------------------------------------------------
 R0002:C00002------------------------------------------------------------------------------
 *#****************************************************************************
 *#  Project Name: [Mansfield Ski Club]    Project Number: [15-319]
 *#  Date        : 07-31-2017
 *#  Modeller    : [J. Lightheart]
 *#  Company     : WMI & Associates Ltd.
 *#  License #   :  2880720
 *#****************************************************************************
 *
 * Post-Development Condition - Mansfield Ski Club
 *
 ------------------------------------------------------------------------------------------
 R0002:C00002------------------------------------------------------------------------------
 -------------------
 | READ STORM       |  Filename: C:\Temp\15-319\PR\6-hour_SCS\2SCS6.stm
 | Ptotal=  36.00 mm|  Comments: 2-Year SCS Type-II Storm Distribution (6-hour) Mansfield,
 -------------------
       TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME
      hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm
       0:30   1.440|   1:30   2.880|   2:30   5.040|   3:30   9.360|   4:30   2.880|   5:30
       1:00   1.440|   2:00   2.880|   3:00  36.720|   4:00   4.320|   5:00   2.160|   6:00

 ------------------------------------------------------------------------------------------
 R0002:C00003------------------------------------------------------------------------------
 * SITE (POST1 - Controlled Area)
 -------------------------
 | CALIB STANDHYD         |   Area    (ha)=    2.74
 | 01:POST1      DT= 1.00 |   Total Imp(%)=   69.00   Dir. Conn.(%)=   59.00
 -------------------------
                               IMPERVIOUS    PERVIOUS (i)
      Surface Area     (ha)=       1.89          .85
      Dep. Storage     (mm)=       2.00         5.00
      Average Slope     (%)=       3.50        33.30
      Length            (m)=     300.00         6.00
      Mannings n           =       .013         .250

      Max.eff.Inten.(mm/hr)=      36.72        27.71
```

```
                 over (min)        5.00         7.00
      Storage Coeff.  (min)=       5.06 (ii)    6.69 (ii)
      Unit Hyd. Tpeak (min)=       5.00         7.00
      Unit Hyd. peak  (cms)=        .22          .17
                                                               *TOTALS*
      PEAK FLOW       (cms)=        .16          .06            .221 (iii)
      TIME TO PEAK    (hrs)=       3.00         3.02           3.000
      RUNOFF VOLUME    (mm)=      34.00        15.09          26.246
      TOTAL RAINFALL   (mm)=      36.00        36.00          36.000
      RUNOFF COEFFICIENT   =        .94          .42            .729

        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN* =  84.0    Ia = Dep. Storage  (Above)
       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

 ------------------------------------------------------------------------------------------
 R0002:C00004------------------------------------------------------------------------------
 * EXTERNAL (Routed through SWM Facility)
 --------------------------
 | CALIB NASHYD           |   Area    (ha)=   11.940   Curve Number   (CN)= 83.00
 | 02:EXT        DT= 1.00 |   Ia      (mm)=    6.800   # of Linear Res.(N)=  3.00
 --------------------------   U.H. Tp(hrs)=     .240

      Unit Hyd Qpeak  (cms)=    1.900

      PEAK FLOW       (cms)=     .310 (i)
      TIME TO PEAK    (hrs)=    3.150
      DURATION        (hrs)=    7.667, (dddd|hh:mm:)=   0|07:40
      AVERAGE FLOW    (cms)=     .045
      RUNOFF VOLUME    (mm)=   10.497
      TOTAL RAINFALL   (mm)=   36.000
      RUNOFF COEFFICIENT   =     .292

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

 ------------------------------------------------------------------------------------------
 R0002:C00005------------------------------------------------------------------------------
 * TOTAL FLOW TO SIDEROAD 15 CROSS CULVERT (POST1 CONTROLLED + EXT)
 -----------------------
 | ADD HYD              |
 | 03:POST1+EXT         |   ID:NHYD           AREA     QPEAK    TPEAK      R.V.     DWF
 -----------------------                      (ha)     (cms)    (hrs)      (mm)   (cms)
                      ID 1 01:POST1          2.740      .221    3.000    26.246    .000
                     +ID 2 02:EXT           11.940      .310    3.150    10.497    .000
                     ===============================================================
                     SUM   03:POST1+EXT     14.680      .483    3.050    13.437    .000

    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

 ------------------------------------------------------------------------------------------
 R0002:C00006------------------------------------------------------------------------------
 * SWM Facility
```

```
-----------------------
|  ROUTE RESERVOIR -> |    Requested routing time step =  1.0 min.
|  IN>03:POST1+EXT    |
| OUT<04:SWM Facili   | =========================  OUTLFOW STORAGE TABLE  =================
----------------------- OUTFLOW   STORAGE| OUTFLOW   STORAGE| OUTFLOW   STORAGE| OUTFLOW
                          (cms)   (ha.m.)|   (cms)   (ha.m.)|   (cms)   (ha.m.)|   (cms)
                           .000 .0000E+00|    .010 .1292E-01|    .065 .4128E-01|   1.071 .
                           .002 .6300E-03|    .010 .1442E-01|    .108 .4430E-01|   1.184 .
                           .003 .1310E-02|    .010 .1601E-01|    .159 .4743E-01|   1.308 .
                           .004 .2050E-02|    .011 .1769E-01|    .217 .5067E-01|   1.445 .
                           .005 .2840E-02|    .011 .1946E-01|    .281 .5403E-01|   1.594 .
                           .006 .3680E-02|    .011 .2133E-01|    .351 .5751E-01|   1.759 .
                           .006 .4590E-02|    .012 .2329E-01|    .425 .6112E-01|   2.020 .
                           .007 .5570E-02|    .012 .2535E-01|    .505 .6486E-01|   2.383 .
                           .007 .6610E-02|    .012 .2777E-01|    .589 .6872E-01|   2.840 .
                           .008 .7720E-02|    .013 .3027E-01|    .677 .7272E-01|   3.391 .
                           .008 .8910E-02|    .013 .3287E-01|    .769 .7686E-01|   4.041 .
                           .009 .1017E-01|    .013 .3557E-01|    .866 .8113E-01|   4.792 .
                           .009 .1150E-01|    .032 .3837E-01|    .966 .8555E-01|   5.649 .

     ROUTING RESULTS             AREA     QPEAK     TPEAK       R.V.
     ----------------------      (ha)     (cms)     (hrs)       (mm)
     INFLOW > 03:POST1+EXT     14.680      .483     3.050     13.437
    OUTFLOW < 04:SWM Facili    14.680      .362     3.250     13.437

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=   74.996
                   TIME SHIFT OF PEAK FLOW         (min)=    12.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=.5807E-01

-----------------------------------------------------------------------------------------
R0002:C00007-----------------------------------------------------------------------------
* SITE (POST2 - Uncontrolled Area)
--------------------------
| CALIB STANDHYD         |   Area    (ha)=     .89
| 05:POST2      DT= 1.00 |   Total Imp(%)=   21.00   Dir. Conn.(%)=   10.50
--------------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .19          .70
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       6.00        11.10
     Length            (m)=     120.00        50.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      36.72        20.32
                over (min)       2.00        12.00
     Storage Coeff.  (min)=       2.49 (ii)   11.61 (ii)
     Unit Hyd. Tpeak (min)=       2.00        12.00
     Unit Hyd. peak  (cms)=        .48          .10
                                                           *TOTALS*
     PEAK FLOW       (cms)=        .01          .03           .037 (iii)
     TIME TO PEAK    (hrs)=       2.77         3.08          3.000
     RUNOFF VOLUME    (mm)=      34.00        13.43         15.590
     TOTAL RAINFALL   (mm)=      36.00        36.00         36.000
```

```
     RUNOFF COEFFICIENT   =        .94          .37           .433

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  84.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-----------------------------------------------------------------------------------------
R0002:C00008-----------------------------------------------------------------------------
-----------------------------------------------------------------------------------------
R0002:C00002-----------------------------------------------------------------------------
  ** END OF RUN :    1

*****************************************************************************************






--------------------
| START            | Project  dir.:C:\Temp\15-319\PR\6-hour_SCS\
-------------------- Rainfall dir.:C:\Temp\15-319\PR\6-hour_SCS\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 0003
    NSTORM=   1
           #  1=5SCS6.stm
-----------------------------------------------------------------------------------------
R0003:C00002-----------------------------------------------------------------------------
*#*******************************************************************************
*#  Project Name: [Mansfield Ski Club]    Project Number: [15-319]
*#  Date        : 07-31-2017
*#  Modeller    : [J. Lightheart]
*#  Company     : WMI & Associates Ltd.
*#  License #   : 2880720
*#*******************************************************************************
*
* Post-Development Condition - Mansfield Ski Club
*
-----------------------------------------------------------------------------------------
R0003:C00002-----------------------------------------------------------------------------
--------------------
| READ STORM       |  Filename: C:\Temp\15-319\PR\6-hour_SCS\5SCS6.stm
| Ptotal=  47.50 mm|  Comments: 5-Year SCS Type-II Storm Distribution (6-hour) Mansfield,
--------------------
      TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME
     hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm
      0:30   1.900|   1:30   3.800|   2:30   6.650|   3:30  12.350|   4:30   3.800|   5:30
      1:00   1.900|   2:00   3.800|   3:00  48.450|   4:00   5.700|   5:00   2.850|   6:00

-----------------------------------------------------------------------------------------
R0003:C00003-----------------------------------------------------------------------------
* SITE (POST1 - Controlled Area)
```

```
      -------------------------
      | CALIB STANDHYD         |   Area    (ha)=    2.74
      | 01:POST1      DT= 1.00 |   Total Imp(%)=   69.00   Dir. Conn.(%)=   59.00
      -------------------------
                                  IMPERVIOUS    PERVIOUS (i)
           Surface Area     (ha)=       1.89         .85
           Dep. Storage     (mm)=       2.00        5.00
           Average Slope     (%)=       3.50       33.30
           Length            (m)=     300.00        6.00
           Mannings n          =        .013        .250

           Max.eff.Inten.(mm/hr)=      48.45       42.87
                      over (min)       5.00        6.00
           Storage Coeff.  (min)=       4.53 (ii)    5.90 (ii)
           Unit Hyd. Tpeak (min)=       5.00        6.00
           Unit Hyd. peak  (cms)=        .24         .19
                                                                *TOTALS*
           PEAK FLOW       (cms)=        .22         .09          .309 (iii)
           TIME TO PEAK    (hrs)=       3.00        3.02         3.000
           RUNOFF VOLUME    (mm)=      45.50       23.80        36.604
           TOTAL RAINFALL   (mm)=      47.50       47.50        47.500
           RUNOFF COEFFICIENT   =        .96         .50          .771

             (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
                 CN* =  84.0    Ia = Dep. Storage  (Above)
            (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
           (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

      ---------------------------------------------------------------------------------------------
      R0003:C00004---------------------------------------------------------------------------------
      * EXTERNAL (Routed through SWM Facility)
      -------------------------
      | CALIB NASHYD           |   Area    (ha)=   11.940   Curve Number   (CN)= 83.00
      | 02:EXT        DT= 1.00 |   Ia      (mm)=    6.800   # of Linear Res.(N)=  3.00
      --------------------------   U.H. Tp(hrs)=     .240

           Unit Hyd Qpeak  (cms)=    1.900

           PEAK FLOW       (cms)=     .547 (i)
           TIME TO PEAK    (hrs)=    3.133
           DURATION        (hrs)=    7.667, (dddd|hh:mm:)=   0|07:40
           AVERAGE FLOW    (cms)=     .077
           RUNOFF VOLUME    (mm)=   17.865
           TOTAL RAINFALL   (mm)=   47.500
           RUNOFF COEFFICIENT   =     .376

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

      ---------------------------------------------------------------------------------------------
      R0003:C00005---------------------------------------------------------------------------------
      * TOTAL FLOW TO SIDEROAD 15 CROSS CULVERT (POST1 CONTROLLED + EXT)
      -----------------------
      | ADD HYD               |
```

```
      | 03:POST1+EXT          |   ID:NHYD            AREA     QPEAK    TPEAK      R.V.     DWF
      ------------------------                       (ha)     (cms)    (hrs)      (mm)   (cms)
                             ID 1 01:POST1          2.740      .309    3.000    36.604    .000
                            +ID 2 02:EXT           11.940      .547    3.133    17.865    .000
                            ===============================================================
                            SUM   03:POST1+EXT     14.680      .789    3.050    21.362    .000

         NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

      ---------------------------------------------------------------------------------------------
      R0003:C00006---------------------------------------------------------------------------------
      * SWM Facility
      ----------------------
      |  ROUTE RESERVOIR -> |    Requested routing time step =  1.0 min.
      |  IN>03:POST1+EXT    |
      | OUT<04:SWM Facili   | =========================  OUTLFOW STORAGE TABLE  =================
      ---------------------- OUTFLOW   STORAGE| OUTFLOW   STORAGE| OUTFLOW   STORAGE| OUTFLOW
                               (cms)   (ha.m.)|   (cms)   (ha.m.)|   (cms)   (ha.m.)|   (cms)
                                .000 .0000E+00|    .010 .1292E-01|    .065 .4128E-01|   1.071 .
                                .002 .6300E-03|    .010 .1442E-01|    .108 .4430E-01|   1.184 .
                                .003 .1310E-02|    .010 .1601E-01|    .159 .4743E-01|   1.308 .
                                .004 .2050E-02|    .011 .1769E-01|    .217 .5067E-01|   1.445 .
                                .005 .2840E-02|    .011 .1946E-01|    .281 .5403E-01|   1.594 .
                                .006 .3680E-02|    .011 .2133E-01|    .351 .5751E-01|   1.759 .
                                .006 .4590E-02|    .012 .2329E-01|    .425 .6112E-01|   2.020 .
                                .007 .5570E-02|    .012 .2535E-01|    .505 .6486E-01|   2.383 .
                                .007 .6610E-02|    .012 .2777E-01|    .589 .6872E-01|   2.840 .
                                .008 .7720E-02|    .013 .3027E-01|    .677 .7272E-01|   3.391 .
                                .008 .8910E-02|    .013 .3287E-01|    .769 .7686E-01|   4.041 .
                                .009 .1017E-01|    .013 .3557E-01|    .866 .8113E-01|   4.792 .
                                .009 .1150E-01|    .032 .3837E-01|    .966 .8555E-01|   5.649 .

           ROUTING RESULTS             AREA     QPEAK     TPEAK       R.V.
           ----------------------      (ha)     (cms)     (hrs)       (mm)
           INFLOW > 03:POST1+EXT     14.680      .789     3.050     21.362
          OUTFLOW < 04:SWM Facili    14.680      .660     3.183     21.362

                         PEAK   FLOW   REDUCTION [Qout/Qin](%)=   83.641
                         TIME SHIFT OF PEAK FLOW         (min)=     8.00
                         MAXIMUM  STORAGE   USED       (ha.m.)=.7197E-01

      ---------------------------------------------------------------------------------------------
      R0003:C00007---------------------------------------------------------------------------------
      * SITE (POST2 - Uncontrolled Area)
      -------------------------
      | CALIB STANDHYD         |   Area    (ha)=     .89
      | 05:POST2      DT= 1.00 |   Total Imp(%)=   21.00   Dir. Conn.(%)=   10.50
      -------------------------
                                  IMPERVIOUS    PERVIOUS (i)
           Surface Area     (ha)=        .19         .70
           Dep. Storage     (mm)=       2.00        5.00
           Average Slope     (%)=       6.00       11.10
           Length            (m)=     120.00       50.00
```

```
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      48.45        32.84
                over (min)        2.00        10.00
     Storage Coeff.  (min)=       2.22 (ii)    9.76 (ii)
     Unit Hyd. Tpeak (min)=       2.00        10.00
     Unit Hyd. peak  (cms)=        .52          .12
                                                           *TOTALS*
     PEAK FLOW       (cms)=        .01          .05          .062 (iii)
     TIME TO PEAK    (hrs)=       2.90         3.05         3.000
     RUNOFF VOLUME    (mm)=      45.50        21.64        24.145
     TOTAL RAINFALL   (mm)=      47.50        47.50        47.500
     RUNOFF COEFFICIENT   =        .96          .46          .508

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  84.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------------------
R0003:C00008-------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------
R0003:C00002-------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------
R0003:C00002-------------------------------------------------------------------------------
  ** END OF RUN :    2

*******************************************************************************************





--------------------
| START            | Project  dir.:C:\Temp\15-319\PR\6-hour_SCS\
-------------------- Rainfall dir.:C:\Temp\15-319\PR\6-hour_SCS\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 0004
    NSTORM=   1
           #  1=25SCS6.stm
-------------------------------------------------------------------------------------------
R0004:C00002-------------------------------------------------------------------------------
*#******************************************************************************
*#  Project Name: [Mansfield Ski Club]    Project Number: [15-319]
*#  Date        : 07-31-2017
*#  Modeller    : [J. Lightheart]
*#  Company     : WMI & Associates Ltd.
*#  License #   :  2880720
*#******************************************************************************
*
* Post-Development Condition - Mansfield Ski Club
*
```

```
-------------------------------------------------------------------------------------------
R0004:C00002-------------------------------------------------------------------------------
--------------------
| READ STORM       |  Filename: C:\Temp\15-319\PR\6-hour_SCS\25SCS6.stm
| Ptotal=  64.80 mm|  Comments: 25-Year SCS Type-II Storm Distribution (6-hour) Mansfield,
--------------------
      TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME
     hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm
      0:30   2.592|   1:30   5.184|   2:30   9.072|   3:30  16.848|   4:30   5.184|   5:30
      1:00   2.592|   2:00   5.184|   3:00  66.096|   4:00   7.776|   5:00   3.888|   6:00

-------------------------------------------------------------------------------------------
R0004:C00003-------------------------------------------------------------------------------
* SITE (POST1 - Controlled Area)
--------------------------
| CALIB STANDHYD         |   Area    (ha)=    2.74
| 01:POST1      DT= 1.00 |   Total Imp(%)=   69.00   Dir. Conn.(%)=   59.00
--------------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.89          .85
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       3.50        33.30
     Length            (m)=     300.00         6.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      66.10        66.82
                over (min)        4.00         5.00
     Storage Coeff.  (min)=       4.00 (ii)    5.15 (ii)
     Unit Hyd. Tpeak (min)=       4.00         5.00
     Unit Hyd. peak  (cms)=        .28          .22
                                                           *TOTALS*
     PEAK FLOW       (cms)=        .30          .15          .445 (iii)
     TIME TO PEAK    (hrs)=       3.00         3.00         3.000
     RUNOFF VOLUME    (mm)=      62.80        38.15        52.693
     TOTAL RAINFALL   (mm)=      64.80        64.80        64.800
     RUNOFF COEFFICIENT   =        .97          .59          .813

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  84.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------------------
R0004:C00004-------------------------------------------------------------------------------
* EXTERNAL (Routed through SWM Facility)
--------------------------
| CALIB NASHYD           |   Area    (ha)=   11.940   Curve Number   (CN)= 83.00
| 02:EXT        DT= 1.00 |   Ia      (mm)=    6.800   # of Linear Res.(N)=  3.00
--------------------------   U.H. Tp(hrs)=     .240

     Unit Hyd Qpeak  (cms)=    1.900

     PEAK FLOW       (cms)=     .960 (i)
```

```
          TIME TO PEAK    (hrs)=    3.117
          DURATION        (hrs)=    7.667, (dddd|hh:mm:)=   0|07:40
          AVERAGE FLOW    (cms)=     .132
          RUNOFF VOLUME    (mm)=   30.575
          TOTAL RAINFALL   (mm)=   64.800
          RUNOFF COEFFICIENT   =     .472

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

     ---------------------------------------------------------------------------------------------
     R0004:C00005--------------------------------------------------------------------------------
     * TOTAL FLOW TO SIDEROAD 15 CROSS CULVERT (POST1 CONTROLLED + EXT)
     ------------------------
     | ADD HYD               |
     | 03:POST1+EXT          |   ID:NHYD            AREA     QPEAK    TPEAK      R.V.     DWF
     ------------------------                       (ha)     (cms)    (hrs)      (mm)   (cms)
                           ID 1 01:POST1          2.740      .445    3.000    52.693    .000
                          +ID 2 02:EXT           11.940      .960    3.117    30.575    .000
                          ==========================================================
                          SUM   03:POST1+EXT     14.680     1.304    3.033    34.703    .000

        NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

     ---------------------------------------------------------------------------------------------
     R0004:C00006--------------------------------------------------------------------------------
     * SWM Facility
     -----------------------
     |  ROUTE RESERVOIR -> |    Requested routing time step =  1.0 min.
     |  IN>03:POST1+EXT    |
     | OUT<04:SWM Facili   | =========================  OUTLFOW STORAGE TABLE  =================
     ----------------------- OUTFLOW   STORAGE| OUTFLOW   STORAGE| OUTFLOW   STORAGE| OUTFLOW
                               (cms)   (ha.m.)|   (cms)   (ha.m.)|   (cms)   (ha.m.)|   (cms)
                                .000 .0000E+00|    .010 .1292E-01|    .065 .4128E-01|   1.071 .
                                .002 .6300E-03|    .010 .1442E-01|    .108 .4430E-01|   1.184 .
                                .003 .1310E-02|    .010 .1601E-01|    .159 .4743E-01|   1.308 .
                                .004 .2050E-02|    .011 .1769E-01|    .217 .5067E-01|   1.445 .
                                .005 .2840E-02|    .011 .1946E-01|    .281 .5403E-01|   1.594 .
                                .006 .3680E-02|    .011 .2133E-01|    .351 .5751E-01|   1.759 .
                                .006 .4590E-02|    .012 .2329E-01|    .425 .6112E-01|   2.020 .
                                .007 .5570E-02|    .012 .2535E-01|    .505 .6486E-01|   2.383 .
                                .007 .6610E-02|    .012 .2777E-01|    .589 .6872E-01|   2.840 .
                                .008 .7720E-02|    .013 .3027E-01|    .677 .7272E-01|   3.391 .
                                .008 .8910E-02|    .013 .3287E-01|    .769 .7686E-01|   4.041 .
                                .009 .1017E-01|    .013 .3557E-01|    .866 .8113E-01|   4.792 .
                                .009 .1150E-01|    .032 .3837E-01|    .966 .8555E-01|   5.649 .

          ROUTING RESULTS             AREA     QPEAK     TPEAK       R.V.
          ----------------------      (ha)     (cms)     (hrs)       (mm)
          INFLOW > 03:POST1+EXT     14.680     1.304     3.033     34.703
         OUTFLOW < 04:SWM Facili    14.680     1.140     3.150     34.703

                        PEAK   FLOW   REDUCTION [Qout/Qin](%)=   87.431
                        TIME SHIFT OF PEAK FLOW         (min)=     7.00
```

```
                    MAXIMUM  STORAGE   USED       (ha.m.)=.9302E-01

      ---------------------------------------------------------------------------------------------
      R0004:C00007--------------------------------------------------------------------------------
      * SITE (POST2 - Uncontrolled Area)
      -------------------------
      | CALIB STANDHYD         |   Area    (ha)=     .89
      | 05:POST2      DT= 1.00 |   Total Imp(%)=   21.00   Dir. Conn.(%)=   10.50
      -------------------------
                                    IMPERVIOUS    PERVIOUS (i)
           Surface Area     (ha)=        .19          .70
           Dep. Storage     (mm)=       2.00         5.00
           Average Slope     (%)=       6.00        11.10
           Length            (m)=     120.00        50.00
           Mannings n          =       .013         .250

           Max.eff.Inten.(mm/hr)=      66.10        53.07
                      over (min)       2.00         8.00
           Storage Coeff.  (min)=       1.96 (ii)    8.18 (ii)
           Unit Hyd. Tpeak (min)=       2.00         8.00
           Unit Hyd. peak  (cms)=        .57          .14
                                                                *TOTALS*
           PEAK FLOW       (cms)=        .02          .09          .106 (iii)
           TIME TO PEAK    (hrs)=       2.85         3.03         3.000
           RUNOFF VOLUME    (mm)=      62.80        35.37        38.252
           TOTAL RAINFALL   (mm)=      64.80        64.80        64.800
           RUNOFF COEFFICIENT   =        .97          .55          .590

             (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
                 CN* =  84.0    Ia = Dep. Storage  (Above)
            (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
           (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

      ---------------------------------------------------------------------------------------------
      R0004:C00008--------------------------------------------------------------------------------
      ---------------------------------------------------------------------------------------------
      R0004:C00002--------------------------------------------------------------------------------
      ---------------------------------------------------------------------------------------------
      R0004:C00002--------------------------------------------------------------------------------
      ---------------------------------------------------------------------------------------------
      R0004:C00002--------------------------------------------------------------------------------
        ** END OF RUN :    3

      *********************************************************************************************





      --------------------
      | START            | Project  dir.:C:\Temp\15-319\PR\6-hour_SCS\
      -------------------- Rainfall dir.:C:\Temp\15-319\PR\6-hour_SCS\
          TZERO =   .00 hrs on       0
```

```
    METOUT=   2 (output = METRIC)
    NRUN  = 0005
    NSTORM=   1
           #  1=100SCS6.stm
-------------------------------------------------------------------------------------------
R0005:C00002-------------------------------------------------------------------------------
*#******************************************************************************
*#  Project Name: [Mansfield Ski Club]    Project Number: [15-319]
*#  Date        : 07-31-2017
*#  Modeller    : [J. Lightheart]
*#  Company     : WMI & Associates Ltd.
*#  License #   :  2880720
*#******************************************************************************
*
* Post-Development Condition - Mansfield Ski Club
*
-------------------------------------------------------------------------------------------
R0005:C00002-------------------------------------------------------------------------------
--------------------
| READ STORM       |  Filename: C:\Temp\15-319\PR\6-hour_SCS\100SCS6.stm
| Ptotal=  79.10 mm|  Comments: 100-Year SCS Type-II Storm Distribution (6-hour) Mansfield,
--------------------
      TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME
     hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm
      0:30   3.164|   1:30   6.328|   2:30  11.074|   3:30  20.566|   4:30   6.328|   5:30
      1:00   3.164|   2:00   6.328|   3:00  80.682|   4:00   9.492|   5:00   4.746|   6:00

-------------------------------------------------------------------------------------------
R0005:C00003-------------------------------------------------------------------------------
* SITE (POST1 - Controlled Area)
--------------------------
| CALIB STANDHYD         |   Area    (ha)=    2.74
| 01:POST1      DT= 1.00 |   Total Imp(%)=   69.00   Dir. Conn.(%)=   59.00
--------------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.89         .85
     Dep. Storage     (mm)=       2.00        5.00
     Average Slope     (%)=       3.50       33.30
     Length            (m)=     300.00        6.00
     Mannings n           =       .013        .250

     Max.eff.Inten.(mm/hr)=      80.68       86.82
                over (min)       4.00        5.00
     Storage Coeff.  (min)=       3.70 (ii)    4.72 (ii)
     Unit Hyd. Tpeak (min)=       4.00        5.00
     Unit Hyd. peak  (cms)=        .30         .23
                                                           *TOTALS*
     PEAK FLOW       (cms)=        .36         .20           .558 (iii)
     TIME TO PEAK    (hrs)=       3.00        3.00          3.000
     RUNOFF VOLUME    (mm)=      77.10       50.70         66.275
     TOTAL RAINFALL   (mm)=      79.10       79.10         79.100
     RUNOFF COEFFICIENT   =        .97         .64           .838
```

```
       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  84.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------------------
R0005:C00004-------------------------------------------------------------------------------
* EXTERNAL (Routed through SWM Facility)
--------------------------
| CALIB NASHYD           |   Area    (ha)=   11.940   Curve Number   (CN)= 83.00
| 02:EXT        DT= 1.00 |   Ia      (mm)=    6.800   # of Linear Res.(N)=  3.00
--------------------------   U.H. Tp(hrs)=     .240

     Unit Hyd Qpeak  (cms)=    1.900

     PEAK FLOW       (cms)=    1.333 (i)
     TIME TO PEAK    (hrs)=    3.117
     DURATION        (hrs)=    7.667, (dddd|hh:mm:)=   0|07:40
     AVERAGE FLOW    (cms)=     .182
     RUNOFF VOLUME    (mm)=   42.046
     TOTAL RAINFALL   (mm)=   79.100
     RUNOFF COEFFICIENT   =     .532

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

-------------------------------------------------------------------------------------------
R0005:C00005-------------------------------------------------------------------------------
* TOTAL FLOW TO SIDEROAD 15 CROSS CULVERT (POST1 CONTROLLED + EXT)
------------------------
| ADD HYD               |
| 03:POST1+EXT          |   ID:NHYD            AREA     QPEAK    TPEAK      R.V.     DWF
------------------------                       (ha)     (cms)    (hrs)      (mm)   (cms)
                      ID 1 01:POST1          2.740      .558    3.000    66.275    .000
                     +ID 2 02:EXT           11.940     1.333    3.117    42.046    .000
                     ===============================================================
                     SUM   03:POST1+EXT     14.680     1.769    3.033    46.568    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------------------
R0005:C00006-------------------------------------------------------------------------------
* SWM Facility
-----------------------
|  ROUTE RESERVOIR -> |    Requested routing time step =  1.0 min.
|  IN>03:POST1+EXT    |
| OUT<04:SWM Facili   | =========================  OUTLFOW STORAGE TABLE  =================
----------------------- OUTFLOW   STORAGE| OUTFLOW   STORAGE| OUTFLOW   STORAGE| OUTFLOW
                          (cms)   (ha.m.)|   (cms)   (ha.m.)|   (cms)   (ha.m.)|   (cms)
                           .000 .0000E+00|    .010 .1292E-01|    .065 .4128E-01|   1.071 .
                           .002 .6300E-03|    .010 .1442E-01|    .108 .4430E-01|   1.184 .
                           .003 .1310E-02|    .010 .1601E-01|    .159 .4743E-01|   1.308 .
                           .004 .2050E-02|    .011 .1769E-01|    .217 .5067E-01|   1.445 .
                           .005 .2840E-02|    .011 .1946E-01|    .281 .5403E-01|   1.594 .
```

```
                              .006 .3680E-02|    .011 .2133E-01|    .351 .5751E-01|   1.759 .
                              .006 .4590E-02|    .012 .2329E-01|    .425 .6112E-01|   2.020 .
                              .007 .5570E-02|    .012 .2535E-01|    .505 .6486E-01|   2.383 .
                              .007 .6610E-02|    .012 .2777E-01|    .589 .6872E-01|   2.840 .
                              .008 .7720E-02|    .013 .3027E-01|    .677 .7272E-01|   3.391 .
                              .008 .8910E-02|    .013 .3287E-01|    .769 .7686E-01|   4.041 .
                              .009 .1017E-01|    .013 .3557E-01|    .866 .8113E-01|   4.792 .
                              .009 .1150E-01|    .032 .3837E-01|    .966 .8555E-01|   5.649 .

          ROUTING RESULTS             AREA     QPEAK     TPEAK       R.V.
          ----------------------      (ha)     (cms)     (hrs)       (mm)
          INFLOW > 03:POST1+EXT     14.680     1.769     3.033     46.568
         OUTFLOW < 04:SWM Facili    14.680     1.590     3.117     46.568

                     PEAK   FLOW   REDUCTION [Qout/Qin](%)=   89.864
                     TIME SHIFT OF PEAK FLOW         (min)=     5.00
                     MAXIMUM  STORAGE   USED       (ha.m.)=.1098E+00

     ------------------------------------------------------------------------------------------
     R0005:C00007------------------------------------------------------------------------------
     * SITE (POST2 - Uncontrolled Area)
     --------------------------
     | CALIB STANDHYD         |   Area    (ha)=     .89
     | 05:POST2      DT= 1.00 |   Total Imp(%)=   21.00   Dir. Conn.(%)=   10.50
     --------------------------
                                IMPERVIOUS    PERVIOUS (i)
          Surface Area     (ha)=        .19          .70
          Dep. Storage     (mm)=       2.00         5.00
          Average Slope     (%)=       6.00        11.10
          Length            (m)=     120.00        50.00
          Mannings n          =        .013         .250

          Max.eff.Inten.(mm/hr)=      80.68        70.28
                     over (min)       2.00         7.00
          Storage Coeff.  (min)=       1.81 (ii)    7.37 (ii)
          Unit Hyd. Tpeak (min)=       2.00         7.00
          Unit Hyd. peak  (cms)=        .59          .16
                                                                  *TOTALS*
          PEAK FLOW       (cms)=        .02          .12            .144 (iii)
          TIME TO PEAK    (hrs)=       2.73         3.02           3.000
          RUNOFF VOLUME    (mm)=      77.10        47.52          50.623
          TOTAL RAINFALL   (mm)=      79.10        79.10          79.100
          RUNOFF COEFFICIENT   =        .97          .60            .640

            (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
                CN* =  84.0    Ia = Dep. Storage  (Above)
           (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
          (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

     ------------------------------------------------------------------------------------------
     R0005:C00008------------------------------------------------------------------------------
     ------------------------------------------------------------------------------------------
     R0005:C00002------------------------------------------------------------------------------
```

```
     ------------------------------------------------------------------------------------------
     R0005:C00002------------------------------------------------------------------------------
     ------------------------------------------------------------------------------------------
     R0005:C00002------------------------------------------------------------------------------
     ------------------------------------------------------------------------------------------
     R0005:C00002------------------------------------------------------------------------------
       ** END OF RUN :    4

     ******************************************************************************************





     --------------------
     | START            | Project  dir.:C:\Temp\15-319\PR\6-hour_SCS\
     -------------------- Rainfall dir.:C:\Temp\15-319\PR\6-hour_SCS\
         TZERO =   .00 hrs on        0
         METOUT=   2 (output = METRIC)
         NRUN  = 0006
         NSTORM=   1
                #  1=12regtim.o89
     ------------------------------------------------------------------------------------------
     R0006:C00002------------------------------------------------------------------------------
     *#*****************************************************************************
     *#  Project Name: [Mansfield Ski Club]    Project Number: [15-319]
     *#  Date        : 07-31-2017
     *#  Modeller    : [J. Lightheart]
     *#  Company     : WMI & Associates Ltd.
     *#  License #   :  2880720
     *#*****************************************************************************
     *
     * Post-Development Condition - Mansfield Ski Club
     *
     ------------------------------------------------------------------------------------------
     R0006:C00002------------------------------------------------------------------------------
     --------------------
     | READ STORM       |  Filename: C:\Temp\15-319\PR\6-hour_SCS\12regtim.o89
     | Ptotal= 193.00 mm|  Comments: TIMMINS REGIONAL STORM (12-hour)
     --------------------
            TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME
           hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm
            1:00  15.000|   3:00  10.000|   5:00   5.000|   7:00  43.000|   9:00  23.000|  11:00
            2:00  20.000|   4:00   3.000|   6:00  20.000|   8:00  20.000|  10:00  13.000|  12:00

     ------------------------------------------------------------------------------------------
     R0006:C00003------------------------------------------------------------------------------
     * SITE (POST1 - Controlled Area)
     --------------------------
     | CALIB STANDHYD         |   Area    (ha)=    2.74
     | 01:POST1      DT= 1.00 |   Total Imp(%)=   69.00   Dir. Conn.(%)=   59.00
     --------------------------
                                IMPERVIOUS    PERVIOUS (i)
```

```
     Surface Area     (ha)=       1.89          .85
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       3.50        33.30
     Length            (m)=     300.00         6.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      43.00        53.33
                over (min)        5.00         6.00
     Storage Coeff.  (min)=       4.75 (ii)    6.00 (ii)
     Unit Hyd. Tpeak (min)=       5.00         6.00
     Unit Hyd. peak  (cms)=        .23          .19
                                                           *TOTALS*
     PEAK FLOW       (cms)=        .19          .13           .318 (iii)
     TIME TO PEAK    (hrs)=       7.00         7.00          7.000
     RUNOFF VOLUME    (mm)=     190.99       158.56        177.702
     TOTAL RAINFALL   (mm)=     193.00       193.00        193.000
     RUNOFF COEFFICIENT   =        .99          .82           .921

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  84.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------------------
R0006:C00004--------------------------------------------------------------------------------
* EXTERNAL (Routed through SWM Facility)
--------------------------
| CALIB NASHYD           |   Area    (ha)=   11.940   Curve Number   (CN)= 83.00
| 02:EXT        DT= 1.00 |   Ia      (mm)=    6.800   # of Linear Res.(N)=  3.00
--------------------------   U.H. Tp(hrs)=     .240

     Unit Hyd Qpeak  (cms)=    1.900

     PEAK FLOW       (cms)=    1.239 (i)
     TIME TO PEAK    (hrs)=    7.017
     DURATION        (hrs)=   13.667, (dddd|hh:mm:)=   0|13:40
     AVERAGE FLOW    (cms)=     .353
     RUNOFF VOLUME    (mm)=  145.537
     TOTAL RAINFALL   (mm)=  193.000
     RUNOFF COEFFICIENT   =     .754

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

--------------------------------------------------------------------------------------------
R0006:C00005--------------------------------------------------------------------------------
* TOTAL FLOW TO SIDEROAD 15 CROSS CULVERT (POST1 CONTROLLED + EXT)
------------------------
| ADD HYD              |
| 03:POST1+EXT         |   ID:NHYD            AREA     QPEAK    TPEAK      R.V.     DWF
------------------------                      (ha)     (cms)    (hrs)      (mm)   (cms)
                      ID 1 01:POST1          2.740      .318    7.000   177.702    .000
                     +ID 2 02:EXT           11.940     1.239    7.017   145.537    .000
                     ===================================================================
```

```
                     SUM   03:POST1+EXT     14.680     1.556    7.000   151.541    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------------------
R0006:C00006--------------------------------------------------------------------------------
* SWM Facility
-----------------------
|  ROUTE RESERVOIR -> |    Requested routing time step =  1.0 min.
|  IN>03:POST1+EXT    |
| OUT<04:SWM Facili   | =========================  OUTLFOW STORAGE TABLE  =================
----------------------- OUTFLOW   STORAGE| OUTFLOW   STORAGE| OUTFLOW   STORAGE| OUTFLOW
                          (cms)   (ha.m.)|   (cms)   (ha.m.)|   (cms)   (ha.m.)|   (cms)
                           .000 .0000E+00|    .010 .1292E-01|    .065 .4128E-01|   1.071 .
                           .002 .6300E-03|    .010 .1442E-01|    .108 .4430E-01|   1.184 .
                           .003 .1310E-02|    .010 .1601E-01|    .159 .4743E-01|   1.308 .
                           .004 .2050E-02|    .011 .1769E-01|    .217 .5067E-01|   1.445 .
                           .005 .2840E-02|    .011 .1946E-01|    .281 .5403E-01|   1.594 .
                           .006 .3680E-02|    .011 .2133E-01|    .351 .5751E-01|   1.759 .
                           .006 .4590E-02|    .012 .2329E-01|    .425 .6112E-01|   2.020 .
                           .007 .5570E-02|    .012 .2535E-01|    .505 .6486E-01|   2.383 .
                           .007 .6610E-02|    .012 .2777E-01|    .589 .6872E-01|   2.840 .
                           .008 .7720E-02|    .013 .3027E-01|    .677 .7272E-01|   3.391 .
                           .008 .8910E-02|    .013 .3287E-01|    .769 .7686E-01|   4.041 .
                           .009 .1017E-01|    .013 .3557E-01|    .866 .8113E-01|   4.792 .
                           .009 .1150E-01|    .032 .3837E-01|    .966 .8555E-01|   5.649 .

     ROUTING RESULTS             AREA     QPEAK     TPEAK       R.V.
     ----------------------      (ha)     (cms)     (hrs)       (mm)
     INFLOW > 03:POST1+EXT     14.680     1.556     7.000    151.541
    OUTFLOW < 04:SWM Facili    14.680     1.540     7.033    151.540

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=   98.975
                   TIME SHIFT OF PEAK FLOW         (min)=     2.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=.1080E+00

--------------------------------------------------------------------------------------------
R0006:C00007--------------------------------------------------------------------------------
* SITE (POST2 - Uncontrolled Area)
--------------------------
| CALIB STANDHYD         |   Area    (ha)=     .89
| 05:POST2      DT= 1.00 |   Total Imp(%)=   21.00   Dir. Conn.(%)=   10.50
--------------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .19          .70
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       6.00        11.10
     Length            (m)=     120.00        50.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      43.00        44.82
                over (min)        2.00         9.00
     Storage Coeff.  (min)=       2.33 (ii)    8.99 (ii)
```

```
     Unit Hyd. Tpeak (min)=       2.00         9.00
     Unit Hyd. peak  (cms)=        .50          .13
                                                           *TOTALS*
     PEAK FLOW       (cms)=        .01          .09           .098 (iii)
     TIME TO PEAK    (hrs)=       6.98         7.00          7.000
     RUNOFF VOLUME    (mm)=     191.00       153.77        157.677
     TOTAL RAINFALL   (mm)=     193.00       193.00        193.000
     RUNOFF COEFFICIENT   =        .99          .80           .817

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  84.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------------------
R0006:C00008-------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------
R0006:C00002-------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------
R0006:C00002-------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------
R0006:C00002-------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------
R0006:C00002-------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------
R0006:C00002-------------------------------------------------------------------------------
--------------------
| FINISH           |
--------------------
-------------------------------------------------------------------------------------------
*******************************************************************************************
     WARNINGS / ERRORS / NOTES
     -------------------------
   Simulation ended on 2020-12-09     at 16:06:26
===========================================================================================
```

Post-Development Condition
4-hour Chicago Storm Distribution

```
2     Metric units
*#******************************************************************************
*#  Project Name: [Mansfield Ski Club]    Project Number: [15-319]
*#  Date        : 07-31-2017
*#  Modeller    : [J. Lightheart]
*#  Company     : WMI & Associates Ltd.
*#  License #   :  2880720
*#******************************************************************************
*
* Post-Development Condition - Mansfield Ski Club
*
*% 25mm Chicago Storm Dist. based on Mansfield, ON. rainfall (4-hr)
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[1]
*%                   ["25mm4hr.stm"] <--storm filename
*%-----------------|-----------------------------------------------------------|
READ STORM          STORM_FILENAME=["STORM.001"]
*%-----------------|-----------------------------------------------------------|
* SITE (POST1 - Controlled Area)
CALIB STANDHYD      ID=[1], NHYD=["POST1"], DT=[1](min), AREA=[2.74](ha),
                    XIMP=[0.59], TIMP=[0.69], DWF=[0](cms), LOSS=[2],
                    SCS curve number CN=[84],
                    Pervious   surfaces: IAper=[5.0](mm), SLPP=[33.3](%),
                                         LGP=[6](m), MNP=[0.25], SCP=[0](min),
                    Impervious surfaces: IAimp=[2.0](mm), SLPI=[3.5](%),
                                         LGI=[300](m), MNI=[0.013], SCI=[0](min),
                    RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
*%-----------------|-----------------------------------------------------------|
* EXTERNAL (Routed through SWM Facility)
CALIB NASHYD        ID=[2], NHYD=["EXT"], DT=[1]min, AREA=[11.94](ha),
                    DWF=[0](cms),  CN/C=[83], IA=[6.8](mm),
                    N=[3], TP=[0.24]hrs,
                    RAINFALL=[ ,  ,  ,  , ](mm/hr),  END=-1
*%-----------------|-----------------------------------------------------------|
* TOTAL FLOW TO SIDEROAD 15 CROSS CULVERT (POST1 CONTROLLED + EXT)
ADD HYD             IDsum=[3], NHYD=["POST1+EXT"], IDs to add=[1+2]
*%-----------------|-----------------------------------------------------------|
* SWM Facility
ROUTE RESERVOIR     IDout=[4], NHYD=["SWM Facility"], IDin=[3], RDT=[1](min),
                         TABLE of ( OUTFLOW-STORAGE ) values
                                   (cms) - (ha-m)
                                 [0.0000 , 0.00000]
                                 [0.0015 , 0.00063]
                                 [0.0031 , 0.00131]
                                 [0.0041 , 0.00205]
                                 [0.0050 , 0.00284]
                                 [0.0057 , 0.00368]
                                 [0.0063 , 0.00459]
                                 [0.0069 , 0.00557]
                                 [0.0074 , 0.00661]
                                 [0.0079 , 0.00772]
                                 [0.0084 , 0.00891]
                                 [0.0088 , 0.01017]
                                 [0.0092 , 0.01150]
                                 [0.0096 , 0.01292]
                                 [0.0100 , 0.01442]
                                 [0.0104 , 0.01601]
                                 [0.0108 , 0.01769]
                                 [0.0111 , 0.01946]
                                 [0.0114 , 0.02133]
                                 [0.0118 , 0.02329]
```

```
                                 [0.0121 , 0.02535]
                                 [0.0124 , 0.02777]
                                 [0.0127 , 0.03027]
                                 [0.0130 , 0.03287]
                                 [0.0133 , 0.03557]
                                 [0.0317 , 0.03837]
                                 [0.0651 , 0.04128]
                                 [0.1082 , 0.04430]
                                 [0.1593 , 0.04743]
                                 [0.2172 , 0.05067]
                                 [0.2811 , 0.05403]
                                 [0.3506 , 0.05751]
                                 [0.4252 , 0.06112]
                                 [0.5047 , 0.06486]
                                 [0.5887 , 0.06872]
                                 [0.6769 , 0.07272]
                                 [0.7693 , 0.07686]
                                 [0.8656 , 0.08113]
                                 [0.9656 , 0.08555]
                                 [1.0706 , 0.09011]
                                 [1.1842 , 0.09483]
                                 [1.3084 , 0.09970]
                                 [1.4447 , 0.10472]
                                 [1.5945 , 0.10990]
                                 [1.7589 , 0.11524]
                                 [2.0195 , 0.12075]
                                 [2.3829 , 0.14300]
                                 [2.8396 , 0.14870]
                                 [3.3911 , 0.15454]
                                 [4.0406 , 0.16053]
                                 [4.7921 , 0.16666]
                                 [5.6495 , 0.17293]
                                 [   -1  ,  -1  ]  (maximum one hundred pairs of points)
                                 IDovf=[   ], NHYDovf=["      "],
*%-----------------|-------------------------------------------------------------------------
* SITE (POST2 - Uncontrolled Area)
CALIB STANDHYD      ID=[5], NHYD=["POST2"], DT=[1](min), AREA=[0.89](ha),
                    XIMP=[0.105], TIMP=[0.21], DWF=[0](cms), LOSS=[2],
                    SCS curve number CN=[84],
                    Pervious   surfaces: IAper=[5.0](mm), SLPP=[11.1](%),
                                         LGP=[50](m), MNP=[0.25], SCP=[0](min),
                    Impervious surfaces: IAimp=[2.0](mm), SLPI=[6.0](%),
                                         LGI=[120](m), MNI=[0.013], SCI=[0](min),
                    RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
*%-----------------|-----------------------------------------------------------|
*% 2-year Chicago Storm Dist. based on Mansfield, ON. rainfall (4-hr)
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[2]
*%                   ["2CHI4.stm"] <--storm filename
*%-----------------|-----------------------------------------------------------|
*% 5-year Chicago Storm Dist. based on Mansfield, ON. rainfall (4-hr)
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[3]
*%                   ["5CHI4.stm"] <--storm filename
*%-----------------|-----------------------------------------------------------|
*% 25-year Chicago Storm Dist. based on Mansfield, ON. rainfall (4-hr)
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[4]
*%                   ["25CHI4.stm"] <--storm filename
*%-----------------|-----------------------------------------------------------|
*% 100-year Chicago Storm Dist. based on Mansfield, ON. rainfall (4-hr)
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[5]
*%                   ["100CHI4.stm"] <--storm filename
```

```
*%-----------------|-----------------------------------------------------------|
*% Timmins Regional Storm (12-hr)
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[6]
*%                   ["12regtim.o89"] <--storm filename
*%-----------------|-----------------------------------------------------------|
FINISH
```

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

 SSSSS   W   W   M   M   H   H   Y   Y   M   M    OOO          222     000    11   77777 ==
 S       W W W   MM MM   H   H    Y Y    MM MM   O   O           2     0   0  11   7   7
 SSSSS   W W W   M M M   HHHHH     Y     M M M   O   O           2     0   0  11       7
     S    W W    M   M   H   H     Y     M   M   O   O        222      0   0  11      7
 SSSSS    W W    M   M   H   H     Y     M   M    OOO         2        0   0  11     7   ==
                                                              2        0   0  11    7    #
       StormWater Management HYdrologic Model                  222     000    11    7    ==

 ******************************************************************************************
 **************************************  SWMHYMO Ver4.05.0  ******************************
 ******************  A single event and continuous hydrologic simulation model  ***********
 ******************     based on the principles of HYMO and its successors      ***********
 ******************                 OTTHYMO-83 and OTTHYMO-89.                  ***********
 ******************************************************************************************
 ****************** Distributed by:  J.F. Sabourin and Associates Inc.          ***********
 ******************                  Ottawa,  Ontario: (613) 836-3884           ***********
 ******************                  Gatineau, Quebec: (819) 243-6858           ***********
 ******************                  E-Mail: swmhymo@jfsa.com                   ***********
 ******************************************************************************************

 ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
 ++++++++++++++++++ Licensed user: WMI & Associates Ltd.                        +++++++++++
 ++++++++++++++++++               Barrie                SERIAL#:2880720         +++++++++++
 ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

 ******************************************************************************************
 ******************            ++++++ PROGRAM ARRAY DIMENSIONS ++++++           ***********
 ******************            Maximum value for ID numbers  :     11          ***********
 ******************            Max. number of rainfall points: 105408          ***********
 ******************            Max. number of flow points    : 105408          ***********
 ******************************************************************************************


 *******************************   D E T A I L E D   O U T P U T   ***********************
 ******************************************************************************************
 *                 RUN DATE: 2020-12-09     TIME: 16:05:29     RUN COUNTER: 000001
 ******************************************************************************************
 * Input   file: C:\Temp\15-319\PR\4-hour_Chic\2-CYRCHI.dat
 * Output  file: C:\Temp\15-319\PR\4-hour_Chic\2-CYRCHI.out
 * Summary file: C:\Temp\15-319\PR\4-hour_Chic\2-CYRCHI.sum
 * User comments:
 * 1:______________________________________________________________________________________
 * 2:______________________________________________________________________________________
 * 3:______________________________________________________________________________________
 ******************************************************************************************

-------------------------------------------------------------------------------------------
R0001:C00001-------------------------------------------------------------------------------
*#*****************************************************************************
*#  Project Name: [Mansfield Ski Club]    Project Number: [15-319]
*#  Date        : 07-31-2017
```

```
*#  Modeller    : [J. Lightheart]
*#  Company     : WMI & Associates Ltd.
*#  License #   :  2880720
*#*******************************************************************************
*
* Post-Development Condition - Mansfield Ski Club
*
--------------------
| START           | Project  dir.:C:\Temp\15-319\PR\4-hour_Chic\
-------------------- Rainfall dir.:C:\Temp\15-319\PR\4-hour_Chic\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 0001
    NSTORM=   1
           #  1=25mm4hr.stm
-------------------------------------------------------------------------------------------
R0001:C00002-------------------------------------------------------------------------------
--------------------
| READ STORM       |  Filename: C:\Temp\15-319\PR\4-hour_Chic\25mm4hr.stm
| Ptotal=  25.00 mm|  Comments: 25mm Chicago Storm Distribution (4-hour) Mansfield, ON.
--------------------
      TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME
     hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm
      0:10   1.970|   0:50   3.820|   1:30  13.830|   2:10   4.080|   2:50   2.650|   3:30
      0:20   2.220|   1:00   5.380|   1:40   8.070|   2:20   3.570|   3:00   2.450|   3:40
      0:30   2.550|   1:10  10.940|   1:50   5.950|   2:30   3.190|   3:10   2.290|   3:50
      0:40   3.030|   1:20  56.670|   2:00   4.810|   2:40   2.890|   3:20   2.150|   4:00

-------------------------------------------------------------------------------------------
R0001:C00003-------------------------------------------------------------------------------
* SITE (POST1 - Controlled Area)
--------------------------
| CALIB STANDHYD         |   Area    (ha)=    2.74
| 01:POST1      DT= 1.00 |   Total Imp(%)=   69.00   Dir. Conn.(%)=   59.00
--------------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.89          .85
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       3.50        33.30
     Length            (m)=     300.00         6.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      56.67        23.86
                over (min)        4.00         6.00
     Storage Coeff.  (min)=       4.26 (ii)    5.98 (ii)
     Unit Hyd. Tpeak (min)=       4.00         6.00
     Unit Hyd. peak  (cms)=        .27          .19
                                                         *TOTALS*
     PEAK FLOW       (cms)=        .22          .04          .255 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.40         1.350
     RUNOFF VOLUME    (mm)=      23.01         7.79        16.768
     TOTAL RAINFALL   (mm)=      25.01        25.01        25.005
     RUNOFF COEFFICIENT   =        .92          .31          .671
```

```
       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  84.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------------------
R0001:C00004-------------------------------------------------------------------------------
* EXTERNAL (Routed through SWM Facility)
-------------------------
| CALIB NASHYD            |   Area    (ha)=   11.940   Curve Number   (CN)= 83.00
| 02:EXT        DT= 1.00 |   Ia      (mm)=    6.800   # of Linear Res.(N)=  3.00
-------------------------    U.H. Tp(hrs)=     .240

     Unit Hyd Qpeak  (cms)=    1.900

     PEAK FLOW       (cms)=     .115 (i)
     TIME TO PEAK    (hrs)=    1.650
     DURATION        (hrs)=    5.667, (dddd|hh:mm:)=   0|05:40
     AVERAGE FLOW    (cms)=     .028
     RUNOFF VOLUME    (mm)=    4.719
     TOTAL RAINFALL   (mm)=   25.005
     RUNOFF COEFFICIENT   =     .189

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

-------------------------------------------------------------------------------------------
R0001:C00005-------------------------------------------------------------------------------
* TOTAL FLOW TO SIDEROAD 15 CROSS CULVERT (POST1 CONTROLLED + EXT)
------------------------
| ADD HYD              |
| 03:POST1+EXT         |   ID:NHYD            AREA     QPEAK    TPEAK      R.V.     DWF
-----------------------                       (ha)     (cms)    (hrs)      (mm)   (cms)
                      ID 1 01:POST1          2.740      .255    1.350    16.768    .000
                     +ID 2 02:EXT           11.940      .115    1.650     4.719    .000
                     ==================================================================
                     SUM   03:POST1+EXT     14.680      .282    1.367     6.968    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------------------
R0001:C00006-------------------------------------------------------------------------------
* SWM Facility
-----------------------
|  ROUTE RESERVOIR -> |    Requested routing time step =  1.0 min.
|  IN>03:POST1+EXT    |
| OUT<04:SWM Facili   | =========================  OUTLFOW STORAGE TABLE  =================
----------------------- OUTFLOW   STORAGE| OUTFLOW   STORAGE| OUTFLOW   STORAGE| OUTFLOW
                          (cms)   (ha.m.)|   (cms)   (ha.m.)|   (cms)   (ha.m.)|   (cms)
                           .000 .0000E+00|    .010 .1292E-01|    .065 .4128E-01|   1.071 .
                           .002 .6300E-03|    .010 .1442E-01|    .108 .4430E-01|   1.184 .
                           .003 .1310E-02|    .010 .1601E-01|    .159 .4743E-01|   1.308 .
                           .004 .2050E-02|    .011 .1769E-01|    .217 .5067E-01|   1.445 .
```

```
                           .005 .2840E-02|    .011 .1946E-01|    .281 .5403E-01|   1.594 .
                           .006 .3680E-02|    .011 .2133E-01|    .351 .5751E-01|   1.759 .
                           .006 .4590E-02|    .012 .2329E-01|    .425 .6112E-01|   2.020 .
                           .007 .5570E-02|    .012 .2535E-01|    .505 .6486E-01|   2.383 .
                           .007 .6610E-02|    .012 .2777E-01|    .589 .6872E-01|   2.840 .
                           .008 .7720E-02|    .013 .3027E-01|    .677 .7272E-01|   3.391 .
                           .008 .8910E-02|    .013 .3287E-01|    .769 .7686E-01|   4.041 .
                           .009 .1017E-01|    .013 .3557E-01|    .866 .8113E-01|   4.792 .
                           .009 .1150E-01|    .032 .3837E-01|    .966 .8555E-01|   5.649 .

     ROUTING RESULTS             AREA     QPEAK     TPEAK       R.V.
     ----------------------      (ha)     (cms)     (hrs)       (mm)
     INFLOW > 03:POST1+EXT     14.680      .282     1.367      6.968
    OUTFLOW < 04:SWM Facili    14.680      .108     2.033      6.968

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=   38.291
                   TIME SHIFT OF PEAK FLOW         (min)=    40.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=.4429E-01

-------------------------------------------------------------------------------------------
R0001:C00007-------------------------------------------------------------------------------
* SITE (POST2 - Uncontrolled Area)
-------------------------
| CALIB STANDHYD         |   Area    (ha)=     .89
| 05:POST2       DT= 1.00 |   Total Imp(%)=   21.00   Dir. Conn.(%)=   10.50
-------------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .19          .70
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       6.00        11.10
     Length            (m)=     120.00        50.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      56.67        11.01
                over (min)       2.00        14.00
     Storage Coeff.  (min)=       2.09 (ii)   13.75 (ii)
     Unit Hyd. Tpeak (min)=       2.00        14.00
     Unit Hyd. peak  (cms)=        .54          .08
                                                           *TOTALS*
     PEAK FLOW       (cms)=        .01          .01           .018 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.55          1.333
     RUNOFF VOLUME    (mm)=      23.00         6.70          8.411
     TOTAL RAINFALL   (mm)=      25.01        25.01         25.005
     RUNOFF COEFFICIENT   =        .92          .27           .336

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  84.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------------------
R0001:C00008-------------------------------------------------------------------------------
  ** END OF RUN :    0
```

```
    ******************************************************************************************





    --------------------
    | START            | Project  dir.:C:\Temp\15-319\PR\4-hour_Chic\
    -------------------- Rainfall dir.:C:\Temp\15-319\PR\4-hour_Chic\
        TZERO =   .00 hrs on        0
        METOUT=   2 (output = METRIC)
        NRUN  = 0002
        NSTORM=   1
               #  1=2CHI4.stm
    ------------------------------------------------------------------------------------------
    R0002:C00002------------------------------------------------------------------------------
    *#******************************************************************************
    *#  Project Name: [Mansfield Ski Club]    Project Number: [15-319]
    *#  Date        : 07-31-2017
    *#  Modeller    : [J. Lightheart]
    *#  Company     : WMI & Associates Ltd.
    *#  License #   :  2880720
    *#******************************************************************************
    *
    * Post-Development Condition - Mansfield Ski Club
    *
    ------------------------------------------------------------------------------------------
    R0002:C00002------------------------------------------------------------------------------
    --------------------
    | READ STORM       |  Filename: C:\Temp\15-319\PR\4-hour_Chic\2CHI4.stm
    | Ptotal=  32.37 mm|  Comments: 2-Year Chicago Storm Distribution (4-hour) Mansfield, ON.
    --------------------
          TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME
         hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm
          0:10   2.552|   0:50   4.945|   1:30  17.908|   2:10   5.281|   2:50   3.431|   3:30
          0:20   2.869|   1:00   6.961|   1:40  10.450|   2:20   4.618|   3:00   3.177|   3:40
          0:30   3.301|   1:10  14.171|   1:50   7.709|   2:30   4.124|   3:10   2.963|   3:50
          0:40   3.928|   1:20  73.380|   2:00   6.227|   2:40   3.740|   3:20   2.781|   4:00

    ------------------------------------------------------------------------------------------
    R0002:C00003------------------------------------------------------------------------------
    * SITE (POST1 - Controlled Area)
    --------------------------
    | CALIB STANDHYD         |   Area    (ha)=    2.74
    | 01:POST1      DT= 1.00 |   Total Imp(%)=   69.00   Dir. Conn.(%)=   59.00
    --------------------------
                                  IMPERVIOUS    PERVIOUS (i)
         Surface Area     (ha)=       1.89          .85
         Dep. Storage     (mm)=       2.00         5.00
         Average Slope     (%)=       3.50        33.30
         Length            (m)=     300.00         6.00
         Mannings n           =       .013         .250
```

```
         Max.eff.Inten.(mm/hr)=      73.38        41.45
                    over (min)        4.00         5.00
         Storage Coeff.  (min)=       3.84 (ii)    5.22 (ii)
         Unit Hyd. Tpeak (min)=       4.00         5.00
         Unit Hyd. peak  (cms)=        .29          .22
                                                               *TOTALS*
         PEAK FLOW       (cms)=        .30          .07           .359 (iii)
         TIME TO PEAK    (hrs)=       1.33         1.37          1.350
         RUNOFF VOLUME    (mm)=      30.37        12.54         23.064
         TOTAL RAINFALL   (mm)=      32.37        32.37         32.374
         RUNOFF COEFFICIENT   =        .94          .39           .712

           (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
               CN* =  84.0    Ia = Dep. Storage  (Above)
          (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
         (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

    ------------------------------------------------------------------------------------------
    R0002:C00004------------------------------------------------------------------------------
    * EXTERNAL (Routed through SWM Facility)
    --------------------------
    | CALIB NASHYD           |   Area    (ha)=   11.940   Curve Number   (CN)= 83.00
    | 02:EXT        DT= 1.00 |   Ia      (mm)=    6.800   # of Linear Res.(N)=  3.00
    --------------------------   U.H. Tp(hrs)=     .240

         Unit Hyd Qpeak  (cms)=    1.900

         PEAK FLOW       (cms)=     .229 (i)
         TIME TO PEAK    (hrs)=    1.617
         DURATION        (hrs)=    5.667, (dddd|hh:mm:)=   0|05:40
         AVERAGE FLOW    (cms)=     .049
         RUNOFF VOLUME    (mm)=    8.428
         TOTAL RAINFALL   (mm)=   32.374
         RUNOFF COEFFICIENT   =     .260

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

    ------------------------------------------------------------------------------------------
    R0002:C00005------------------------------------------------------------------------------
    * TOTAL FLOW TO SIDEROAD 15 CROSS CULVERT (POST1 CONTROLLED + EXT)
    ------------------------
    | ADD HYD                |
    | 03:POST1+EXT           |   ID:NHYD            AREA     QPEAK    TPEAK      R.V.     DWF
    ------------------------                         (ha)     (cms)    (hrs)      (mm)   (cms)
                          ID 1 01:POST1          2.740      .359    1.350    23.064    .000
                         +ID 2 02:EXT           11.940      .229    1.617     8.428    .000
                         ==========================================================
                         SUM   03:POST1+EXT     14.680      .434    1.367    11.160    .000

       NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

    ------------------------------------------------------------------------------------------
```

```
R0002:C00006-------------------------------------------------------------------------------
* SWM Facility
-----------------------
|  ROUTE RESERVOIR -> |    Requested routing time step =  1.0 min.
|  IN>03:POST1+EXT    |
| OUT<04:SWM Facili   | =========================  OUTLFOW STORAGE TABLE  =================
----------------------- OUTFLOW   STORAGE| OUTFLOW   STORAGE| OUTFLOW   STORAGE| OUTFLOW
                          (cms)   (ha.m.)|   (cms)   (ha.m.)|   (cms)   (ha.m.)|   (cms)
                           .000 .0000E+00|    .010 .1292E-01|    .065 .4128E-01|   1.071 .
                           .002 .6300E-03|    .010 .1442E-01|    .108 .4430E-01|   1.184 .
                           .003 .1310E-02|    .010 .1601E-01|    .159 .4743E-01|   1.308 .
                           .004 .2050E-02|    .011 .1769E-01|    .217 .5067E-01|   1.445 .
                           .005 .2840E-02|    .011 .1946E-01|    .281 .5403E-01|   1.594 .
                           .006 .3680E-02|    .011 .2133E-01|    .351 .5751E-01|   1.759 .
                           .006 .4590E-02|    .012 .2329E-01|    .425 .6112E-01|   2.020 .
                           .007 .5570E-02|    .012 .2535E-01|    .505 .6486E-01|   2.383 .
                           .007 .6610E-02|    .012 .2777E-01|    .589 .6872E-01|   2.840 .
                           .008 .7720E-02|    .013 .3027E-01|    .677 .7272E-01|   3.391 .
                           .008 .8910E-02|    .013 .3287E-01|    .769 .7686E-01|   4.041 .
                           .009 .1017E-01|    .013 .3557E-01|    .866 .8113E-01|   4.792 .
                           .009 .1150E-01|    .032 .3837E-01|    .966 .8555E-01|   5.649 .

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     ----------------------     (ha)     (cms)     (hrs)       (mm)
     INFLOW > 03:POST1+EXT     14.680      .434     1.367     11.160
    OUTFLOW < 04:SWM Facili    14.680      .252     1.800     11.160

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=   58.087
                   TIME SHIFT OF PEAK FLOW         (min)=    26.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=.5250E-01

-------------------------------------------------------------------------------------------
R0002:C00007-------------------------------------------------------------------------------
* SITE (POST2 - Uncontrolled Area)
--------------------------
| CALIB STANDHYD         |   Area    (ha)=     .89
| 05:POST2      DT= 1.00 |   Total Imp(%)=   21.00   Dir. Conn.(%)=   10.50
--------------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .19          .70
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       6.00        11.10
     Length            (m)=     120.00        50.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      73.38        22.33
                over (min)       2.00        11.00
     Storage Coeff.  (min)=       1.88 (ii)   10.67 (ii)
     Unit Hyd. Tpeak (min)=       2.00        11.00
     Unit Hyd. peak  (cms)=        .58          .11
                                                           *TOTALS*
     PEAK FLOW       (cms)=        .02          .03          .032 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.48          1.483
```

```
     RUNOFF VOLUME    (mm)=      30.37        11.06         13.091
     TOTAL RAINFALL   (mm)=      32.37        32.37         32.374
     RUNOFF COEFFICIENT   =        .94          .34           .404

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  84.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------------------
R0002:C00008-------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------
R0002:C00002-------------------------------------------------------------------------------
  ** END OF RUN :    1

*******************************************************************************************





--------------------
| START            | Project  dir.:C:\Temp\15-319\PR\4-hour_Chic\
-------------------- Rainfall dir.:C:\Temp\15-319\PR\4-hour_Chic\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 0003
    NSTORM=   1
           #  1=5CHI4.stm
-------------------------------------------------------------------------------------------
R0003:C00002-------------------------------------------------------------------------------
*#******************************************************************************
*#  Project Name: [Mansfield Ski Club]    Project Number: [15-319]
*#  Date        : 07-31-2017
*#  Modeller    : [J. Lightheart]
*#  Company     : WMI & Associates Ltd.
*#  License #   :  2880720
*#******************************************************************************
*
* Post-Development Condition - Mansfield Ski Club
*
-------------------------------------------------------------------------------------------
R0003:C00002-------------------------------------------------------------------------------
--------------------
| READ STORM       |  Filename: C:\Temp\15-319\PR\4-hour_Chic\5CHI4.stm
| Ptotal=  42.60 mm|  Comments: 5-Year Chicago Storm Distribution (4-hour) Mansfield, ON.
--------------------
      TIME    RAIN|  TIME    RAIN|  TIME    RAIN|  TIME    RAIN|  TIME    RAIN|  TIME
     hh:mm   mm/hr| hh:mm   mm/hr| hh:mm   mm/hr| hh:mm   mm/hr| hh:mm   mm/hr| hh:mm
      0:10   3.347|  0:50   6.492|  1:30  23.565|  2:10   6.934|  2:50   4.502|  3:30
      0:20   3.764|  1:00   9.144|  1:40  13.736|  2:20   6.062|  3:00   4.168|  3:40
      0:30   4.331|  1:10  18.640|  1:50  10.128|  2:30   5.413|  3:10   3.887|  3:50
      0:40   5.155|  1:20  96.860|  2:00   8.178|  2:40   4.908|  3:20   3.648|  4:00
```

```
-------------------------------------------------------------------------------------------
R0003:C00003-------------------------------------------------------------------------------
* SITE (POST1 - Controlled Area)
--------------------------
| CALIB STANDHYD         |   Area    (ha)=    2.74
| 01:POST1      DT= 1.00 |   Total Imp(%)=   69.00   Dir. Conn.(%)=   59.00
--------------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.89          .85
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       3.50        33.30
     Length            (m)=     300.00         6.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      96.86        67.61
                over (min)        3.00         5.00
     Storage Coeff.  (min)=       3.44 (ii)    4.57 (ii)
     Unit Hyd. Tpeak (min)=       3.00         5.00
     Unit Hyd. peak  (cms)=        .34          .24
                                                           *TOTALS*
     PEAK FLOW       (cms)=        .41          .12           .516 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.37          1.333
     RUNOFF VOLUME    (mm)=      40.60        19.99         32.151
     TOTAL RAINFALL   (mm)=      42.60        42.60         42.603
     RUNOFF COEFFICIENT   =        .95          .47           .755

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  84.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------------------
R0003:C00004-------------------------------------------------------------------------------
* EXTERNAL (Routed through SWM Facility)
--------------------------
| CALIB NASHYD           |   Area    (ha)=   11.940   Curve Number   (CN)= 83.00
| 02:EXT        DT= 1.00 |   Ia      (mm)=    6.800   # of Linear Res.(N)=  3.00
--------------------------   U.H. Tp(hrs)=     .240

     Unit Hyd Qpeak  (cms)=    1.900

     PEAK FLOW       (cms)=     .433 (i)
     TIME TO PEAK    (hrs)=    1.600
     DURATION        (hrs)=    5.667, (dddd|hh:mm:)=   0|05:40
     AVERAGE FLOW    (cms)=     .085
     RUNOFF VOLUME    (mm)=   14.595
     TOTAL RAINFALL   (mm)=   42.603
     RUNOFF COEFFICIENT   =     .343

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

-------------------------------------------------------------------------------------------
```

```
R0003:C00005-------------------------------------------------------------------------------
* TOTAL FLOW TO SIDEROAD 15 CROSS CULVERT (POST1 CONTROLLED + EXT)
------------------------
| ADD HYD              |
| 03:POST1+EXT         |   ID:NHYD            AREA     QPEAK    TPEAK      R.V.     DWF
------------------------                      (ha)     (cms)    (hrs)      (mm)   (cms)
                      ID 1 01:POST1         2.740      .516    1.333    32.151    .000
                     +ID 2 02:EXT          11.940      .433    1.600    14.595    .000
                     ==================================================================
                     SUM   03:POST1+EXT     14.680      .669    1.350    17.872    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------------------
R0003:C00006-------------------------------------------------------------------------------
* SWM Facility
-----------------------
|  ROUTE RESERVOIR -> |    Requested routing time step =  1.0 min.
|  IN>03:POST1+EXT    |
| OUT<04:SWM Facili   | =========================  OUTLFOW STORAGE TABLE  =================
----------------------- OUTFLOW   STORAGE| OUTFLOW   STORAGE| OUTFLOW   STORAGE| OUTFLOW
                          (cms)   (ha.m.)|   (cms)   (ha.m.)|   (cms)   (ha.m.)|   (cms)
                           .000 .0000E+00|    .010 .1292E-01|    .065 .4128E-01|   1.071 .
                           .002 .6300E-03|    .010 .1442E-01|    .108 .4430E-01|   1.184 .
                           .003 .1310E-02|    .010 .1601E-01|    .159 .4743E-01|   1.308 .
                           .004 .2050E-02|    .011 .1769E-01|    .217 .5067E-01|   1.445 .
                           .005 .2840E-02|    .011 .1946E-01|    .281 .5403E-01|   1.594 .
                           .006 .3680E-02|    .011 .2133E-01|    .351 .5751E-01|   1.759 .
                           .006 .4590E-02|    .012 .2329E-01|    .425 .6112E-01|   2.020 .
                           .007 .5570E-02|    .012 .2535E-01|    .505 .6486E-01|   2.383 .
                           .007 .6610E-02|    .012 .2777E-01|    .589 .6872E-01|   2.840 .
                           .008 .7720E-02|    .013 .3027E-01|    .677 .7272E-01|   3.391 .
                           .008 .8910E-02|    .013 .3287E-01|    .769 .7686E-01|   4.041 .
                           .009 .1017E-01|    .013 .3557E-01|    .866 .8113E-01|   4.792 .
                           .009 .1150E-01|    .032 .3837E-01|    .966 .8555E-01|   5.649 .

     ROUTING RESULTS             AREA     QPEAK     TPEAK       R.V.
     ----------------------      (ha)     (cms)     (hrs)       (mm)
     INFLOW > 03:POST1+EXT     14.680      .669     1.350     17.872
    OUTFLOW < 04:SWM Facili    14.680      .494     1.700     17.872

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=   73.761
                   TIME SHIFT OF PEAK FLOW         (min)=    21.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=.6436E-01

-------------------------------------------------------------------------------------------
R0003:C00007-------------------------------------------------------------------------------
* SITE (POST2 - Uncontrolled Area)
--------------------------
| CALIB STANDHYD         |   Area    (ha)=     .89
| 05:POST2      DT= 1.00 |   Total Imp(%)=   21.00   Dir. Conn.(%)=   10.50
--------------------------
                              IMPERVIOUS    PERVIOUS (i)
```

```
     Surface Area     (ha)=        .19          .70
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       6.00        11.10
     Length            (m)=     120.00        50.00
     Mannings n          =        .013         .250

     Max.eff.Inten.(mm/hr)=      96.86        46.11
                over (min)        2.00         8.00
     Storage Coeff.  (min)=       1.69 (ii)    8.26 (ii)
     Unit Hyd. Tpeak (min)=       2.00         8.00
     Unit Hyd. peak  (cms)=        .62          .14
                                                           *TOTALS*
     PEAK FLOW       (cms)=        .03          .06          .065 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.42         1.350
     RUNOFF VOLUME    (mm)=      40.60        18.03        20.399
     TOTAL RAINFALL   (mm)=      42.60        42.60        42.603
     RUNOFF COEFFICIENT   =        .95          .42          .479

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  84.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------------------
R0003:C00008-------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------
R0003:C00002-------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------
R0003:C00002-------------------------------------------------------------------------------
  ** END OF RUN :    2

*******************************************************************************************





--------------------
| START            | Project  dir.:C:\Temp\15-319\PR\4-hour_Chic\
-------------------- Rainfall dir.:C:\Temp\15-319\PR\4-hour_Chic\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 0004
    NSTORM=   1
           #  1=25CHI4.stm
-------------------------------------------------------------------------------------------
R0004:C00002-------------------------------------------------------------------------------
*#*****************************************************************************
*#  Project Name: [Mansfield Ski Club]    Project Number: [15-319]
*#  Date        : 07-31-2017
*#  Modeller    : [J. Lightheart]
*#  Company     : WMI & Associates Ltd.
*#  License #   :  2880720
```

```
*#*****************************************************************************
*
* Post-Development Condition - Mansfield Ski Club
*
-------------------------------------------------------------------------------------------
R0004:C00002-------------------------------------------------------------------------------
--------------------
| READ STORM       |  Filename: C:\Temp\15-319\PR\4-hour_Chic\25CHI4.stm
| Ptotal=  58.08 mm|  Comments: 25-Year Chicago Storm Distribution (4-hour) Mansfield, ON.
--------------------
      TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME
     hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm
      0:10   4.562|   0:50   8.850|   1:30  32.125|   2:10   9.453|   2:50   6.138|   3:30
      0:20   5.131|   1:00  12.466|   1:40  18.726|   2:20   8.265|   3:00   5.682|   3:40
      0:30   5.904|   1:10  25.411|   1:50  13.807|   2:30   7.379|   3:10   5.299|   3:50
      0:40   7.028|   1:20 132.047|   2:00  11.148|   2:40   6.691|   3:20   4.973|   4:00

-------------------------------------------------------------------------------------------
R0004:C00003-------------------------------------------------------------------------------
* SITE (POST1 - Controlled Area)
--------------------------
| CALIB STANDHYD         |   Area    (ha)=    2.74
| 01:POST1      DT= 1.00 |   Total Imp(%)=   69.00   Dir. Conn.(%)=   59.00
--------------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.89          .85
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       3.50        33.30
     Length            (m)=     300.00         6.00
     Mannings n          =        .013         .250

     Max.eff.Inten.(mm/hr)=     132.05       113.47
                over (min)        3.00         4.00
     Storage Coeff.  (min)=       3.03 (ii)    3.96 (ii)
     Unit Hyd. Tpeak (min)=       3.00         4.00
     Unit Hyd. peak  (cms)=        .37          .28
                                                           *TOTALS*
     PEAK FLOW       (cms)=        .57          .21          .773 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.35         1.333
     RUNOFF VOLUME    (mm)=      56.08        32.44        46.388
     TOTAL RAINFALL   (mm)=      58.08        58.08        58.079
     RUNOFF COEFFICIENT   =        .97          .56          .799

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  84.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------------------
R0004:C00004-------------------------------------------------------------------------------
* EXTERNAL (Routed through SWM Facility)
--------------------------
| CALIB NASHYD           |   Area    (ha)=   11.940   Curve Number   (CN)= 83.00
```

```
| 02:EXT        DT= 1.00 |   Ia      (mm)=    6.800   # of Linear Res.(N)=  3.00
-------------------------   U.H. Tp(hrs)=     .240

     Unit Hyd Qpeak  (cms)=    1.900

     PEAK FLOW       (cms)=     .810 (i)
     TIME TO PEAK    (hrs)=    1.583
     DURATION        (hrs)=    5.667, (dddd|hh:mm:)=   0|05:40
     AVERAGE FLOW    (cms)=     .149
     RUNOFF VOLUME    (mm)=   25.455
     TOTAL RAINFALL   (mm)=   58.079
     RUNOFF COEFFICIENT   =     .438

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

-------------------------------------------------------------------------------------------
R0004:C00005-------------------------------------------------------------------------------
* TOTAL FLOW TO SIDEROAD 15 CROSS CULVERT (POST1 CONTROLLED + EXT)
------------------------
| ADD HYD              |
| 03:POST1+EXT         |   ID:NHYD           AREA     QPEAK    TPEAK      R.V.     DWF
------------------------                     (ha)     (cms)    (hrs)      (mm)   (cms)
                      ID 1 01:POST1          2.740      .773    1.333    46.388    .000
                     +ID 2 02:EXT           11.940      .810    1.583    25.455    .000
                     ===============================================================
                     SUM   03:POST1+EXT     14.680     1.105    1.350    29.362    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------------------
R0004:C00006-------------------------------------------------------------------------------
* SWM Facility
----------------------
|  ROUTE RESERVOIR -> |    Requested routing time step =  1.0 min.
|  IN>03:POST1+EXT    |
| OUT<04:SWM Facili   | =========================  OUTLFOW STORAGE TABLE  =================
---------------------- OUTFLOW   STORAGE| OUTFLOW   STORAGE| OUTFLOW   STORAGE| OUTFLOW
                         (cms)   (ha.m.)|   (cms)   (ha.m.)|   (cms)   (ha.m.)|   (cms)
                          .000 .0000E+00|    .010 .1292E-01|    .065 .4128E-01|   1.071 .
                          .002 .6300E-03|    .010 .1442E-01|    .108 .4430E-01|   1.184 .
                          .003 .1310E-02|    .010 .1601E-01|    .159 .4743E-01|   1.308 .
                          .004 .2050E-02|    .011 .1769E-01|    .217 .5067E-01|   1.445 .
                          .005 .2840E-02|    .011 .1946E-01|    .281 .5403E-01|   1.594 .
                          .006 .3680E-02|    .011 .2133E-01|    .351 .5751E-01|   1.759 .
                          .006 .4590E-02|    .012 .2329E-01|    .425 .6112E-01|   2.020 .
                          .007 .5570E-02|    .012 .2535E-01|    .505 .6486E-01|   2.383 .
                          .007 .6610E-02|    .012 .2777E-01|    .589 .6872E-01|   2.840 .
                          .008 .7720E-02|    .013 .3027E-01|    .677 .7272E-01|   3.391 .
                          .008 .8910E-02|    .013 .3287E-01|    .769 .7686E-01|   4.041 .
                          .009 .1017E-01|    .013 .3557E-01|    .866 .8113E-01|   4.792 .
                          .009 .1150E-01|    .032 .3837E-01|    .966 .8555E-01|   5.649 .

     ROUTING RESULTS             AREA     QPEAK     TPEAK       R.V.
```

```
     ----------------------      (ha)     (cms)     (hrs)       (mm)
     INFLOW > 03:POST1+EXT     14.680     1.105     1.350     29.362
    OUTFLOW < 04:SWM Facili    14.680      .915     1.650     29.362

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=   82.841
                   TIME SHIFT OF PEAK FLOW         (min)=    18.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=.8335E-01

-------------------------------------------------------------------------------------------
R0004:C00007-------------------------------------------------------------------------------
* SITE (POST2 - Uncontrolled Area)
--------------------------
| CALIB STANDHYD         |   Area    (ha)=     .89
| 05:POST2      DT= 1.00 |   Total Imp(%)=   21.00   Dir. Conn.(%)=   10.50
--------------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .19          .70
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       6.00        11.10
     Length            (m)=     120.00        50.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=     132.05        82.34
                over (min)       1.00         7.00
     Storage Coeff.  (min)=       1.49 (ii)    6.70 (ii)
     Unit Hyd. Tpeak (min)=       1.00         7.00
     Unit Hyd. peak  (cms)=        .83          .17
                                                           *TOTALS*
     PEAK FLOW       (cms)=        .03          .11           .120 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.40          1.333
     RUNOFF VOLUME    (mm)=      56.07        29.88         32.634
     TOTAL RAINFALL   (mm)=      58.08        58.08         58.079
     RUNOFF COEFFICIENT   =        .97          .51           .562

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  84.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------------------
R0004:C00008-------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------
R0004:C00002-------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------
R0004:C00002-------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------
R0004:C00002-------------------------------------------------------------------------------
  ** END OF RUN :    3

*******************************************************************************************
```

```
--------------------
| START            | Project  dir.:C:\Temp\15-319\PR\4-hour_Chic\
-------------------- Rainfall dir.:C:\Temp\15-319\PR\4-hour_Chic\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 0005
    NSTORM=   1
           #  1=100CHI4.stm
-------------------------------------------------------------------------------------------
R0005:C00002-------------------------------------------------------------------------------
*#******************************************************************************
*#  Project Name: [Mansfield Ski Club]    Project Number: [15-319]
*#  Date        : 07-31-2017
*#  Modeller    : [J. Lightheart]
*#  Company     : WMI & Associates Ltd.
*#  License #   :  2880720
*#******************************************************************************
*
* Post-Development Condition - Mansfield Ski Club
*
-------------------------------------------------------------------------------------------
R0005:C00002-------------------------------------------------------------------------------
--------------------
| READ STORM       |  Filename: C:\Temp\15-319\PR\4-hour_Chic\100CHI4.stm
| Ptotal=  70.93 mm|  Comments: 100-Year Chicago Storm Distribution (4-hour) Mansfield, ON.
--------------------
      TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME
     hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm
      0:10   5.571|   0:50  10.808|   1:30  39.231|   2:10  11.544|   2:50   7.495|   3:30
      0:20   6.266|   1:00  15.223|   1:40  22.869|   2:20  10.093|   3:00   6.939|   3:40
      0:30   7.210|   1:10  31.032|   1:50  16.861|   2:30   9.012|   3:10   6.472|   3:50
      0:40   8.582|   1:20 161.254|   2:00  13.614|   2:40   8.171|   3:20   6.073|   4:00

-------------------------------------------------------------------------------------------
R0005:C00003-------------------------------------------------------------------------------
* SITE (POST1 - Controlled Area)
--------------------------
| CALIB STANDHYD         |   Area    (ha)=    2.74
| 01:POST1      DT= 1.00 |   Total Imp(%)=   69.00   Dir. Conn.(%)=   59.00
--------------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.89          .85
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       3.50        33.30
     Length            (m)=     300.00         6.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=     161.25       151.92
                over (min)        3.00         4.00
     Storage Coeff.  (min)=       2.80 (ii)    3.62 (ii)
     Unit Hyd. Tpeak (min)=       3.00         4.00
```

```
     Unit Hyd. peak  (cms)=        .39          .30
                                                           *TOTALS*
     PEAK FLOW       (cms)=        .70          .30           .990 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.35          1.333
     RUNOFF VOLUME    (mm)=      68.93        43.47         58.488
     TOTAL RAINFALL   (mm)=      70.93        70.93         70.926
     RUNOFF COEFFICIENT   =        .97          .61           .825

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  84.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------------------
R0005:C00004-------------------------------------------------------------------------------
* EXTERNAL (Routed through SWM Facility)
-------------------------
| CALIB NASHYD           |   Area    (ha)=   11.940   Curve Number   (CN)= 83.00
| 02:EXT        DT= 1.00 |   Ia      (mm)=    6.800   # of Linear Res.(N)=  3.00
-------------------------    U.H. Tp(hrs)=     .240

     Unit Hyd Qpeak  (cms)=    1.900

     PEAK FLOW       (cms)=    1.168 (i)
     TIME TO PEAK    (hrs)=    1.567
     DURATION        (hrs)=    5.667, (dddd|hh:mm:)=   0|05:40
     AVERAGE FLOW    (cms)=     .207
     RUNOFF VOLUME    (mm)=   35.404
     TOTAL RAINFALL   (mm)=   70.926
     RUNOFF COEFFICIENT   =     .499

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

-------------------------------------------------------------------------------------------
R0005:C00005-------------------------------------------------------------------------------
* TOTAL FLOW TO SIDEROAD 15 CROSS CULVERT (POST1 CONTROLLED + EXT)
-----------------------
| ADD HYD              |
| 03:POST1+EXT         |   ID:NHYD            AREA     QPEAK    TPEAK      R.V.     DWF
-----------------------                       (ha)     (cms)    (hrs)      (mm)   (cms)
                      ID 1 01:POST1          2.740      .990    1.333    58.488    .000
                     +ID 2 02:EXT           11.940     1.168    1.567    35.404    .000
                     ===============================================================
                     SUM   03:POST1+EXT     14.680     1.506    1.367    39.713    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------------------
R0005:C00006-------------------------------------------------------------------------------
* SWM Facility
----------------------
|  ROUTE RESERVOIR -> |    Requested routing time step =  1.0 min.
|  IN>03:POST1+EXT    |
```

```
| OUT<04:SWM Facili   | =========================  OUTLFOW STORAGE TABLE  =================
----------------------- OUTFLOW   STORAGE| OUTFLOW   STORAGE| OUTFLOW   STORAGE| OUTFLOW
                          (cms)   (ha.m.)|   (cms)   (ha.m.)|   (cms)   (ha.m.)|   (cms)
                           .000 .0000E+00|    .010 .1292E-01|    .065 .4128E-01|   1.071 .
                           .002 .6300E-03|    .010 .1442E-01|    .108 .4430E-01|   1.184 .
                           .003 .1310E-02|    .010 .1601E-01|    .159 .4743E-01|   1.308 .
                           .004 .2050E-02|    .011 .1769E-01|    .217 .5067E-01|   1.445 .
                           .005 .2840E-02|    .011 .1946E-01|    .281 .5403E-01|   1.594 .
                           .006 .3680E-02|    .011 .2133E-01|    .351 .5751E-01|   1.759 .
                           .006 .4590E-02|    .012 .2329E-01|    .425 .6112E-01|   2.020 .
                           .007 .5570E-02|    .012 .2535E-01|    .505 .6486E-01|   2.383 .
                           .007 .6610E-02|    .012 .2777E-01|    .589 .6872E-01|   2.840 .
                           .008 .7720E-02|    .013 .3027E-01|    .677 .7272E-01|   3.391 .
                           .008 .8910E-02|    .013 .3287E-01|    .769 .7686E-01|   4.041 .
                           .009 .1017E-01|    .013 .3557E-01|    .866 .8113E-01|   4.792 .
                           .009 .1150E-01|    .032 .3837E-01|    .966 .8555E-01|   5.649 .

     ROUTING RESULTS             AREA     QPEAK     TPEAK       R.V.
     ----------------------      (ha)     (cms)     (hrs)       (mm)
     INFLOW > 03:POST1+EXT     14.680     1.506     1.367     39.713
    OUTFLOW < 04:SWM Facili    14.680     1.312     1.633     39.712

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=   87.069
                   TIME SHIFT OF PEAK FLOW         (min)=    16.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=.9983E-01

-------------------------------------------------------------------------------------------
R0005:C00007-------------------------------------------------------------------------------
* SITE (POST2 - Uncontrolled Area)
--------------------------
| CALIB STANDHYD         |   Area    (ha)=     .89
| 05:POST2      DT= 1.00 |   Total Imp(%)=   21.00   Dir. Conn.(%)=   10.50
--------------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .19          .70
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       6.00        11.10
     Length            (m)=     120.00        50.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=     161.25       116.15
                over (min)        1.00         6.00
     Storage Coeff.  (min)=       1.38 (ii)    5.92 (ii)
     Unit Hyd. Tpeak (min)=       1.00         6.00
     Unit Hyd. peak  (cms)=        .88          .19
                                                             *TOTALS*
     PEAK FLOW       (cms)=        .04          .16            .182 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.38           1.333
     RUNOFF VOLUME    (mm)=      68.92        40.51          43.489
     TOTAL RAINFALL   (mm)=      70.93        70.93          70.926
     RUNOFF COEFFICIENT   =        .97          .57            .613

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
```

```
           CN* =  84.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------------------
R0005:C00008-------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------
R0005:C00002-------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------
R0005:C00002-------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------
R0005:C00002-------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------
R0005:C00002-------------------------------------------------------------------------------
  ** END OF RUN :    4

*******************************************************************************************




--------------------
| START            | Project  dir.:C:\Temp\15-319\PR\4-hour_Chic\
-------------------- Rainfall dir.:C:\Temp\15-319\PR\4-hour_Chic\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 0006
    NSTORM=   1
           #  1=12regtim.o89
-------------------------------------------------------------------------------------------
R0006:C00002-------------------------------------------------------------------------------
*#*****************************************************************************
*#  Project Name: [Mansfield Ski Club]    Project Number: [15-319]
*#  Date        : 07-31-2017
*#  Modeller    : [J. Lightheart]
*#  Company     : WMI & Associates Ltd.
*#  License #   :  2880720
*#*****************************************************************************
*
* Post-Development Condition - Mansfield Ski Club
*
-------------------------------------------------------------------------------------------
R0006:C00002-------------------------------------------------------------------------------
--------------------
| READ STORM       |  Filename: C:\Temp\15-319\PR\4-hour_Chic\12regtim.o89
| Ptotal= 193.00 mm|  Comments: TIMMINS REGIONAL STORM (12-hour)
--------------------
      TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME
     hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm
      1:00  15.000|   3:00  10.000|   5:00   5.000|   7:00  43.000|   9:00  23.000|  11:00
      2:00  20.000|   4:00   3.000|   6:00  20.000|   8:00  20.000|  10:00  13.000|  12:00
```

```
 ------------------------------------------------------------------------------------------
 R0006:C00003------------------------------------------------------------------------------
 * SITE (POST1 - Controlled Area)
 --------------------------
 | CALIB STANDHYD         |   Area    (ha)=    2.74
 | 01:POST1      DT= 1.00 |   Total Imp(%)=   69.00   Dir. Conn.(%)=   59.00
 --------------------------
                               IMPERVIOUS    PERVIOUS (i)
      Surface Area     (ha)=       1.89          .85
      Dep. Storage     (mm)=       2.00         5.00
      Average Slope     (%)=       3.50        33.30
      Length            (m)=     300.00         6.00
      Mannings n          =       .013         .250

      Max.eff.Inten.(mm/hr)=      43.00        53.33
                 over (min)        5.00         6.00
      Storage Coeff.  (min)=       4.75 (ii)    6.00 (ii)
      Unit Hyd. Tpeak (min)=       5.00         6.00
      Unit Hyd. peak  (cms)=        .23          .19
                                                            *TOTALS*
      PEAK FLOW       (cms)=        .19          .13           .318 (iii)
      TIME TO PEAK    (hrs)=       7.00         7.00          7.000
      RUNOFF VOLUME    (mm)=     190.99       158.56        177.702
      TOTAL RAINFALL   (mm)=     193.00       193.00        193.000
      RUNOFF COEFFICIENT   =        .99          .82           .921

        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
             CN* =  84.0    Ia = Dep. Storage  (Above)
       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

 ------------------------------------------------------------------------------------------
 R0006:C00004------------------------------------------------------------------------------
 * EXTERNAL (Routed through SWM Facility)
 --------------------------
 | CALIB NASHYD           |   Area    (ha)=   11.940   Curve Number   (CN)= 83.00
 | 02:EXT        DT= 1.00 |   Ia      (mm)=    6.800   # of Linear Res.(N)=  3.00
 --------------------------   U.H. Tp(hrs)=     .240

      Unit Hyd Qpeak  (cms)=    1.900

      PEAK FLOW       (cms)=    1.239 (i)
      TIME TO PEAK    (hrs)=    7.017
      DURATION        (hrs)=   13.667, (dddd|hh:mm:)=   0|13:40
      AVERAGE FLOW    (cms)=     .353
      RUNOFF VOLUME    (mm)=  145.537
      TOTAL RAINFALL   (mm)=  193.000
      RUNOFF COEFFICIENT   =     .754

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

 ------------------------------------------------------------------------------------------
 R0006:C00005------------------------------------------------------------------------------
```

```
 * TOTAL FLOW TO SIDEROAD 15 CROSS CULVERT (POST1 CONTROLLED + EXT)
 ------------------------
 | ADD HYD               |
 | 03:POST1+EXT          |   ID:NHYD            AREA     QPEAK    TPEAK      R.V.     DWF
 ------------------------                        (ha)     (cms)    (hrs)      (mm)   (cms)
                       ID 1 01:POST1          2.740      .318    7.000   177.702    .000
                      +ID 2 02:EXT           11.940     1.239    7.017   145.537    .000
                      ==================================================================
                      SUM   03:POST1+EXT     14.680     1.556    7.000   151.541    .000

    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

 ------------------------------------------------------------------------------------------
 R0006:C00006------------------------------------------------------------------------------
 * SWM Facility
 -----------------------
 |  ROUTE RESERVOIR -> |    Requested routing time step =  1.0 min.
 |  IN>03:POST1+EXT    |
 | OUT<04:SWM Facili   | =========================  OUTLFOW STORAGE TABLE  =================
 ----------------------- OUTFLOW   STORAGE| OUTFLOW   STORAGE| OUTFLOW   STORAGE| OUTFLOW
                           (cms)   (ha.m.)|   (cms)   (ha.m.)|   (cms)   (ha.m.)|   (cms)
                            .000 .0000E+00|    .010 .1292E-01|    .065 .4128E-01|   1.071 .
                            .002 .6300E-03|    .010 .1442E-01|    .108 .4430E-01|   1.184 .
                            .003 .1310E-02|    .010 .1601E-01|    .159 .4743E-01|   1.308 .
                            .004 .2050E-02|    .011 .1769E-01|    .217 .5067E-01|   1.445 .
                            .005 .2840E-02|    .011 .1946E-01|    .281 .5403E-01|   1.594 .
                            .006 .3680E-02|    .011 .2133E-01|    .351 .5751E-01|   1.759 .
                            .006 .4590E-02|    .012 .2329E-01|    .425 .6112E-01|   2.020 .
                            .007 .5570E-02|    .012 .2535E-01|    .505 .6486E-01|   2.383 .
                            .007 .6610E-02|    .012 .2777E-01|    .589 .6872E-01|   2.840 .
                            .008 .7720E-02|    .013 .3027E-01|    .677 .7272E-01|   3.391 .
                            .008 .8910E-02|    .013 .3287E-01|    .769 .7686E-01|   4.041 .
                            .009 .1017E-01|    .013 .3557E-01|    .866 .8113E-01|   4.792 .
                            .009 .1150E-01|    .032 .3837E-01|    .966 .8555E-01|   5.649 .

      ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
      ----------------------      (ha)     (cms)     (hrs)       (mm)
      INFLOW > 03:POST1+EXT     14.680     1.556     7.000    151.541
     OUTFLOW < 04:SWM Facili    14.680     1.540     7.033    151.540

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=   98.975
                   TIME SHIFT OF PEAK FLOW         (min)=     2.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=.1080E+00

 ------------------------------------------------------------------------------------------
 R0006:C00007------------------------------------------------------------------------------
 * SITE (POST2 - Uncontrolled Area)
 --------------------------
 | CALIB STANDHYD         |   Area    (ha)=     .89
 | 05:POST2      DT= 1.00 |   Total Imp(%)=   21.00   Dir. Conn.(%)=   10.50
 --------------------------
                               IMPERVIOUS    PERVIOUS (i)
      Surface Area     (ha)=        .19          .70
```

```
          Dep. Storage     (mm)=       2.00         5.00
          Average Slope     (%)=       6.00        11.10
          Length            (m)=     120.00        50.00
          Mannings n           =       .013         .250

          Max.eff.Inten.(mm/hr)=      43.00        44.82
                     over (min)       2.00         9.00
          Storage Coeff.  (min)=       2.33 (ii)    8.99 (ii)
          Unit Hyd. Tpeak (min)=       2.00         9.00
          Unit Hyd. peak  (cms)=        .50          .13
                                                            *TOTALS*
          PEAK FLOW       (cms)=        .01          .09           .098 (iii)
          TIME TO PEAK    (hrs)=       6.98         7.00          7.000
          RUNOFF VOLUME    (mm)=     191.00       153.77        157.677
          TOTAL RAINFALL   (mm)=     193.00       193.00        193.000
          RUNOFF COEFFICIENT   =        .99          .80           .817

            (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
                CN* =  84.0    Ia = Dep. Storage  (Above)
           (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
          (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

     -------------------------------------------------------------------------------------------
     R0006:C00008-------------------------------------------------------------------------------
     -------------------------------------------------------------------------------------------
     R0006:C00002-------------------------------------------------------------------------------
     -------------------------------------------------------------------------------------------
     R0006:C00002-------------------------------------------------------------------------------
     -------------------------------------------------------------------------------------------
     R0006:C00002-------------------------------------------------------------------------------
     -------------------------------------------------------------------------------------------
     R0006:C00002-------------------------------------------------------------------------------
     -------------------------------------------------------------------------------------------
     R0006:C00002-------------------------------------------------------------------------------
     --------------------
     | FINISH           |
     --------------------
     -------------------------------------------------------------------------------------------
     *******************************************************************************************
          WARNINGS / ERRORS / NOTES
          -------------------------
        Simulation ended on 2020-12-09     at 16:05:29
     ===========================================================================================
```

APPENDIX E

TRAFFIC IMPACT OPINION LETTER

WMI & Associates Limited
119 Collier Street, Barrie, Ontario, L4M 1H5
P (705) 797-2027 F (705)797-2028

August 9, 2017
Revised December 10, 2020

Via: Email

Township of Mulmur
758070 2nd Line East
Mulmur, Ontario
L9V 0G8

Attention: **Tracey Atkinson**
CAO/Deputy Clerk/Planner

Re: **Mansfield Ski Club**
Community of Mansfield, Township of Mulmur
Traffic Impact Opinion
WMI File No.: 15-319

Dear Tracey,

The following provides our opinion of the traffic impact associated with the proposed development within the existing Mansfield Ski Club (MSC) that is located in the Township of Mulmur, Ontario.

Overview

The area of MSC that is proposed to be re-developed is accessed from the Ski Club's existing main entrance on the 15th Sideroad, approximately 0.7km west of the Airport Road and 15th Sideroad intersection.

The development is to comprise 91 residential units, as well as office and personal business spaces and an expanded parking lot; all of which is to reside within existing site boundaries. It is understood that the purpose of the proposed development is to provide additional amenities and offer on-site accommodation for the existing members.

Existing Conditions:

Access to MSC's main complex is off of 15th Sideroad, at the south end of the Club. The existing complex currently contains a main chalet building, an administration building, general manager office building, ski house, and a large gravel parking lot. From previous planning studies prepared for MSC, it has been identified that the observed parking capacity is approximately 356 vehicles as referenced from the Mansfield Ski Club Functional Assessment and Recommendations, Winter 2008/09 report, prepared by Stempski Kelly Associates Inc. This report further concludes that the main parking lot is adequate to support the demand during the peak ski season.

More recent data obtained from MSC reveals that their membership levels have remained within a consistent range over the past 15 years, and that these membership levels are constrained by hill capacity- as determined by lifts and hill space.

It is further noted that there are local members who reside adjacent to MSC's main complex and do not drive to the facility, and that not all of the Club's members and their families visit the facility at any given time.

Overall, it has been observed that the existing parking lot has always been sufficient in accommodating the demands during peak ski season.

Refer to the **Figure 1** for an illustration of the main complex's site layout.

Proposed Conditions:

The proposed development within the main complex is to be comprised of 91 residential units in the form of lofts and stacked townhomes, as well as ground floor office and personal business space. The existing parking lot is proposed to be re-developed and additional parking will be situated to the south and east of the existing parking lot. In total, the proposed parking lot will accommodate 371 vehicles. In addition to a marginal increase in capacity (from the observed 356 spaces under existing conditions), the new parking lot will also provide formalized vehicular circulation and improved parking space efficiency by delineating the internal laneways and parking stalls.

It should be noted that the existing site access onto 15th Sideroad is proposed to be maintained.

Refer to the **Figure 2** for an illustration of the proposed development within the main complex of MSC.

Vehicular Trip Impact

It is understood that other factors that could otherwise increase membership and associated vehicular trips such as lift capacity and hill space are not proposed to be altered, but rather the primary intent of the project is to provide additional amenities for the existing members.

The residential units are intended to offer on-site accommodation for members, which will inherently reduce the amount of vehicular trips in to and out of the facility. The remaining building space is intended to serve as accessory amenities to MSC's members. Any additional vehicular trips made by employees to these facilities are expected to be negligible, and furthermore they would be more than offset by the anticipated reduction in trips due to the onsite residential accommodations as noted previously.

It is expected that travel demand patterns and the timing of peak hourly trips may evolve from current peak ski season conditions as a result of the proposed amenities and onsite accommodations, however any changes in this regard will be negligible. As a result, and since the overall volume of vehicular trips is not anticipated to increase from existing conditions, it is our opinion that the proposed re-development of The Mansfield Ski Club can be accommodated by the existing road network without adverse impacts.

Should you have any questions or require additional information, please contact the undersigned.

Yours truly,

WMI & Associates Limited

Jonathan Reimer, P. Eng.

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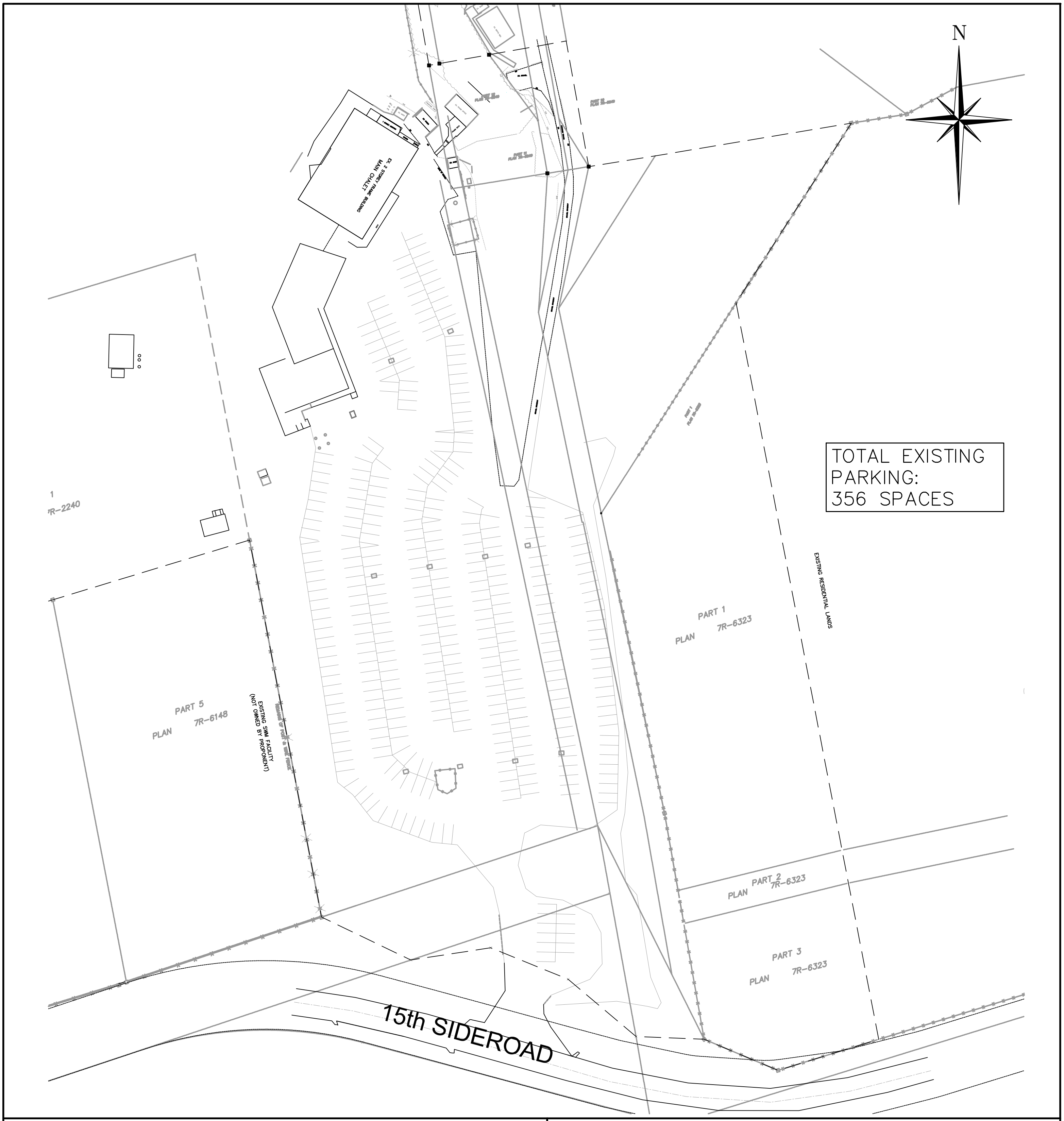


Drawing Title

EXISTING SKI CLUB SITE PLAN

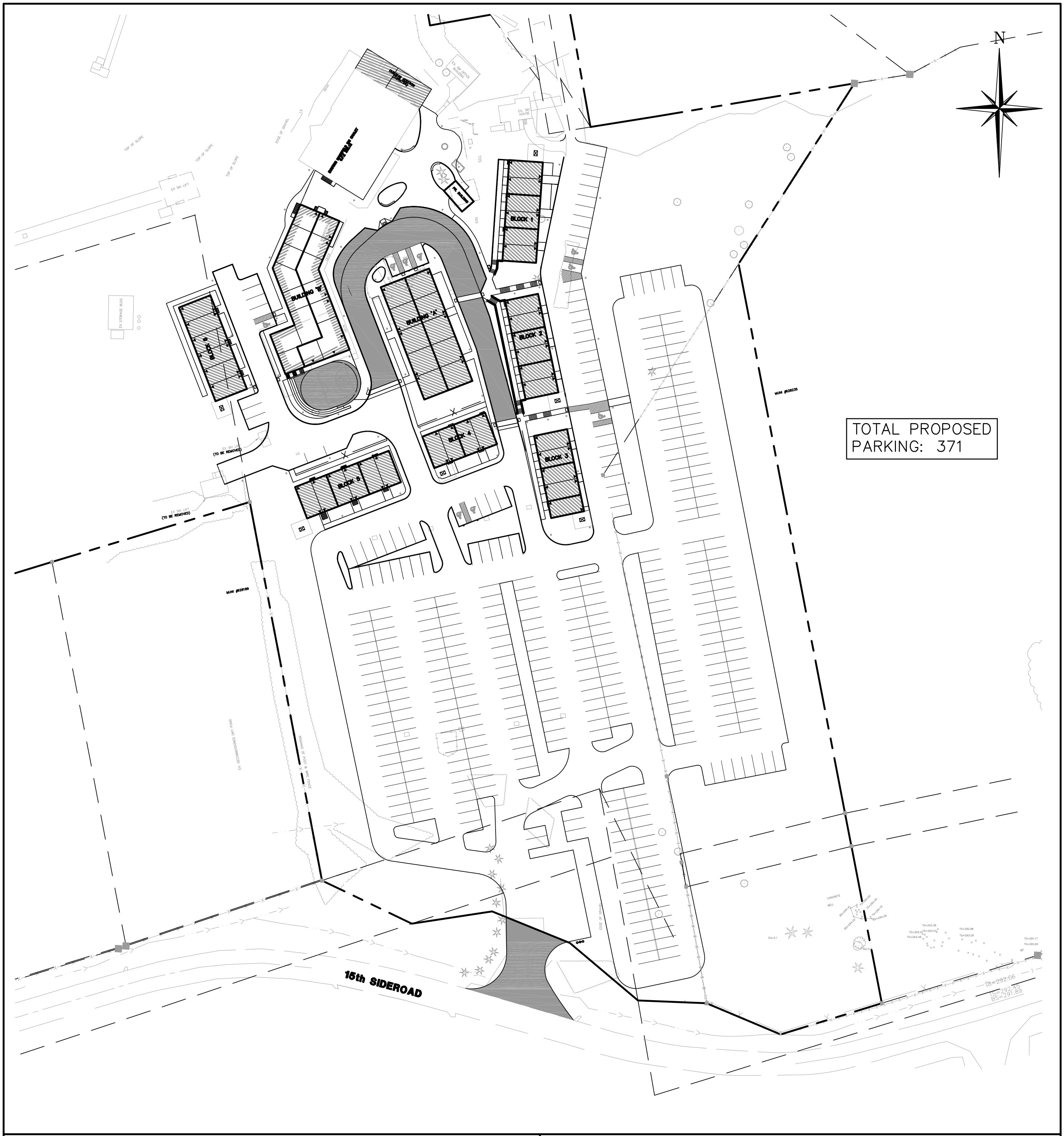
Project Title

MANSFIELD SKI CLUB

WMI & Associates Limited
119 Collier Street
Barrie, Ontario
L4M 1H5
705-797-2027
www.wmiengineering.ca

Drawn By	Checked By	Figure No.
JR	JWL	FIG1
Scale 1:1500	Project No. 15–319	

\\WMI-SERVER\wmi-server\Data\Projects\2015\15-319\CAD\WMI\FSR\FSR_Issue_No3\Level_3-Models\15-319_TIS_figures2.dwg,



Drawing Title

PROPOSED SKI CLUB SITE PLAN

Project Title

MANSFIELD SKI CLUB

WMI & Associates Limited
119 Collier Street
Barrie, Ontario
L4M 1H5
705-797-2027
www.wmiengineering.ca

Drawn By JR	Checked By JWL	Figure No. FIG2
Scale N.T.S.	Project No. 15–319	

\\WMI–SERVER\wmi–server\Data\Projects\2015\15–319\CAD\WMI\Issue_No2\201118_Baseplan_15–319.dwg, TIS–FIG2, 1:25.4

APPENDIX F

EXISTING SEWAGE TREATMENT SYSTEM ANALYSIS

WMI & Associates Limited
119 Collier Street, Barrie, Ontario, L4M 1H5
P (705) 797-2027 F (705)797-2028

January 20, 2016

Via: Email

County of Dufferin
55 Zina Street,
Orangeville, Ontario
L9W 1E5

Attention: Rita Geurts, M.A.A.T.O., C.B.C.O.
Building Inspector/Plans Examiner

Re: Ski House Development at the Mansfield Ski Club
Sewage Treatment System Analysis
WMI File No. 15-319

Dear Rita,

Based on our recent emailed correspondence, please find enclosed documentation supporting the use of the existing sewage treatment system for the proposed Ski House development at the Mansfield Ski Club (MSC) in Mansfield, Ontario.

Based on the background information provided to us and our correspondence with staff at the MSC, it is our understanding that the current on-site sewage treatment system consists of a 150mm diameter gravity sanitary sewer which collects the on-site sewage from both the existing 2-storey service/operations building and the 2-storey main chalet building. The 150mm diameter sanitary sewer drains from the main chalet building, southeast to an existing sewage pump chamber. The existing pump chamber is located approximately 20m east of the main chalet at the east limit of the gravel parking area and just west of the top of bank of the existing slope located between the gravel parking area and the existing gravel driveway which provides access to existing chalets located northeast of the MSC's main chalet building. From the existing pump chamber, the sewage is lifted and pumped into a Northern Purification System (NPS), model GC-2. Lastly from the GC-2 unit, the sewage is pumped southeast approximately 40m to an existing leaching bed located immediately east of the existing gravel driveway which provides access to the existing chalets located northeast of the MSC's main chalet building.

To determine the total daily sewage flow delivered to the sewage treatment system at the above mentioned site, the daily recorded water consumption records as well as the previously analyzed NPS systems batch meter records were analyzed. In addition to the review and analysis of the above mentioned data provided by the MSC, a site visit by WMI & Associates Limited on November 26, 2015 with Dave Morrison of the MSC present, was completed to confirm the existing layout and equipment is consistent with the background information provided by the client.

The MSC operates seasonally, typically between late December and early April. The MSC monitors and records daily during times of operation, the water consumption for each of its sources of water. The MSC primary domestic water supply is provided via a drilled well located just north of the convergence between the east limit of the existing gravel parking area and the existing driveway which services the chalets located northeast of the MSC's main chalet building. One other source of potable water which is rarely used, is an existing bored well located north of the MSC's main chalet building. Lastly, the remaining water source which is only used in the existing water closets and urinals, is provided by the Pine River located immediately northeast of the MSC. Each water source is metered and recorded by the MSC. This information was provided to WMI & Associates Limited for the months of December 2014 to March 2015 and was analyzed to determine the total daily sewage flows experienced at the MSC during the most recent ski season in order to confirm actual sewage flow values experienced by the sewage treatment system. It was determined based on the above mentioned water consumption records for December 2014 to March 2015, that the average total daily sewage flow produced at the MSC over this period of operation was 6.6m^3/day (6,600L/day). Refer to the attached Water Consumption Records Analysis spreadsheet provided herein for additional details.

In addition to the more recent water consumption records analysis provided above, please find attached supporting documentation from NPS which reports that based on the systems batch meter reading, during the ski season from December 2004 to April 2005, the average total daily sewage flow was approximately 7,350L/day.

Based on a design flow of 1,600L/day for a 3 bedroom dwelling as per the Ontario Building Code (OBC), Section 8.2.1.3. Sewage System Design Flows, Table 8.2.1.3.A, Residential Occupancy, and the most recent water consumption log records as noted above, the anticipated total daily sewage flow experienced by the existing sewage treatment system at the MSC including the development of the proposed Ski House is 8,200L/day. Considering the 24-hour rated capacity of the existing sewage treatment system which is 22,700L/day as well as its reserve volume of 9,100L and the additional surge tank located immediately east of the NPS system of 18,000L, the existing sewage treatment system is considered more than capable of providing the necessary treatment for all sewage flows generated in the post-development condition.

We trust the written confirmation provided above sufficiently addresses your requests outlined within our emailed correspondence dated January 7, 2016, but should you have any questions or require additional information please do not hesitate to contact the undersigned.

Yours truly,

WMI & Associates Limited

Jeremy W. Lightheart, P. Eng.

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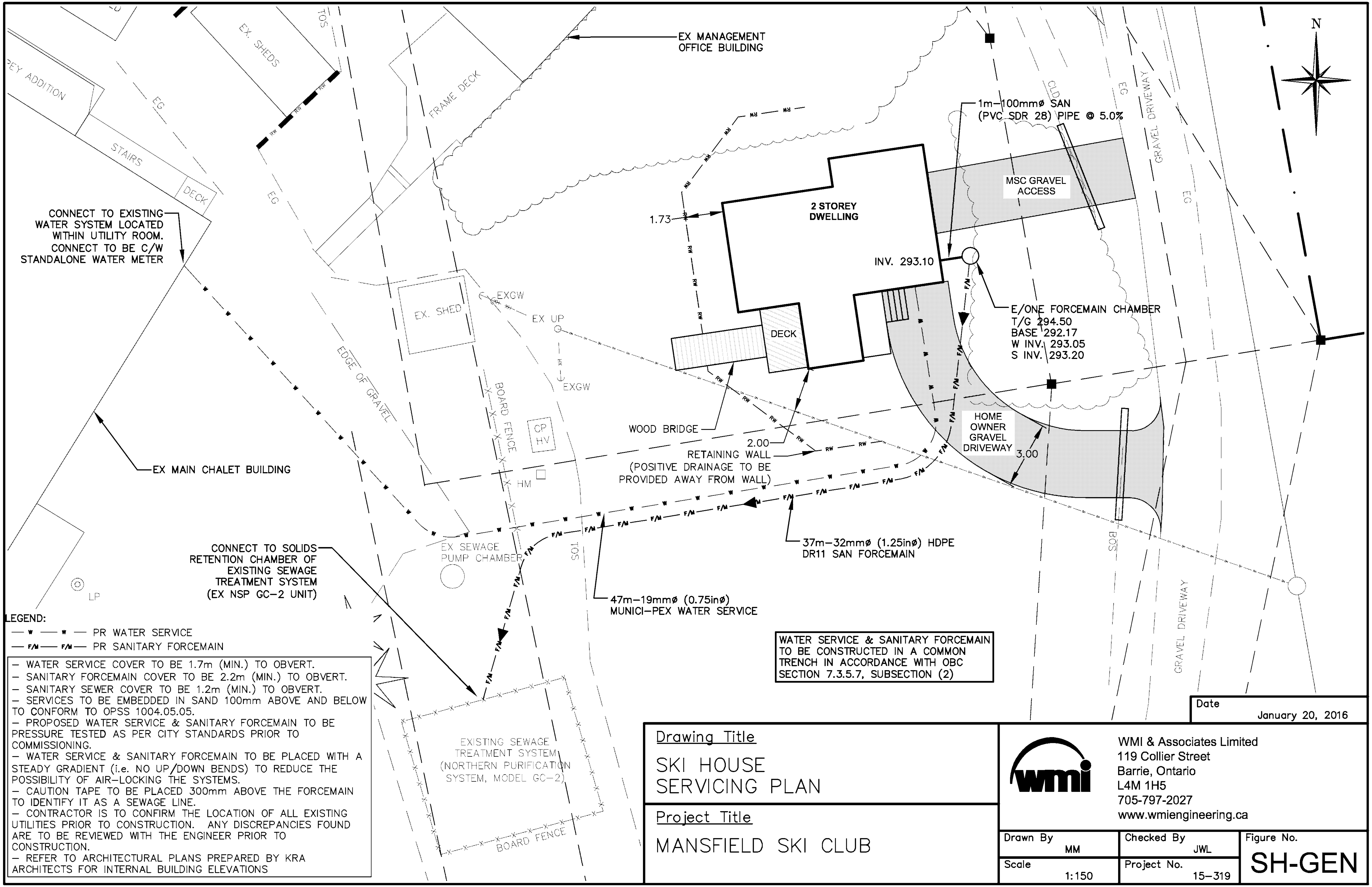


WATER SERVICE & SANITARY FORCEMAIN TO BE CONSTRUCTED IN A COMMON TRENCH IN ACCORDANCE WITH OBC SECTION 7.3.5.7, SUBSECTION (2)

LEGEND:

— W — W —	PR WATER SERVICE
— F/M — F/M —	PR SANITARY FORCEMAIN

- WATER SERVICE COVER TO BE 1.7m (MIN.) TO OBVERT.
- SANITARY FORCEMAIN COVER TO BE 2.2m (MIN.) TO OBVERT.
- SANITARY SEWER COVER TO BE 1.2m (MIN.) TO OBVERT.
- SERVICES TO BE EMBEDDED IN SAND 100mm ABOVE AND BELOW TO CONFORM TO OPSS 1004.05.05.
- PROPOSED WATER SERVICE & SANITARY FORCEMAIN TO BE PRESSURE TESTED AS PER CITY STANDARDS PRIOR TO COMMISSIONING.
- WATER SERVICE & SANITARY FORCEMAIN TO BE PLACED WITH A STEADY GRADIENT (i.e. NO UP/DOWN BENDS) TO REDUCE THE POSSIBILITY OF AIR–LOCKING THE SYSTEMS.
- CAUTION TAPE TO BE PLACED 300mm ABOVE THE FORCEMAIN TO IDENTIFY IT AS A SEWAGE LINE.
- CONTRACTOR IS TO CONFIRM THE LOCATION OF ALL EXISTING UTILITIES PRIOR TO CONSTRUCTION. ANY DISCREPANCIES FOUND ARE TO BE REVIEWED WITH THE ENGINEER PRIOR TO CONSTRUCTION.
- REFER TO ARCHITECTURAL PLANS PREPARED BY KRA ARCHITECTS FOR INTERNAL BUILDING ELEVATIONS

Date January 20, 2016

Drawing Title

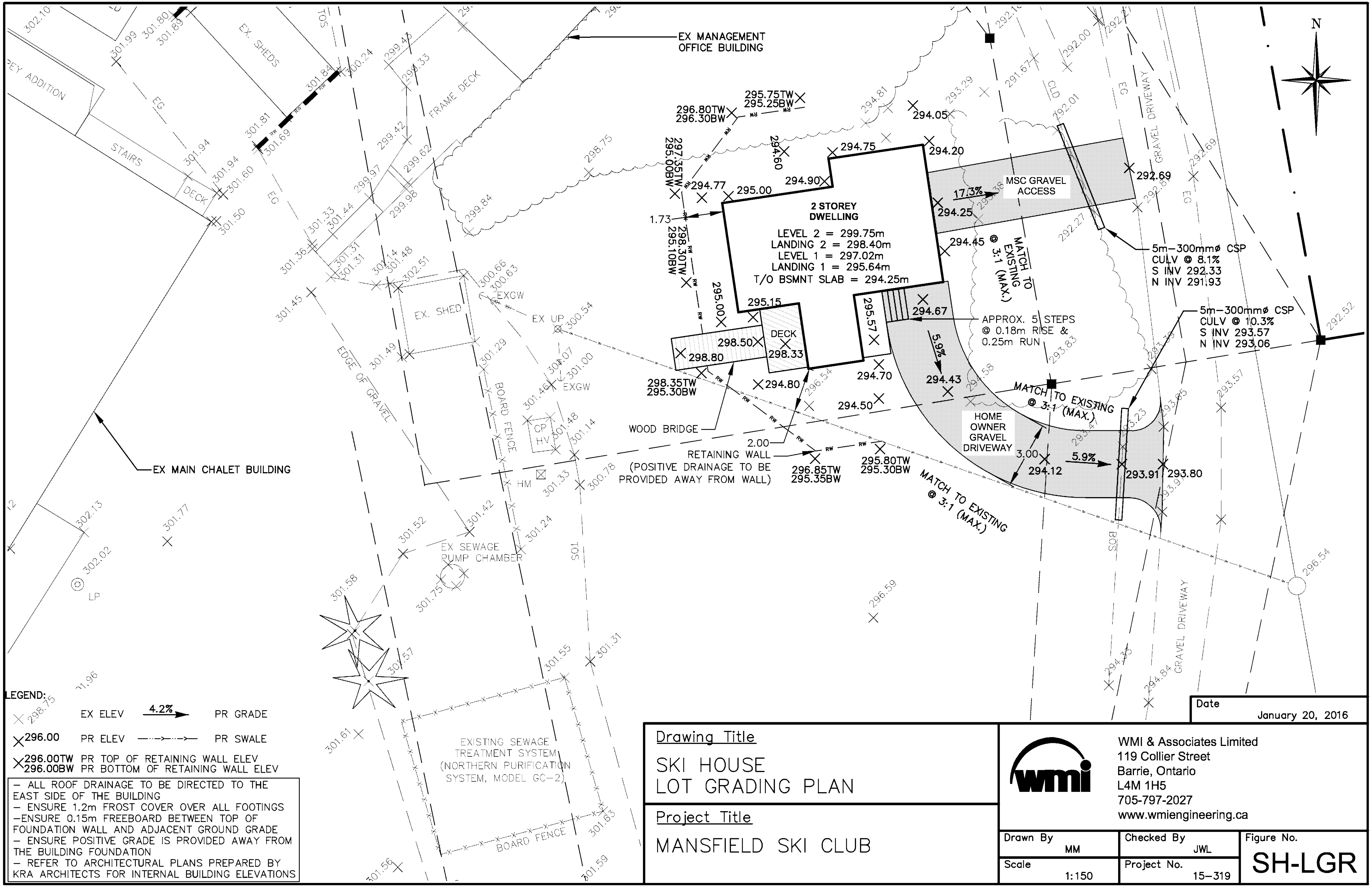
SKI HOUSE
SERVICING PLAN

Project Title

MANSFIELD SKI CLUB

WMI & Associates Limited
119 Collier Street
Barrie, Ontario
L4M 1H5
705-797-2027
www.wmiengineering.ca

Drawn By MM	Checked By JWL	Figure No.
Scale 1:150	Project No. 15–319	SH-GEN



LEGEND:

✕ 298.75	EX ELEV	4.2% →	PR GRADE
✕296.00	PR ELEV	—·—>—·—>	PR SWALE

✕296.00TW PR TOP OF RETAINING WALL ELEV
296.00BW PR BOTTOM OF RETAINING WALL ELEV

- ALL ROOF DRAINAGE TO BE DIRECTED TO THE EAST SIDE OF THE BUILDING
- ENSURE 1.2m FROST COVER OVER ALL FOOTINGS
-ENSURE 0.15m FREEBOARD BETWEEN TOP OF FOUNDATION WALL AND ADJACENT GROUND GRADE
- ENSURE POSITIVE GRADE IS PROVIDED AWAY FROM THE BUILDING FOUNDATION
- REFER TO ARCHITECTURAL PLANS PREPARED BY KRA ARCHITECTS FOR INTERNAL BUILDING ELEVATIONS

Date January 20, 2016

Drawing Title

SKI HOUSE
LOT GRADING PLAN

Project Title

MANSFIELD SKI CLUB

WMI & Associates Limited
119 Collier Street
Barrie, Ontario
L4M 1H5
705-797-2027
www.wmiengineering.ca

Drawn By	Checked By	Figure No.
MM	JWL	SH-LGR
Scale 1:150	Project No. 15-319	

WATER CONSUMPTION LOG RECORDS - MANSFIELD SKI CLUB

	DEC 2014				JAN 2015				FEB 2015				MARCH 2015			
Days of the Month	DRILLED WELL Flow Meter Reading (m^3)	BORED WELL Flow Meter Reading (m^3)	RIVER Flow Meter Reading (m^3)	Daily Flow (m^3/day)	DRILLED WELL Flow Meter Reading (m^3)	BORED WELL Flow Meter Reading (m^3)	RIVER Flow Meter Reading (m^3)	Daily Flow (m^3/day)	DRILLED WELL Flow Meter Reading (m^3)	BORED WELL Flow Meter Reading (m^3)	RIVER Flow Meter Reading (m^3)	Daily Flow (m^3/day)	DRILLED WELL Flow Meter Reading (m^3)	BORED WELL Flow Meter Reading (m^3)	RIVER Flow Meter Reading (m^3)	Daily Flow (m^3/day)
1								6.35				6.32	1695.1	1749.5	4018.7	13.50
2					1527.3	1746.5	3759	6.35				6.32				4.50
3					1529.7	1746.5	3765.5	8.90				6.32				4.50
4								4.73				6.32	1699.6	1749.5	4027.7	4.50
5								4.73	1616.5	1747.8	3909.7	6.32	1701.5	1750	4030.3	5.00
6								4.73	1621.2	1748.3	3913	8.50	1703.3	1750	4033.2	4.70
7								4.73	1625.9	1748.3	3917.5	9.20	1706.7	1750	4038.1	8.30
8								4.73	1630.9	1748.3	3928.5	16.00	1709.3	1750	4045.7	10.20
9					1540.2	1747	3782.9	4.73				4.50				5.23
10								6.16				4.50				5.23
11								6.16	1635.8	1748.3	3937.1	4.50	1712	1755.6	4053.1	5.23
12								6.16	1638.7	1748.3	3938.8	4.60	1712.9	1756.6	4055.5	4.30
13								6.16	1640.1	1748.3	3941.6	4.20	1713.7	1757.5	4058.7	4.90
14								6.16	1642.7	1748.3	3944.8	5.80	1715.4	1758.5	4061.1	5.10
15								6.16	1648.2	1748.3	3955.5	16.20	1716.9	1760.3	4064.4	6.60
16					1555.1	1747.3	3810.8	6.16	1652.1	1748.3	3960.7	9.10				7.05
17								12.10				6.20	1719.7	1763.6	4072.4	7.05
18					1564.4	1747.3	3825.7	12.10				6.20	1720.8	1764.7	4075.5	5.30
19								4.63	1661.2	1748.3	3970.2	6.20	1722.1	1766.2	4079.2	6.50
20	1500	1745	3720	-				4.63	1664	1748.3	3971.9	4.50	1723.6	1767.5	4083.5	7.10
21	1502	1745	3723.2	5.20	1568.9	1747.8	3834.6	4.63	1667.9	1748.3	3975.2	7.20	1725.1	1768.8	4087	6.30
22	1505.1	1745.6	3725.3	5.80	1571.3	1747.8	3839.9	7.70	1673.5	1748.3	3986	16.40	1726.2	1773.3	4093.3	11.90
23	1507.3	1746.2	3726.6	4.10	1573.7	1747.8	3842.4	4.90				5.07				1.90
24				1.17	1576.1	1747.8	3846.8	6.80				5.07				1.90
25				1.17	1582.3	1747.8	3858.4	17.80	1678.8	1748.3	3995.9	5.07				1.90
26	1509.9	1746.2	3727.5	1.17				4.97	1681.4	1749.5	3999.7	7.60				1.90
27	1511.2	1746.2	3728.7	2.50				4.97	1683.7	1749.5	4003.1	5.70	1730.5	1775.3	4096.5	1.90
28	1513.9	1746.2	3733.7	7.70	1587.8	1747.8	3867.8	4.97				13.50				
29	1517.2	1746.5	3738.7	8.60				16.35								
30	1519.8	1746.5	3745.6	9.50	1600.2	1747.8	3888.1	16.35								
31	1522.1	1746.5	3751.5	8.20				6.32								
Monthly MAX				9.50				17.80				16.40				13.50
Monthly MEAN				5.01				7.17				7.41				5.65
Monthly MIN				1.17				4.63				4.20				1.90

2014/2015 DAYS IN OPERATION **97**

MAX	**17.80**	**m^3/day**
MEAN	**6.57**	**m^3/day**
MIN	**1.17**	**m^3/day**

NOTES: - For days with no daily flow meter reading, the following flow meter reading has been assumed to be averaged over the previous unrecorded days.

8.2.1.3. Sewage System Design Flows

(1) For *residential occupancies*, the total daily design *sanitary sewage* flow shall be at least the value in Column 2 as determined from Table 8.2.1.3.A. (See Appendix A.)

(2) For all other *occupancies*, the total daily design *sanitary sewage* flow shall be at least the value in Column 2 as determined from Table 8.2.1.3.B. (See Appendix A.)

(3) Where a *building* contains more than one establishment, the total daily design *sanitary sewage* flow shall be the sum of the total daily design *sanitary sewage* flow for each establishment.

(4) Where an *occupancy* is not listed in Table 8.2.1.3.B., the highest of metered flow data from at least 3 similar establishments shall be acceptable for determining the total daily design *sanitary sewage* flow.

Table 8.2.1.3.A.
Residential Occupancy
Forming Part of Sentence 8.2.1.3.(1)

Residential Occupancy	Volume, litres
Apartments, Condominiums, Other Multi-family Dwellings - per person(1)	275
Boarding Houses	
(a) Per person,	
(i) with meals and laundry facilities, or,	200
(ii) without meal or laundry facilities, and	150
(b) Per non-resident staff per 8 hour shift	40
Boarding School - per person	300
Dwellings	
(a) 1 bedroom dwelling	750
(b) 2 bedroom dwelling	1 100
(c) 3 bedroom dwelling	1 600
(d) 4 bedroom dwelling	2 000
(e) 5 bedroom dwelling	2 500
(f) Additional flow for(2)	
(i) each bedroom over 5,	500
(ii) (A) each 10 m^2 (or part of it) over 200 m^2 up to 400 m^2 (3),	100
(B) each 10 m^2 (or part of it) over 400 m^2 up to 600 m^2 (3), and	75
(C) each 10 m^2 (or part of it) over 600 m^2 (3), or	50
(iii) each fixture unit over 20 fixture units	50
Hotels and Motels (excluding bars and restaurants)	
(a) Regular, per room	250
(b) Resort hotel, cottage, per person	500
(c) Self service laundry, add per machine	2 500
Work Camp/Construction Camp, semi-permanent per worker	250
Column 1	2

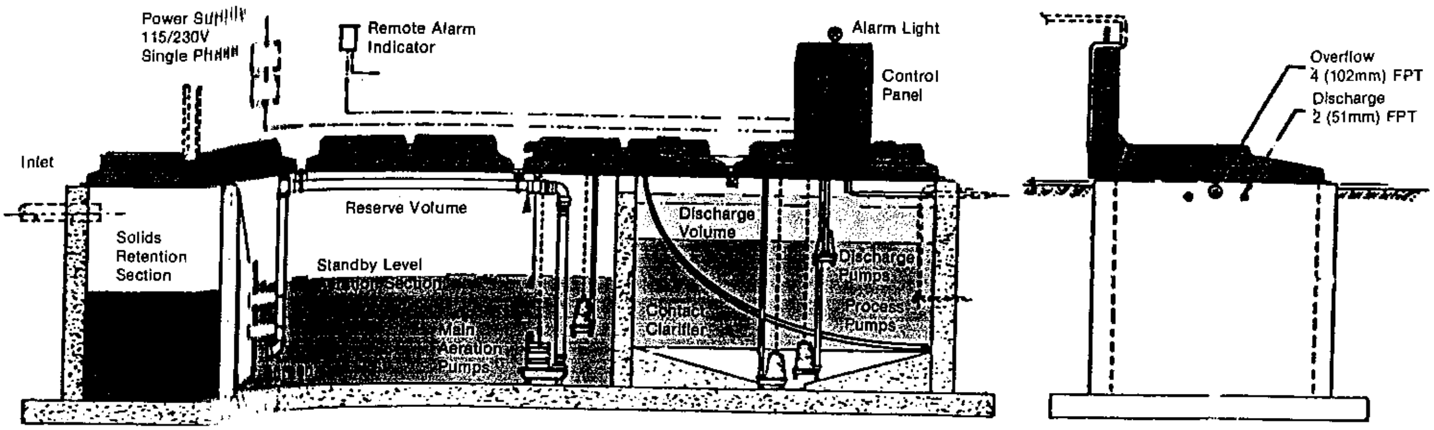
Notes to Table 8.2.1.3.A.:

(1) The *occupant load* shall be calculated using Subsection 3.1.17.
(2) Where multiple calculations of *sanitary sewage* volume is permitted, the calculation resulting in the highest flow shall be used in determining the design daily *sanitary sewage* flow.
(3) Total finished area, excluding the area of the finished *basement*.

Larger capacity Systems

GC SERIES

CONCRETE TANK



STANDARD EQUIPMENT: NPS systems have modular assembled components that are interchangeable and easily serviced. Plants are totally enclosed with low maintenance, non-corroding fibreglass covers and hatches. Plastic pipe and fittings are used in all module assemblies. The only moving parts are oil-filled submersible pumps. The control system is modular automatic digital computer system. Fibreglass covers and hatches containing all piping and wiring hydraulic fragmentation and submersible aeration system. Submersible process pumps. Duplex alternator discharge pumps. Automatic control panel. Flow discharge recorder. Remote alarm indicator. Accessory equipment programmer.

POWER SUPPLY: All systems require 115/240v - single phase - 60hz - 3 wire supply See Table below for supply amperage requirements. All systems are CSA approved.

DISCHARGE SYSTEM: Two discharge pumps alternate automatically, or can be preset to operate in single or tandem. If one pump malfunctions, the control activates the main alarm and alternates to the second pump.

INSTALLATION DRAWINGS: Detailed drawings for tank slabs and concrete tank construction are supplied to the purchaser by NPS. Material and work must conform to building code regulations and specifications.

Plant Model	IMPERIAL GALLONS			METRIC m³			PLANT LENGTH C		Shipping Weight	Power Supply AMPS
	24 Hr. Rated Capacity	Discharge Volume	Reserve Volume	24 Hr. Rated Capacity	Discharge Volume	Reserve Volume	Ft.	mm	lbs. MODULES ONLY	
GC-2	[illegible]	455	2,000	22.7	2.1	9.1	17	5,182	1,800	60
-3	[illegible]	773	3,000	38.6	3.5	13.6	25	7,620	2,100	60
-4	[illegible]	1,136	4,000	56.8	5.2	18.2	33	10,058	2,200	60
-5	[illegible]	1,364	5,000	68.2	6.2	22.7	41	12,497	2,600	100
-6	[illegible]	1,590	5,500	79.6	7.2	25.0	49	14,935	3,000	100
-7	[illegible]	1,910	7,000	95.5	8.7	31.8	57	17,374	3,500	100
-7S	[illegible]	2,272	8,700	113.7	10.3	39.6	57	17,374	3,600	100
-8S	[illegible]	2,727	10,200	136.4	12.4	46.4	65	19,812	4,400	150

(a) Based on 16 hour raw sewage inflow.
(b) Sized for 11 batches per 24 hours at full loading.
(c) Reserve/surge volume capacity based on standby liquid level.

Northern Purification Systems
2614 Conc 4, R.R. #1
Loretto Ontario
L0G-1L0

August 16/06

Re; **MANSFIELD SKI CLUB**

To Whom it May Concern

The sewage system located at Mansfield Ski Club is a Northern Purification System model GC-2 with a 24 hour rated capacity of 22,700 litres per day.

The system was installed in the summer of 1997 by Northern Purification Systems and has been serviced and maintained by same till present.

The batch count since installation is 3607 as of June 6/06. Each batch is 2100 litres. Being approx 8 years since start up this would be 2920 days.
3607 X 2100 = 7,574,700 litres Divided by 2920 days =2,594 litres per day.
Average over the total time

Reports for the period from Dec 17/04 to Apr 28/05 being a time of peek flows show a total of 462 batches for 132 days.
462 X 2100 = 970,200 litres Divided by 132 days = 7,350 litres per day.

The above shows that the system is running at about one third of capacity.

I hope that this will be of help.

Any questions please call

Yours Truly

Tom Musgrove. Principal
TM/mt

APPENDIX G

MECP PRE-CONSULTATION CORRESPONDENCE

Hutchinson
Environmental Sciences Ltd.

Suite 202 – 501 Krug Street, Kitchener, ON N2B 1L3 │ 519-576-1711

September 20, 2016 HESL Job #: J160071

Finley McEwen
20 Queen Street West, 5th Floor
Toronto, Ontario
M5H 3R4

Dear Mr. McEwen:

Re: Work Plan – Mansfield Ski Club – Receiving Water Assessment for Surface Discharge of Treated Wastewater Effluent to the Pine River

Hutchinson Environmental Sciences Ltd. (HESL) is pleased to submit this work plan to complete a receiving water assessment for a surface discharge of treated domestic wastewater effluent to the Pine River from a proposed redevelopment/expansion of the Mansfield Ski Club (MSC), located at 628213 Side Rd 15, Mansfield, Ontario, in the Township of Mulmur.

The existing MSC operates seasonally from late December to early April. Sanitary servicing for the site (an existing Chalet Building and an Operations Building) is by a private on-site sewage treatment system (Northern Purification System) with subsurface disposal to a leaching bed. The proposed redevelopment of the site is to include the existing Chalet Building, and renovation of the Operations Building and new development providing a total of 1,595 m^2 of commercial retail space and 93 residential units.

The Site Servicing and Stormwater Management Report[1] (WMI 2016) for the redevelopment reported that sewage flows from the site will increase from 14,740 L/day to 116,765 L/day with the proposed redevelopment, which will necessitate a new sanitary sewage treatment system to accommodate the expanded flows. A package plant was proposed consisting of a Waterloo Biofilter System with UV disinfection and sodium aluminate dosing with disposal of the effluent to a new onsite wetland stormwater management facility. The effluent would then be conveyed off site a distance of 1,050 m via a series of grass-covered roadside ditches, swales and two existing dry ponds/basins for surface discharge to the Pine River as the ultimate receiver. The proposed effluent treatment objectives were 10.0 mg/L for carbonaceous oxygen demand (CBOD5) and total suspended solids (TSS), 0.5 mg/L for total phosphorus (TP), 3.0 mg/L for total ammonia nitrogen (TAN) and a geometric annual mean concentration of 100 organisms/100 mL for *Escherichia coli*. The proposed effluent treatment limits were 15 mg/L for CBOD5 and TSS, 1.0 mg/L for TP, 5.0 mg/L for TAN and a geometric annual mean concentration of 200 organisms/100 mL for *E. coli*.

As previously discussed, the proposed effluent conveyance route (i.e., roadside ditches, swales, dry ponds) would provide minimal dilution of the effluent and would thereby represent a ‘dry ditch’ discharge. The conveyance route passes through residential lands which could be of concern to local residents and the Ministry of Environment and Climate Change (MOECC). Moreover, the Pine River near the subject property

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[1] *WMI & Associates Limited, 2016. Site servicing & stormwater management report. Mansfield Ski Club, Township of Mulmur. Report WMI 15-319. June 2016.*

is a high quality receiver that supports a sensitive trout fishery and is used by local residents for recreation (swimming and fishing). Better treatment objectives are therefore likely warranted to protect the beneficial uses of the river. These concerns were also expressed by MOECC at the pre-consultation meeting at the Guelph District Office on August 9th, 2016, and further supported by the results of a site reconnaissance visit by HESL on August 10th, 2016.

Alternate methods of effluent disposal may be feasible including direct discharge to the Pine River to the northwest of the subject property at the existing pump house, or discharge to an onsite 3-5 acre pond that is located in the northeast corner of the subject property and draining to the Pine River through a conduit. These options would avoid issues associated with an open, dry ditch discharge, and be more amenable to the MOECC.

During our site visit, we observed five large trout in the Pine River upstream of the rock weir adjacent to the pump house on the subject property, confirming the presence of trout habitat. We collected water samples from the centre of the river immediately downstream of the weir, which were analysed for total phosphorus (TP), orthophosphate (PO4), total ammonia nitrogen (TAN), nitrate (NO3), nitrite (NO2) and total suspended solids (TSS). Results indicated that the river at this location had very low concentrations of phosphorus (TP = 0.0053 mg/L, PO4 = <0.003 mg/L), TAN (<0.02 mg/L) and TSS (<2.0 mg/L). NO3 was elevated at 2.1 mg-N/L but was below the Canadian Environmental Quality Guideline (CEQG) of 3.0 mg-N/L. A farm with cattle was located across the river just upstream of the sampling location that is likely a source of nitrate at this sampling location, in addition to other rural land uses upstream. Based on these results, the Pine River adjacent to the subject property likely has capacity to receive effluent from the MSC, however, additional data are required to confirm the status of the river, in particular for the period of operation of the MSC from December to April.

A surface discharge of treated effluent to the Pine River requires a receiving water assessment to determine the impacts of that effluent on water quality in the river. Key to this assessment is the determination of suitable effluent quality and a discharge location so that the size and quality of the effluent plume in the river meets the guidelines of the MOECC to protect water quality and beneficial uses. Based on our project understanding and input from the MOECC at the Pre-consultation Meeting, we have developed a comprehensive work plan to complete this assessment with the objectives to:

1. Characterize the existing water quality and flows of the Pine River at the proposed discharge location and determine its assimilative capacity to receive treated effluent,
2. Identify environmental and beneficial usage constraints for the discharge,
3. Recommend alternative discharge options (e.g., direct to river or via an existing man-made pond) and locations based on identified constraints,
4. Complete a mixing zone analysis at the point of effluent discharge to the Pine River to determine the size of the mixing zone and provide recommendations for a discharge configuration to minimize the size of the mixing zone,
5. Recommend appropriate treatment objectives and limits based on the assimilative capacity of the river and results of the mixing zone analysis, and
6. Develop a water quality monitoring program to confirm the results of the assessment and to monitor the effects of the discharge on water quality of the Pine River.

Work Plan

We propose the following work plan tasks to complete the assessment:

Task 1. Compilation of Data and Background Information

We will work with WMI & Associates Limited to confirm and document details of the preferred servicing approach including expected effluent volumes, treatment objectives and the specific discharge location.

We will compile relevant water quality and flow data for the Pine River from the following sources:

- Water Survey of Canada Station Pine River near Everett (02ED014) located approximately 10 km downstream of the study site. Continuous flow data are available for this station from 1967 to present;
- Provincial Water Quality Monitoring Network (PWQMN) Station 03005701002 located upstream of the Nottawasaga River at Mill Street, Angus, ON. Long-term data are available for this site from 1972 to 2015, which is typically monitored monthly from April to November by the Nottawasaga Valley Conservation Authority (NVCA).

We will also contact the MOECC and the NVCA to request any additional water quality monitoring data or information that may be relevant to the assessment including fish inventories, fish habitat and benthic invertebrate assessments.

Task 2. Field Work

While the above water quality and flow data exist for the Pine River, site-specific data closer to the proposed discharge location and for the full period of discharge are required for the assimilative capacity assessment and the mixing zone analysis (Task 6). We therefore propose to sample water quality and stream flows monthly from September 2016 until April 2017 at two locations in the river (immediately downstream of the rock weir near the MSC pump house and at the crossing of the river at Airport Road (Regional Road 18). Water quality monitoring parameters will include:

- Field parameters (pH, temperature, dissolved oxygen, conductivity);
- TP;
- Nitrogen species (TAN, NO3, NO2, and total Kjeldahl nitrogen (TKN));
- Total suspended solids (TSS);
- Carbonaceous biochemical oxygen demand (CBOD5); and
- *E. coli*.

Water samples will be shipped to ALS Laboratories in Waterloo, Ontario, for analysis of all chemical parameters. River discharge will be measured at both sampling locations using the transect method and a Flo Mate or equivalent meter.

It is our understanding that the NVCA has conducted fish habitat and benthic invertebrate assessments in the Pine River that are likely suitable to document these biological characteristics for the purposes of the receiving water assessment. If additional information is required, we will submit a revised work plan to collect this information.

Task 3. Low Flow Analysis

Effluent discharge to any receiver requires the determination that the receiver can effectively assimilate or dilute the effluent. In Ontario streams and rivers, the 7Q20 low-flow statistic is used as a basic design flow to determine the assimilative capacity of a stream or river. The 7Q20 flow represents the minimum 7-day average flow with a recurrence period of 20 years. This value determines the 5% chance of there not being adequate streamflow to properly dilute the point discharge.

We will calculate the 7Q20 flows in the Pine River at the proposed discharge site using the most recent 20-year data record from WSC Station, pro-rated and for the watershed area upstream of the proposed discharge location and verified with the measured flows from Task 2. We will also use this dataset to calculate the mean, minimum, maximum, and lower quartile (25th percentile) flows to fully describe flow and dilution potential of the river.

Task 4. Water Quality Summary

We will summarize water quality data from the PWQMN Station and results of the Task 2 monitoring. Data will be assessed against applicable Provincial Water Quality Objectives (PWQO) to determine the policy status of the Pine River to receive treated effluent at the proposed discharge location in accordance with MOECC policies and guidelines[2]:

- Policy 1 - In areas which have water quality better than the PWQO, water quality shall be maintained at or above the objectives;
- Policy 2 - Water quality which presently does not meet the PWQO shall not be degraded further and all practical measures shall be taken to upgrade the water quality to the objectives.

Task 5. Documentation of Natural Heritage and Beneficial Use Constraints

We will perform a desk-top search to document natural heritage features and beneficial uses of the Pine River in the vicinity of the proposed discharge that may pose constraints to siting the discharge location and configuration of the effluent plume, to include:

- Water takings for drinking water,
- Recreation (swimming and fishing) areas,
- Sensitive fish habitat,
- Natural heritage features, and
- Aquatic Species at Risk (SAR) and critical habitat

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[2] *Ontario Ministry of Environment and Energy (MOEE), 1994. Water Management, Policies, Guidelines, Provincial Water Quality Objectives. Queen's Printer for Ontario. 32 pp.*

Task 6. Assimilative Capacity Assessment

The assimilative capacity assessment will be completed using a mass balance modeling approach to determine water quality in the Pine River at the point of complete mixing of the effluent and a CORMIX model to determine the size and shape of the mixing zone. CORMIX is a software system developed by Cornell University for the analysis, prediction, and design of aqueous toxic or conventional pollutant discharges into diverse water bodies[3]. CORMIX requires a small number of inputs in order to generate meaningful simulation data, which will be gathered from our background review and field work (Tasks 1 to 3).

Modeling will be conducted for low flow conditions over the proposed operational period of the package plant (to be determined) to inform recommendations for effluent limits and the discharge configuration under different flow, water quality and temperature regimes of the river. A preferred discharge location and configuration (i.e., single port discharge versus multi-port discharge) will be recommended that provides the most rapid assimilation but that also considers any identified constraints from Task 4. Factors including temperature (water density) of the water, the number of ports, and the location of the discharge in relation to banks and the river bottom all affect the resulting discharge mixing zone.

Recommendations for effluent limits will be based on the above modeling and MOECC's requirements in *Deriving Receiving Water Based, Point-Source Effluent Requirements for Ontario Waters*[4], which provides requirements for point-source discharges and the procedures for determining effluent requirements for an Environmental Compliance Approval (ECA). This assessment will also consider the need to meet the condition of "no acute lethality" at the discharge point to the creek based on unionized ammonia concentration.

Task 7. Reporting and Meetings

Completion of the full receiving water assessment will not be possible until early summer of 2017 once the field work in Task 2 is completed. To permit design planning to move forward, we will prepare a technical memorandum that documents the preliminary results of Tasks 1 to 5 (to include results of two Task 2 field events) in October 2016. We anticipate that this technical memorandum will provide sufficient information for pre-consultation with MOECC to further discuss the design concept, to be refined and finalized once all data have been collected. This will allow MOECC to comment on a) the proposed field study in advance of the critical operation period of the MSC from December to April, and b) the approach to the assimilative capacity assessment and mixing zone modelling (Task 6). At this meeting, we will also discuss the potential for extending the operating season of the MSC, and hence the effluent discharge period. We will prepare meeting minutes from the pre-consultation meeting and revise our work plan if necessary to address MOECC concerns.

We will complete a technical report for submission to the MOECC Guelph District Office for review and concurrence by the Technical Support Unit, which is required for the Environmental Compliance Approval application. The report will summarize the field investigations, constraints, assimilation assessment,

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[3] *Doneker, R. L. and G. H. Jirka, 2007. CORMIX User Manual, USEPA: EPA-823-K-07-001.*

[4] *Ontario Ministry of the Environment (MOE). 1994. Deriving receiving water based point source effluent requirements for Ontario waters. PIBS#3302 Procedure B-1-5.*

recommendations for effluent limits and for continued water quality monitoring to track the influence of the discharge in the future.

Over the course of the project, we will provide monthly updates on the progress of the study.

Schedule

The following schedule is proposed to complete the ACS:

Technical Memorandum of preliminary results – October 28, 2016
MOECC Pre-consultation Meeting – Week of October 31, 2016
Field Work – September, 2016 to April, 2017 (monthly)
Final Report – May 31, 2017

We thank MSC for inviting Hutchinson Environmental Sciences Ltd. to submit this work plan. Please do not hesitate to contact us if you have any questions.

Sincerely,
Hutchinson Environmental Sciences Ltd.

T. KR

Tammy Karst-Riddoch, Ph.D.
Senior Aquatic Scientist
tammy@environmentalsciences.ca

Jeremy Lightheart

From:	Spencer, Michael (MOECC) <Michael.Spencer@ontario.ca>
Sent:	April 4, 2017 2:56 PM
To:	Tomlinson, Gary (MOECC); Jeremy Lightheart
Cc:	'Finley McEwen'; 'Finley McEwen'; 'Tammy Karst-Riddoch'
Subject:	RE: 15-319 Mansfield Ski Club (Pre-Consultation Update)

Hi Jeremy,

I have been in field sampling and only received the emails today. Any discussion on the Receiving Water Assessment and options would be best after I've reviewed the report, and I won't be getting to it this month. Please schedule in May. Thanks.

Michael Spencer
Surface Water Group Leader
Ministry of Environment and Climate Change
119 King Street West, 12th Flr
Hamilton, ON L8P 4Y7
Ph (905) 521-7734

-----Original Message-----
From: Tomlinson, Gary (MOECC)
Sent: April 04, 2017 9:42 AM
To: Jeremy Lightheart; Spencer, Michael (MOECC)
Cc: 'Finley McEwen'; 'Finley McEwen'; 'Tammy Karst-Riddoch'
Subject: Re: 15-319 Mansfield Ski Club (Pre-Consultation Update)

Jeremy:

Sorry for the short notice but at this point it looks to me as if Mike is not available to participate in a telecon this morning. I understand he will be passing you some available dates and times a bit later in the month to make this happen.

G.W. Tomlinson
Provincial Officer
Senior Environmental Officer
Guelph District Office
West Central Region
Ontario Ministry of Environment and Climate Change
Tel: 519 826 4272
Fax: 519 826 4286
Original Message
From: Jeremy Lightheart
Sent: Monday, April 3, 2017 16:00
To: Tomlinson, Gary (MOECC); Spencer, Michael (MOECC)
Cc: 'Finley McEwen'; 'Finley McEwen'; 'Tammy Karst-Riddoch'
Subject: RE: 15-319 Mansfield Ski Club (Pre-Consultation Update)

Gary/Mike,

Please find attached an agenda as well the "Receiving Water Assessment for Surface Discharge of Treated Wastewater Effluent to the Pine River" for your review prior to the conference call tomorrow morning at 10:30am.

Mike, if you could please confirm that you will be available for the call tomorrow it would be greatly appreciated.

Regards,

Jeremy W. Lightheart, P. Eng.
WMI & Associates Limited
119 Collier Street
Barrie, ON. L4M 1H5
Office 705-797-2027 Ext 104
Fax 705-797-2028
wmiengineering.ca

-----Original Message-----
From: Tomlinson, Gary (MOECC) [mailto:gary.tomlinson@ontario.ca]
Sent: April 3, 2017 11:44 AM
To: Jeremy Lightheart <jlightheart@wmiengineering.ca>; Spencer, Michael (MOECC) <Michael.Spencer@ontario.ca>
Subject: Re: 15-319 Mansfield Ski Club (Pre-Consultation Update)

I can call in at 10:30 but will need the phone number and access code again.

G.W. Tomlinson
Provincial Officer
Senior Environmental Officer
Guelph District Office
West Central Region
Ontario Ministry of Environment and Climate Change
Tel: 519 826 4272
Fax: 519 826 4286
Original Message
From: Jeremy Lightheart
Sent: Monday, April 3, 2017 11:41
To: Tomlinson, Gary (MOECC); Spencer, Michael (MOECC)
Subject: RE: 15-319 Mansfield Ski Club (Pre-Consultation Update)

Gary/Mike,

Just following up to confirm that you are both still available for tomorrow mornings conference call at 10:30am? I trust you both have received Finley McEwen's invite via email which outlines the call details/instructions for calling in?

Your earliest response would be much appreciated.

Regards,

Jeremy W. Lightheart, P. Eng.
WMI & Associates Limited
119 Collier Street
Barrie, ON. L4M 1H5
Office 705-797-2027 Ext 104
Fax 705-797-2028
wmiengineering.ca

-----Original Message-----
From: Tomlinson, Gary (MOECC) [mailto:gary.tomlinson@ontario.ca]
Sent: March 20, 2017 10:53 PM
To: Jeremy Lightheart <jlightheart@wmiengineering.ca>
Cc: Spencer, Michael (MOECC) <Michael.Spencer@ontario.ca>
Subject: Re: 15-319 Mansfield Ski Club (Pre-Consultation Update)

Jeremy:

Sorry for being a while getting back to you but things here have been real busy.

I'm afraid I will not be able to do a face to face any time the week of 03 April. I might be able to call into a meeting on the 4th provided it is happening in the middle of the morning or mid pm. I understand that Mike Spencer is available on the 4th so possibly we can make this happen this way.

G.W. Tomlinson
Provincial Officer
Senior Environmental Officer
Guelph District Office
West Central Region
Ontario Ministry of Environment and Climate Change
Tel: 519 826 4272
Fax: 519 826 4286
Original Message
From: Jeremy Lightheart
Sent: Friday, March 10, 2017 10:36
To: Tomlinson, Gary (MOECC)
Cc: Spencer, Michael (MOECC)
Subject: RE: 15-319 Mansfield Ski Club (Pre-Consultation Update)

Gary,

It has been a while since we last spoke but now that we are part way through the Assimilation Capacity Study work for the above mentioned site and have now received some feedback via public meetings, etc., we would like to sit back down with you and your colleagues to have an updated pre-consultation meeting if possible?

Would you be available to meet myself, Finley McEwen (Mansfield Ski Club) and Tammy Karst-Riddoch (Hutchinson Environmental Sciences Ltd.) any time on Tuesday April 4th?

Thanks in advance for your assistance,

Jeremy W. Lightheart, P. Eng.
WMI & Associates Limited

119 Collier Street
Barrie, ON. L4M 1H5
Office 705-797-2027 Ext 104
Fax 705-797-2028
wmiengineering.ca

-----Original Message-----
From: Tomlinson, Gary (MOECC) [mailto:gary.tomlinson@ontario.ca]
Sent: September 21, 2016 10:35 AM
To: Jeremy Lightheart <jlightheart@wmiengineering.ca>
Cc: Spencer, Michael (MOECC) <Michael.Spencer@ontario.ca>
Subject: Re: 15-319 Mansfield Ski Club (Assimilative Capacity Study Work Plan)

Thanks Jeremy.

G.W. Tomlinson
Provincial Officer
Senior Environmental Officer
Guelph District Office
West Central Region
Ontario Ministry of Environment and Climate Change
Tel: 519 826 4272
Fax: 519 826 4286
  Original Message
From: Jeremy Lightheart
Sent: Wednesday, September 21, 2016 09:27
To: Tomlinson, Gary (MOECC)
Cc: Spencer, Michael (MOECC)
Subject: RE: 15-319 Mansfield Ski Club (Assimilative Capacity Study Work Plan)

Gary,

As promised, please find attached the revised Assimilative Capacity Study Work Plan for your review. Should you have any questions, please do not hesitate to contact me.

Regards,

Jeremy W. Lightheart, P. Eng.
WMI & Associates Limited
119 Collier Street
Barrie, ON. L4M 1H5
Office 705-797-2027 Ext 104
Fax 705-797-2028
wmiengineering.ca

-----Original Message-----
From: Tomlinson, Gary (MOECC) [mailto:gary.tomlinson@ontario.ca]
Sent: September 16, 2016 12:53 PM
To: Jeremy Lightheart <jlightheart@wmiengineering.ca>

Cc: Spencer, Michael (MOECC) <Michael.Spencer@ontario.ca>
Subject: Re: 15-319 Mansfield Ski Club (Assimilative Capacity Study Work Plan)

Great. Thanks.

G.W. Tomlinson
Provincial Officer
Senior Environmental Officer
Guelph District Office
West Central Region
Ontario Ministry of Environment and Climate Change
Tel: 519 826 4272
Fax: 519 826 4286
From: Jeremy Lightheart
Sent: Friday, September 16, 2016 11:57
To: Tomlinson, Gary (MOECC)
Cc: Spencer, Michael (MOECC)
Subject: RE: 15-319 Mansfield Ski Club (Assimilative Capacity Study Work Plan)

Gary,

Sorry for the delay in getting back to you, I was off yesterday. Based on my discussions with Tammy at Hutchison Environmental, the first round of sampling was completed on Wednesday and they plan to begin with the other tasks next week.

Tammy has promised to get me the revised work plan today. I hope to have the work plan to you either later today or early next week.

Regards,

Jeremy W. Lightheart, P. Eng.
WMI & Associates Limited
119 Collier Street
Barrie, ON. L4M 1H5
Office 705-797-2027 Ext 104
Fax 705-797-2028
wmiengineering.ca

From: Tomlinson, Gary (MOECC) [mailto:gary.tomlinson@ontario.ca]
Sent: September 15, 2016 9:15 AM
To: Jeremy Lightheart <jlightheart@wmiengineering.ca>
Cc: Spencer, Michael (MOECC) <Michael.Spencer@ontario.ca>
Subject: RE: 15-319 Mansfield Ski Club (Assimilative Capacity Study Work Plan)

Jeremy:

Just curious, has the ACS work gone forward and is there a modified work plan floating around somewhere that someone can send us?

G.W. Tomlinson
Provincial Officer
Badge # 132
Senior Environmental Officer
Guelph District Office
West Central Region
Ontario Ministry of the Environment and Climate Change
Tel: 519 826 4272
Fax: 519 826 4286
Gary.Tomlinson@ontario.ca<mailto:Gary.Tomlinson@ontario.ca>
Spills Action Centre 1 800 268 6060
[Peace_Officer_Exemplary_Service_Medal_Ribbon]
[cid:image001.gif@01C70356.E58073E0] [cid:image002.jpg@01C70356.E58073E0]

From: Tomlinson, Gary (MOECC)
Sent: September-01-16 3:07 PM
To: 'Jeremy Lightheart'
Cc: Spencer, Michael (MOECC)
Subject: RE: 15-319 Mansfield Ski Club (Assimilative Capacity Study Work Plan)

Jeremy:

MOECC’s comments on the 29 August, 2016 Mansfield Ski Club Work Plan are as follows:

1.) Overall the Work Plan is acceptable with the following exceptions\comments:

2.) The 29 August, 2016 Work Plan identifies that the operational period of the proposed redevelopment\expansion of the Mansfield Ski Club as from December to April. During the 09 August, 2016 pre-consultation meeting our notes indicate that the discussion was around an expanded operational period, (that being some point in September to some point in April). As such, the proposed sewage discharge period needs to be clarified\identified;

3.) In Task 1, the Work Plan identified that the Water Survey of Canada station Pine River station near Everett, (02ED014), has flow data from 1967 to 1970. This may be a typing error since this station appears to have flow records from 1967 to present;

4.) In Task 7, the Work Plan identified that a technical memorandum will be submitted in October of this year to document the preliminary results of Tasks 1 through 5 in order to provide information to the Ministry for approval in concept on the design, which will be refined and finalized once all the data has been collected. The Work Plan identified that this will allow the Ministry to comment on the proposed field study in advance of the December to April, (or September to April), period and the approach to the assimilative capacity assessment/mixing zone modelling. It should be noted that this Ministry does not review preliminary results for these type of assessments, especially since the Work Plan already contains the proposed field study and the approach to the assimilative capacity assessment\mixing zone which the Ministry has reviewed and commented on. Having said that, if the proponent requires an additional meeting through the process, Staff from both the District Office and Technical Support Unit can make themselves available to attend, and;

5.) The final report will need to be submitted to the MOECC Guelph District Office for review and concurrence by the MOECC Technical Support Unit prior before an Environmental Compliance Approval application being submitted.

I would suggest that based on the comments provided above that it would be acceptable for the proponent to commence with the activities identified in the Work Plan at such time as it modifies the Work Plan accordingly, (and provides the modified Work Plan to this Office).

G.W. Tomlinson
Provincial Officer
Badge # 132
Senior Environmental Officer
Guelph District Office
West Central Region
Ontario Ministry of the Environment and Climate Change
Tel: 519 826 4272
Fax: 519 826 4286
Gary.Tomlinson@ontario.ca<mailto:Gary.Tomlinson@ontario.ca>
Spills Action Centre 1 800 268 6060
[Peace_Officer_Exemplary_Service_Medal_Ribbon]
[cid:image001.gif@01C70356.E58073E0] [cid:image002.jpg@01C70356.E58073E0]

From: Jeremy Lightheart [mailto:jlightheart@wmiengineering.ca]
Sent: August-31-16 9:05 AM
To: Tomlinson, Gary (MOECC)
Subject: 15-319 Mansfield Ski Club (Assimilative Capacity Study Work Plan)

Gary,

Please find attached our proposed work plan for the required Assimilative Capacity Study associated with the above mentioned project. If you could please review the work plan and confirm your acceptance it would be greatly appreciated. Please note that there are a few time sensitivity items which require monitoring to start immediately.

Regards,

Jeremy W. Lightheart, P. Eng.
WMI & Associates Limited
119 Collier Street
Barrie, ON. L4M 1H5
Office 705-797-2027 Ext 104
Fax 705-797-2028
wmiengineering.ca

Ministry of the Environment
and Climate Change
West Central Region

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Ministère de l'Environnement
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Direction régionale du Centre-Ouest

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July 14, 2017

MEMORANDUM

To: Gary Tomlinson
Senior Environmental Officer
Guelph District Office

From: Michael Spencer
Surface Water Group Leader
Technical Support Section

RE: Mansfield Ski Club Redevelopment Project
Preliminary Receiving Water Assessment
Township of Mulmur, Pine River

As requested, I have reviewed the following document for surface water issues:

> February 10, 2017 Memo, Re: Mansfield Ski Club, Receiving Water Assessment for Surface Discharge of Treated Wastewater Effluent to the Pine River, Hutchinson Environmental Sciences Ltd.

Background

The Mansfield Ski Club redevelopment project includes renovation of the Operations Building and a new development including commercial retail and residential. A sewage effluent discharge to the Pine River is proposed. The preliminary Receiving Water Assessment (Feb. 10, 2017) contains the results of the monitoring and the study to date and is based on the September 20, 2016 work plan which was previously reviewed by the Ministry.

Comments

Based on my review of the preliminary Receiving Water Assessment (Feb. 10, 2017), I have the following comments:

1. Based on my July 6, 2017 telephone conversation with Deborah Sinclair, Hutchinson Environmental, it is my understanding that the Mansfield Ski Club is now considering a year round sewage effluent discharge and the monthly water quality sampling program is continuing. As such, the final receiving water assessment should incorporate a monthly assessment in regards to the low flow analysis (ie. monthly 7Q20) and the corresponding

assimilative capacity study. The submitted preliminary Receiving Water Assessment was based on a seasonal assessment period since a seasonal discharge was proposed at the time of writing.

2. Table 4 and 5 listed the PWQO (or CWQG) for un-ionized ammonia as 16 ug/L. The PWQO for un-ionized ammonia is 20 ug/L and the CWQG is 19 ug/L.

3. The need for a DO sag assessment should be determined and included in the final receiving water assessment as needed.

4. The preliminary Receiving Water Assessment identified that further study is required in regards to the presence and habitat of snapping turtles and the presence of wetlands which I concur with.

5. The preliminary Receiving Water Assessment identified that a site specific assessment is recommended to characterize sensitive aquatic communities and fish habitat near the proposed effluent outfall which I concur with.

Michael Spencer
Surface Water Group Leader
Technical Support Section

cc: B. Koblik, TSS

IDS Ref. No.
File H-04-PI-32-01

Limitations: *The purpose of the preceding review is to provide advice to the Ministry of the Environment and Climate Change regarding surface water impacts based on a review of the information provided in the above referenced documents. The conclusions, opinions and recommendations of the reviewer are based on information provided by others, except where otherwise noted. The Ministry cannot guarantee that the information that is provided by others is accurate or complete. A lack of specific comment by the reviewer is not to be construed as endorsing the content or views expressed in the reviewed material.*

Ministry of the Environment,
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January 31, 2019

MEMORANDUM

To: Gary Tomlinson
Environmental Officer
Guelph District Office

From: Michael Spencer
Surface Water Group Leader
Technical Support Section

RE: Mansfield Ski Club
Receiving Water Assessment for New Wastewater Treatment Plant
Township of Mulmur, Pine River

As requested, I have reviewed the following document for surface water issues:

> Pine River Receiving Water Assessment – Final Report, Mansfield Ski Club, Hutchinson Environmental Sciences Ltd., May 17, 2018.

Background

The Mansfield Ski Club is located at 628213 15th Sideroad in the Town of Mansfield, Township of Mulmur. The site currently operates seasonally from late December to early April with sanitary servicing provided by a sewage treatment system with subsurface disposal. The proposed redevelopment includes renovation of existing buildings, a new commercial space and new residential units for year round occupancy. To accommodate redevelopment with expanded sewage flows, a package plant (Waterloo Biofilter with UV disinfection and phosphorus removal) is proposed with continuous discharge to the Pine River.

The Pine River near Mansfield Ski Club has very good water quality with low concentrations of nutrients and total suspended solids. The river water quality was determined to be surface water Policy 1 for total phosphorus and un-ionized ammonia near the site. As well, dissolved oxygen concentrations were better the PWQO. The Pine River provides spawning habitat and supports various fish species including Chinook salmon and rainbow trout. Available dilution in the Pine River (7Q20 = 432 L/s) for the proposed effluent discharge (1.39 L/s) was determined to be

311:1. A mass balance assessment was completed as well as Cormix modelling for a diffuser discharge.

Comments

Based on my review of the Mansfield Ski Club's "Pine River Receiving Water Assessment – Final Report" (Hutchinson, May 2018), I have the following comments:

1. The report assessed the end-of-pipe acute toxicity threshold with an un-ionized ammonia value of 0.27 mg/L based on the US EPA document "Draft 2009 Update Aquatic Life Ambient Water Quality Criteria for Ammonia – Freshwater, Dec. 2009". The assessment used a total ammonia nitrogen concentration of 5 mg/L (proposed effluent limit), temperature of 22°C and pH of 8.0.

   Historically and procedurally West Central Region has used a non-acutely lethal end-of-pipe un-ionized ammonia concentration of 0.1 mg/L. That being said, the report's assessment can be considered very conservative since a pH of 8.0 was used while it identified for comparison purposes that a 75th percentile pH of 7.2 was calculated for the Caledonia and Hagersville Wastewater Treatment Plants. Using an un-ionized ammonia concentration of 0.1 mg/L for a non-acutely lethal discharge, a pH of 7.65 would have to be consistently reached which is higher than the Caledonia and Hagersville Wastewater Treatment Plants. As such, the proposed total ammonia nitrogen effluent limit of 5 mg/L is acceptable.

2. The report recommended that the effluent be discharged directly to the Pine River at the pump house based on the water quality analysis and aquatic habitat requirements which is acceptable.

3. The report's proposed effluent objectives and limits listed below are acceptable and can be incorporated into an ECA.

Parameter	Objective	Limit
cBOD5	10 mg/L	15 mg/L
Total Suspended Solids	10 mg/L	15 mg/L
Total Phosphorus	0.5 mg/L	1 mg/L
Total Ammonia N.	3 mg/L	5 mg/L
E.coli (per 100mL)	100	200

4. The report proposed a pH effluent objective of 8.0 and limit of 8.5. However, I recommend the ECA include the standard pH range effluent objective (6.5 to 8.5) and limit (6.0 to 9.0).

5. The ECA should incorporate effluent loading limits as listed below. The loading for total phosphorus and total ammonia nitrogen is the same as Table 9 in the report. However, I have recommended 1.8 kg/d for cBOD5 and total suspended solids since it seems that Table 9 rounded off the value (2 kg/d).

Parameter	Loading Limit
cBOD5	1.8 kg/d
Total Suspended Solids	1.8 kg/d
Total Phosphorus	0.12 kg/d
Total Ammonia N.	0.6 kg/d

6. The ECA should incorporate standard effluent toxicity testing (ie. rainbow trout and *Daphnia magna*).

7. The report identified that additional information about snapping turtles, wetlands and other natural heritage features will be examined in an Environmental Impact Study during the site plan approval which is acceptable.

Conclusion

In conclusion, the Mansfield Ski Club's "Pine River Receiving Water Assessment – Final Report" (Hutchinson, May 2018) is acceptable with the recommendations discussed above. The proposal can proceed forward to Environmental Approvals and Permissions Branch accordingly.

Original Signed By

Michael Spencer
Surface Water Group Leader
Technical Support Section

cc: B. Koblik, TSS

IDS Ref. No. 2063-AZGRZ7
File H-04-PI-32-01

Limitations: The purpose of the preceding review is to provide advice to the Ministry of the Environment and Climate Change regarding surface water impacts based on a review of the information provided in the above referenced documents. The conclusions, opinions and recommendations of the reviewer are based on information provided by others, except where otherwise noted. The Ministry cannot guarantee that the information that is provided by others is accurate or complete. A lack of specific comment by the reviewer is not to be construed as endorsing the content or views expressed in the reviewed material.

APPENDIX H

Geotechnical Investigations Reports & Addendum

SHAD & ASSOCIATES INC.

June 21, 2018
Ref. No.: T18733

Mansfield Ski Club
628213 Sideroad 15
Mulmur, Ontario
L9V 3M6

Attention: Mr. Finley McEwen

Dear Mr. McEwen,

RE: **FEASIBILITY ASSESSMENT**
PRELIMINARY GEOTECHNICAL INVESTIGATION
PROPOSED DEVELOPMENT
MANSFIELD SKI CLUB
628213 SIDEROAD 15, MULMUR, ONTARIO

Please find enclosed the Feasibility Assessment - Preliminary Geotechnical Investigation Report prepared for the above-mentioned project. Should you have any questions or require any clarifications, please do not hesitate to contact our office.

We thank you for giving us this opportunity to be of service to you.

Sincerely,
Shad & Associates Inc.

H. Shad

Houshang Shad, Ph.D., P. Eng.
Principal

SHAD & ASSOCIATES INC. **GEOTECHNICAL, ENVIRONMENTAL AND MATERIALS CONSULTING ENGINEERS**
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FEASIBILITY ASSESSMENT
PRELIMINARY GEOTECHNICAL INVESTIGATION
PROPOSED DEVELOPMENT
MANSFIELD SKI CLUB
628213 SIDEROAD 15, MULMUR, ONTARIO

Submitted to:

Mansfield Ski Club
628213 Sideroad 15
Mulmur, Ontario
L9V 3M6

Attention:

Mr. Finley McEwen

Submitted by:

Shad & Associates Inc.
83 Citation Drive, Unit 9
Vaughan, Ontario, L4K 2Z6
Canada
Tel: (905) 760-5566
Fax: (905) 760-5567

June 21, 2018

T18733

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1.0 INTRODUCTION

Shad & Associates Inc. was retained by Mansfield Ski Club ('Client') to carry out a preliminary geotechnical investigation for the proposed development being considered at 628213 Sideroad 15 in Mulmur, Ontario. The site location is shown in Figure 1. We understand that the preliminary geotechnical report is required to confirm the general viability of each of the following proposed works:

- Construction of a 6.0 m deep snow making pond on the north end of the property, adjacent to 17 Sideroad;
- Addition of 25 m of fill to be placed on top of the ski hill;
- Construction of six block of chalet type housing units (Blocks 1 to 6), two buildings (Building A and B), a water treatment plant and firefighting tanks to be located on the north end of the main parking lot at Sideroad 15; and
- Construction of a 1.2 to 2.2 m deep Dry Detention Basin to be located at the southeast portion of the site (south of the proposed building structures).

The Client requested the following boreholes to be drilled:

- one borehole in the vicinity of the 6.6 m snow making pond;
- three boreholes for the top of the ski hill where 25 m of fill will be placed;
- three boreholes in the vicinity of proposed buildings, water treatment plant and firefighting tanks; and
- one borehole in the vicinity of the dry detention basin.

Authorization to proceed with this investigation was provided by Mr. Dave Morrison of Mansfield Ski Club on May 18, 2018. The work carried out for this investigation was completed in accordance with Shad Proposal P18666-Revised, dated May 7, 2018.

The purpose of the current preliminary geotechnical feasibility assessment was to obtain some general information about the subsurface conditions at the site by means of a number of boreholes. Based on our interpretation of the data obtained, some preliminary recommendations are provided on the geotechnical aspects of design for the proposed development.

This report contains the findings of our geotechnical investigation, together with our recommendations and comments. These recommendations and comments are based on factual information and are intended only for use by the design engineer.

We recommend on-going liaison with Shad & Associates Inc. during the design and construction phases of the project to ensure that the recommendations provided in this report are applicable and/or correctly interpreted and implemented. Also, any queries concerning the geotechnical aspects of the proposed project should be directed to Shad & Associates Inc. for further elaboration and/or clarification.

2.0 INVESTIGATION PROCEDURES

The fieldwork for the investigation was performed during the period of May 24, 25, 29 and 30, 2018, and it consisted of drilling and sampling altogether eight boreholes down to depths ranging from approximately 4.7 m to 12.3 m below the existing ground surface. The borehole locations were stake-out by the Client and their approximate locations are shown in Figure 2. The Client also provided us with a base plan showing some limited existing topographical information at the development site as well as proposed grading information (un-dated, un-numbered plan 161117-Baseplan-15-319-1 as well as the landscape architectural plan prepared by Stempski Kelly Associates Inc. (Figure 2, dated 2009)). These plans were used to extrapolate the “approximate” existing ground surface elevations at the borehole locations. However, the elevations should only be considered as being approximate and should be confirmed once the actual survey information is received from the Client. We have assumed the elevations to be Geodetic.

The boreholes were advanced using solid and hollow stem continuous flight augers, with a track-mounted drilling rig, under the full-time supervision of geotechnical personnel from our office. Soil samples were taken at 0.76 to 1.5 m intervals for the full depth of the investigation and the Standard Penetration Test (SPT) was performed in accordance with ASTM D1586. This consists of freely dropping a 63.5 kg (140 lbs) hammer a vertical distance of 0.76 m (30 inches) to drive a 51 mm (2 inches) diameter o.d. split-barrel (split spoon) sampler into the ground. The number of blows of the hammer required to drive the sampler into the relatively undisturbed ground by a vertical distance of 0.30 m (12 inches) is recorded as the SPT ‘N’-value of the soil and this gives an indication of the consistency or the relative density of the soil deposit.

Upon completion of boreholes, the soil samples were transported to our Soils Laboratory for further examination and laboratory testing. Soil laboratory testing, consisting of moisture content determination, gradation analysis (Sieve and Hydrometer tests) and Atterberg Limits (Liquid and Plastic Limits), were performed on selected representative soil samples. The results of the in-situ and laboratory tests are presented on the corresponding Record of Borehole Sheets as well as in Enclosure A.

Samples obtained during this investigation will be stored in our Soils Laboratory for three months and will be disposed thereafter.

3.0 SUB-SURFACE CONDITIONS

The stratigraphic units and groundwater conditions are briefly discussed in the following sections for each of the proposed works. For more detailed information, reference should be made to the Record of Borehole Sheets.

3.1 Proposed Snow Making Pond (Borehole 1)

The snow making pond is proposed to be located on the north end of the property, adjacent to 17

Sideroad. As requested, Borehole 1 was drilled at this location. Based on the subsurface conditions encountered at this borehole, the site is underlain by topsoil and fill extending down to a depth of about 0.8 m below existing grade. It should however be noted that the thickness and quality of topsoil and fill can vary significantly beyond the borehole location. Considering this, the extent of fill at the site and the limited size of an auger hole, we recommend that allowance be made for possible variations when making estimates. Alternatively, the depth and quality of topsoil and fill could be further investigated by test pitting.

The fill was then underlain by gravelly sand and layers of sand deposits with occasional gravel, silty sand interbeddings, trace to some silt and clay, extending to the completion of the borehole at approximately 9.0 m below existing ground surface.

Standard Penetration Tests were performed at the site and the recorded 'N'-values within the gravelly sand and sand layers were found to range widely from 8 to more than 50 blows/0.3m, indicating a loose to very dense, but generally compact relative density. Samples from these deposits were also tested for natural moisture content and the results were found to generally range from 8 to 19%. Considering these results as well as visual and tactile examination of the recovered soil samples, the deposits were generally wet.

Representative samples from the sand deposits were tested for gradation analysis. The results are presented on the Record of Boreholes as well as in Enclosure A and they are summarized below:

	BH 1: S5	BH 1: S8	BH 1: S10
Gravel:	1%	0%	11%
Sand:	92%	74%	87%
Silt and Clay:	7%	26%*	2%

* (Silt: 10%, Clay: 16%)

The groundwater condition at this borehole was monitored during and upon the completion of drilling as well as by installing a monitoring well. The results are summarized in below:

Table 1: Measured Groundwater data

Borehole	"Approx." Geodetic Ground Surface Elevation (m)	Measured Groundwater Depth / Elevation (m)		
		Upon Completion	June 6, 2018	June 13, 2018
BH 1	~264	2.0 / 262	+ 0.9 / 264.9	+ 0.8 / 264.8

It should be mentioned that the groundwater condition at the site would fluctuate seasonally and can be expected to be somewhat higher during the spring months and in response to major weather events.

3.2 Heightening the Top of the Existing Ski Hill (Boreholes 2 to 4)

Boreholes 2, 3 and 4 were drilled for this proposed work and they encountered some surficial topsoil that was underlain by fill, generally consisting of silty clay/clayey silt with occasional organic stains, trace to some rootlets and topsoil, that extended down to depths ranging from approximately 0.7 m in Borehole 2 to 5.2 m in Borehole 3. The fill at Borehole 2 was in turn underlain by a 0.3 m thick topsoil (may be the original topsoil layer). The recorded 'N'-values within the silty clay to clayey silt fill ranged from about 6 to 12 blows/0.3 m. Samples from the fill layer were also tested for moisture content and the results were found to generally range from 12 to 23%. The collected fill samples were generally damp and the higher measured moisture content values could be due to the presence of organic content within the fill deposit. Considering the above results, we are of the opinion that the fill has received some non-systematic compaction and quality control. It should however be noted that the thickness and quality of topsoil and fill can vary significantly between and beyond the boreholes locations. Considering this, the extent of fill at the site and the limited size of an auger hole, we recommend that allowance be made for possible variations when making estimates.

Native silty clay/clayey silt was encountered below the fill layer in Boreholes 2 and 4 and below the lower topsoil layer in Borehole 3 and it extended down to depths ranging from about 0.8 m to 10.0 m below existing grade, where it was in turn underlain by highly weathered to weathered shale.

The measured 'N'-values within the silty clay/clayey silt ranged from about 14 to more than 30 blows/0.3 m, indicating a stiff to hard, but generally very stiff to hard consistency. Representative samples from this layer were also tested for natural moisture content and the results were found to range from 10 to 17%. Based on these results as well as visual and tactile examination of the recovered soil samples, the silty clay/clayey silt was generally damp. A representative sample from this deposit was analyzed for gradation and Atterberg Limits. The results are presented on the Record of Boreholes as well as in Enclosure A and they are summarized below:

	BH 4: S54
Gravel:	0%
Sand:	4%
Silt:	52%
Clay:	44%
Liquid Limit:	36%
Plastic Limit:	21%
Plasticity Index:	15%

Considering the above results, the silty clay/clayey silt has medium plasticity.

Highly weathered to weathered shale was encountered below the silty clay to clayey silt at all three boreholes. This was further confirmed by drilling additional two shallower boreholes at a 2 m radius around Borehole 4 to ensure that a large cobble or boulder was not being encountered. The recorded 'N'-values within the highly weathered to weathered shale deposit were all well in excess of 50 blows/0.3 m. The natural moisture content test results performed on selected samples ranged from 5 to 9%. It should however be noted that the quality and the surface elevation of the highly weathered to weathered shale as described in the borehole logs should be considered as approximate only, as they were inferred from the observations during drilling rather than proven by rock coring.

The groundwater condition at these boreholes were monitored during and upon the completion of drilling as well as by installing a monitoring well in Borehole 3. The results are summarized in Table 2, below:

Table 2: Measured Groundwater data

Borehole	"Approx." Geodetic Ground Surface Elevation (m)	Measured Groundwater Depth / Elevation (m)		
		Upon Completion	June 6, 2018	June 13, 2018
BH 2	~377	Dry	-	-
BH 3	~385	12.2 / 372.8	11.1 / 373.9	11.1 / 373.9
BH 4	~374	Dry	-	-

It should be mentioned that the groundwater at the site would fluctuate seasonally and can be expected to be somewhat higher during the spring months and in response to major weather events. Furthermore, a perched water condition may also exist within the fill deposit.

3.3 Proposed Housing Units, Buildings, Water Treatment Plant & Firefighting Tanks (Boreholes 5 to 7)

As requested, Boreholes 5 to 7 were drilled to obtain some general information below the proposed six block of chalet type housing units (Blocks 1 to 6), two buildings (Building A and B), a water treatment plant and firefighting tanks to be located on the north end of the main parking lot at Sideroad 15. Based on the subsurface conditions encountered at these boreholes, fill soils generally consisting of silty sand to sandy silt, granular fill and clayey silt were contacted at all boreholes that extended down to depths ranging from approximately 0.7 m (at Boreholes 5 and 7) to 2.2 m (at Borehole 6) below existing ground surface. However, at Borehole 6, a topsoil layer was also contacted interbedded within the fill deposit. It should be noted that the thickness and quality of fill and topsoil can vary significantly in between and beyond the borehole locations. Considering this, the extent of fill at the site and the limited size of an auger hole, we recommend that allowance be made for possible variations when making estimates. Alternatively, the depth and quality of topsoil and fill could be further investigated by test pitting.

The fill layer at all boreholes was then underlain by glacial deposits, generally consisting of silty sand till and/or sandy silt till, that extended down to the completion of the boreholes at 4.9 to 5.0

m below existing grade. The recorded 'N'-values within the glacial deposits ranged from 16 to more than 50 blows/0.3 m penetration, indicating a compact to very dense, but generally dense to very dense relative density. Samples from these deposits were also tested for natural moisture content determination and the results within the sandy silt till were 12 and 13% and within the silty sand till ranged from 7 to 11%. Considering these results as well as visual and tactile examination of the recovered soil samples, the silty sand till and sandy silt till deposits were generally damp and occasionally damp to moist or moist.

Representative samples from the silty sand till and sandy silt till deposits were tested for gradation analysis. The results are presented on the Record of Boreholes as well as in Enclosure A and they are summarized below:

	BH 5: S2	BH 5: S5	BH 7: S2
Gravel:	13%	5%	2%
Sand:	59%	59%	24%
Silt:	28%	35%	69%
Clay:	0%	1%	5%

It should be noted that the occurrence of cobbles and boulders should always be expected when working in glacial till deposits.

The groundwater condition at these boreholes were monitored during and upon the completion of drilling as well as by installing a monitoring well in Borehole 7. The results are summarized in Table 3 below:

Table 3: Measured Groundwater data

Borehole	"Approx." Geodetic Ground Surface Elevation (m)	Measured Groundwater Depth / Elevation (m)		
		Upon Completion	June 6, 2018	June 13, 2018
BH 5	~307	3.2 / 303.80	-	-
BH 6	~302	4.3 / 297.7	-	-
BH 7	~286	4.5 / 281.5	2.6 / 283.4	2.8 / 283.2

It should be mentioned that the groundwater at the site would fluctuate seasonally and can be expected to be somewhat higher during the spring months and in response to major weather events. Furthermore, a perched water condition may also exist within the fill deposit.

3.4 Proposed Dry Detention Pond Basin (Borehole 8)

The dry basin is proposed to be located south of the proposed building structures, on the southeast portion of the site. Based on the subsurface conditions encountered at Borehole 8 drilled for this structure, the site is underlain by a surficial topsoil layer followed by fill that extended down to approximately 4.4 m below the ground surface. The fill generally consisted of sandy silt

…/…

with trace clay, organic stains and some topsoil. The fill was found to overlie a layer of deeper topsoil (may be the original topsoil layer) that extended to about 4.8 m below existing grade. It should be noted that the thickness and quality of fill and topsoil can vary significantly beyond the borehole location. Considering this, the extent of fill at the site and the limited size of an auger hole, we recommend that allowance be made for possible variations when making estimates. Alternatively, the depth and quality of topsoil and fill could be further investigated by test pitting.

The fill deposit was then underlain by a relatively thin layer of silty sand to sandy silt that extended to approximately 5.2 m below grade. The recorded 'N'-value with this deposit was 6 blows/0.4 m with a moisture content of more than 40%, indicating a loose and wet condition.

The silty sand to sandy silt was then underlain by glacial till deposits consisting of silty sand till or silty sand to sandy silt till that extended down to the completion of the borehole. The measured 'N'-values within these layers ranged widely from 22 to more than 50 blows/0.3 m penetration, indicating a compact to very dense relative density. Samples from these deposits were also tested for natural moisture content determination and the results were found to range from 9 to 13%. Considering these results as well as visual and tactile examination of the recovered soil samples, the silty sand till and/or sandy silt till deposits were wet at higher elevations and became damp to moist with increased depth.

A representative sample from the silty sand to sandy silt till deposit was tested for gradation analysis. The results are presented on the Record of Boreholes as well as in Enclosure A and they are summarized below:

	BH 8: S11
Gravel:	3%
Sand:	50%
Silt:	42%
Clay:	5%

It should be noted that the occurrence of cobbles and boulders should always be expected when working in glacial till deposits.

The groundwater condition at this borehole was monitored during and upon the completion of drilling as well as by installing a monitoring well. The results are summarized in below:

Table 4: Measured Groundwater data

Borehole	"Approx." Geodetic Ground Surface Elevation (m)	Measured Groundwater Depth / Elevation (m)		
		Upon Completion	June 6, 2018	June 13, 2018
BH 8	~296	4.6 / 291.4	3.7 / 292.3	3.8 / 292.2

It should be mentioned that the groundwater at the site would fluctuate seasonally and can be expected to be somewhat higher during the spring months and in response to major weather events. Furthermore, a perched water condition may also exist within the fill deposit.

4.0 DISCUSSION AND RECOMMENDATIONS

According to the preliminary information provided to us, we understand that the general viability of the following works is being considered at the site:

- Construction of a 6.0 m deep snow making pond on the north end of the property, adjacent to 17 Sideroad;
- Addition of 25 m of fill to be placed on top of the ski hill;
- Construction of six blocks of chalet type housing units (Blocks 1 to 6), two buildings (Building A and B), a water treatment plant and firefighting tanks to be located on the north end of the main parking lot at Sideroad 15. The proposed buildings appear to be slab-on-grade structures; and
- Construction of a 1.2 to 2.2 m deep Dry Detention Basin to be located at the southeast portion of the site (south of the proposed building structures).

Considering the above information and the subsurface conditions encountered at the borehole locations, some discussions and recommendations are provided in this section. However, they should be considered as general in nature and will need to be reviewed and confirmed by supplementary geotechnical investigations once the exact project details are known.

4.1 Construction of a Snow Making Pond

According to the information provided to us, the pond will be located on the north end of the property, adjacent to 17 Sideroad and will be 6.0 m deep with a base elevation of 257.40 m and an approximate side slope of 3H:1V.

Based on the preliminary topographic information provided to us, the existing ground surface elevation within the pond footprint generally varies from about 263 to 264 m and therefore the pond will be generally in cut.

Borehole 1 was drilled at this location. Based on the subsurface conditions encountered at this location, the pond base and walls would generally be within gravelly sand and sand deposits with the exception of the top part of the pond walls, where some engineered fill will be required to replace any existing topsoil and silty sand fill. Furthermore, the short-term groundwater level in the monitoring well installed in this borehole is measured above the existing ground surface, at Elevations 264.8 to 264.9 m and this will fluctuate with time.

Considering the above information, the stability of the pond walls was assessed by assuming a representative Section A, as shown in Figure 3. The section was analysed by assuming conservative soil parameters, as summarized in Table 5 below, based on the borehole information, the field and laboratory tests performed, our experience with similar site conditions as well as published geotechnical data.

Table 5: Assumed Conservative Geotechnical Parameters

Soil Type	**Bulk Unit Weight (kN/m³)**	**Shear Strength Parameters**			
		C' (kPa)	**Φ' (degree)**	**C_u (kPa)**	**$Φ_u$ (degree)**
Loose Fine Sand, Trace to Some Clay and Silt	16.5	0	20	10	10
Compact Sand, Gravelly Sand	19.0	0	30	0	30
Dense to Very Dense Sand	21.0	0	32	0	32
Engineered Fill (Sandy)	19.0	0	30	0	30

For slope stability analysis, computer program Slope/W 2012 and the Bishop's Simplified method for the calculation of the factor of safety for slip surface were used. For a slope to be assessed as being stable, a minimum Factor of Safety of 1.5 is normally required under a static loading condition.

The assumed cross-section was analysed under the following conditions:
-During Construction (Undrained Analysis); and
-Full Pool (Drained Analysis).

Furthermore, the pond wall was analysed under seismic loading conditions. The site specific seismic hazards as per National Building Code of Canada (2015) were obtained from Earthquakes Canada website (www.EarthquakesCanada.ca) and are provided in Appendix A. The peak ground acceleration (PGA) for 2 percent probability in 50 years (0.000404 per annum or return period of 2,475 years) for the site is 0.062g corresponding to Site Class C. For this study, although a geophysical assessment was not completed in assessing the applicable seismic site classification, considering the subsurface conditions encountered at the boreholes drilled at the site, a site Class D (Stiff Soil) is recommended for the property. Therefore, the peak ground acceleration corresponding to Site Class D at the site will be PGA=1.3×0.062g=0.0806g. According to industry standards, the acceleration used in pseudostatic analysis is equal to 0.5 × PGA. Based on these values and in accordance to the Canadian Foundation Manual (4th Edition), the following parameters were used for seismic stability evaluations:

Horizontal Seismic Coefficient = 0.5 X 0.0806g=0.0403g
Vertical Seismic Coefficient = 0

For a stable slope under seismic loading using pseudostatic analysis, a minimum FOS of 1.1 is normally recommended.

Considering the above details, the stability of the assumed representative cross-section under construction and ponding conditions was analysed and some of the results are shown in

Enclosures B-1 to B-3. The results indicate that the calculated Factors of Safety for static and seismic loading conditions were all above the recommended minimum values. Based on these results, the pond walls are considered to be stable.

It should be noted that as the pond base and the walls will be constructed in sandy deposits with high groundwater levels, they would need proper protection against erosion and washout. Furthermore, if a permanent water level has to be maintained in the pond, a suitable impermeable liner would be required. The liner would need to be designed against uplift hydrostatic pressures due to high groundwater levels measured at the site. We will review and provide additional recommendations once the pond information is finalized.

The pond excavation would require temporary dewatering to lower the groundwater level to below the pond base. This should be provided by the Project Dewatering Consultant.

4.2 Heightening of the Top of the Ski Hill

According to the information provided to us, we understand that the top of the existing ski hill is proposed to be raised by as much as 25 m on the front side and also a retaining wall system, ranging in height from approximately 4 to more than 18 m, is being considered for the backside.

Boreholes 2, 3 and 4 were drilled within the proposed heightening part of the hill. Based on the subsurface conditions encountered at these boreholes, below some surficial topsoil, the existing top of the hill has about 5 m of silty clay/clayey silt fill at Borehole 3 and this reduces to about 0.2 m at Borehole 2 and to about 1.5 m at Borehole 4. The fill at Borehole 3 was in turn underlain by a 0.3 m thick deeper topsoil layer. The field and laboratory test results appear to indicate that the existing fill has received some relatively non-systematic low compaction and quality control. The topsoil and fill layers were in turn underlain by still to hard silty clay/clayey silt that was found to overlie highly weathered to weathered shale.

Based on the provided topographic survey information, two sections were assumed that pass through the front of the ski hill (i.e. Sections B and C). The sections were analysed by assuming conservative soil parameters, as summarized in Table 6 below, based on the borehole information, the field and laboratory tests performed, our experience with similar site conditions as well as published geotechnical data.

Table 6: Assumed Conservative Geotechnical Parameters

Soil Type	**Bulk Unit Weight (kN/m^3)**	**Shear Strength Parameters**			
		C' (kPa)	**Φ' (degree)**	**C_u (kPa)**	**Φ_u (degree)**
Topsoil	16.5	0	15	20	0
Silty Clay/Clayey Silt Fill	17.0	0	22	35	0
Stiff Silty Clay Clayey Silt	17.5	0	25	40	0
Very Stiff to Hard Silty Clay/Clayey Silt	19.5	5	30	100	0
Highly Weathered to Weathered Shale	-	-	-	-	-
Engineered Fill (Clayey)	19.0	0	30	90	0

The assumed cross-sections were analysed under the following conditions:

-During and Immediately After Construction (Undrained Analysis);
-Long-term after Construction (Drained Analysis); and
-Seismic Loading.

Considering the above details, the stability of the assumed representative cross-sections for during and after construction was analysed and some of the results are shown in Enclosure B-4 to B-9. The results indicate that the calculated Factors of Safety under static and seismic loading conditions were all above the recommended minimum values. Based on these results, the proposed slope heightening would have adequate factor of safety against slope failure for the front slope. However, additional boreholes should be drilled within the proposed filling area as well as at lower elevations down the slope face in order to better define the existing subsurface conditions.

For raising the slope, the following 'preliminary' placement procedure is recommended.

(i) The area to receive the engineered fill should be stripped of any topsoil and other compressible, weak and deleterious materials. After stripping, the entire area should be inspected and approved by the geotechnical engineer. Spongy, wet or soft/loose spots should be sub-excavated to stable subgrade and replaced with compactable approved soil, compatible with subgrade conditions, as directed by the geotechnical engineer.

(ii) The fill material should be placed in thin layers not exceeding approximately 200 mm when loose. Oversize particles (cobbles and boulders) larger than 120 mm should be discarded, and each fill layer should be uniformly compacted with heavy compactors, suitable for the type of fill used, to at least 100% of its Standard Proctor Maximum Dry Density.

The on-site inorganic soils are generally acceptable for use as engineered fill, provided they are not contaminated with the overlying organic rich deposits and any organic inclusions are removed. Depending on the construction season, the on-site soils may require some reconditioning, wetting or drying. It should also be noted that the sandy and silty deposits are sensitive to moisture and they will require a more strict control on their moisture content if they are to be used in the engineered fill operation.

(iii) Full-time geotechnical inspection and quality control (by means of frequent field density and laboratory testing) are necessary for the construction of a certifiable engineered fill. Compaction procedures and efficiency should be controlled by a qualified geotechnical technician.

(iv) The engineered fill should not be frozen and should be placed at a moisture content within 2% of the optimum value for compaction. The engineered fill should not be performed during winter months when freezing ambient temperatures occur persistently or intermittently.

The proposed fill will settle under self-weight and it will also cause settlement of the underlying existing fill and native soils. Assuming the above procedure, the total settlement is estimated to range from approximately 40 to 60 cm. However, depending on the actual organic content within the existing fill, the settlement values could be higher. Also, considering the cohesive nature of the existing fill and assuming that a similar soil type is used for raising the hill, the settlements should occur over several years. We would however recommend that the settlements at the site (within the proposed fill areas as well as down the existing hill) to be instrumented and monitored by surveying. Due to the non-homogeneous nature of the existing fill and the presence of topsoil and organic matters within the fill, some excessive differential settlement should also be expected.

With respect to the proposed retaining walls for the backside of the hill, we would recommend that global slope stability analysis to be performed once the wall designs are available. Additional boreholes would be required along the proposed wall to better identify the subsurface conditions. The wall designer should also confirm the internal stability of the walls (sliding, overturning and bearing capacity). We would recommend the walls to be placed on the native and competent silty clay/clayey silt deposit, properly engineered fill or on the highly weathered to weathered shale. Based on these as well as the wall design, additional geotechnical parameters and recommendations will be provided.

4.3 Proposed Housing Units, Buildings, Water Treatment Plant & Fire Fighting Tanks

According to the Client, six blocks of chalet type housing units, two buildings, a water treatment plant and firefighting tanks are being assessed for construction on the north end of the main parking lot at Sideroad 15. The proposed buildings appear to be slab-on-grade structures. Boreholes 5, 6 and 7 were drilled in this area. Based on the subsurface conditions encountered at these boreholes, below some fill and/or topsoil, the site is predominantly underlain by compact to very dense silty sand till and/or sandy silt till. Furthermore, the groundwater level over our short-term monitoring program was measured below a depth of about 2.6 m below existing ground surface.

4.3.1 Site Grading

The development of the site will require clearing and stripping of all topsoil and fill. Where residential lots or structures are being considered, it is recommended that all fill be placed as engineered fill to provide competent subgrade. Prior to placement of engineered fill, all the surficial topsoil and fill should be stripped from planned fill areas to expose the inorganic subgrade. The exposed subgrade should then be proof-rolled with a suitably heavy roller to identify weak areas. Any weak or excessively wet zones identified during proof-rolling should be sub-excavated and replaced with compacted competent material to establish stable and uniform conditions. Prior to placement of engineered fill, the subgrade should be inspected and approved by a geotechnical engineer. Reference is made to Section 4.3.4 for recommendations regarding engineered fill placement.

Provided the above recommendations are followed, and all topsoil and compressible materials are stripped or sub-excavated, the existing deposits are not considered to be highly compressible and long-term settlements should be minimal.

4.3.2 Foundations

Based on the subsurface conditions encountered at Boreholes 5, 6 and 7 drilled at the site, the footings would need to be extended down to the competent undisturbed native deposits or be placed on properly compacted engineered fill. The recommended spread footing depths and allowable soil bearing pressures are given in the following table.

Table 7: Recommended Soil Bearing Capacity Values

Borehole	**Depth Below Existing Grade (m)**	**Recommended Geotechnical Reaction at SLS * (kPa)**	**Factored Geotechnical Resistance at ULS (with a Geotechnical Resistance Factor of 0.5), (kPa)***
BH 5	± 1.1	150	225
BH 6	± 2.3	150	225
BH 7	± 1.1	150	225

* Higher Allowable Soil Bearing Capacity values are available at lower elevations, if required.

The minimum footing sizes, footing thickness, excavations and other footing requirements should be designed in accordance to the latest edition of the Ontario Building Code.

The footing subgrade should be inspected and evaluated by the Geotechnical Engineer prior to concreting to ensure that the footings are founded on competent subgrade capable of supporting the recommended design pressure.

Design frost penetration depth for the general area is 1.6 m. Therefore, a permanent soil cover of 1.6 m or its thermal equivalent is required for frost protection of foundations. All exterior footings and footings beneath unheated areas should have at least 1.6 m of earth cover or equivalent synthetic insulation for frost protection.

Where necessary, the stepping of the footings at different elevations should be carried out at an angle no steeper than 2 horizontal (clear horizontal distance between footings) to 1 vertical (difference in elevation) and no individual footing step should be greater than 0.6 m and may have to be as low as 0.3 m if weaker soils are encountered.

For footings designed and constructed in accordance with the above criteria, total and differential settlements should be less than 25 mm and 15 mm, respectively. These values are usually within tolerable limits for most types of structures.

4.3.3 Earthquake Considerations

In conformance to the Criteria in Table 4.1.8.4.A, Part 4, Division B of the National Building Code (NBC 2005), for footings designed as recommended in Section 4.3.2, the subject site is classified as Site Class “D-Stiff Soil”. The four values of the Spectral Response Acceleration $S_a(T)$ for the different periods and the peak ground acceleration (PGA) can be obtained from Table C-2 in Appendix C, Division B of the NBC (2005). The design values of F_a and F_v for the project site should be calculated in accordance to Table 4.1.8.4.B and C.

4.3.4 Engineered Fill

Depending on the proposed grades for the site, engineered fill may be required to replace the existing fill and topsoil as well as to raise the site grades for the possible support of footings and floor slabs. Engineered fill could be placed after stripping all topsoil, any soils containing excessive organics and otherwise unsuitable soils, within an area extending at least 2.5 m beyond the perimeter of the footprint of the proposed structures. Engineered fill would then be suitable to support the foundations including the slabs provided that the following criteria are strictly followed. Engineered fill may also be carried out to raise the existing grades below the proposed roads and parking lots.

The following placement procedure is recommended.

(i) The areal extent of engineered fill should be controlled by proper surveying techniques to ensure that the top of the engineered fill extends a minimum of 2.5 m beyond the perimeter of the buildings to be supported. Where the depth of engineered fill exceeds 1.5 m, this horizontal distance of 2.5 m beyond the perimeter of the building should be increased by at least 1.0 m for each 1.0 m depth of fill.

(ii) The area to receive the engineered fill should be stripped of any topsoil, fill and other compressible, weak and deleterious materials. After stripping, the entire area should be inspected and approved by the geotechnical engineer. Spongy, wet or soft/loose spots should be sub-excavated to stable subgrade and replaced with compactable approved soil, compatible with subgrade conditions, as directed by the geotechnical engineer.

(iii) The fill material should be placed in thin layers not exceeding approximately 200 mm when loose. Oversize particles (cobbles and boulders) larger than 120 mm should be discarded, and each fill layer should be uniformly compacted with heavy compactors, suitable for the type of fill used, to at least 98% of its Standard Proctor Maximum Dry Density.

The on-site inorganic soils are generally acceptable for use as engineered fill, provided they are not contaminated with the overlying organic rich deposits and any organic inclusions are removed. Depending on the construction season, the on-site soils may require some reconditioning.

(iv) Full-time geotechnical inspection and quality control (by means of frequent field density and laboratory testing) are necessary for the construction of a certifiable engineered fill. Compaction procedures and efficiency should be controlled by a qualified geotechnical technician.

(v) The engineered fill should not be frozen and should be placed at a moisture content within 2% of the optimum value for compaction. The engineered fill should not be performed during winter months when freezing ambient temperatures occur persistently or intermittently.

The allowable soil bearing pressure is 150 kPa for footings supported by at least 1.0 m of engineered fill constructed in accordance with the above recommendations. We also recommend that the footing subgrade be evaluated by the geotechnical engineer prior to placing the formwork. It is recommended to increase the rigidity of foundations of structures erected over engineered fill, and this is generally achieved by making the footings at least 0.5 m wide, and adding reinforcing rebars to the footings and walls. This measure helps to bridge over eventual weak spots in the fill.

All footings should have at least 1.6 m of earth cover or equivalent artificial insulation for frost protection.

For footings designed and constructed in accordance with the above criteria, total and differential settlements should be less than 25 mm and 15 mm, respectively. These values are usually within tolerable limits.

4.3.5 Excavating and Dewatering

All temporary excavations should be carried out in accordance with the Ontario Health and Safety Regulations. The soils to be excavated can be classified as follows:

-Topsoil / Fill	Type 4
-Compact Silty Sand/Sandy Silt Till	Type 3
-Dense to Very Dense Silty Sand/Sandy Silt Till (above groundwater level or when dewatered)	Type 2

Accordingly, for Type 3 Soils, a side slope of 1H:1V is required for excavations in accordance with the Ontario Health and Safety Regulations. Within Type 4 Soils, the side slope of the excavation would need to be flattened to at least 3H:1V. In Type 2 soils, the bottom 1.2 m of the excavation could be carried out close to vertical.

Stockpiles of excavated materials should be kept at least 5 m away from the edge of the excavation to avoid slope instability. This distance should be increased for any stockpiling along the top of the existing slopes (we should be informed to provide additional recommendations if soil stockpiling on top of slopes is being considered). Care should also be taken to avoid overloading of any underground services/structures by stockpiles.

Based on the subsurface conditions encountered at the boreholes, within the recommended depth for footings provided in Table 7, we anticipate all footing excavations to be above the measured groundwater levels, either in engineered fill or within native deposits. Considering this, we do not anticipate major dewatering problems for footing excavations, although some dewatering may have to be carried out for excavations due to surface runoff, from any perched water within the fill layer or groundwater seepage. We are of the opinion that these should be manageable by pumping from temporary sumps protected against erosion. Such sumps should be dug outside the footprint of the structures to minimize disturbance to the footing grade. We recommend that once the structure footing invert information are known and prior to construction, the groundwater conditions at the site to be further assessed by test pitting.

4.3.6 Building Slab Construction & Drainage

Concrete floor slab may be built on properly prepared subgrade or engineered fill. If the existing topsoil/fill is left underneath the slab, long-term settlement and/or cracks may occur. The existing fill and topsoil should be removed and replaced with compacted engineered fill in order to support the floor slab. For engineered fill subgrade, Section 4.3.4 should be followed.

Underneath the building slabs, a 150 mm thick base course consisting of 20 mm size clear stone or OPSS Granular A should be placed to improve the support for the floor slab and function as drainage layer. This base course should be compacted with vibratory equipment to a uniform high density. If the subgrade is wet, the clear stone or OPSS Granular A base should be separated from the subgrade by an approved filter fabric (e.g. non-woven geotextile, with FOS of 75 - 150 µm, Class II).

The site should be graded for drainage away from foundations. A minimum cross fall of three percent (3%) immediately adjacent to foundations is recommended to allow for some settlement and promote good surface drainage.

4.4 Proposed Dry Detention Basin

Based on the information provided to us we understand that a 1.2 to 2.2 m deep dry detention basin is proposed to be constructed on the southeast portion of the site, south of the proposed building structures. The dry pond base will be at Elevation 293.80 m and the top of the pond at Elevation 296.35 m. The pond will have a side slope of 4H:1V.

Based on the preliminary topographic information provided to us, the existing ground surface elevation within the pond footprint generally varies from about 295 to 297 m and therefore the pond will generally in cut.

Borehole 8 was drilled at this location. Based on the subsurface conditions encountered at this location, the pond base and walls would generally be within sandy silt fill with occasional topsoil interbeddings. Furthermore, the short-term highest groundwater level in the monitoring well installed in this borehole was measured at depth of about 3.7 m below existing ground surface and this will fluctuate with time.

Considering the above information, the pond will be placed within a fill deposit which appears to have received little to no compactive effort or quality control and will not provide a long-term stable pond structure. We would therefore recommend the fill to be removed and then the area to be engineered up. For recommendations on the construction of the engineered fill reference should be made to Section 4.3.4. It should be noted that the pond is designed as a dry pond and threfeore by definition it will not be holding a permanent water level. We would however recommend the pond side slopes to be protected against erosion and washout.

Considering the above information, the stability of the pond wall was assessed by assuming a representative section (i.e., Section F), as shown in Figure 5. The section was analysed by assuming conservative soil parameters, as summarized in Table 8 below, based on the borehole information, the field and laboratory tests performed, our experience with similar site conditions as well as published geotechnical data.

Table 8: Assumed Conservative Geotechnical Parameters

Soil Type	**Bulk Unit Weight (kN/m^3)**	**Shear Strength Parameters**			
		C' (kPa)	**Φ' (degree)**	**C_u (kPa)**	**Φ_u (degree)**
Engineered Fill (Sandy)	19.0	0	30	0	30

For slope stability analysis, computer program Slope/W 2012 and the Bishop's Simplified method for the calculation of the factor of safety for slip surface were used.

The assumed cross-section was analysed under the following conditions:

-During Construction (Undrained Analysis);
-Normal Water Level (Drained Analysis); and
-Seismic Loading.

Considering the above details, the stability of the assumed representative cross-section was analysed under construction, normal water level as well as seismic loading conditions. Some of the results are shown in Enclosure B-10 to B-15. The results indicate that the calculated Factors of Safety were all above the recommended minimum values for static and seismic loading conditions. Based on these results, the pond walls are considered to be stable.

The pond excavation would require temporary dewatering to lower the groundwater level down to the native deposit, so that the engineered fill could be constructed. Recommendations on the dewatering methodology should be provided by the Project Dewatering Consultant.

5.0 CLOSURE

As requested, the viability of some proposed works at the ski club was investigated and this preliminary feasibility report was prepared to summarise the subsurface findings at the requested borehole locations together with some preliminary geotechnical comments and recommendations. We would however recommend that once the development details are finalized and a detailed topographic survey map is available, our recommendations should be reviewed for their specific applicability and the recommendations to be finalized. A supplemental geotechnical investigation will be required.

The attached Report Limitations are an integral part of this report.

Sincerely,
Shad & Associates Inc.

S Chong

LICENSED PROFESSIONAL ENGINEER
H. SHAD
PROVINCE OF ONTARIO

H. Shad

Stephen Chong, P. Eng.
Senior Engineer

Houshang Shad, Ph. D., P. Eng.
Principal

STATEMENT OF LIMITATION

The conclusions and recommendations given in this report are based on information obtained at the testhole locations. Subsurface and groundwater conditions between and beyond the testholes may differ from those encountered at the testhole locations, and conditions may become apparent during construction which could not be detected or foreseen at the time of the site investigation.

The information contained herein in no way reflects on the environmental aspects of the project, unless stated otherwise.

The benchmark and elevations used in this report are primarily to establish relative elevation differences between the testhole locations and should not be used for other purposes, such as planning, grading, excavating, etc.

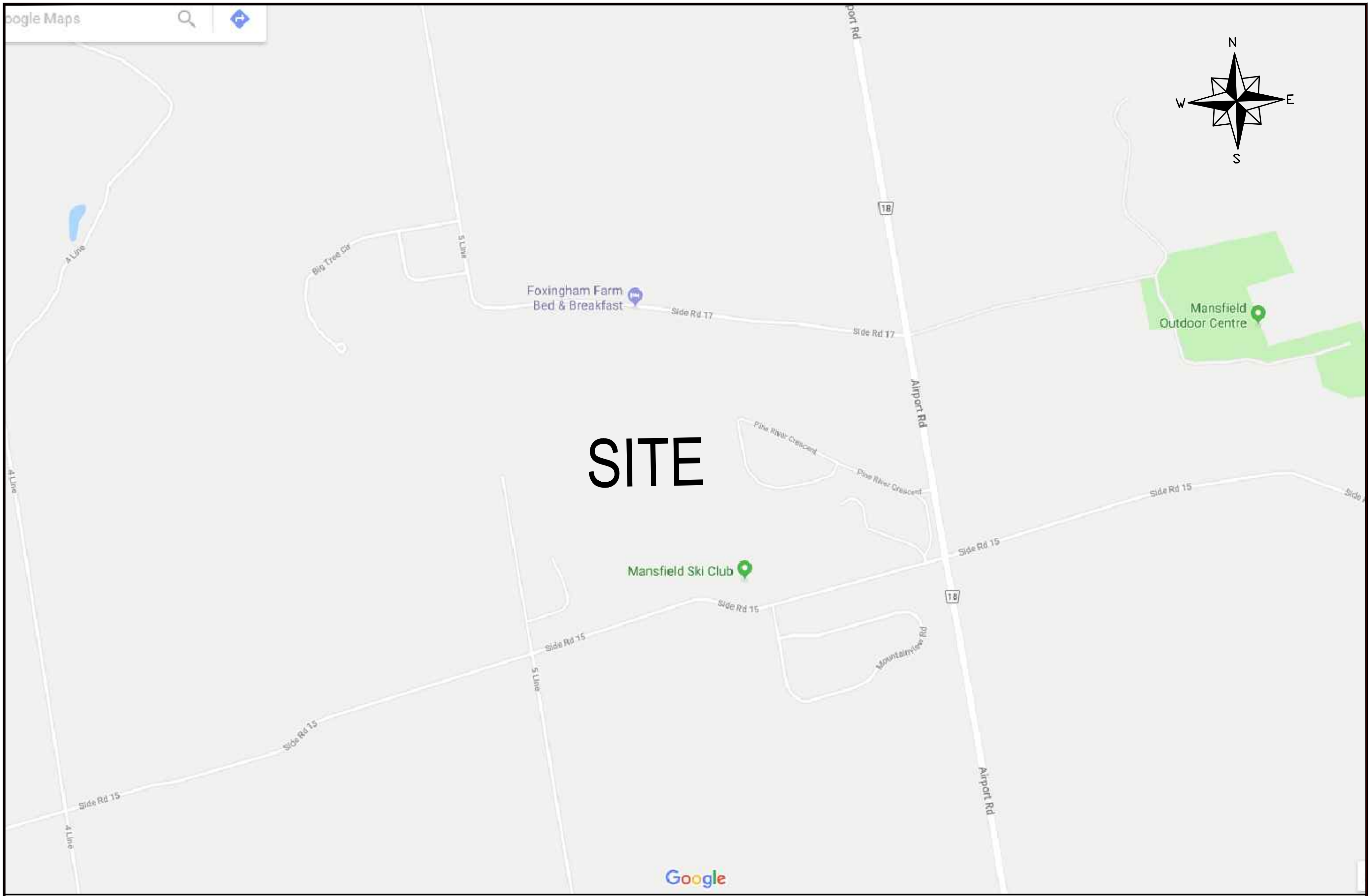
The design recommendations given in this report are project as well as site specific and then only if constructed substantially in accordance with the details stated in this report. We recommend, therefore, that we be retained during the final design stage to review the design drawings and to verify that they are consistent with our recommendations or the assumptions made in our analysis.

The comments given in this report on potential construction problems and possible methods are intended only for the guidance of the designer. The number of the testholes may not be sufficient to determine all the factors that may affect construction methods and costs. The contractors bidding on this project or undertaking construction should, therefore, make their own interpretation of the factual information presented and draw their own conclusions as to how the subsurface conditions may affect their work.

We recommend that we be retained during construction to confirm that the subsurface conditions throughout the site do not deviate materially from those encountered in the testholes.

Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, is the responsibility of such third party. We accept no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

FIGURES



CLIENT:

Mansfield Ski Club

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SHAD & ASSOCIATES INC.

Drawn By: M.Z.
Checked By: H.S.
Datum: -
Projection: -
Scale: N.T.S.

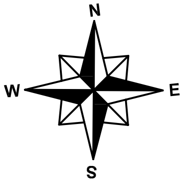
TITLE:

SITE LOCATION PLAN

PROJECT:

Feasibility Assessment
Preliminary Geotechnical Investigation
Proposed Development
628213 Sideroad 15
Mulmur, Ontario

Date: June, 2018
Project No.: T18733
Figure No.: 1



LEGEND:

BH 1
⊕ Borehole Location

NOTES:

1. All Borehole locations are approximate.
2. Drawing not to scale.
3. The base drawing was provided by Client.
4. The drawing should be read in conjunction with the associated report by Shad & Associates Inc., T18733.

CLIENT:

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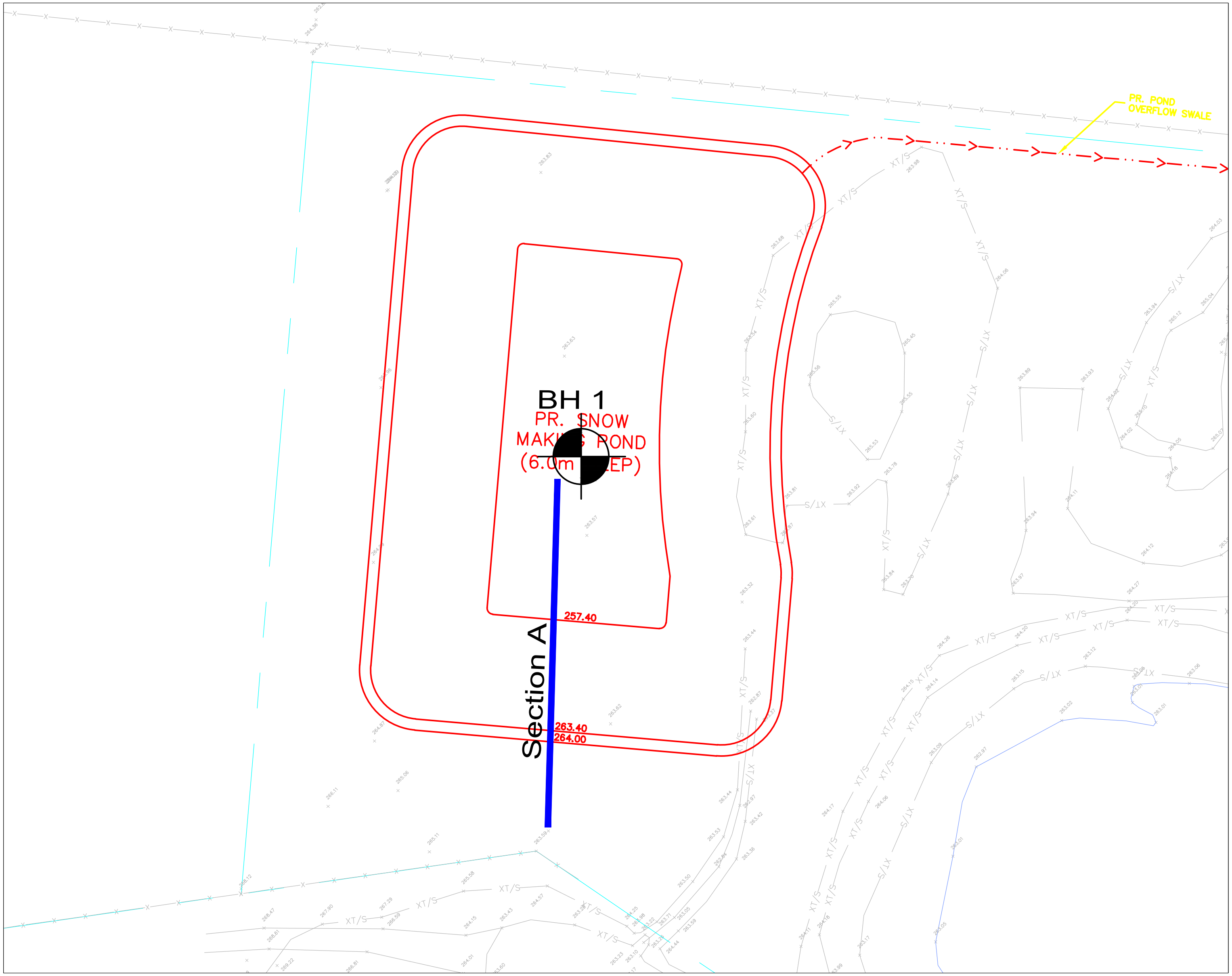
Datum: -
Projection: -
Scale: N.T.S.

TITLE:

Borehole Location Plan

PROJECT:
Feasibility Assessment
Preliminary Geotechnical Investigation
Proposed Development
628213 Sideroad 15
Mulmur, Ontario

Date: June, 2018
Project No.: **T18733**
Figure No.:
2



N
W E
S

LEGEND:

BH 1 ⊕	Borehole Location
Section A ▬	Assumed Sections

NOTES:

1. All Borehole locations are approximate.
2. Drawing not to scale.
3. The base drawing was provided by the Client.
4. The drawing should be read in conjunction with the associated report by Shad & Associates Inc., T18733.

CLIENT:

Mansfield Ski Club

Drawn By: M.Z.

Checked By: H.S.

TITLE:

Assumed Section for Snow Making Pond

Date: June, 2018

Project No.: **T18733**

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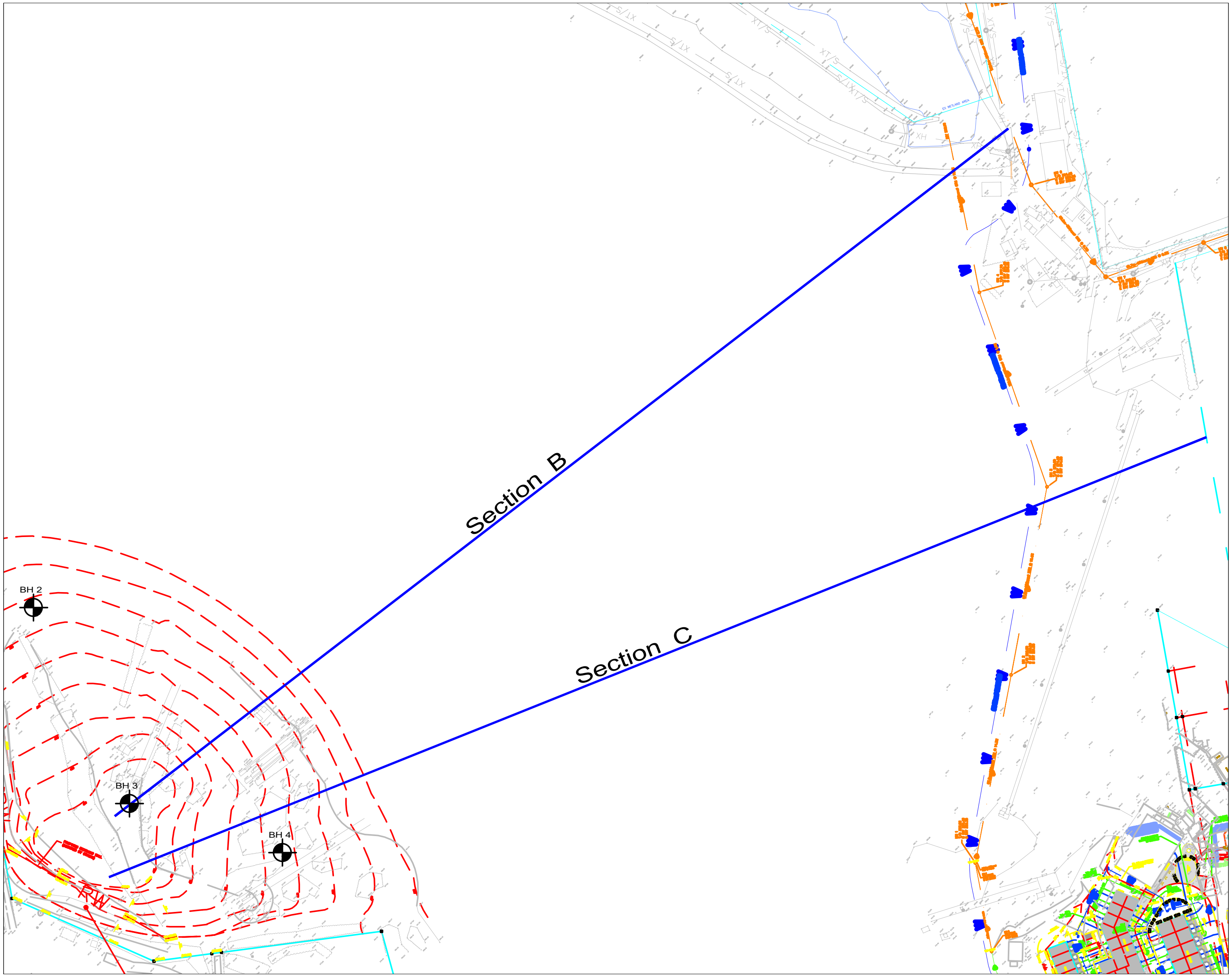
Datum: -

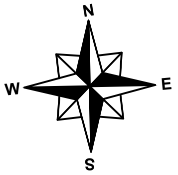
Projection: -

Scale: N.T.S.

PROJECT:
Feasibility Assessment
Preliminary Geotechnical Investigation
Proposed Development
628213 Sideroad 15
Mulmur, Ontario

Figure No.: 3





LEGEND:

BH 1

⌖ Borehole Location

Section B

▬ Assumed Sections

NOTES:

1. All Borehole locations are approximate.
2. Drawing not to scale.
3. The base drawing was provided by the Client.
4. The drawing should be read in conjunction with the associated report by Shad & Associates Inc., T18733.

CLIENT:
Mansfield Ski Club

Drawn By: M.Z.

Checked By: H.S.

TITLE:
Assumed Sections for Ski Hill Heightening

Date: June, 2018

Project No.: **T18733**

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Datum: -

Projection: -

Scale: N.T.S.

PROJECT:
Feasibility Assessment
Preliminary Geotechnical Investigation
Proposed Development
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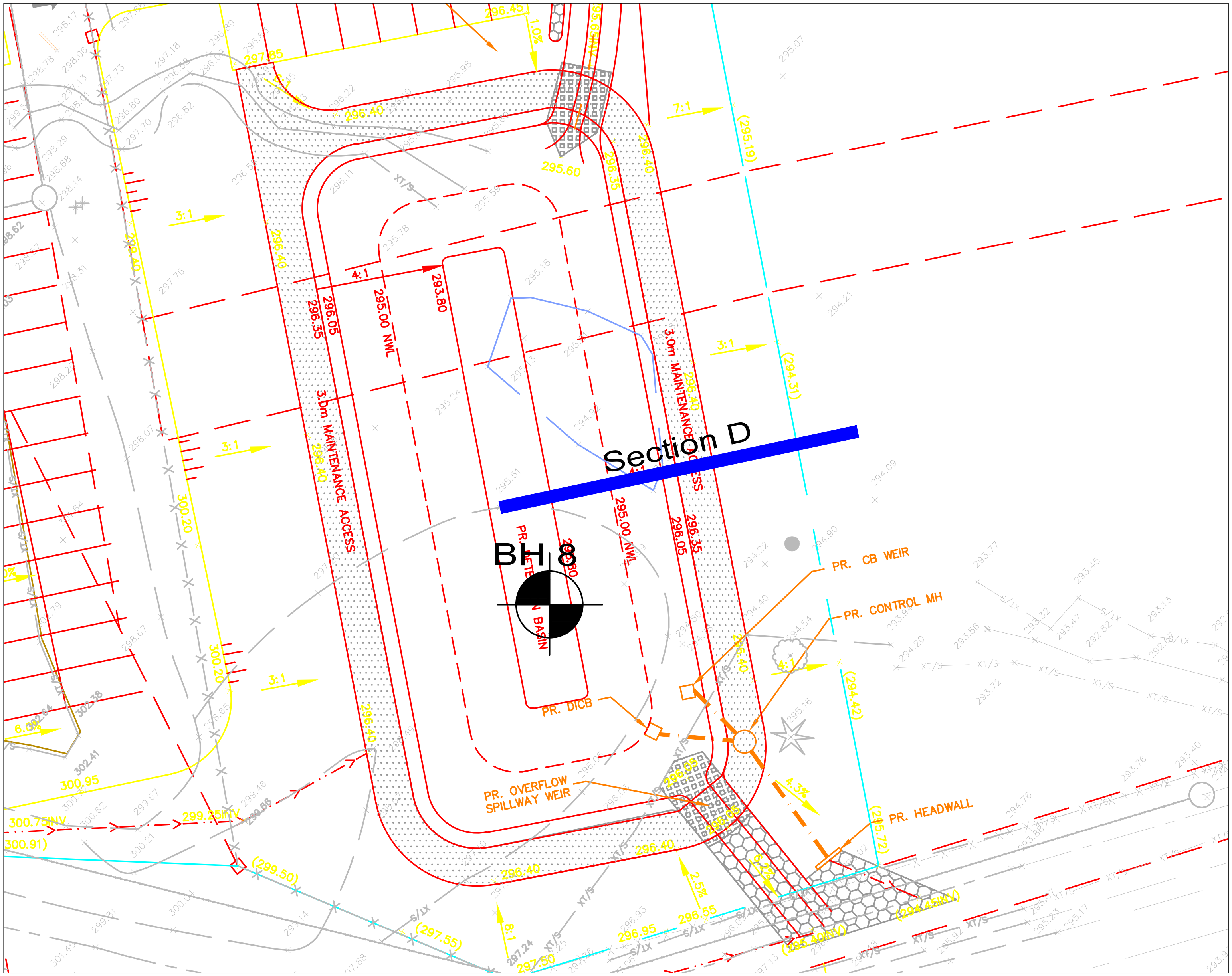
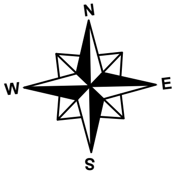
Mulmur, Ontario

Figure No.:
4





LEGEND:

BH 1

⊕ Borehole Location

Section D

▬ Assumed Sections

NOTES:

1. All Borehole locations are approximate.
2. Drawing not to scale.
3. The base drawing was provided by the Client.
4. The drawing should be read in conjunction with the associated report by Shad & Associates Inc., T18733.

CLIENT:

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www.shadinc.ca

Drawn By: M.Z.
Checked By: H.S.
Datum: -
Projection: -
Scale: N.T.S.

TITLE:

Assumed Section for Dry Detention Pond

PROJECT:

Feasibility Assessment
Preliminary Geotechnical Investigation
Proposed Development
628213 Sideroad 15
Mulmur, Ontario

Date: June, 2018
Project No.: **T18733**
Figure No.:
5

RECORD OF BOREHOLES

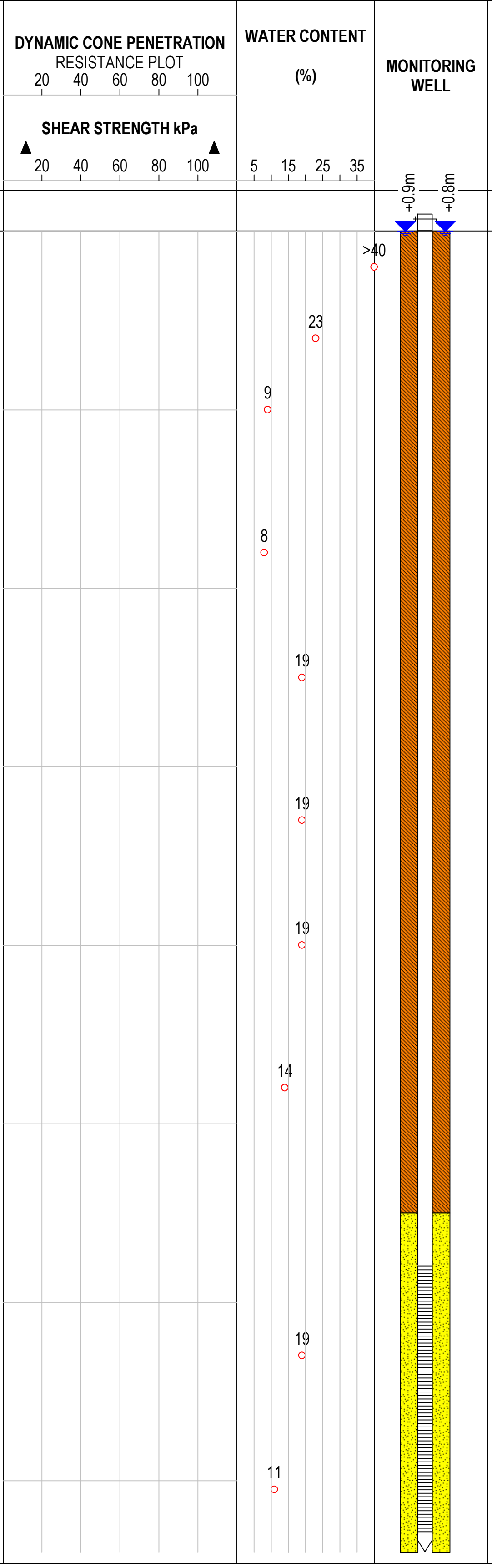
RECORD OF BOREHOLES (BH 1 to 8)
EXPANATION OF BOREHOLE LOGS

RECORD OF BOREHOLE 1

SHAD & ASSOCIATES INC.
83 Citation Dr, Unit 9,
Vaughan, Ontario, L4K 2Z6

Project No.: T18733
CLIENT: Mansfield Ski Club
ORIGINATED BY: M.Z.
DATE: May 24, 2018
LOCATION: Mulmur, Ontario
COMPILED BY: M.Z.
DATUM: Approximate Geodetic
BOREHOLE TYPE: Hollow Stem Augers
CHECKED BY: H.S.

SOIL PROFILE			SAMPLES				GROUND WATER CONDITIONS	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEVATION (metres)	DEPTH SCALE (metres)	DESCRIPTION	SAMPLE NUMBER	TYPE	RECOVERY (cm)	" N " VALUES		
264.0		Ground Surface						
	0	**Topsoil**	1	SS	60	5		
263.6		dark brown to black **Silty Sand Fill** some rootlets, occ. organic stains some gravel, wet						
263.2	1	occ. organic stains	2	SS	23	21		
		greyish brown **Gravelly Sand** wet, compact						
		grey	3	SS	20	28	May 24, 2018	
261.9	2	grey **Fine Sand** occ. gravel wet, compact	4	SS	10	10		
	3		5	SS	25	11		Gradation Analysis, S(5): 1 92 7
	4		6	SS	41	16		
		very dense	7	SS	35	100		The high 'N'-Value could be due to the presence of gravel particles within the soil matrix.
	5	occ. silty sand interbeddings occ. gravel						
258.5	6	grey **Fine Sand** trace to some clay and silt wet, loose	8	SS	28	8		Gradation Analysis, S(8): 0 74 10 16
257.3	7	grey **Sand** some gravel, occ. silty sand/sandy silt seams wet, dense	9	SS	35	47		



RECORD OF BOREHOLE 1

Project No.: T18733
CLIENT: Mansfield Ski Club
ORIGINATED BY: M.Z.
DATE: May 24, 2018
LOCATION: Mulmur, Ontario
COMPILED BY: M.Z.
DATUM: Approximate Geodetic
BOREHOLE TYPE: Hollow Stem Augers
CHECKED BY: H.S.

SHAD & ASSOCIATES INC.
83 Citation Dr, Unit 9,
Vaughan, Ontario, L4K 2Z6

SOIL PROFILE				SAMPLES								
ELEVATION (metres)	DEPTH SCALE (metres)	DESCRIPTION	STRATA PLOT	SAMPLE NUMBER	TYPE	RECOVERY (cm)	" N " VALUES	GROUND WATER CONDITIONS	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH kPa ▲ 20 40 60 80 100 ▲	WATER CONTENT (%) 5 15 25 35	MONITORING WELL	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	8	occ. gravel, compact		10	SS	30	26			14		Gradation Analysis, S(10): 11 87 2
255.8		grey **Fine to Medium Sand** occ. gravel, wet, very dense		11	SS	30	77			17		
255.0	9	**End of Borehole** Cave-in Depth on Completion: N/A Groundwater Depth on Completion: 2.0m Measured Groundwater in Installed Monitoring Well on: June 6, 2018: 0.9m above ground June 13, 2018: 0.8m above ground										
	10											
	11											
	12											
	13											
	14											

RECORD OF BOREHOLE 2

Project No.: T18733
CLIENT: Mansfield Ski Club
ORIGINATED BY: M.Z.
DATE: May 29, 2018
LOCATION: Mulmur, Ontario
COMPILED BY: M.Z.
DATUM: Approximate Geodetic
BOREHOLE TYPE: Solid Stem Augers
CHECKED BY: H.S.

SHAD & ASSOCIATES INC.
83 Citation Dr, Unit 9,
Vaughan, Ontario, L4K 2Z6

SOIL PROFILE

ELEVATION (metres)	DESCRIPTION
377.0	Ground Surface
	Topsoil
376.6	mottled brown **Silty Clay/Clayey Silt Fill** occ. organic stains, damp
376.4	
376.2	reddish brown, occ. greyish brown **Silty Clay/Clayey Silt** damp, stiff
	reddish brown **Highly Weathered Shale** occ. limestone seams/fragments
	Weathered Shale
	occ. limestone seams/interbeddings
372.3	**End of Borehole** Cave-in Depth on Completion: None Groundwater Depth on Completion: Dry

SAMPLES

SAMPLE NUMBER	TYPE	RECOVERY (cm)	" N " VALUES	WATER CONTENT (%)	REMARKS
1	SS	46	5	28 21	
2	SS	13	50/8cm	6	
3	SS	15	50/8cm	7	Hard Augering
4	SS	15	50/8cm	5	
5	SS	13	50/5cm	7	
6	SS	8	50/8cm	9	

DEPTH SCALE (metres): 0, 1, 2, 3, 4, 5, 6, 7

GROUND WATER CONDITIONS

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

SHEAR STRENGTH kPa: 20 40 60 80 100

WATER CONTENT (%): 5 15 25 35

MONITORING WELL

REMARKS AND GRAIN SIZE DISTRIBUTION (%): GR SA SI CL

RECORD OF BOREHOLE 3

Project No.: T18733
CLIENT: Mansfield Ski Club
ORIGINATED BY: M.Z.
DATE: May 29, 2018
LOCATION: Mulmur, Ontario
COMPILED BY: M.Z.
DATUM: Approximate Geodetic
BOREHOLE TYPE: Hollow Stem Augers
CHECKED BY: H.S.

SHAD & ASSOCIATES INC.
83 Citation Dr, Unit 9,
Vaughan, Ontario, L4K 2Z6

SOIL PROFILE

ELEVATION (metres)	DEPTH SCALE (metres)	DESCRIPTION
385.0		Ground Surface
384.8	0	**Topsoil**
		some rootlets, occ. organic stains
		reddish brown, occ. greyish brown **Silty Clay/Clayey Silt Fill** occ. gravel, damp
		occ. organic stains
		occ. rootlets
379.8		**Topsoil**
379.5		reddish brown, occ. greyish brown **Silty Clay/Clayey Silt** occ. shale fragments damp, very stiff

SAMPLES

SAMPLE NUMBER	TYPE	RECOVERY (cm)	" N " VALUES	WATER CONTENT (%)
				21
1	SS	28	7	18
2	SS	10	6	21
3	SS	18	7	19
4	SS	15	12	16
5	SS	28	12	16
6	SS	25	10	16
7	SS	23	9	12
8	SS	15	17	18 16
9	SS	28	21	17
10	SS	25	18	17

GROUND WATER CONDITIONS

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

SHEAR STRENGTH kPa: 20 40 60 80 100

WATER CONTENT (%): 5 15 25 35

MONITORING WELL

REMARKS AND GRAIN SIZE DISTRIBUTION (%): GR SA SI CL

Depth scale: 0 1 2 3 4 5 6 7

RECORD OF BOREHOLE 3

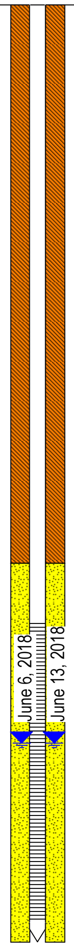
Project No.: T18733
CLIENT: Mansfield Ski Club
ORIGINATED BY: M.Z.

DATE: May 29, 2018
LOCATION: Mulmur, Ontario
COMPILED BY: M.Z.

DATUM: Approximate Geodetic
BOREHOLE TYPE: Hollow Stem Augers
CHECKED BY: H.S.

SHAD & ASSOCIATES INC.
83 Citation Dr, Unit 9,
Vaughan, Ontario, L4K 2Z6

SOIL PROFILE				SAMPLES								
ELEVATION (metres)	DEPTH SCALE (metres)	DESCRIPTION	STRATA PLOT	SAMPLE NUMBER	TYPE	RECOVERY (cm)	" N " VALUES	GROUND WATER CONDITIONS	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH kPa 20 40 60 80 100	WATER CONTENT (%) 5 15 25 35	MONITORING WELL	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	8 9	reddish brown, occ. greyish brown **Silty Clay/Clayey Silt** occ. shale fragments damp, hard	▨	11	SS	30	38			10		
				12	SS	46	32			14		
375.0	10 11	reddish brown, occ. greyish brown **Highly Weathered Shale**	▨	13	SS	8	50/10cm			5		Hard Augering
	12	**Weathered Shale**	▨	14	SS	10	50/13cm	May 29, 2018		9		
372.6	13 14	**End of Borehole** Cave-in Depth on Completion: N/A Groundwater Depth on Completion: 12.2m Measured Groundwater in Installed Monitoring Well on: June 6, 2018: 11.1m June 13, 2018: 11.1m										



RECORD OF BOREHOLE 4

Project No.: T18733
CLIENT: Mansfield Ski Club
ORIGINATED BY: M.Z.
DATE: May 25, 2018
LOCATION: Mulmur, Ontario
COMPILED BY: M.Z.
DATUM: Approximate Geodetic
BOREHOLE TYPE: Hollow Stem Augers
CHECKED BY: H.S.

SHAD & ASSOCIATES INC.
83 Citation Dr, Unit 9,
Vaughan, Ontario, L4K 2Z6

ELEVATION (metres)	DEPTH SCALE (metres)	DESCRIPTION	SAMPLE NUMBER	TYPE	RECOVERY (cm)	" N " VALUES	GROUND WATER CONDITIONS	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa	WATER CONTENT (%)	MONITORING WELL	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
374.0		Ground Surface									
	0	**Topsoil**							36		Additionally drilled Boreholes 4A and 4B about 2m west and east of Borehole 4 to confirm the shale deposit.
373.7		some topsoil	1	SS	41	6			23		
		reddish brown **Silty Clay/Clayey Silt Fill** occ. organic stains, trace rootlets, damp									
	1		2	SS	30	11			18		**BH 4A:** Approx. Depth: 4.6m Highly Weathered Shale @~ 3.0m with a SPT value of 50 blow/2cm and moisture content of 6%.
372.2		reddish brown **Silty Clay/Clayey Silt** occ. silt seams damp, stiff	3	SS	28	14			20		
	2	occ. shale fragments, hard	4	SS	30	41			13		**BH 4B:** Approx. Depth: 4.6m Highly Weathered Shale @~ 3.0m with a SPT value of 50 blow/10cm and moisture content of 6%.
371.1	3	reddish brown **Highly Weathered Shale** occ. limestone fragments	5	SS	18	50/10cm			7		Gradation Analysis & Atterberg Limits, S(4): 0 4 52 44 LL: 36% PL: 21% PI: 15%
	4		6	SS	15	50/8cm			7		
		Weathered Shale	7	SS	15	50/3cm			6		
	5										
	6		8	SS	8	50/10cm			7		
	7										

RECORD OF BOREHOLE 4

Project No.: T18733
CLIENT: Mansfield Ski Club
ORIGINATED BY: M.Z.

DATE: May 25, 2018
LOCATION: Mulmur, Ontario
COMPILED BY: M.Z.

DATUM: Approximate Geodetic
BOREHOLE TYPE: Hollow Stem Augers
CHECKED BY: H.S.

SHAD & ASSOCIATES INC.
83 Citation Dr, Unit 9,
Vaughan, Ontario, L4K 2Z6

SOIL PROFILE				SAMPLES								
ELEVATION (metres)	DEPTH SCALE (metres)	DESCRIPTION	STRATA PLOT	SAMPLE NUMBER	TYPE	RECOVERY (cm)	" N " VALUES	GROUND WATER CONDITIONS	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH kPa ▲ 20 40 60 80 100 ▲	WATER CONTENT (%) 5 15 25 35	MONITORING WELL	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
		reddish brown **Weathered Shale**		9	SS	10	50/13cm			8		
	8											
	9			10	SS	10	50/10cm			6		
364.7		**End of Borehole** Cave-in Depth on Completion: None Groundwater Depth on Completion: Dry										
	10											
	11											
	12											
	13											
	14											

RECORD OF BOREHOLE 5

Project No.: T18733
CLIENT: Mansfield Ski Club
ORIGINATED BY: M.Z.
DATE: May 30, 2018
LOCATION: Mulmur, Ontario
COMPILED BY: M.Z.
DATUM: Approximate Geodetic
BOREHOLE TYPE: Solid Stem Augers
CHECKED BY: H.S.

SHAD & ASSOCIATES INC.
83 Citation Dr, Unit 9,
Vaughan, Ontario, L4K 2Z6

SOIL PROFILE				SAMPLES								
ELEVATION (metres)	DEPTH SCALE (metres)	DESCRIPTION	STRATA PLOT	SAMPLE NUMBER	TYPE	RECOVERY (cm)	" N " VALUES	GROUND WATER CONDITIONS	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH kPa 20 40 60 80 100	WATER CONTENT (%) 5 15 25 35	MONITORING WELL	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
307.0		Ground Surface										
	0	dark brown **Silty Sand/Sandy Silt Fill** some topsoil, trace clay, moist		1	SS	30	3			15 12		
306.3		occ. organic stains										
	1	**Silty Sand Till** occ. oxidized fissures moist, compact		2	SS	41	16			11		Gradation Analysis, S(2): 13 59 28 0
		damp		3	SS	41	30			8		
	2	very dense		4	SS	30	81			7		
	3			5	SS	30	87	May 30, 2018 ▼		8		Gradation Analysis, S(5): 5 59 35 1
	4	moist		6	SS	28	50/13cm			10		
302.1	5	**End of Borehole** Cave-in Depth on Completion: 4.1m Groundwater Depth on Completion: 3.2m										
	6											
	7											

RECORD OF BOREHOLE 6

Project No.: T18733
CLIENT: Mansfield Ski Club
ORIGINATED BY: M.Z.
DATE: May 30, 2018
LOCATION: Mulmur, Ontario
COMPILED BY: M.Z.
DATUM: Approximate Geodetic
BOREHOLE TYPE: Solid Stem Augers
CHECKED BY: H.S.

SHAD & ASSOCIATES INC.
83 Citation Dr, Unit 9,
Vaughan, Ontario, L4K 2Z6

SOIL PROFILE				SAMPLES								
ELEVATION (metres)	DEPTH SCALE (metres)	DESCRIPTION	STRATA PLOT	SAMPLE NUMBER	TYPE	RECOVERY (cm)	" N " VALUES	GROUND WATER CONDITIONS	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH kPa 20 40 60 80 100	WATER CONTENT (%) 5 15 25 35	MONITORING WELL	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
302.0		Ground Surface										
	0	**Granular Fill**		1	SS	48	14			3 14		
		some clayey silt fill occ. organic stains								8		
300.9	1	**Topsoil**		2	SS	41	17			19		
300.3		brown, occ. dark brown **Sandy Silt Fill** some clay, some organic stains moist to wet		3	SS	35	2			27 26		
299.8	2	brown **Silty Sand Till** damp, dense		4	SS	35	47			8		
	3	damp, very dense		5	SS	20	50/13cm			7		
	4							May 30, 2018				
				6	SS	35	93			8		
297.0	5	**End of Borehole** Cave-in Depth on Completion: 4.3m Groundwater Depth on Completion: 4.3m										
	6											
	7											

RECORD OF BOREHOLE 7

Project No.: T18733
CLIENT: Mansfield Ski Club
ORIGINATED BY: M.Z.
DATE: May 30, 2018
LOCATION: Mulmur, Ontario
COMPILED BY: M.Z.
DATUM: Approximate Geodetic
BOREHOLE TYPE: Hollow Stem Augers
CHECKED BY: H.S.

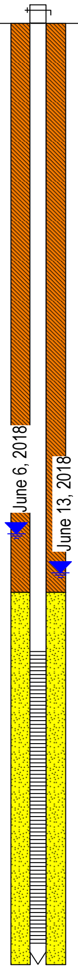
SHAD & ASSOCIATES INC.
83 Citation Dr, Unit 9,
Vaughan, Ontario, L4K 2Z6

SOIL PROFILE | SAMPLES | GROUND WATER CONDITIONS | DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 | SHEAR STRENGTH kPa 20 40 60 80 100 | WATER CONTENT (%) 5 15 25 35 | MONITORING WELL | REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

ELEVATION (metres)	DEPTH SCALE (metres)	DESCRIPTION	SAMPLE NUMBER	TYPE	RECOVERY (cm)	" N " VALUES	GROUND WATER CONDITIONS	WATER CONTENT (%)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
286.0		Ground Surface							
	0	dark brown, some topsoil							
		mottled brown **Clayey Silt Fill** some organic stains, some topsoil some rootlets, damp	1	SS	43	4		17	
285.3	1	brown **Sandy Silt Till** trace clay, occ. oxidized fissures occ. sand seams damp, compact	2	SS	30	18		12	Gradation Analysis, S(2): 2 24 69 5
		dense	3	SS	28	44		13	
		some sand interbeddings/zones							
283.9	2	greyish brown **Silty Sand Till** damp, very dense	4	SS	30	56		7	
	3		5	SS	35	78		7	
	4	damp to moist					May 30, 2018		
			6	SS	30	80		8	
281.0	5	**End of Borehole**							
	6								
	7								

Cave-in Depth on Completion: N/A
Groundwater Depth on Completion:4.5m

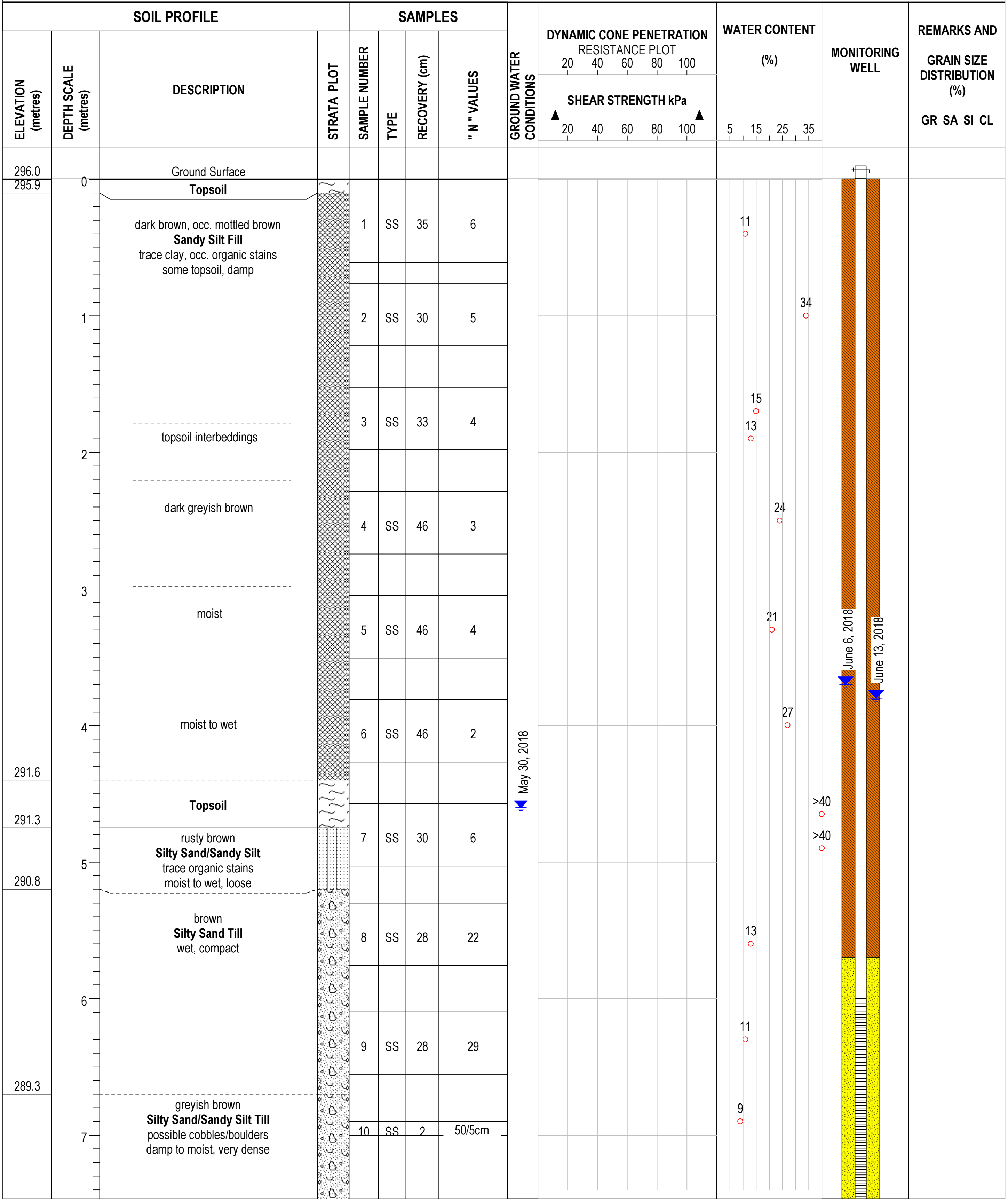
Measured Groundwater in Installed Monitoring Well on:
June 6, 2018: 2.6m
June 13, 2018: 2.8m



RECORD OF BOREHOLE 8

Project No.:	T18733	**CLIENT:**	Mansfield Ski Club	**ORIGINATED BY:**	M.Z.
DATE:	May 30, 2018	**LOCATION:**	Mulmur, Ontario	**COMPILED BY:**	M.Z.
DATUM:	Approximate Geodetic	**BOREHOLE TYPE:**	Hollow Stem Augers	**CHECKED BY:**	H.S.

SHAD & ASSOCIATES INC.
83 Citation Dr, Unit 9,
Vaughan, Ontario, L4K 2Z6



ELEVATION (metres)	DEPTH SCALE (metres)	DESCRIPTION
296.0		Ground Surface
295.9	0	**Topsoil**
		dark brown, occ. mottled brown **Sandy Silt Fill** trace clay, occ. organic stains some topsoil, damp
		topsoil interbeddings
		dark greyish brown
		moist
		moist to wet
291.6		**Topsoil**
291.3		rusty brown **Silty Sand/Sandy Silt** trace organic stains moist to wet, loose
290.8		brown **Silty Sand Till** wet, compact
289.3		greyish brown **Silty Sand/Sandy Silt Till** possible cobbles/boulders damp to moist, very dense

SAMPLE NUMBER	TYPE	RECOVERY (cm)	" N " VALUES	WATER CONTENT (%)
1	SS	35	6	11
2	SS	30	5	34
3	SS	33	4	15 13
4	SS	46	3	24
5	SS	46	4	21
6	SS	46	2	27
7	SS	30	6	>40 >40
8	SS	28	22	13
9	SS	28	29	11
10	SS	2	50/5cm	9

RECORD OF BOREHOLE 8

Project No.: T18733
CLIENT: Mansfield Ski Club
ORIGINATED BY: M.Z.
DATE: May 30, 2018
LOCATION: Mulmur, Ontario
COMPILED BY: M.Z.
DATUM: Approximate Geodetic
BOREHOLE TYPE: Hollow Stem Augers
CHECKED BY: H.S.

SHAD & ASSOCIATES INC.
83 Citation Dr, Unit 9,
Vaughan, Ontario, L4K 2Z6

SOIL PROFILE				SAMPLES								
ELEVATION (metres)	DEPTH SCALE (metres)	DESCRIPTION	STRATA PLOT	SAMPLE NUMBER	TYPE	RECOVERY (cm)	" N " VALUES	GROUND WATER CONDITIONS	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH kPa ▲ 20 40 60 80 100 ▲	WATER CONTENT (%) 5 15 25 35	MONITORING WELL	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
288.1		greyish brown **Silty Sand/Sandy Silt Till** occ. oxidized fissures damp to moist, very dense		11	SS	20	50/13cm			9		Gradation Analysis, S(11): 3 50 42 5
	8	**End of Borehole** Cave-in Depth on Completion: N/A Groundwater Depth on Completion:4.6m Measured Groundwater Level in Installed Monitoring Well on: June 6, 2018: 3.7m June 13, 2018: 3.8m										
	9											
	10											
	11											
	12											
	13											
	14											

SHAD & ASSOCIATES INC.

EXPLANATION OF BOREHOLE LOG

This form describes some of the information provided on the borehole logs, which is based primarily on examination of the recovered samples, and the results of the field and laboratory tests. It should be noted that materials, boundaries and conditions have been established only at the borehole locations at the time of investigation and are not necessarily representative of subsurface conditions elsewhere across the site. Additional description of the soil/rock encountered is given in the accompanying geotechnical report.

GENERAL INFORMATION

Project details, borehole number, location coordinates and type of drilling equipment used are given at the top of the borehole log.

SOIL LITHOLOGY

Elevation and depth

This column gives the elevation and depth of inferred geologic layers. The elevation is referred to the datum shown in the Description column.

Lithology Plot

This column presents a graphic depiction of the soil and rock stratigraphy encountered within the borehole.

Description

This column gives a description of the soil stratums, based on visual and tactile examination of the samples augmented with field and laboratory test results. Each stratum is described according to the following classification and terminology (Ref. Unified Soil Classification System):

The compactness condition of cohesionless soils (SPT) and the consistency of cohesive soils (undrained shear strength) are defined as follows (Ref. Canadian Foundation Engineering Manual):

Compactness of Cohesionless Soils	**SPT N-Value**
Very loose	0 to 4
Loose	4 to 10
Compact	10 to 30
Dense	30 to 50
Very Dense	> 50

Consistency of Cohesive Soils	**SPT N-Value**	**Undrained Shear Strength**	
		kPa	**psf**
Very soft	0 to 2	0 to 12	0 to 250
Soft	2 to 4	12 to 25	250 to 500
Firm	4 to 8	25 to 50	500 to 1000
Stiff	8 to 15	50 to 100	1000 to 2000
Very stiff	15 to 30	100 to 200	2000 to 4000
Hard	> 30	Over 200	Over 4000

Soil Sampling

Sample types are abbreviated as follows:

SS	Split Spoon	TW	Thin Wall Open (Pushed)	RC	Rock Core
AS	Auger Sample	TP	Thin Wall Piston (Pushed)	WS	Washed Sample

Additional information provided in this section includes sample numbering, sample recovery and numerical testing results.

Field and Laboratory Testing

Results of field testing (e.g., SPT, pocket penetrometer, and vane testing) and laboratory testing (e.g., natural moisture content, and limits) executed on the recovered samples are plotted in this section.

Instrumentation Installation

Instrumentation installations (monitoring wells, piezometers, inclinometers, etc.) are plotted in this section. Water levels, if measured during fieldwork, are also plotted. These water levels may or may not be representative of the static groundwater level depending on the nature of soil stratum where the piezometer tips are located, the time elapsed from installation to reading and other applicable factors.

Comments

This column is used to describe non-standard situations or notes of interest.

MODIFIED * UNIFIED CLASSIFICATION SYSTEM FOR SOILS
*The soil of each stratum is described using the Unified Soil Classification System (Technical Memorandum 36-357 prepared by Waterways Experiment Station, Vicksburg, Mississippi, Corps of Engineers, U.S Army. Vol. 1 March 1953.) modified slightly so that an inorganic clay of "medium plasticity" is recognized.

MAJOR DIVISION			GROUP SYMBOL	TYPICAL DESCRIPTION	LABORATORY CLASSIFICATION CRITERIA
COARSE GRAINED SOILS (MORE THAN HALF BY WEIGHT LARGER THAN 75µm)	GRAVELS MORE THAN HALF THE COARSE FRACTION LARGER THAN 4.75mm	CLEAN GRAVELS (TRACE OR NO FINES)	GW	WELL GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES	$C_u = \frac{D_{60}}{D_{10}} > 4;\ C_C = \frac{(D_{30})^2}{D_{10}\ x\ D_{60}} = 1 \text{ to } 3$
			GP	POORLY GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES	NOT MEETING ABOVE REQUIREMENTS
		DIRTYGRAVELS (WITH SOME OR MORE FINES)	GM	SILTY GRAVELS, GRAVEL-SAND- SILT MIXTURES	ATTERBERG LIMITS BELOW "A" LINE OR P.I. MORE THAN 4
			GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES	ATTERBERG LIMITS BELOW "A" LINE OR P.I. MORE THAN 7
	SANDS MORE THAN HALF THE COARSE FRACTION SMALLER THAN 4.75mm	CLEAN SANDS (TRACE OR NO FINES)	SW	WELL GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES	$C_u = \frac{D_{60}}{D_{10}} > 6;\ C_C = \frac{(D_{30})^2}{D_{10}\ x\ D_{60}} = 1 \text{ to } 3$
			SP	POORLY GRADED GRAVELS, GRAVEL- SAND MIXTURES, LITTLE OR NO FINES	NOT MEETING ABOVE REQUIREMENTS
		DIRTY SANDS (WITH SOME OR MORE FINES)	SM	SILTY SANDS, SAND-SILT MIXTURES	ATTERBERG LIMITS BELOW "A" LINE OR P.I MORE THAN 4
			SC	CLAYEY SANDS, SAND-CLAY MIXTURES	ATTERBERG LIMITS BELOW "A" LINE OR P.I MORE THAN 7
FINE-GRAINED SOILS (MORE THAN HALF BY WEIGHT SMALLER THAN 75µm)	SILTS BELOW "A" LINE NEGLIGIBLE ORGANIC CONTENT	$W_L < 50\%$	ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY SANDS OF SLIGHT PLASTICITY	CLASSIFICATION IS BASED UPON PLASTICITY CHART (SEE BELOW)
		$W_L < 50\%$	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS, FINE SANDY OR SILTY SOILS	
	CLAY ABOVE "A" LINE NEGLIGIBLE ORGANIC CONTENT	$W_L < 30\%$	CL	INORGANIC CLAYS OF LOW PLASTICITY, GRAVELLY, SANDY OR SILTY CLAYS, LEAN CLAYS	
		$30\% < W_L < 50\%$	CI	INORGANIC CLAYS OF MEDIUM PLASTICITY, SILTY CLAYS	
		$W_L < 50\%$	CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS	
	ORGANIC SILTS & CLAYS BELOW "A" LINE	$W_L < 50\%$	OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY	WHENEVER THE NATURE OF THE FINES CONTENT HAS NOT BEEN DETERMINED, IT IS DESIGNATED BY THE LETTER "F", E.G SF IS A MIXTURE OF SAND WITH SILT OR CLAY
		$W_L < 50\%$	OH	ORGANIC CLAYS OF HIGH PLASTICITY	
HIGH ORGANIC SOILS			Pt	PEAT AND OTHER HIGHLY ORGANIC SOILS	STRONG COLOUR OR ODOUR, AND OFTEN FIBROUS TEXTURE

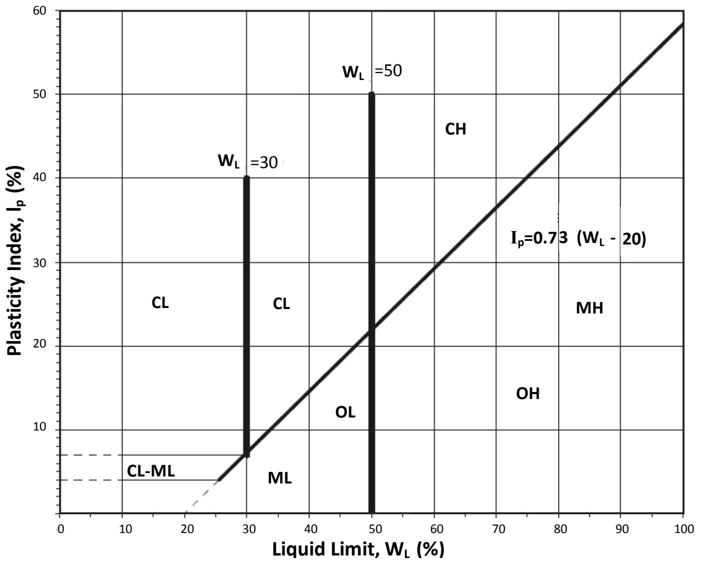
SOIL COMPONENTS

FRACTION	U.S STANDARD SIEVE SIZE		DEFINING RANGES OF PERCENTAGE BY WEIGHT OF MINOR COMPONENTS		
		PASSING	RETAINED	PERCENT	DESCRIPTOR
GRAVEL	COARSE	76 mm	19 mm	35-50 20-35 10-20 1-10	AND Y/EY SOME TRACE
	FINE	19 mm	4.75 mm		
SAND	COARSE	4.75 mm	2.00 mm		
	MEDIUM	2.00 mm	425 µm		
	FINE	425 µm	75 µm		
FINES (SILT OR CLAY BASED ON PLASTICITY)		75 µm			

OVERSIZED MATERIAL

ROUNDED OR SUBROUNDED: COBBLES 76 mm TO 200 mm BOULDERS > 200 mm	NOT ROUNDED: ROCK FRAGMENTS > 76 mm ROCKS> 0.76 CUBIC METRE IN VOLUME

Plasticity Chart for Soil Passing 425 Micron Sieve

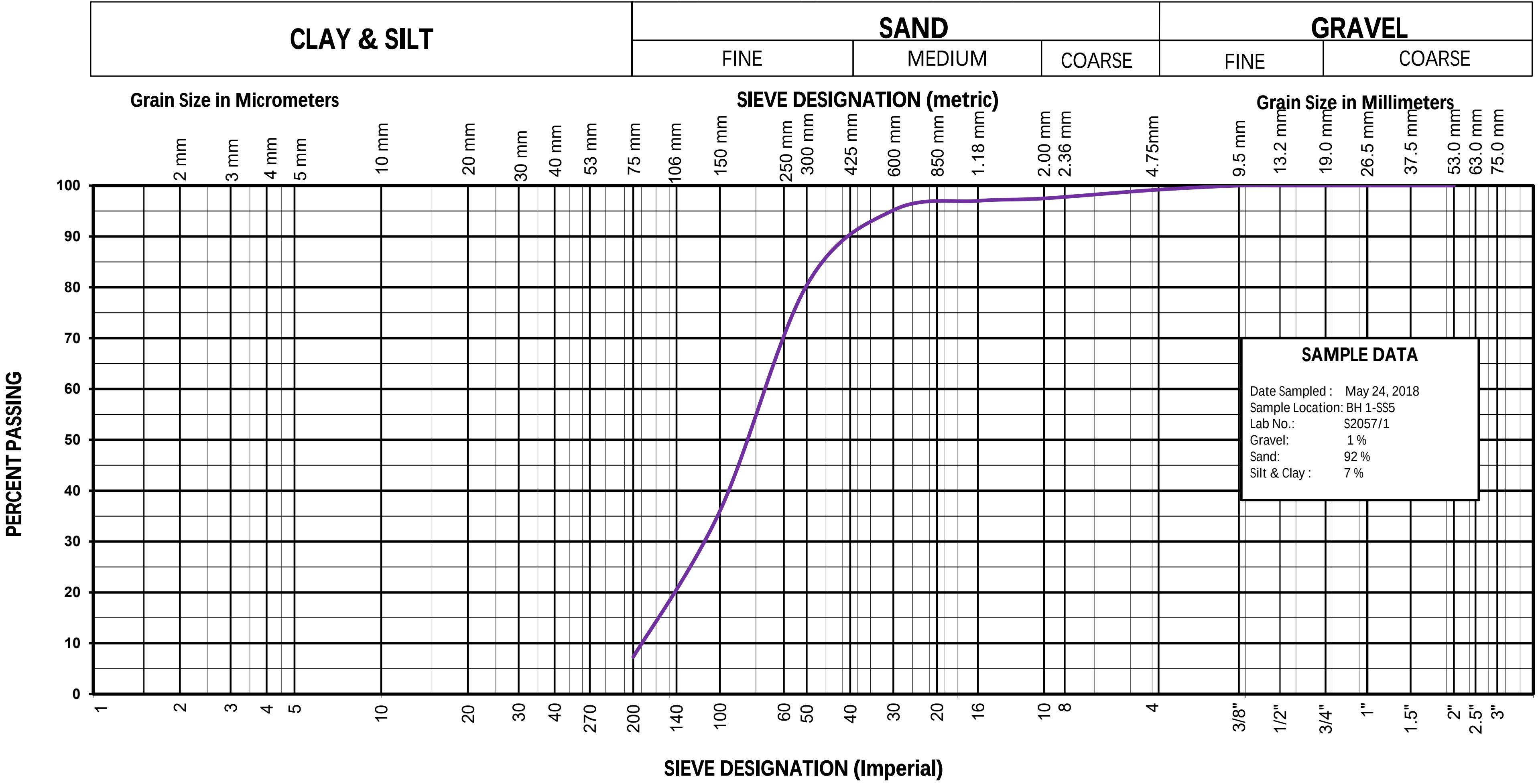


Note 1: Soils are classified and described according to their engineering properties and behavior.
Note 2: The modifying adjectives used to define the actual or estimated percentage range by weight of minor components are consistent with the Canadian Foundation Engineering Manual (3rd Edition, Canadian Geotechnical Society, 1992)

ENCLOSURES

Enclosure A: Laboratory Test Results

UNIFIED SOIL CLASSIFICATION SYSTEM



SAMPLE DATA

Date Sampled : May 24, 2018
Sample Location: BH 1-SS5
Lab No.: S2057/1
Gravel: 1 %
Sand: 92 %
Silt & Clay : 7 %

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SHAD & ASSOCIATES INC.

GRAIN SIZE ANALYSIS

Project :

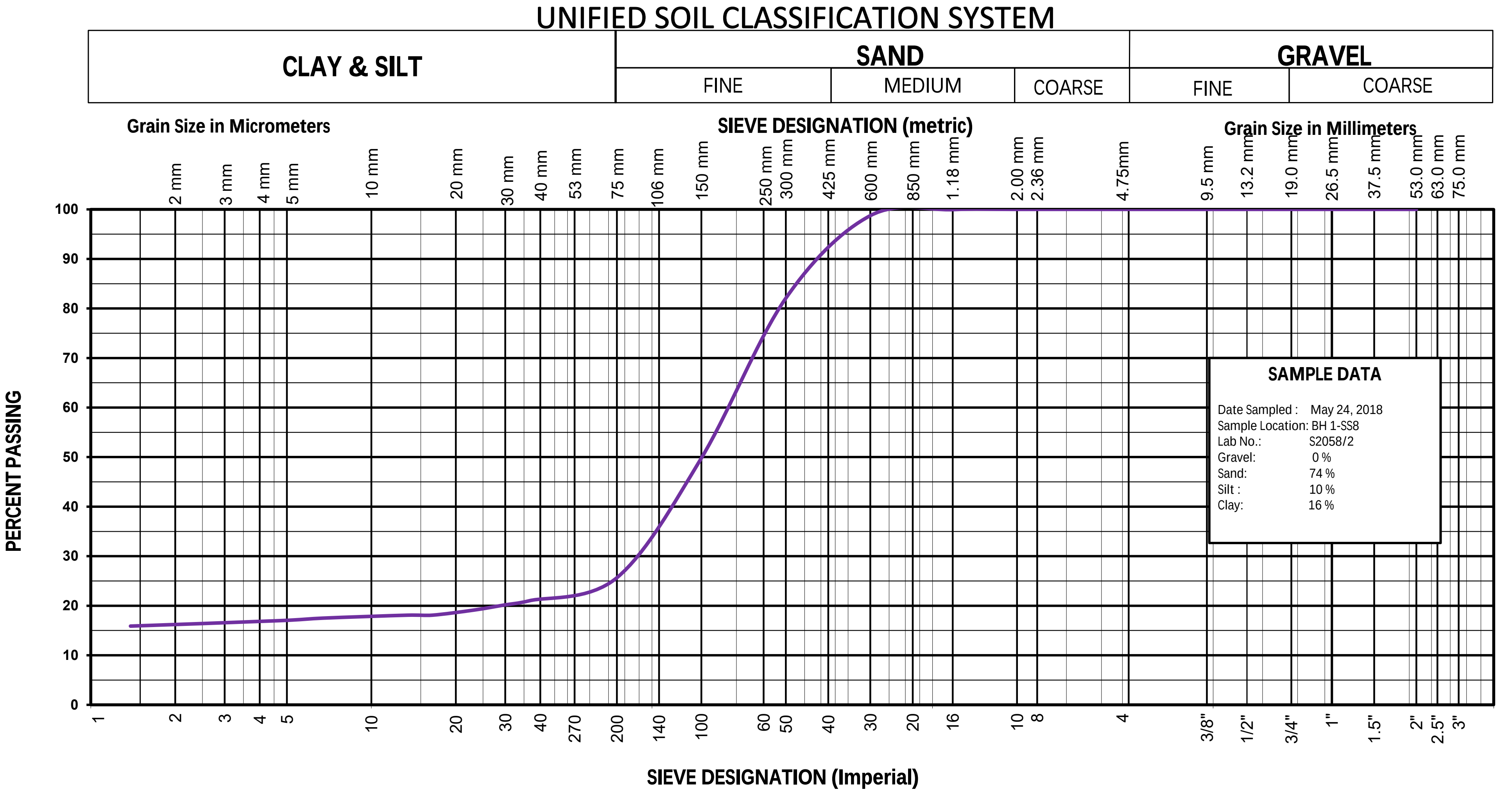
Preliminary Geotechnical Investigation

Project No.:

T18733

Client:

Mansfield Ski Club

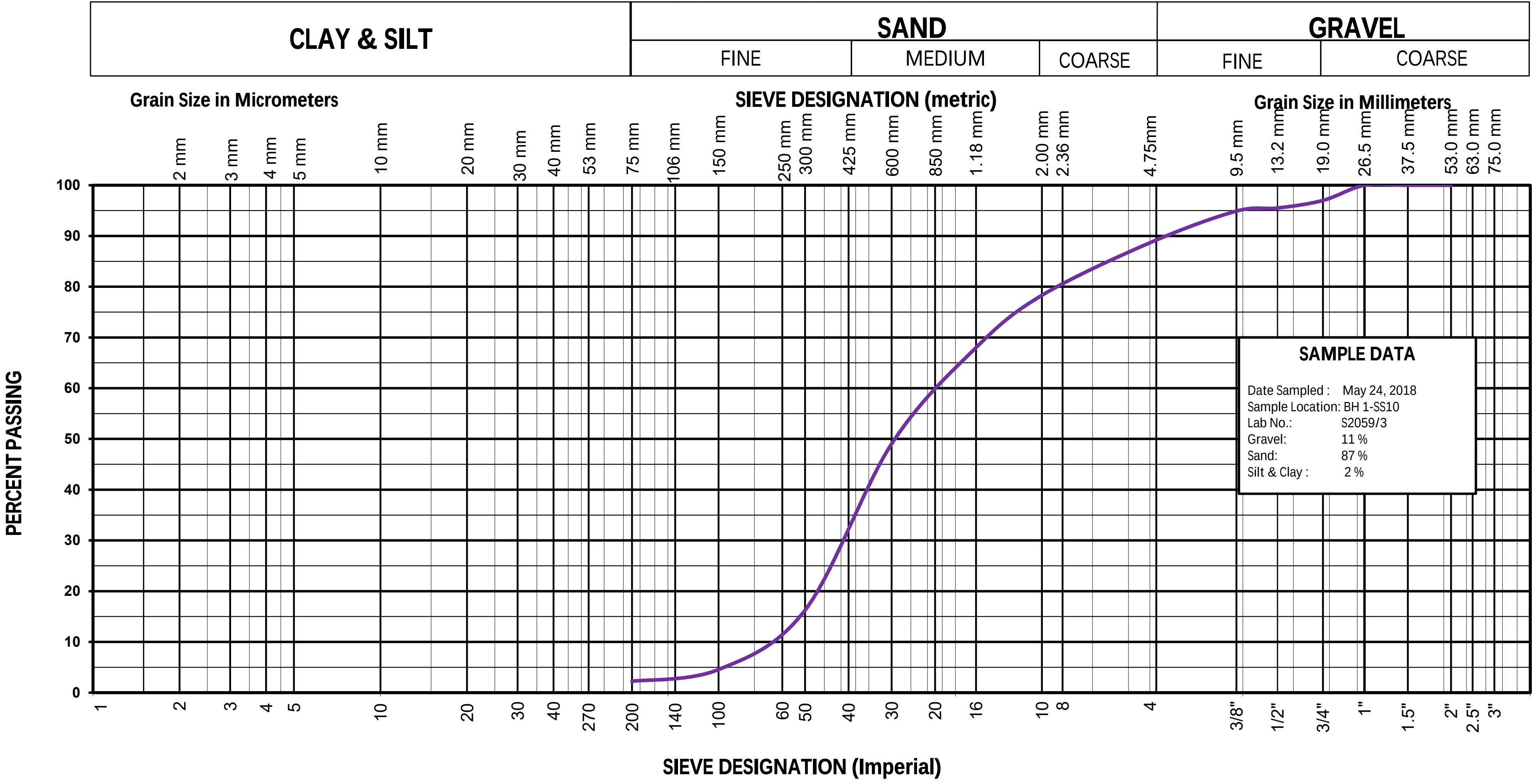


SAMPLE DATA

Date Sampled : May 24, 2018
Sample Location: BH 1-SS8
Lab No.: S2058/2
Gravel: 0 %
Sand: 74 %
Silt : 10 %
Clay: 16 %

SHAD & ASSOCIATES INC. 83 Citation Drive, Unit 9 Vaughan, Ontario L4K 2Z6 Tel: 905) 760-5566 Fax: (905) 760-5567 www.shadinc.ca SHAD & ASSOCIATES INC.	**GRAIN SIZE ANALYSIS**	**Project :** **Preliminary Geotechnical Investigation**	**Project No.:** **T18733**
		Client: **Mansfield Ski Club**	

UNIFIED SOIL CLASSIFICATION SYSTEM



SAMPLE DATA

Date Sampled : May 24, 2018
Sample Location: BH 1-SS10
Lab No.: S2059/3
Gravel: 11 %
Sand: 87 %
Silt & Clay : 2 %

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SHAD & ASSOCIATES INC.

GRAIN SIZE ANALYSIS

Project :

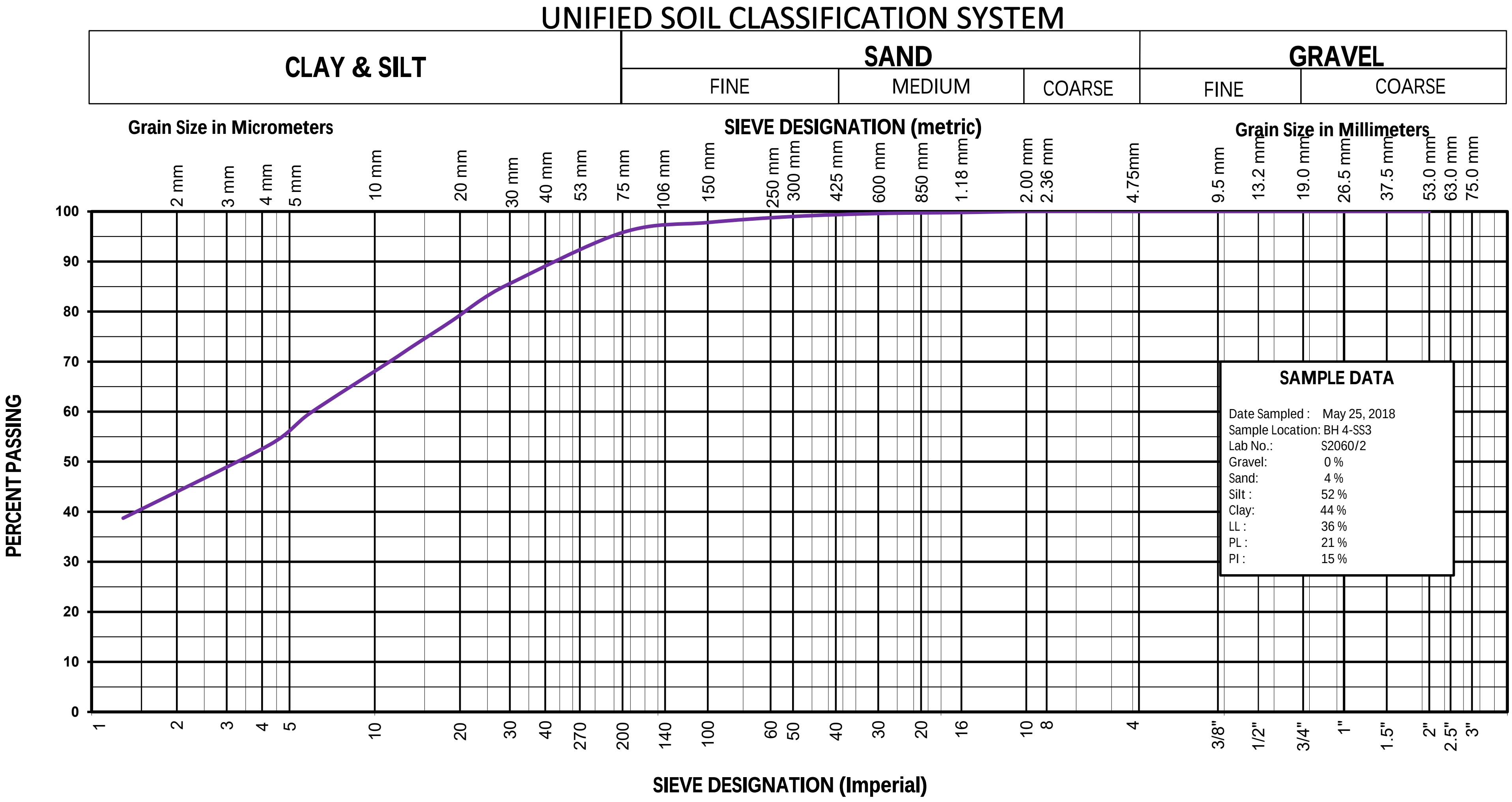
Preliminary Geotechnical Investigation

Project No.:

T18733

Client:

Mansfield Ski Club



SAMPLE DATA

Date Sampled :	May 25, 2018
Sample Location:	BH 4-SS3
Lab No.:	S2060/2
Gravel:	0 %
Sand:	4 %
Silt :	52 %
Clay:	44 %
LL :	36 %
PL :	21 %
PI :	15 %

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SHAD & ASSOCIATES INC.

GRAIN SIZE ANALYSIS

Project :

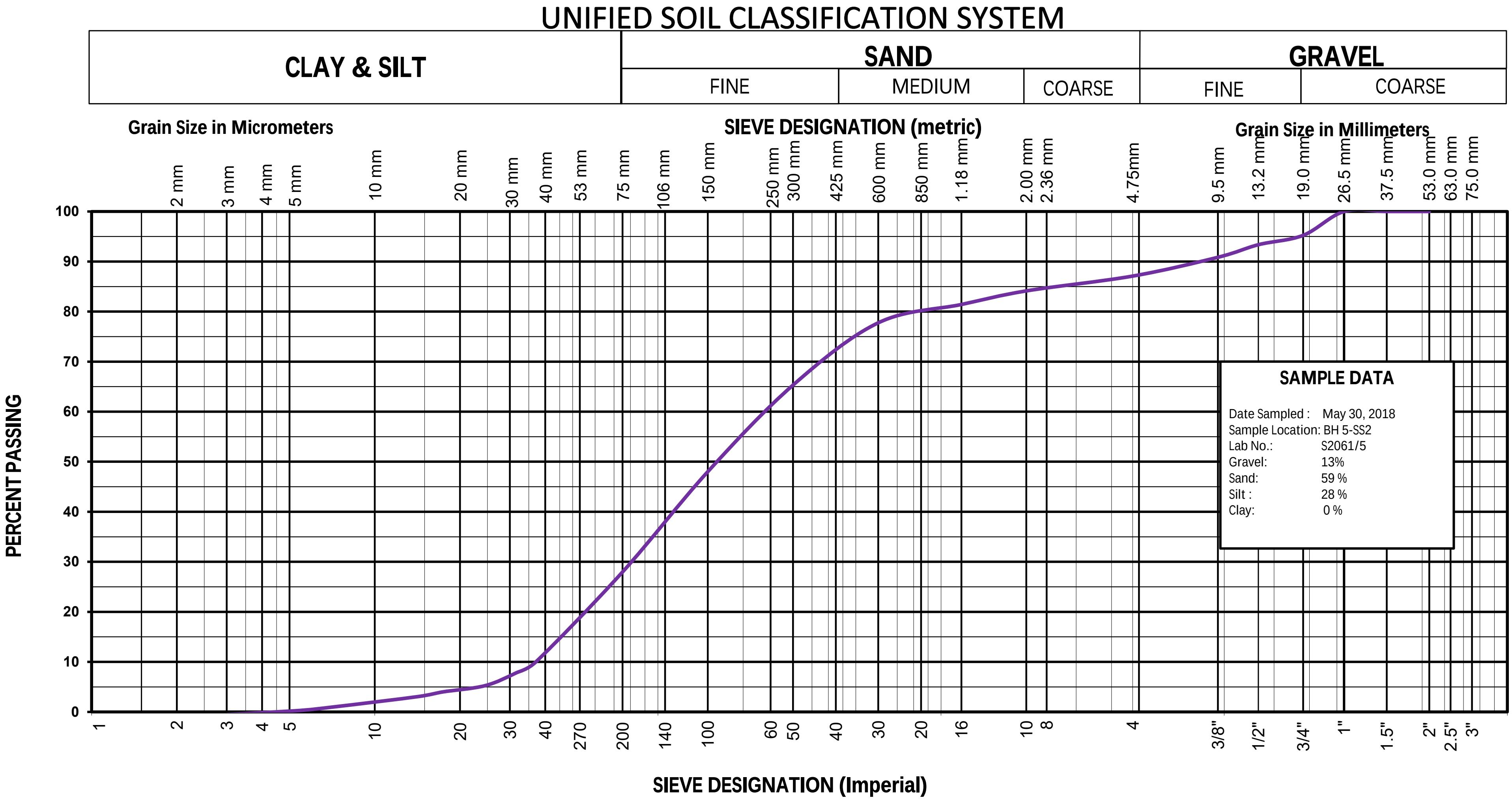
Preliminary Geotechnical Investigation

Project No.:

T18733

Client:

Mansfield Ski Club



SAMPLE DATA

Date Sampled :	May 30, 2018
Sample Location:	BH 5-SS2
Lab No.:	S2061/5
Gravel:	13%
Sand:	59 %
Silt :	28 %
Clay:	0 %

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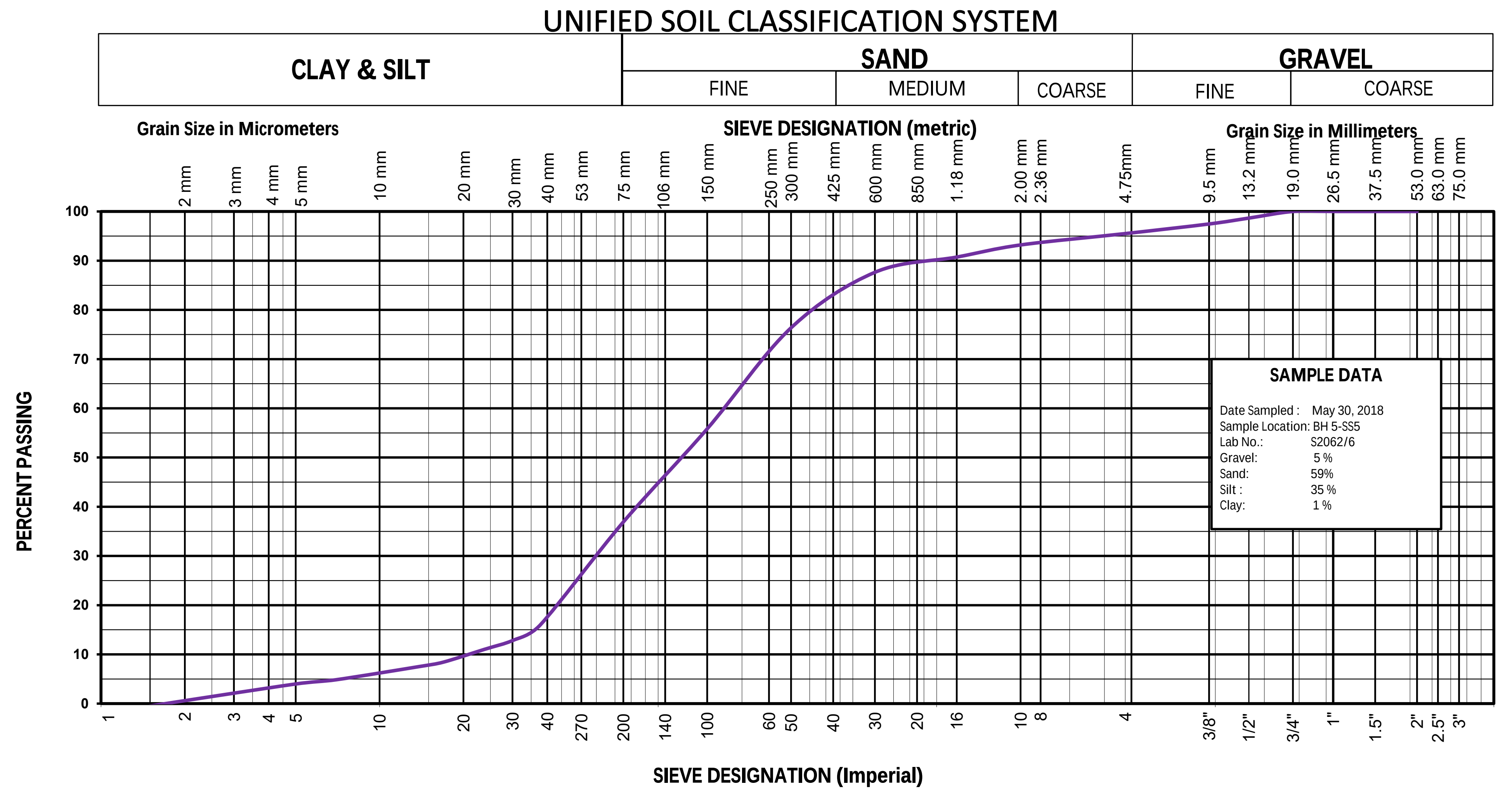
GRAIN SIZE ANALYSIS

Project : **Preliminary Geotechnical Investigation**

Project No.: **T18733**

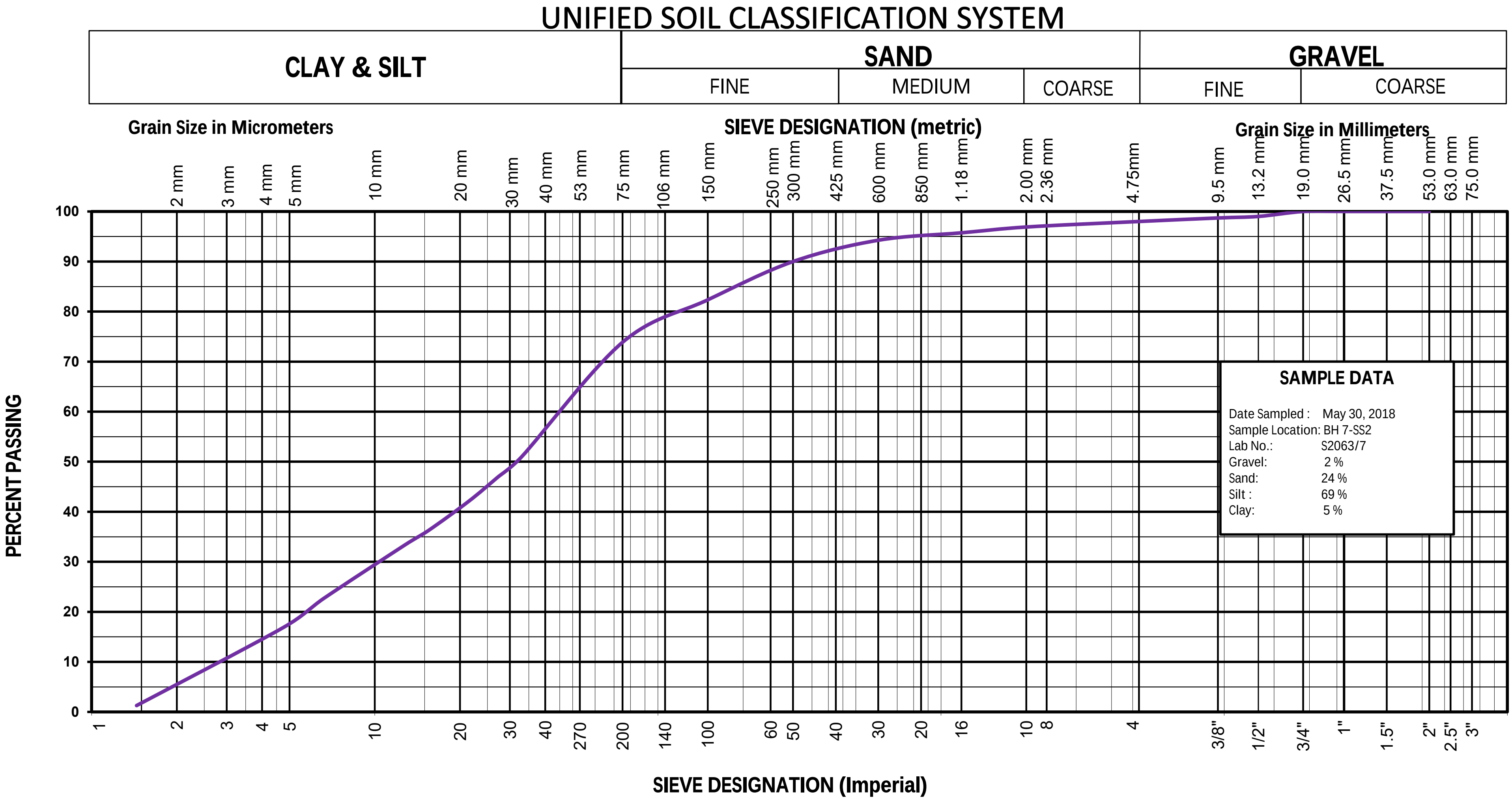
Client: **Mansfield Ski Club**



SAMPLE DATA

Date Sampled : May 30, 2018
Sample Location: BH 5-SS5
Lab No.: S2062/6
Gravel: 5 %
Sand: 59%
Silt : 35 %
Clay: 1 %

SHAD & ASSOCIATES INC. 83 Citation Drive, Unit 9 Vaughan, Ontario L4K 2Z6 Tel: 905) 760-5566 Fax: (905) 760-5567 www.shadinc.ca	**GRAIN SIZE ANALYSIS**	**Project :** **Preliminary Geotechnical Investigation**	**Project No.:** **T18733**
		Client: **Mansfield Ski Club**	



SAMPLE DATA

Date Sampled :	May 30, 2018
Sample Location:	BH 7-SS2
Lab No.:	S2063/7
Gravel:	2 %
Sand:	24 %
Silt :	69 %
Clay:	5 %

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GRAIN SIZE ANALYSIS

Project :

Preliminary Geotechnical Investigation

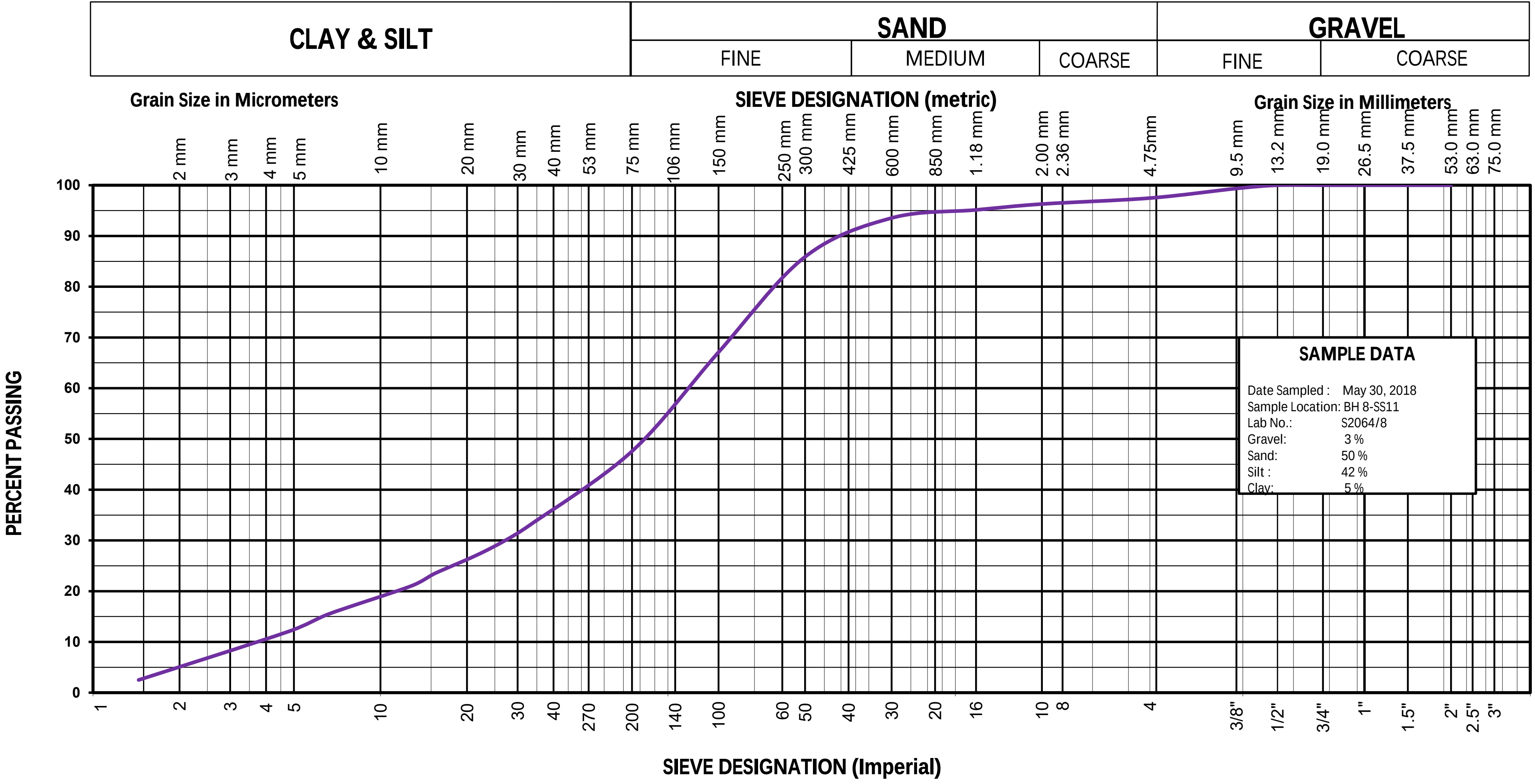
Project No.:

T18733

Client:

Mansfield Ski Club

UNIFIED SOIL CLASSIFICATION SYSTEM



SAMPLE DATA

Date Sampled : May 30, 2018
Sample Location: BH 8-SS11
Lab No.: S2064/8
Gravel: 3 %
Sand: 50 %
Silt : 42 %
Clay: 5 %

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SHAD & ASSOCIATES INC.

GRAIN SIZE ANALYSIS

Project : **Preliminary Geotechnical Investigation**

Project No.: **T18733**

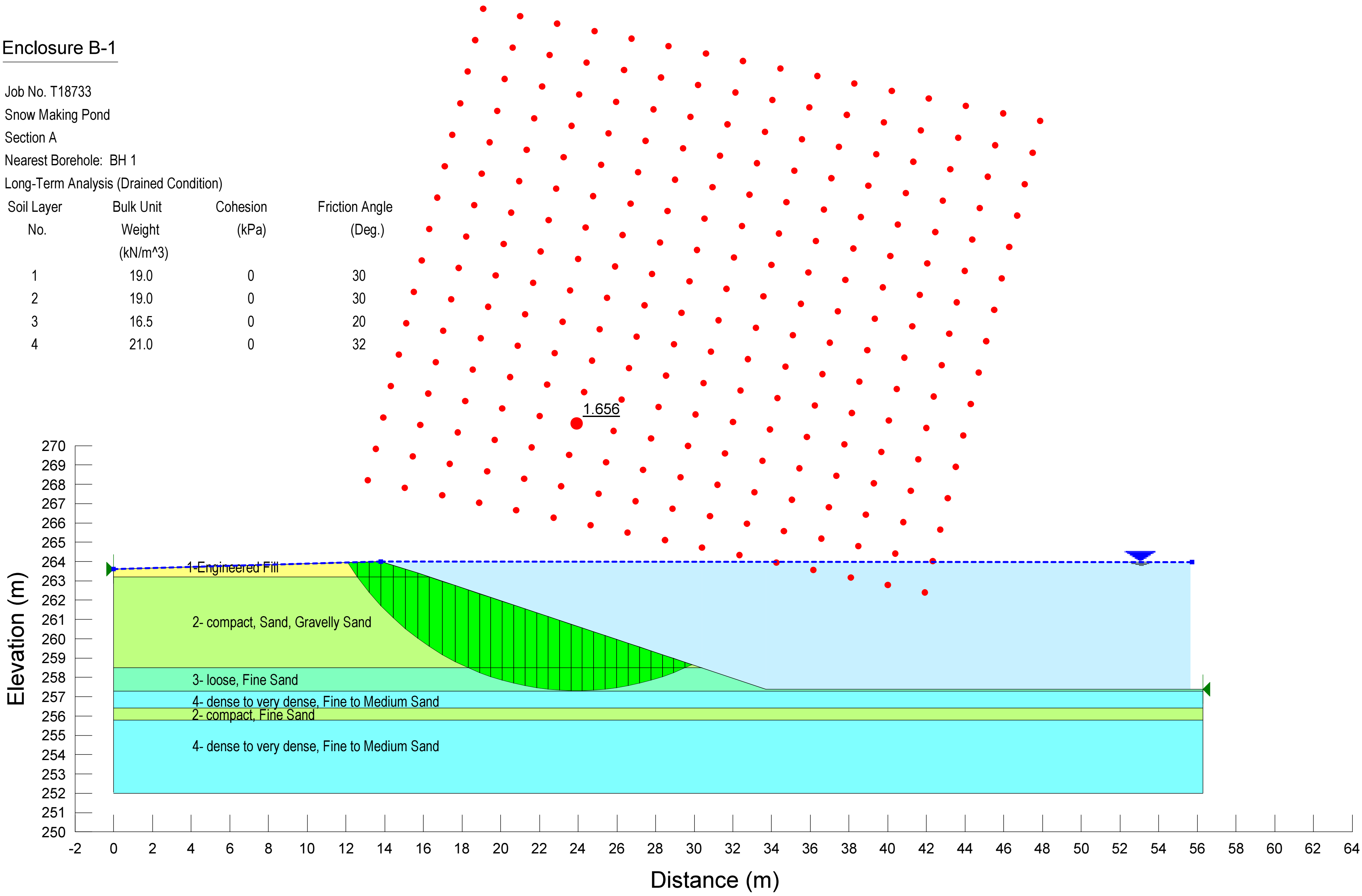
Client: **Mansfield Ski Club**

Enclosure B: Slope Stability Analysis Results

Enclosure B-1

Job No. T18733
Snow Making Pond
Section A
Nearest Borehole: BH 1
Long-Term Analysis (Drained Condition)

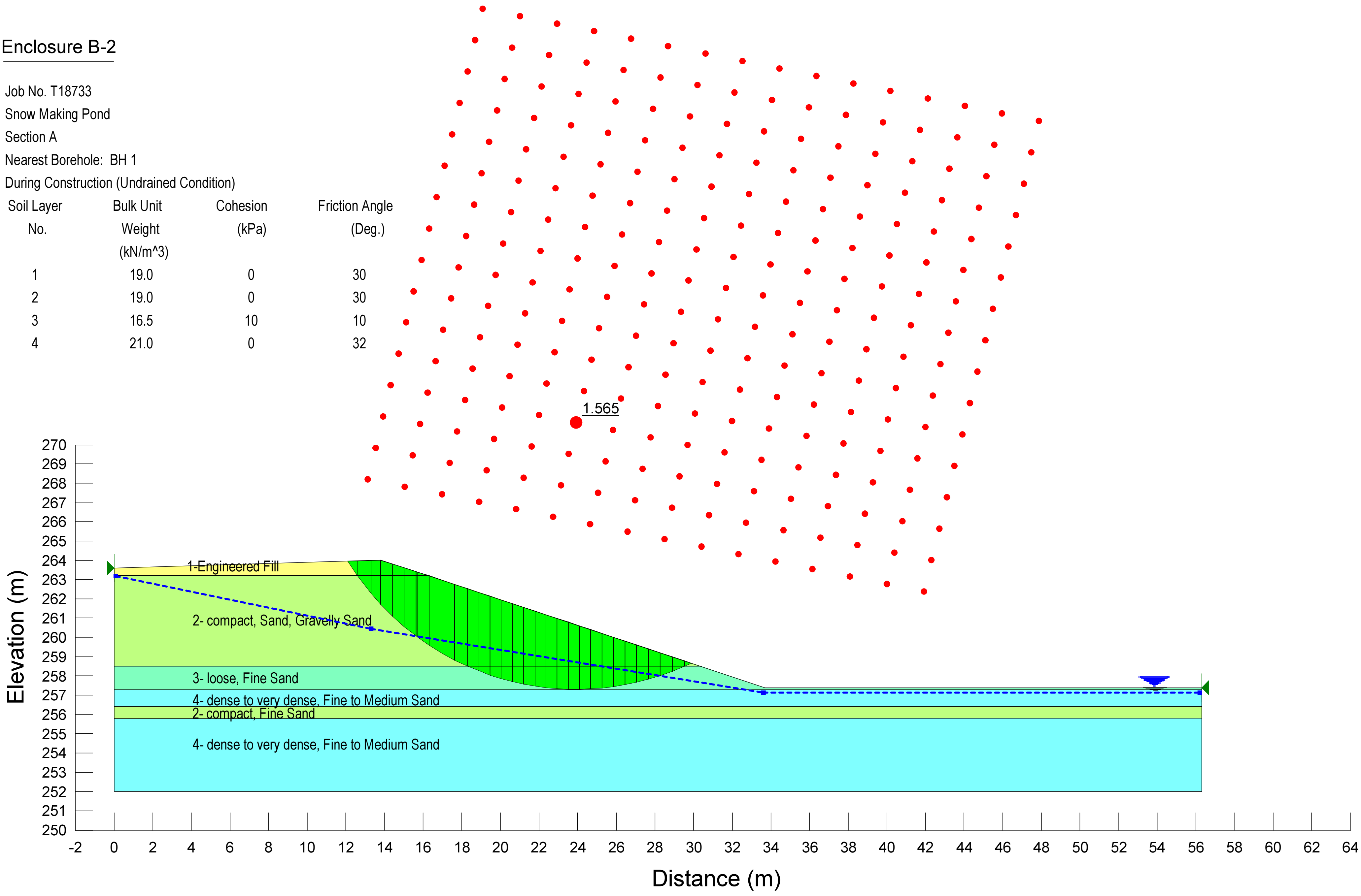
Soil Layer No.	Bulk Unit Weight (kN/m^3)	Cohesion (kPa)	Friction Angle (Deg.)
1	19.0	0	30
2	19.0	0	30
3	16.5	0	20
4	21.0	0	32



Enclosure B-2

Job No. T18733
Snow Making Pond
Section A
Nearest Borehole: BH 1
During Construction (Undrained Condition)

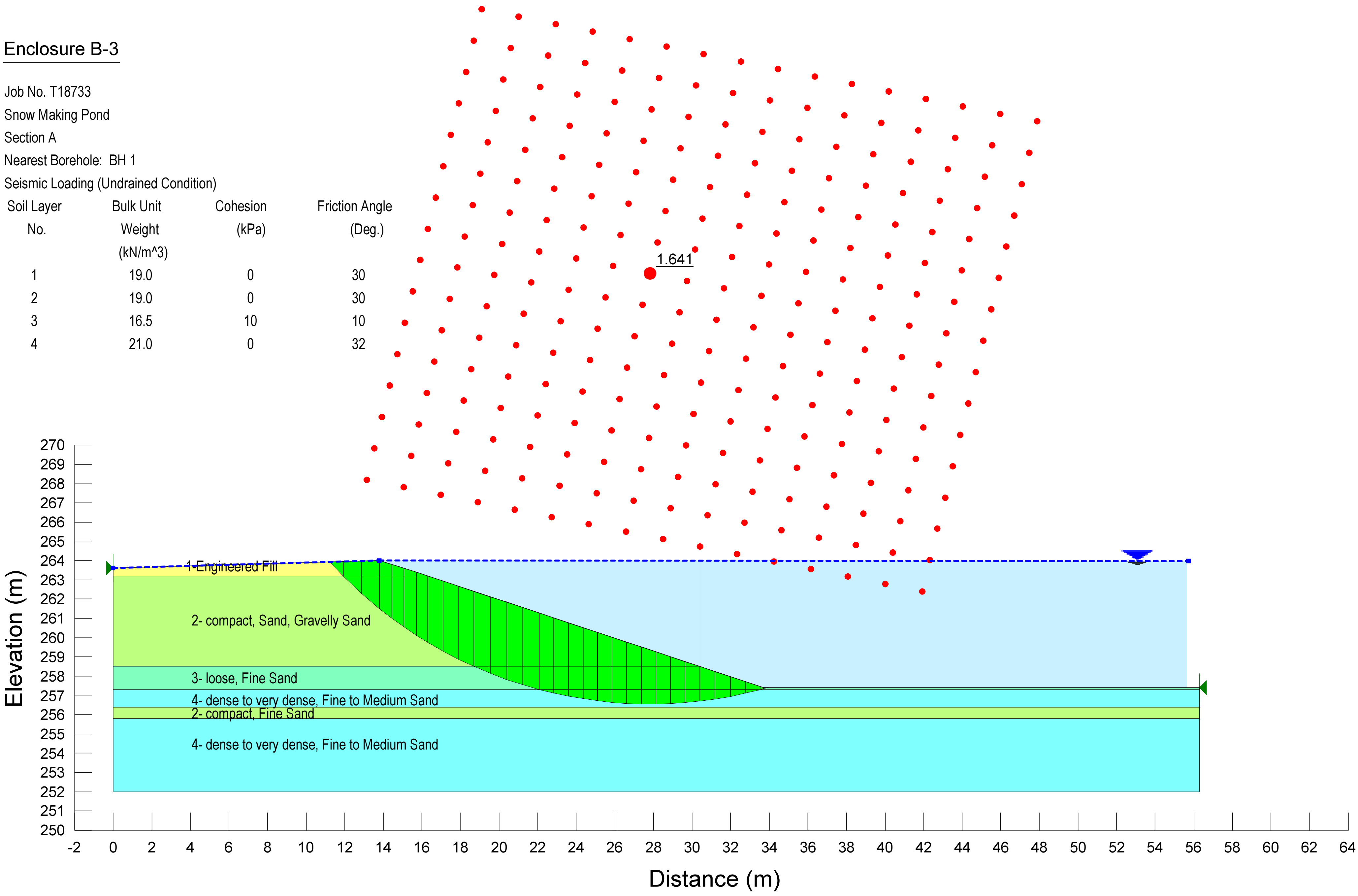
Soil Layer No.	Bulk Unit Weight (kN/m^3)	Cohesion (kPa)	Friction Angle (Deg.)
1	19.0	0	30
2	19.0	0	30
3	16.5	10	10
4	21.0	0	32

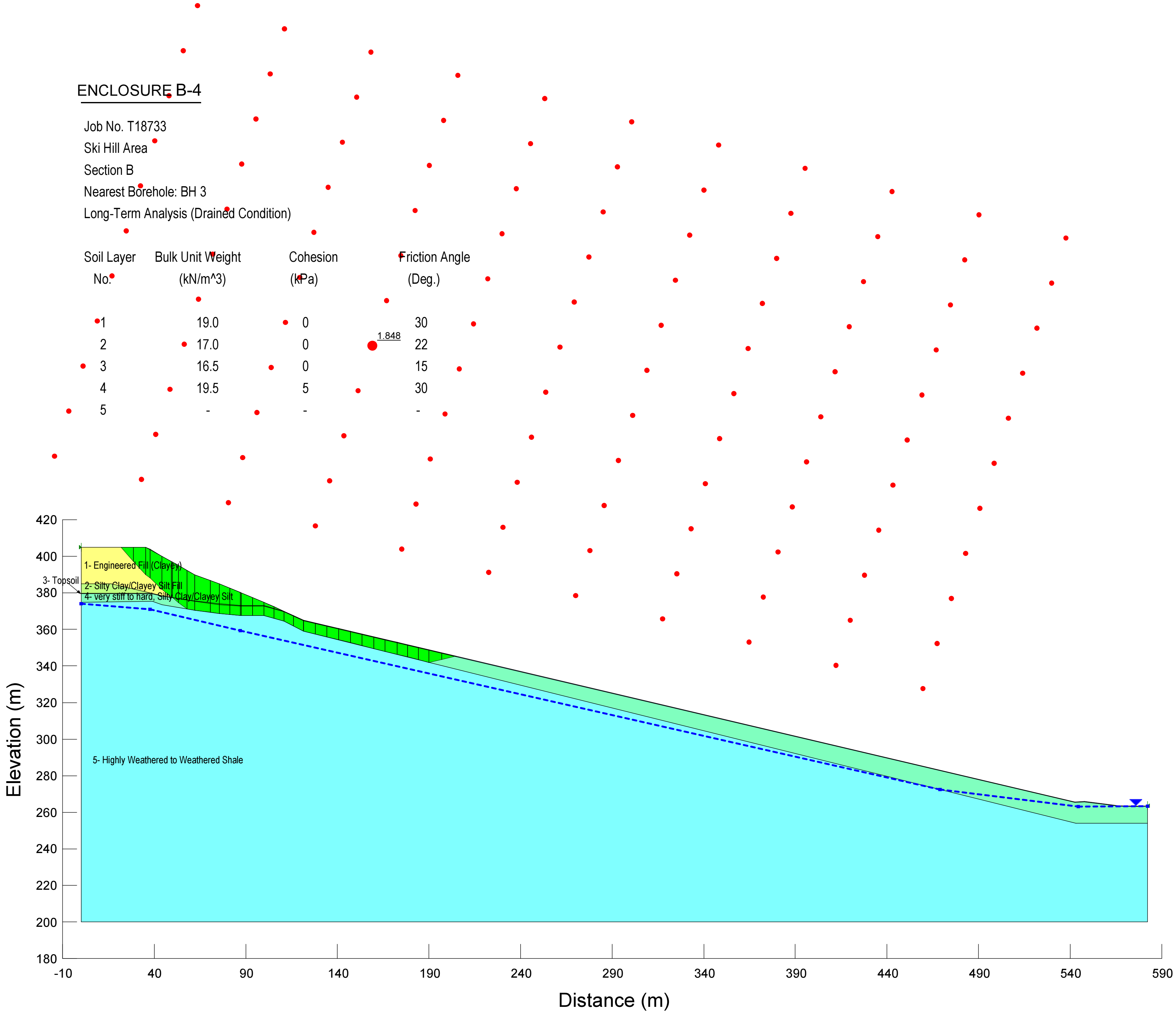


Enclosure B-3

Job No. T18733
Snow Making Pond
Section A
Nearest Borehole: BH 1
Seismic Loading (Undrained Condition)

Soil Layer No.	Bulk Unit Weight (kN/m^3)	Cohesion (kPa)	Friction Angle (Deg.)
1	19.0	0	30
2	19.0	0	30
3	16.5	10	10
4	21.0	0	32





ENCLOSURE B-4

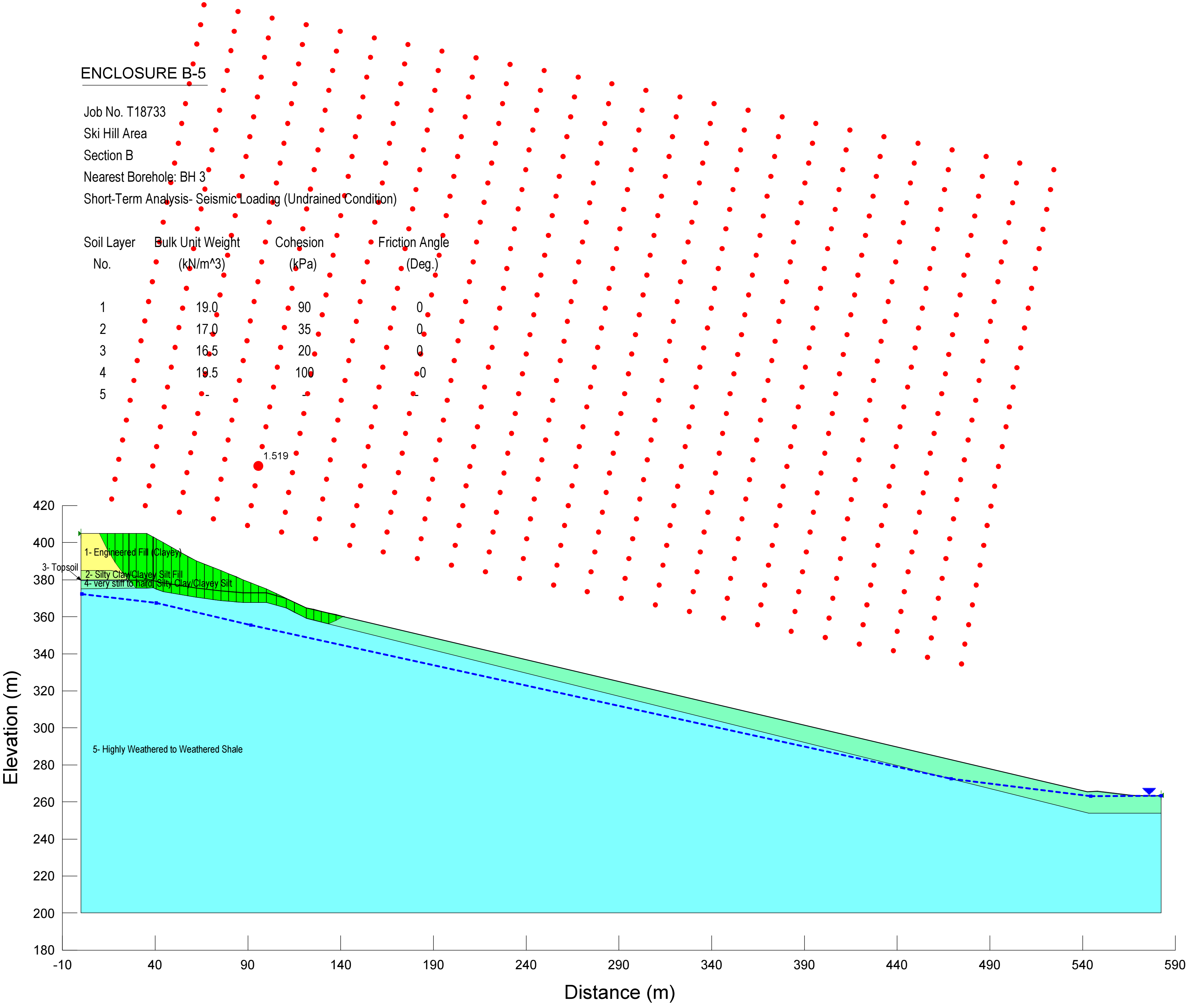
Job No. T18733
Ski Hill Area
Section B
Nearest Borehole: BH 3
Long-Term Analysis (Drained Condition)

Soil Layer No.	Bulk Unit Weight (kN/m^3)	Cohesion (kPa)	Friction Angle (Deg.)
1	19.0	0	30
2	17.0	0	22
3	16.5	0	15
4	19.5	5	30
5	-	-	-

ENCLOSURE B-5

Job No. T18733
Ski Hill Area
Section B
Nearest Borehole: BH 3
Short-Term Analysis- Seismic Loading (Undrained Condition)

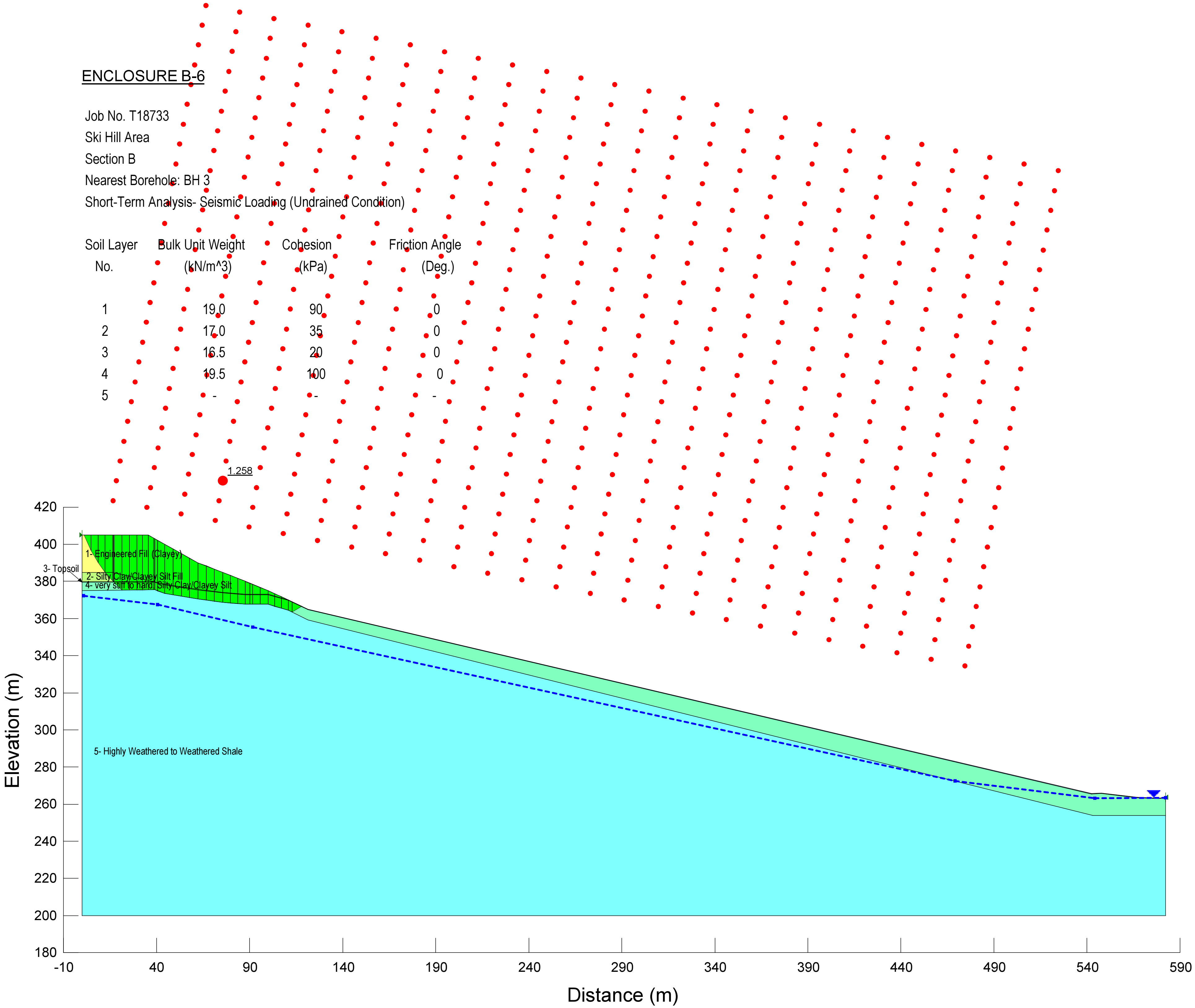
Soil Layer No.	Bulk Unit Weight (kN/m^3)	Cohesion (kPa)	Friction Angle (Deg.)
1	19.0	90	0
2	17.0	35	0
3	16.5	20	0
4	19.5	100	0
5	-	-	-



ENCLOSURE B-6

Job No. T18733
Ski Hill Area
Section B
Nearest Borehole: BH 3
Short-Term Analysis- Seismic Loading (Undrained Condition)

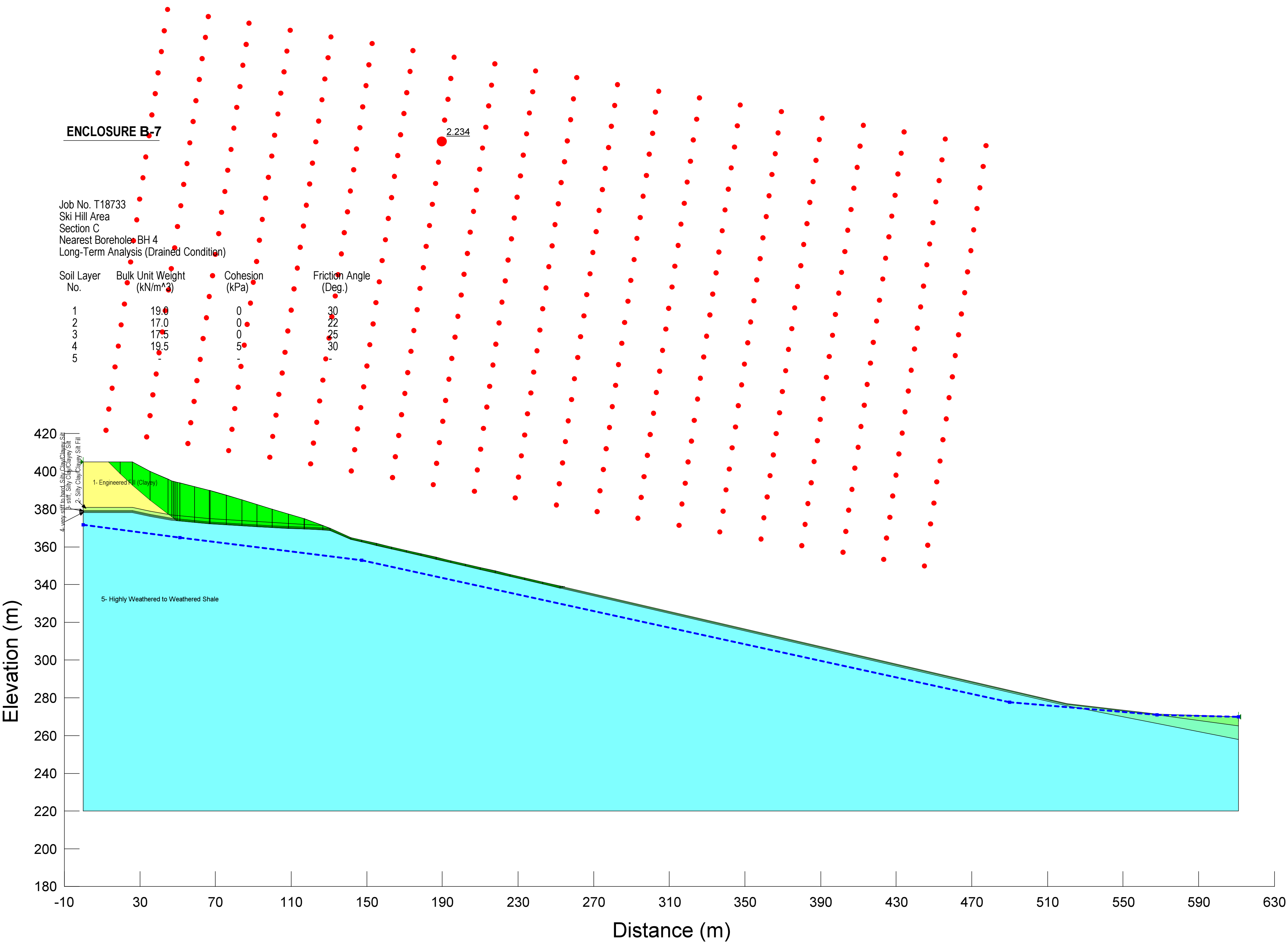
Soil Layer No.	Bulk Unit Weight (kN/m^3)	Cohesion (kPa)	Friction Angle (Deg.)
1	19.0	90	0
2	17.0	35	0
3	16.5	20	0
4	19.5	100	0
5	-	-	-



ENCLOSURE B-7

Job No. T18733
Ski Hill Area
Section C
Nearest Borehole BH 4
Long-Term Analysis (Drained Condition)

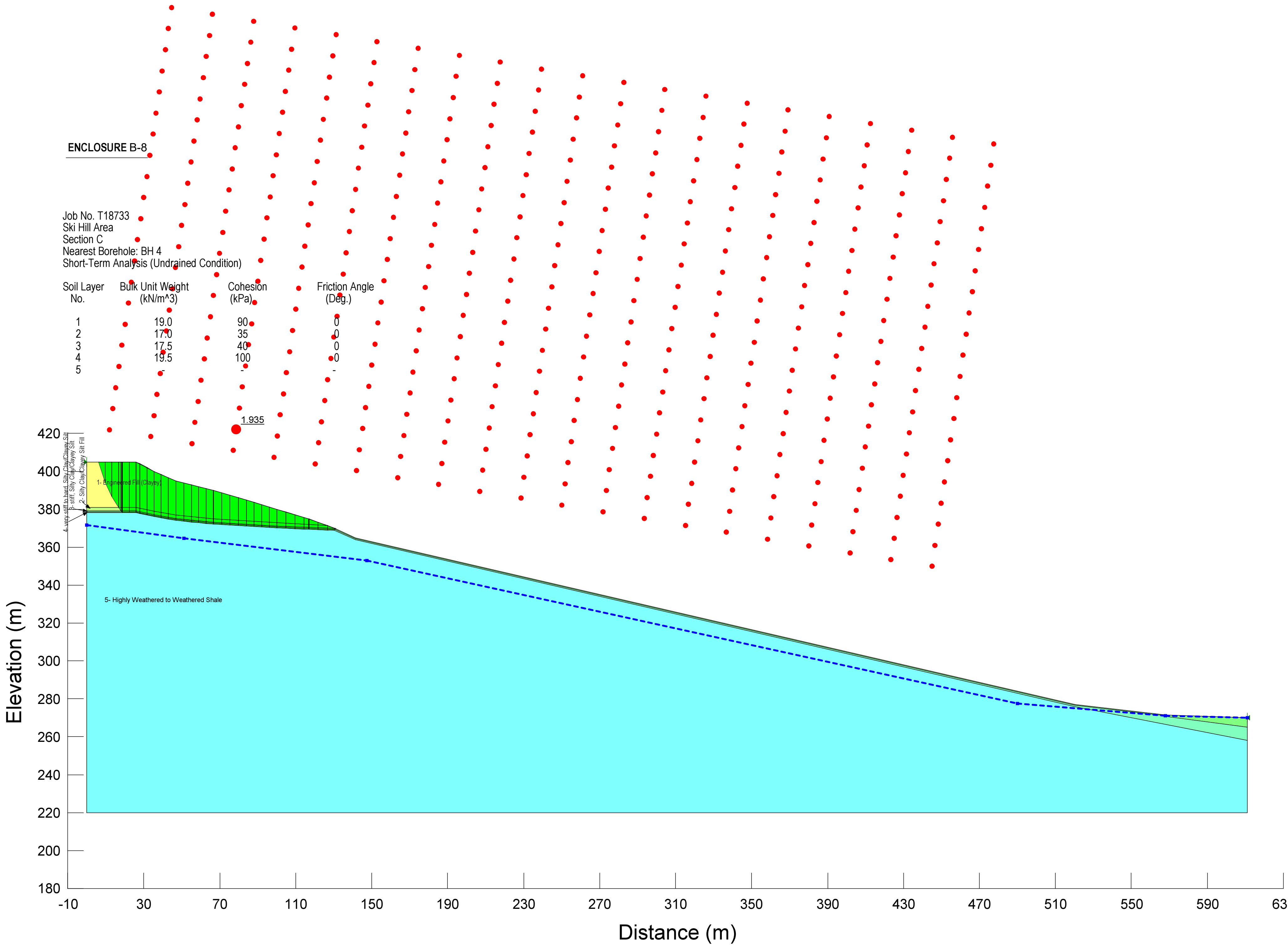
Soil Layer No.	Bulk Unit Weight (kN/m^3)	Cohesion (kPa)	Friction Angle (Deg.)
1	19.0	0	30
2	17.0	0	22
3	17.5	0	25
4	19.5	5	30
5	-	-	-



ENCLOSURE B-8

Job No. T18733
Ski Hill Area
Section C
Nearest Borehole: BH 4
Short-Term Analysis (Undrained Condition)

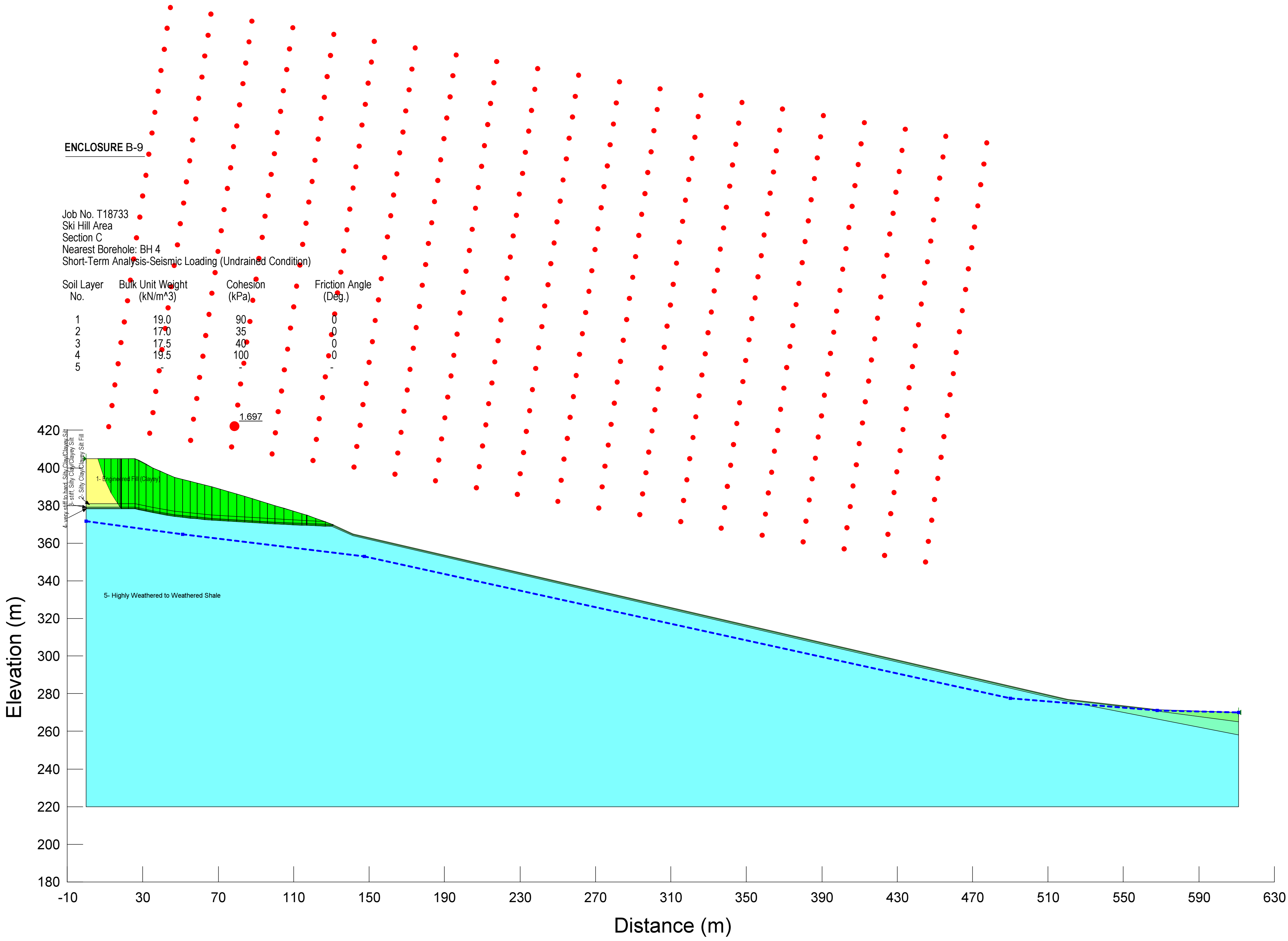
Soil Layer No.	Bulk Unit Weight (kN/m^3)	Cohesion (kPa)	Friction Angle (Deg.)
1	19.0	90	0
2	17.0	35	0
3	17.5	40	0
4	19.5	100	0
5	-	-	-



ENCLOSURE B-9

Job No. T18733
Ski Hill Area
Section C
Nearest Borehole: BH 4
Short-Term Analysis-Seismic Loading (Undrained Condition)

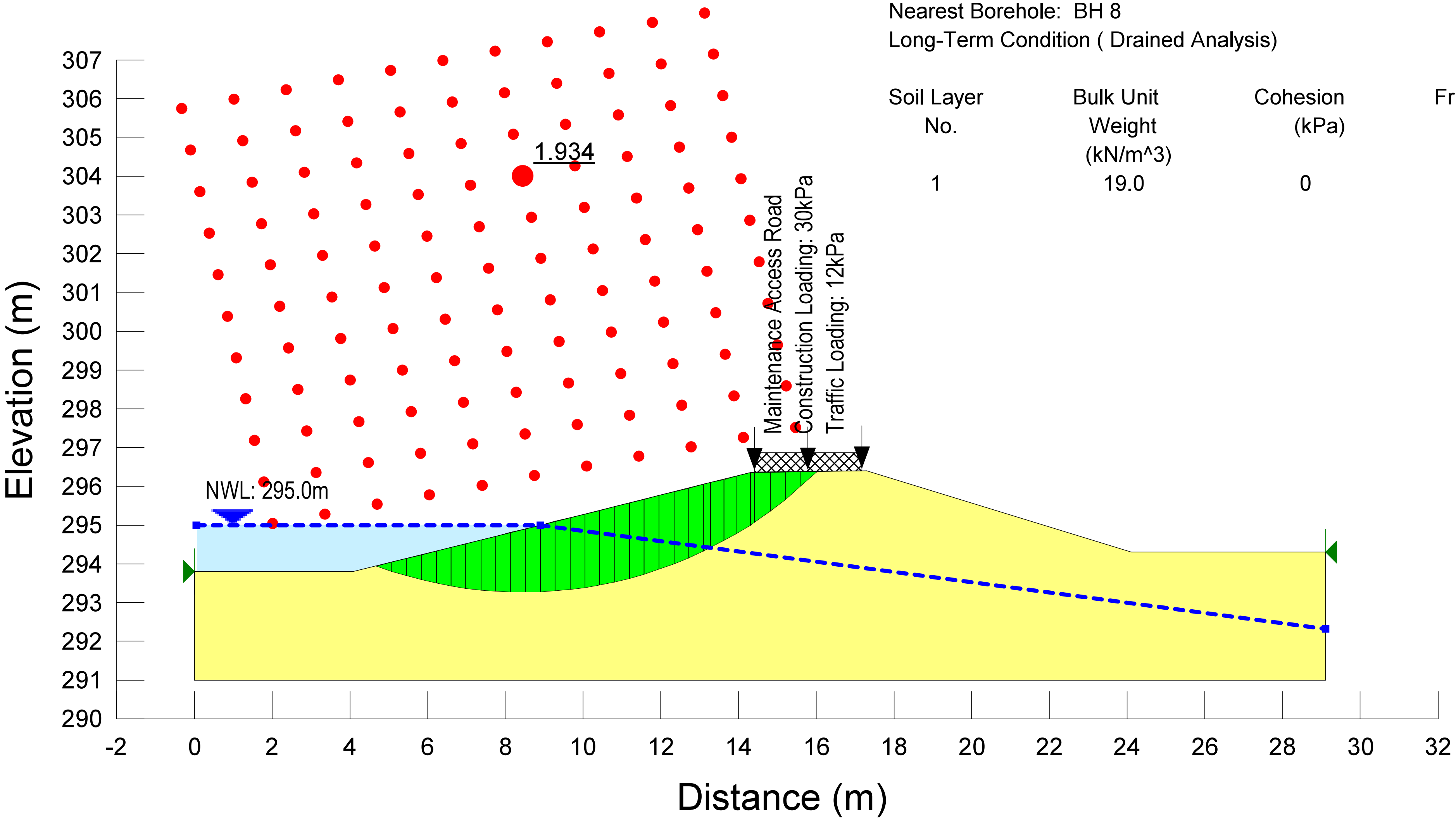
Soil Layer No.	Bulk Unit Weight (kN/m^3)	Cohesion (kPa)	Friction Angle (Deg.)
1	19.0	90	0
2	17.0	35	0
3	17.5	40	0
4	19.5	100	0
5	-	-	-



Enclosure B-10

Job No. T18733
Dry Detention Basin (Pond Side)
Section D
Nearest Borehole: BH 8
Long-Term Condition (Drained Analysis)

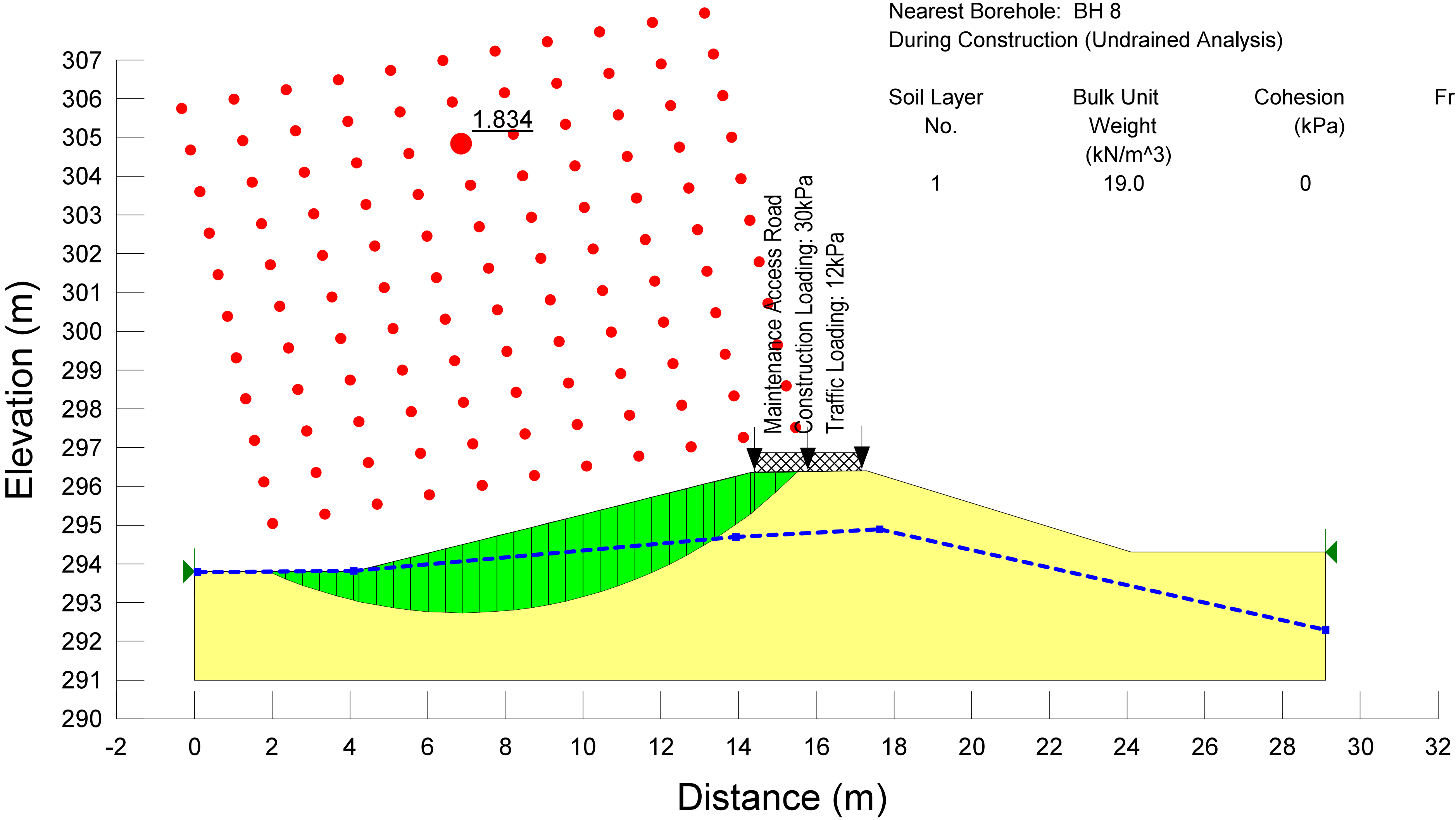
Soil Layer No.	Bulk Unit Weight (kN/m^3)	Cohesion (kPa)	Friction Angle (Deg.)
1	19.0	0	30



Enclosure B-11

Job No. T18733
Dry Detention Basin (Pond Side)
Section D
Nearest Borehole: BH 8
During Construction (Undrained Analysis)

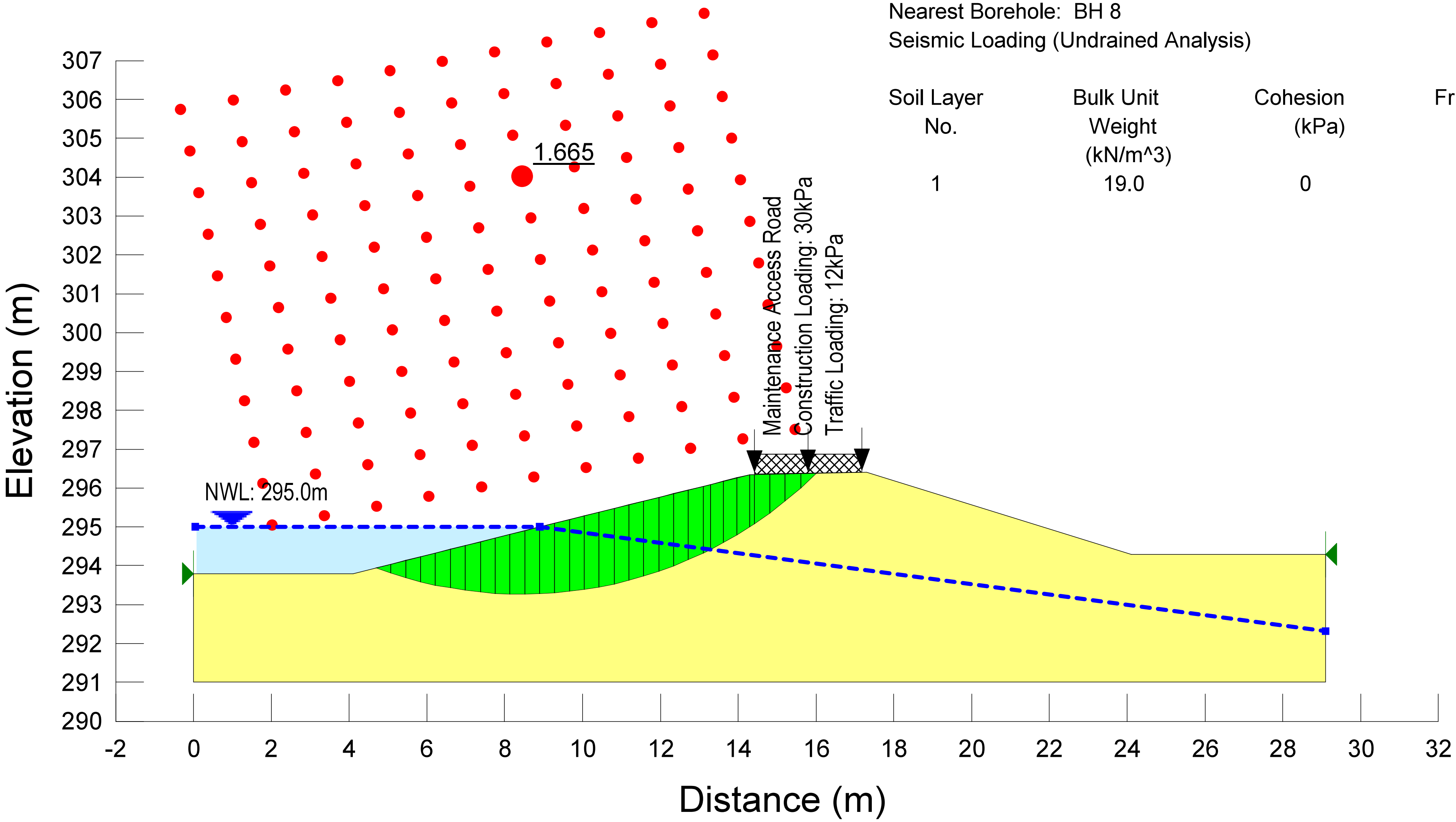
Soil Layer No.	Bulk Unit Weight (kN/m^3)	Cohesion (kPa)	Friction Angle (Deg.)
1	19.0	0	30



Enclosure B-12

Job No. T18733
Dry Detention Basin (Pond Side)
Section D
Nearest Borehole: BH 8
Seismic Loading (Undrained Analysis)

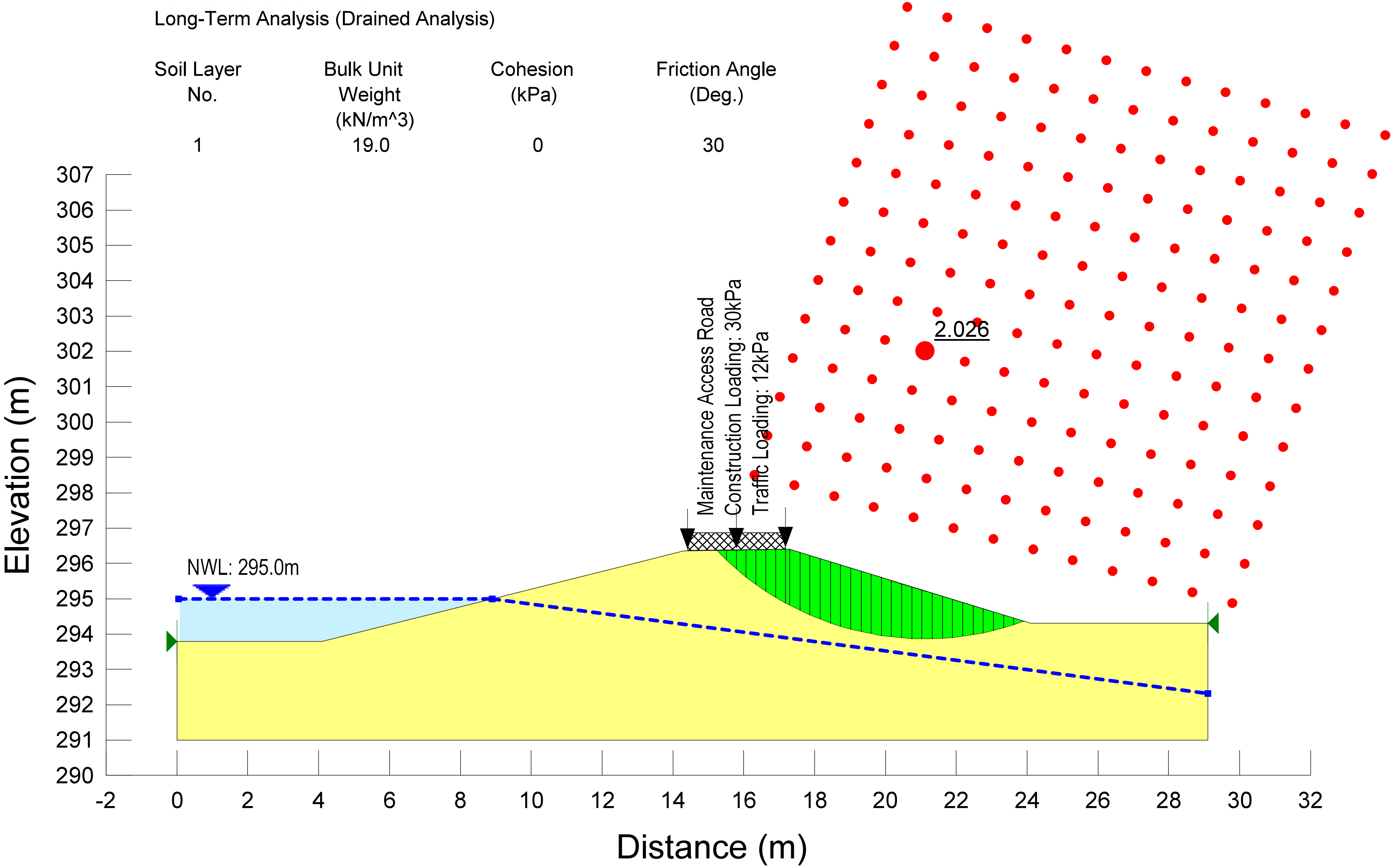
Soil Layer No.	Bulk Unit Weight (kN/m^3)	Cohesion (kPa)	Friction Angle (Deg.)
1	19.0	0	30



Enclosure B-13

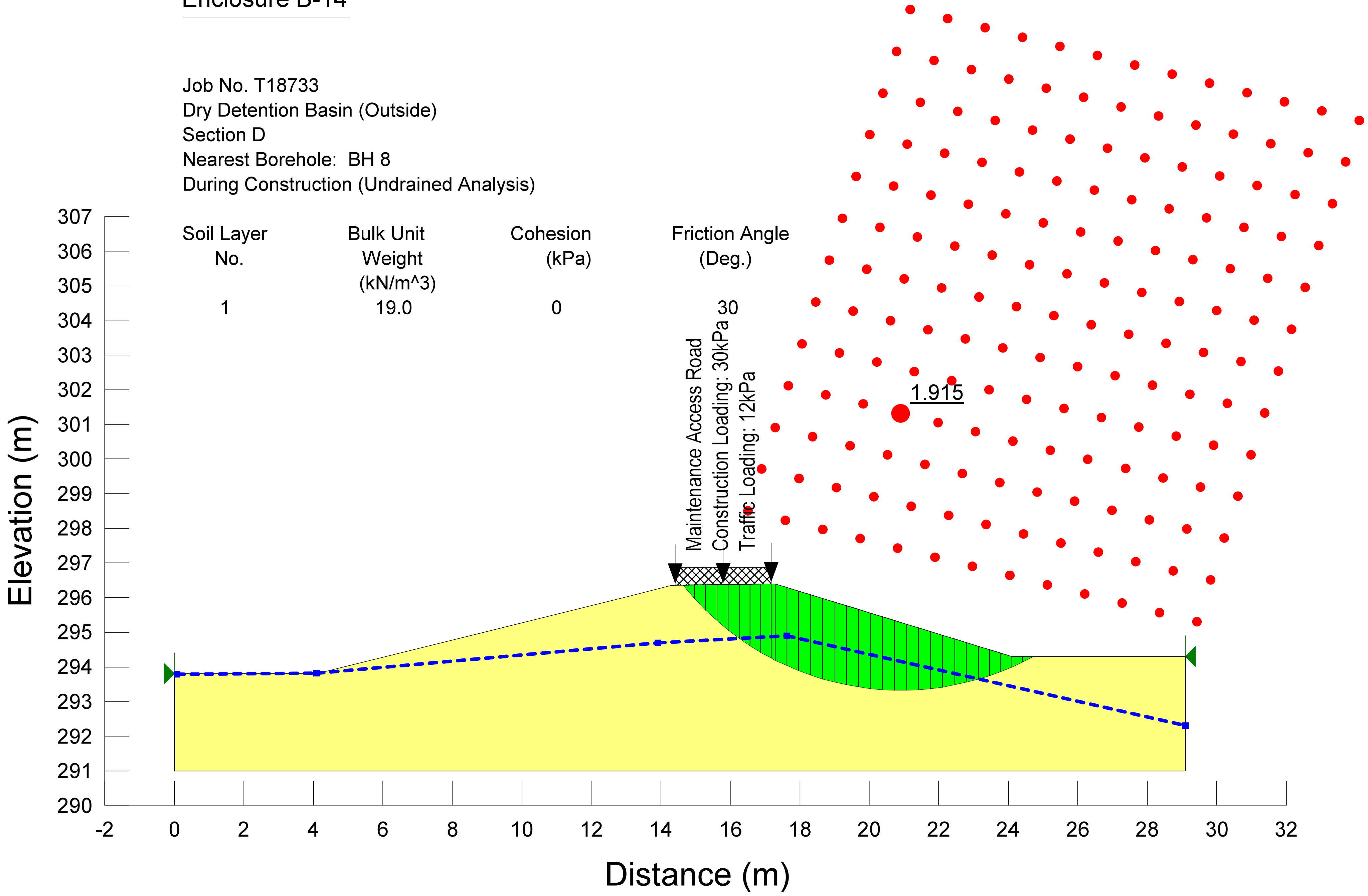
Job No. T18733
Dry Detention Basin (Outside)
Section D
Nearest Borehole: BH 8
Long-Term Analysis (Drained Analysis)

Soil Layer No.	Bulk Unit Weight (kN/m^3)	Cohesion (kPa)	Friction Angle (Deg.)
1	19.0	0	30



Enclosure B-14

Job No. T18733
Dry Detention Basin (Outside)
Section D
Nearest Borehole: BH 8
During Construction (Undrained Analysis)

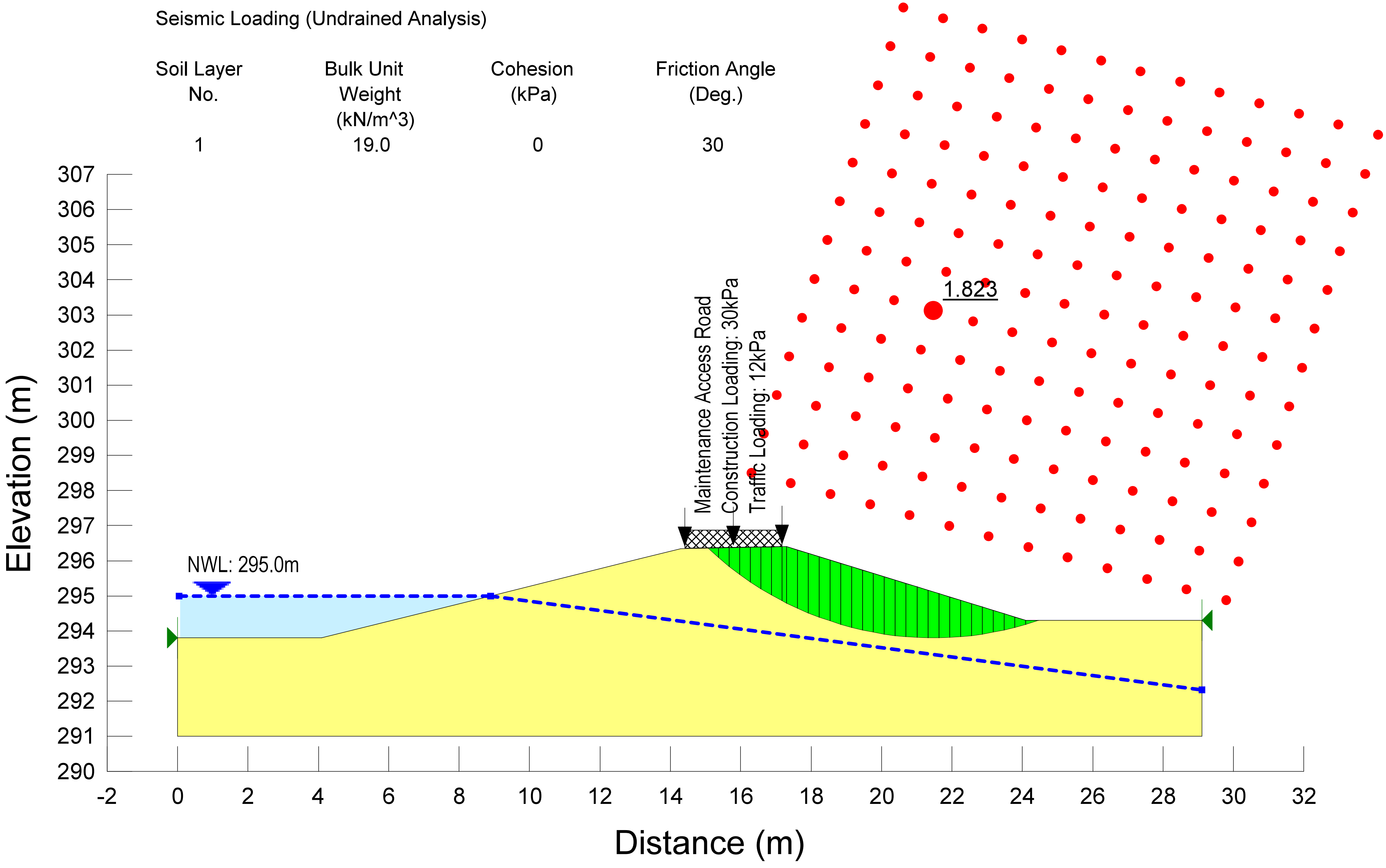


Soil Layer No.	Bulk Unit Weight (kN/m^3)	Cohesion (kPa)	Friction Angle (Deg.)
1	19.0	0	30

Enclosure B-15

Job No. T18733
Dry Detention Basin (Outside)
Section D
Nearest Borehole: BH 8
Seismic Loading (Undrained Analysis)

Soil Layer No.	Bulk Unit Weight (kN/m^3)	Cohesion (kPa)	Friction Angle (Deg.)
1	19.0	0	30



APPENDECIES

Appendix A: Site Specific Seismic Hazard Parameters as Per 2015 NBC of Canada

2015 National Building Code Seismic Hazard Calculation

INFORMATION: Eastern Canada English (613) 995-5548 français (613) 995-0600 Facsimile (613) 992-8836
Western Canada English (250) 363-6500 Facsimile (250) 363-6565

June 15, 2018

Site: 44.1977 N, 80.0598 W User File Reference: Mansfield Ski Club

Requested by: ,

National Building Code ground motions: 2% probability of exceedance in 50 years (0.000404 per annum)

Sa(0.05)	Sa(0.1)	**Sa(0.2)**	Sa(0.3)	**Sa(0.5)**	**Sa(1.0)**	**Sa(2.0)**	**Sa(5.0)**	**Sa(10.0)**	**PGA (g)**	**PGV (m/s)**
0.079	0.109	**0.105**	0.089	**0.074**	**0.045**	**0.023**	**0.0057**	**0.0025**	**0.062**	**0.060**

Notes. Spectral (Sa(T), where T is the period in seconds) and peak ground acceleration (PGA) values are given in units of g (9.81 m/s^2). Peak ground velocity is given in m/s. Values are for "firm ground" (NBCC 2015 Site Class C, average shear wave velocity 450 m/s). NBCC2015 and CSAS6-14 values are specified in **bold** font. Three additional periods are provided - their use is discussed in the NBCC2015 Commentary. Only 2 significant figures are to be used. ***These values have been interpolated from a 10-km-spaced grid of points. Depending on the gradient of the nearby points, values at this location calculated directly from the hazard program may vary. More than 95 percent of interpolated values are within 2 percent of the directly calculated values.***

Ground motions for other probabilities:

Probability of exceedance per annum	0.010	0.0021	0.001
Probability of exceedance in 50 years	40%	10%	5%
Sa(0.05)	0.0098	0.031	0.048
Sa(0.1)	0.016	0.045	0.069
Sa(0.2)	0.017	0.046	0.069
Sa(0.3)	0.016	0.041	0.060
Sa(0.5)	0.012	0.034	0.049
Sa(1.0)	0.0060	0.020	0.030
Sa(2.0)	0.0026	0.0096	0.015
Sa(5.0)	0.0006	0.0021	0.0036
Sa(10.0)	0.0004	0.0010	0.0015
PGA	0.0086	0.026	0.039
PGV	0.0072	0.024	0.038

References

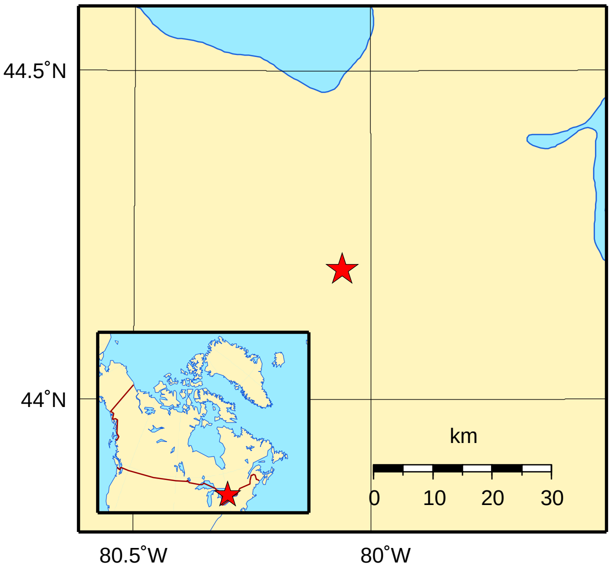
National Building Code of Canada 2015 NRCC no. 56190;
Appendix C: Table C-3, Seismic Design Data for Selected Locations in Canada

User's Guide - NBC 2015, Structural Commentaries NRCC no. xxxxxx (in preparation)
Commentary J: Design for Seismic Effects

Geological Survey of Canada Open File 7893 Fifth Generation Seismic Hazard Model for Canada: Grid values of mean hazard to be used with the 2015 National Building Code of Canada

See the websites *www.EarthquakesCanada.ca* and *www.nationalcodes.ca* for more information

Aussi disponible en français



Natural Resources Canada Ressources naturelles Canada

Canada

SHAD & ASSOCIATES INC.

March 20, 2020
Ref. No.: T18733

Mansfield Ski Club
628213 Sideroad 15, Mulmur, Ontario, L9V 3M6

Attention: **Mr. Finley McEwen**

RE: **Recommended Gravel Fire Route Pavement Thickness**
Mansfield Ski Club
628213 SDRD 15, Mulmur, Ontario

Based on your information, we understand that a gravel fire route is proposed to be constructed on a portion of the gravel driveway at the above captioned site. We wish to mention that a feasibility geotechnical assessment was previously carried out at above property and our recommendations were provided to the Client in Shad Report T18733 dated June 22, 2018. As requested, this addendum letter report is prepared to provide our recommendations for the proposed pavement thickness and its construction at the above captioned site.

- Pavement Thickness

In accordance with the 2018 report, Boreholes 5 and 6 appear to be located close to the north end of the proposed fire route. Based on the subsurface conditions encountered at these boreholes, below some fill (generally consisting of silty sand/sandy silt fill and/or granular fill), the site was underlain by a competent and compact to very dense silty sand till. However, some topsoil was also noted interbedded within the fill at Borehole 6. The groundwater level was monitored during and upon completion of drilling and it was measured at 3.2 m and 4.3 m below existing ground surface at Boreholes 5 and 6, respectively.

Considering the subsurface information, for a trouble-free performance of the proposed pavement, we would recommend the existing topsoil and fill to be removed and the excavated subgrade to be raised up to the design grade to accept the pavement structure using properly placed and compacted engineered fill in accordance with the recommendations provided in Section 4.3.4: Engineered Fill of the 2018 report. Assuming this and using good engineering and construction practice, the following minimum pavement structure for the proposed gravel fire route may be used:

PAVEMENT STRUCTURE	**COMPACTION**	**PAVEMENT THICKNESS (mm)**
Granular 'A' Base	100%	150
Granular 'B' Sub-base	100%	450

Alternatively, the pavement thickness could be reduced to 400 mm (Granular 'A': 150 mm and Granular 'B': 250 mm) by strengthening the subgrade by including a layer of BX1200 Geogrid. The geogrid should be extended out at least 1.0 m beyond the route footprint. To ensure the longevity of the pavement, the roadbed should be well drained at all times.

- Construction Comments

In order to provide a durable pavement structure, the following pavement construction method is recommended.

The subgrade should be adequately prepared to receive the sub-base course. Any disturbed and wet subgrade materials should be removed, and the top of the subgrade should then be inspected and approved by proof-rolling by qualified geotechnical personnel. Cavities created by the removal of unsuitable materials should be backfilled with approved, inorganic fill materials similar to the existing subgrade material. All new fill should be placed in maximum 200 mm loose lifts within ±2% of its optimum moisture content, and each lift compacted with suitable equipment to minimum 98% Standard Proctor Maximum Dry Density, before placing the next lift. If construction of the roadfill is carried out in wet weather, the thickness of the sub-base course may need to be increased.

Special attention should be paid to proper grading of the subgrade surface. Depressions and undulations should be eliminated and, to permit quick drainage, the subgrade surface should be sloped towards ditches, sub-drains and/or catch-basins.

It is recommended that a programme of geotechnical/material inspection and testing be carried out during the construction phase of the project to confirm that the conditions exposed in the excavations are consistent with those encountered in the boreholes and the design assumptions, and to confirm that the various project specifications and materials requirements are being met.

- Closure

It should be noted that this letter report is prepared as an addendum to Shad Report T18733 dated June 22, 2018 and should be referenced for more information.

We trust that the above is an accordance with your current requirements. Should you require additional information or clarification, please contact our office.

Sincerely,
Shad & Associates Inc.

S. Chong

LICENSED PROFESSIONAL ENGINEER
H. SHAD
PROVINCE OF ONTARIO

H. Shad

Stephen Chong, P. Eng.
Senior Engineer

Houshang Shad, Ph. D., P. Eng.
Principal

SHAD & ASSOCIATES INC.

April 22, 2020
Ref. No.: T18733

Mansfield Ski Club
c/o WMI & Associates Limited
119 Collier Street
Barrie, Ontario
L4M 1H5

Attention: **Mr. Andrew Windrem**

RE: **Addendum Geotechnical Report**
Mansfield Ski Club
628213 SDRD 15, Mulmur, Ontario

Further to your email of April 17, 2020 and our conversation, this addendum report is prepared to provide our geotechnical opinion and recommendations on the following Items:

1) Asphalt pavement structure for entrance off 15th Sideroad and fire route;
2) Maintenance access to the Dry Pond basin;
3) Sewers & watermain;
4) Snow Making Pond;
5) 2.0 m wide berm east of Dry Pond; and
6) Enhanced seeded grass swale along the east side of the parking lot.

The Items are discussed below. We wish to mention that a feasibility geotechnical assessment was previously carried out at the property and our recommendations were provided to the Client in Shad Report T18733 dated June 22, 2018. This addendum report is prepared as an addendum to the 2018 report.

1) Asphalt Pavement Structure for Site Entrance off 15th Sideroad & Fire Route

Based on our conversation, we understand that the entrance will have a heavy duty use and that part of the fire route inside the property will also be asphalt paved.

Considering the subsurface information encountered at Boreholes 5, 6 and 8, for a trouble-free performance of the proposed asphalt pavement, we would recommend the existing topsoil and/or fill to be removed down to competent inorganic and undisturbed subgrade. The exposed native subgrade should then be inspected and approved by experienced geotechnical staff. Following its approval, the subgrade should be raised up to the design grades to accept the pavement structure using properly placed and compacted engineered fill in accordance with the recommendations provided in Section 4.3.4: Engineered Fill of the 2018 report. Assuming this and using good engineering and construction practice, the minimum pavement structure provided in Table 1 may be used.

Table 1: Recommended Minimum Pavement Structure

Pavement Structure	Compaction	Heavy Duty & Fire Route (mm)
HL-3 Asphaltic Concrete HL-8 Asphaltic Concrete	97% Marshall Density	50 50
Granular 'A' Base	100%	150
Granular 'B' Sub-base	100%	350

Note: HL-3 and HL-8 asphaltic Concrete to conform to OPSS 1150 & 310

To ensure the longevity of the pavement, the roadbed should be well drained at all times. We recommend that full-length perforated sub-drains of 150 mm diameter be installed along both sides of the road, below the roadbed level, to ensure effective drainage. The sub-drain should be surrounded by 20 mm size clear stone drainage zone of minimum 150 mm thickness, which should have non-woven geotextile (Terrafix 270R or approved equal) wraparound to minimize infiltration of fines in pipes which would reduce their effectiveness.

The granular materials should be compacted as per American Society for Testing and Material's Number D698. The placing, spreading and rolling of the asphalt should be in accordance with Ontario Provincial Standard Specifications Form 310, or equivalent.

Construction traffic over exposed subgrade materials should be minimized, and temporary construction hauling routes should be established. If these routes coincide with future paved areas, adequately reinforced haul roads (increased thickness of granular base, use of geo-fabrics, etc.) should be constructed to reduce disturbance to the subgrade soils. These provisions are particularly important if the construction is scheduled during wet and cold season.

1.1 Construction Comments

In order to provide a durable pavement structure, the following pavement construction method is recommended.

The subgrade should be adequately prepared to receive the sub-base course. Any disturbed and wet subgrade materials should be removed, and the top of the subgrade should then be inspected and approved, by proof-rolling, by qualified geotechnical personnel. Cavities created by the removal of unsuitable materials should be backfilled with approved, inorganic fill materials similar to the existing subgrade material. All new fill should be placed in maximum 200 mm loose lifts within ±2% of its optimum moisture content, and each lift compacted with suitable equipment to minimum 95% Standard Proctor Maximum Dry Density, before placing the next lift.

The uppermost zones of the roadfill, within 1.0 m of the roadbed, should be compacted to minimum 98% Standard Proctor Maximum Dry Density. If construction of the roadfill is carried out in wet weather, the thickness of the sub-base course should be increased.

Special attention should be paid to proper grading of the subgrade surface. Depressions and undulations should be eliminated and, to permit quick drainage, the subgrade surface should be sloped towards ditches, sub-drains and/or catch-basins.

2) Maintenance access to the Dry Pond basin

According to the information provided to us, we understand that a 3.0 m wide gravel access road will be constructed in the pond. Based on the subsurface conditions encountered at Borehole 8 and the considerable presence of fill and topsoil, all the unsuitable material would need to be removed and the grade raised up to the design elevations using properly placed and compacted engineered fill. (For additional information on the construction of the dry pond, reference should be made to Section 4.4 of the 2018 report). Assuming this, we recommend the 3.0 m wide gravel access road to consist of 150 mm of Granular B overlain by 150 mm of Granular A. The pavement structure should be placed in maximum 150 mm loose lifts within ±2% of its optimum moisture content, and each lift compacted to 100% of the material's Standard Proctor Maximum Dry Density.

3) Sewers & Watermain

According to Drawings GENN and SSOP (with a SPA 1st submission date of February 7, 2020), we understand that the depth of proposed services will be within 4.2 m of the road grade. The following discussion is based on this assumption.

3.1 Trenching

Trench excavations should be carried out as per the Safety Regulations of the Province of Ontario. Considering the subsurface conditions encountered at Boreholes 5, 6 and 7, below the existing topsoil and fill, the sewer trenches will be predominantly excavated within the compact to very dense, but generally dense to very dense silty sand to sandy silt till. These deposits are classified in Section 4.3.5 of the 2018 report in accordance with the Ontario Health and Safety Regulations. Within these soils, the side slopes of excavations are expected to be temporarily stable at 1H:1V, although above the groundwater level in the dense to very dense silty sand to sandy silt till, the bottom 1.2 m of the trench walls could be excavated close to vertical. Flatter slopes may be required in surficial topsoil and fill layers and below the groundwater level in silty sand to sandy silt till. Approved trench boxes or equivalent may be used to limit the extent of the excavation, if required.

Groundwater seepage within the glacial deposits should be minor and manageable by gravity drainage and pumping from filtered sumps. However, increased seepage may occur from any perched water condition within the topsoil and fill, which may require a series of sump pumps. Increased seepage should also be expected if the excavation is extended below the groundwater level in the silty sand to sandy silt till. We recommend that once the pipe inverts are finalized and before construction, the groundwater conditions at the site to be further assessed by test pitting to ensure that the most suitable dewatering methodology is selected. In no case should the pipes be placed on dilated or disturbed subsoil.

Attention is called to the possible presence of cobbles and/or boulders that may be encountered during the excavation in the glacial till deposits.

Normal excavation equipment will be suitable for making trenches within soils in which the proposed underground services will be installed. The terms describing the relative density (compact, dense, very dense) of soil strata give an indication of the effort needed for excavation.

3.2 Bedding

The boreholes showed that the sewer pipes will be predominantly laid within a compact to very dense silty sand to sandy silt till or engineered fill which are considered to be suitable to support the pipes. The recommended minimum thickness of granular bedding for normal Class 'B' Type of bedding (i.e., compacted granular bedding material – OPSD-802) below the invert is 150 mm. The thickness of the bedding may, however, have to be increased depending on the pipe diameter or if wet or weak subgrade conditions are encountered.

3.3 Backfill

Based on the visual and tactile examination of the soil samples, the on-site inorganic excavated soils could be re-used as backfill in service trenches. The moisture contents at the time of construction should be at or near optimum. The backfill should be placed in maximum 200 mm thick layers at or near (±2%) their optimum moisture content, and each layer should be compacted to at least 95% Standard Proctor Maximum Dry Density. This value should be increased to at least 98% within 1.0 m of the road subgrade surface.

The excavated native deposits may require reconditioning (e.g., wetting or drying) prior to reuse. The on-site excavated soils should not be used in confined areas (e.g., around catch-basins and laterals under roadways) where heavy compaction equipment cannot be operated. The use of good backfill together with an appropriate frost taper would be preferable in confined areas. Unsuitable materials such as organic soils, boulders, cobbles, frozen soils, etc., should not be used for backfilling.

We recommend that frost tapers be provided at backfilled trenches to ensure gradual transition from the frost-free materials to the frost susceptible natural soil, otherwise differential frost heaving may occur. Frost taper would not be necessary if the backfill material can be matched within the frost zone (i.e. within about 1.6 m depth below the pavement surface) with subgrade-type material.

The need for anti-seepage collars should be assessed during site servicing.

4) Snow Making Pond

The design and construction of the snow making pond were discussed in Section 4.1 of the 2018 report. The conditions were further discussed with Mr. Dan Hurley of Tatham Engineering Limited on April 20, 2020. Considering the subsurface conditions encountered at Borehole 1, below some surficial topsoil and fill, the site is predominantly underlain by wet and sandy deposit with the short-term groundwater level being measured at 0.9 m above the ground surface. Currently, the proposed pond is designed to extend to a depth of about 6 m or so below the existing grade. Considering these, from a geotechnical viewpoint, we would recommend the pond not to be lined, if allowed. For the unlined pond, the base and walls of the pond would still need to be protected against erosion and washout, perhaps through the use of riprap stones, separated from the base and walls using a suitable geofabric separator, such as Terrafix 300 or 360. However, if the pond must be lined, for an economical design, we would recommend reducing the pond depth below the existing ground surface as much as possible in attempt to reduce the uplift hydrostatic pressure. The uplift pressure would need to be counterbalanced (using weight placed over the liner) or the pressure would need to be minimized by permanent water level lowering (by using a subsurface drainage network connected to a frost-free outlet). We would also need to ensure that any manholes or associated structures (such as wet well or pumping house, etc.) are assess for the uplift condition to ensure that they do not float. The liner could be clayey or geosynthetic. We would recommend that once the pond design is known, we should review and provide additional geotechnical recommendations.

5) 2.0 m wide berm east of Dry Pond

Considering the existing and design grades for the proposed dry pond, we understand that following the east berm of the pond, the grade will fall from Elevation 296.40 m to the existing grades at approximately 294.3 m at a gradient of 3H:1V. This proposal was modelled for slope stability analysis and the proposed outside berm of the pond was found to be stable. Reference should be made to Section 4.4 of the 2018 report for full details. We would recommend the berm to be vegetated to minimize surface erosion and localized gulleying.

6) Enhanced seeded grass swale along the east side of the parking lot

According to Drawings SP.1 (dated January 2020) and SGRS (with a SPA 1st submission date of February 7, 2020), we understand that an enhanced seeded grass swale is proposed to be constructed on the east side of the proposed parking lot. The proposed swale will have its bottom invert elevation on the north end at about El.297.08 m, falling to El.295.65 m at the south end where it meets the dry pond basin. The proposed channel will be 1 m wide at the base and 0.5 m deep, with a side slope of 3H:1V. The swale will be topsoil seeded and a 100 mm diameter perforated subdrain will be installed at about 0.2 m below the base to minimize any potential for flooding.

Boreholes 7 and 8 are drilled near the north and south ends of the proposed swale, according to these boreholes, the proposed channel would be constructed in engineered fill. Assuming, the native onsite silty sand to sandy silt soils to be used for the earthworks, the soils would have permeability values of approximately $1x10^{-6}$ to $1x10^{-4}$ cm/sec, depending on the silt content, indicating a medium to low permeability condition.

- Closure

It is recommended that a programme of geotechnical/material inspection and testing be carried out during the construction phase of the project to confirm that the conditions exposed in the excavations are consistent with those encountered in the boreholes and the design assumptions, and to confirm that the various project specifications and materials requirements are being met.

It should be noted that this letter report is prepared as an addendum to Shad Report T18733 dated June 22, 2018 and should be referenced for more information.

We trust that the above is an accordance with your current requirements. Should you require additional information or clarification, please contact our office.

Sincerely,
Shad & Associates Inc.

S. Chong

LICENSED PROFESSIONAL ENGINEER
H. SHAD
PROVINCE OF ONTARIO

H. Shad

Stephen Chong, P. Eng.
Senior Engineer

Houshang Shad, Ph. D., P. Eng.
Principal

cc. Mr. Finley McEwen, Manfield Ski Club

WMI & Associates Limited
119 Collier Street, Barrie, Ontario, L4M 1H5
P (705) 797-2027 F (705)797-2028

December 15, 2020

Via: Email

Township of Mulmur
758070 2nd Line East,
Mulmur, Ontario
L9V 0G8

Attention: **Tracey Atkinson**
CAO/Deputy Clerk/Planner

Re: **Mansfield Ski Club**
Community of Mansfield, Township of Mulmur,
Project No. 300038655.0000
1st Engineering Submission (SPA) Response Letter
WMI File No. 15-319

Dear Mrs. Atkinson,

The following provides a response summary of the 1st Engineering Submission comments related to Site Plan Approval for the re-development of the Mansfield Ski Club. Each of the comments provided by R.J. Burnside & Associated Ltd dated September 28, 2020 are provided herein along with their respective responses in red.

Based on the conference call with yourself, RJB and Finley McEwen (MSC) on Monday October 26, 2020 @ 1pm, each of the following comments were discussed/clarified. The following responses are considered to be consistent with the approach agreed to during the call and the engineering drawings and Site Servicing and Stormwater Management Report have been revised accordingly.

Sanitary Sewage Treatment

Temporary Conditions (Phase 1)- The approval authority for wastewater treatment is either the County of Dufferin (for systems less than 10,000 litres per day) or MECP for larger systems. The Township is not a direct reviewer of wastewater treatment design details, but we are providing our general comments due to public interest that was expressed to the Township.
Although the Site Servicing Report contains correspondence with the County of Dufferin Building Department, I have discussed this file with the County and was told that they have no jurisdiction. The existing system and proposed are both large enough to fall under the jurisdiction of MECP.

- The proposed sewage treatment system will be completely installed as part of Phase 1A. An ECA application is concurrently being submitted to the MECP as part of this submission.

It is proposed to construct Phase 1A (a 12 Unit Townhouse) with servicing to the existing septic system, and then divert it to the new sewage treatment plant as part of a future phase. In our opinion, the Site Servicing Report does not provide the required support to add additional flows to the existing system, even on a temporary basis:

- The proposed sewage treatment system will be completely installed as part of Phase 1A. The existing sewage treatment system will be decommissioned as part of Phase 1A and all flows from the Main Chalet, Admin Office, Ski House and proposed Block 1 will be directed to the Waterloo Biofilter system.

The *capacity* of the existing system is unclear:

- The report provides information on the treatment component of the system but makes no mention of the capacity of the leaching disposal beds which could be the limiting factor.

- The rated capacity of the treatment system is not made clear. While the report references a “total daily design capacity of 22,700 L/day, a 9,100 L reserve tank and an 18,000L surge tank” there is no explanation of whether they components would be added together or if they work independently. The material submitted in Appendix F shows that the GC-2 System is rated for 22,700 L/day, but that the 9,100 L reserve tank is internal to the system so that it would be included in, but not be added to the rated capacity. This seems to be confirmed by the attached letter from the manufacturer, who clearly states that the sewage system has a rated capacity of 22,700 L/day.

- We were unable to find a Certificate of Approval for the existing system, either through Dufferin County or on the MECP website.

- We concluded that the system is rated for 22,700 litres on a daily basis, and it may accept surges up to an additional 18,000 L if more detail can be provided with respect to the surge tank and how it operates.

- In summary, the *capacity* of the existing system should be defined for both average day and maximum day usages, and it should be reported on the basis of the original design and approval of the system. Typically, this is found on the Certificate of Approval.

- The capacity of the existing sewage treatment system is 22,700L/day. The 9,100L reserve tank and additional 18,000L surge tank are considered above and beyond the system’s capacity. They were originally provided as a means of temporarily attenuating sewage during peak conditions. The entire existing sewage treatment system will be decommissioned and removed as part of Phase 1A including the existing filter beds.

  As per our pre-consultation discussions with the MECP, an ECA application is required and is concurrently being submitted to the MECP as part of this submission.

The *existing usage* of the wastewater system is also unclear:

- The letter in Appendix F from Northern Purification Systems does a rough calculation to arrive at an average daily flow of 2,594 L/day, over the period of 1997 to June, 2006. This average would include summer days when the ski club is not used so it is not informative to the true operation.

- The letter also provides a calculation over the period Dec 17, 2004 to April 28, 2005 which more accurately captures the ski season (although usage in April would presumably be less than average). This calculation leads to an average day calculation of 7,350 L/day.

- It isn't clear why such old information would be presented. Systems tend to gain additional flows as they age and it would have been relatively easy to obtain data last winter.

- Both of the above calculations determine the <u>average</u> usage, but not the maximum day usage. The best information provided is that on February 16, 2020 (Family Day Sunday) the water system supplied 27,700 litres. Also, it supplied 21,500 litres on January 24, 2020 (Ladies Day). These number are close to and beyond the "rated capacity" of the sewage treatment system and it would be large flows such as this that could cause the septic system to break out. (Again, we were not provided with any description of the surge tank or how it functions within the system.)

- The report also indicates that the maximum day sewage usage in the period of December 2014 to March 2015 was 17,800 L/day.

- The proposed sewage treatment system will be completely installed as part of Phase 1A.

The *proposed temporary addition* includes a 12 unit townhouse, calculated to have an average flow of 13,200 L/day. But again, this in an average. The Site Servicing Report determines that the peaking factor for water flows is 2.0 and for sewage flows it is 2.7. However, the report also uses a peaking factor of 3.34 in Appendix B for both sewer and water. Applying these various peaking factors produces maximum day flows from this Townhouse unit that range from 26,400 L/day to 44,100 L/day, and the numbers in this range would have to be added to the *existing* maximum day flows. (Note that the low number if would be even higher it we'd more accurately used the peaking factor of 2.7 for sewage as opposed to the factor of 2.0 for water).

Water peaking factors used (for water supply, treatment and distribution system sizing):

- For the existing buildings (Main Chalet, Admin Bldg, GM Office and Ski house), a MDD peaking factor of 2 was used as this value was determined based on monitored data (actual use from last ski season). The PHD peaking factor of 4 was assumed to be double that of the MDD.

- For Commercial uses, a MDD peaking factor of 1.5 and PHD of 3 was used as these are typical peaking factors for this use.

- For Residential uses, the peaking factors of 3.34 and 5.02 are based on Table 3.1 and 3.3 of the MOE Design Guidelines for Drinking-Water Systems (2008).

Sanitary peaking factors used (for sanitary sewer sizing only):

- All peaking factors are identical to that of the water peaking factors with the exception of the residential peaking factor. The Residential peaking factors are based on the Harmon equation rather than Table 3.1 and 3.3 of the MOE Design Guidelines for Drinking-Water Systems (2008) as this is typical for all sanitary sewer system designs.

It is important to note that sewage treatment systems are designed based on total daily design flows calculated from the Ontario Building Code (OBC), 2012, Division B, Part 8, Table 8.2.1.3.A. Residential Occupancy & Table 8.2.1.3.B. Other Occupancies. No peaking factor is used. Peaking is accounted for within the balancing tank capacity of the system (approximately 1 days' worth of additional storage).

At the low end and using the 17,800 L/d figure for existing flows (which is lower than actual usages), the Maximum Day flow would be 44,200 litres. This exceeds the existing capacity even if the surge tank is added to the Northern Purification capacity. At the high end and using the 27,700 litres that was experienced on February 16, 2020, the total flows would be over 70,000 litres and well beyond the most optimistic reporting of rated capacity of the existing system.

In summary, all of the estimations exceed 10,000 litres per day so it is a matter for MECP to approve. We are of the opinion that the report does not justify the phasing of the development into the existing sewage system and we expect that the new sewage system will need to be constructed in order to support any expansion.

The proposed sewage treatment system will be completely installed as part of Phase 1A. An ECA application is concurrently being submitted to the MECP as part of this submission.

Permanent Sewage System

Again, the submitted material is inconsistent:

- The MECP approval of the Hutchinson Assimilative Capacity Study is contained within Appendix F of the Site Servicing Report. It refers to a proposed effluent discharge of 1.39 L/s, which equates to 120,096 Litres per day.

- The WMI Site Servicing Report calculates a total daily sewage flow generated by the application at 132,133 Litres per day of wastewater, which exceeds the amount approved by MECP for assimilative capacity. The difference is about 11 accommodation units and no explanation is provided for how they will be serviced given the exceedance of the Assimilative Capacity of the river.

- The total daily design flow is 118,950L/day (1.38L/s). Previously the value referenced above accounted for the main floor and a portion of the second floor of Building B in the existing Admin Building flows as well as the proposed Building B flows (accounted for twice since the Admin Building is being renovated and will be a portion of Building B). In addition, Building A & B uses have been revised to reflect the actual proposed uses (i.e. no restaurant use but rather offices and personal business space).

- Note that both of the daily flows discussed above are estimates of *average* flow, not peak flows. The engineering drawings in the latest submission are discussed in more detail below, but Biofilter Plan 2 contains a note that also relates to the anticipated sewage flows. The drawing contains a note that says "The peak design sanitary sewage flow for this facility is 126,503 litres per day." By comparison, the *peak* flow determined in the Site Servicing Report is 389,283 Litres per day (Appendix B). Perhaps the engineering drawings were incorrect in using the word "peak", as the Site Servicing Report describes the same number as the "total daily design flow", which would suggest that it is average flow as opposed to peak. But still, the treatment system design (126,503 litres per day) is higher than the approved Assimilative Capacity flow (120,096 litres per day) which is appropriate, but it is less than the calculated design flows for the project (132,133 litres per day) which is a problem.

- All reference have been updated to read "Total Daily Design Flow". As noted above, this is the flow used for sizing of the sewage treatment system.

- The Site Servicing Report discusses two 60,000 litre balancing tanks as part of the system, but it is not clear whether these tanks accommodate the peak hour surges or the peak day surges. We expect that is it the former.

- The balancing tanks will accommodate all peaks. They will provide approximately 1 days' worth of storage to help balance out any peaks. The sizing of the sewage treatment system is provided by the manufacturer (Waterloo Biofilter) and is based off of the total daily design flow as noted above.

- Typically, the collection system for wastewater flows is assumed to collect extraneous flows through groundwater leakage over time.

- The sanitary sewer design sheet does account for infiltration from groundwater but the sewage treatment system is designed based on total daily design flow.

- The design submission should include backup power supply and an overflow design for rare emergency occasions.

- None of the site services will consist of backup power including the water supply system. If the power goes out, the water still be shut down resulting in no additional sewage being produced during that time. With that being said, there is approximately 1 days' worth of storage within the sewage treatment system and if necessary, sewage could be collected and disposed of off-site by a septic disposal company.

Water Supply

A total of 4 wells are proposed, each having a capacity of 91 L/m. This will allow 3 wells to supply the maximum day demand of 270 L/m (different units of measurement are used, but this is the same as 389,283 litres per day as discussed in the wastewater section) and the 4th well is a backup.

However, a water treatment system has been selected with a capacity of 151 L/m, meaning that running more than 2 of the 4 wells will exceed the capacity of the treatment system. The treatment capacity totals 217,400 litres over a 24 hour period (i.e. 151 L/m over 24 hours). This is supplemented with Day Tanks, holding an additional volume of 66,284 litres, but still the daily treatment together with the Day tanks is insufficient to supply the Maximum Day demand of 389,283 litres as reported.

- Of the 4 wells, only 2 will work simultaneously. The wells will work in pairs and alternate duty while sufficiently supplying the water treatments system with sufficient flow.

  A water treatment system with a capacity greater than 151L/min is considered to be cost prohibitive. As a result, day tanks are proposed to store treated/potable water to account for the MDD and PHD of the system.

We did not review the fire flow calculations in detail but would do so at the request of the Fire Department or Building Department. We suggest that an alarm should be placed on the fire protection system to signify if the levels in the tanks were to drop (due to leakage).

- A note has been added to the Fire Water Storage Plan indicating that a water level alarm be installed on system to alert the operator when the level drops below the minimum allowable.

Stormwater Management

In our search for the rated capacity of the existing wastewater system we became aware of Certificate of Approval Number 0065-5QEJDE, issued on September 18, 2003 to Mansfield Ski Club. The works are described on drawing prepared by Stantec Consulting which we were unable to access, but it appears to apply to the existing snow making pond. This historic Certificate of Approval needs to be incorporated into the current ECA application with MECP.

- Acknowledged

There is a very brief mention of an ‘existing dry pond/basin’ located upstream of the subject lands where runoff is supposedly attenuated. Is this an engineered facility? Is it a private or public pond? Is there a risk of this pond failing and flooding the subject lands? Further information is required.

- As confirmed through email correspondence, the existing dry pond/basin located on Municipal #628189 (owned by the proponent) has been decommissioned.

Residents living downstream of the 15 Sideroad outlet have expressed concern with the duration of runoff coming from the Ski Club area. In general, their watercourse contains physical restrictions and they claim that their properties are wet for increasingly longer periods of time. Commentary should be provided on the duration of release from the subject lands. While the proposed pond is effective at shaving down peak flows the duration of release is extended beyond predevelopment levels. Also, the diversion of drainage from Area 2 to Area 1 will further extent the duration of runoff. Snow melt from the ski hill may be yet another factor. All of this may be mitigated with increased infiltration.

- The proposed dry detention basin will attenuate all contributing runoff from both the site and external lands upstream as per the Townships request. Extended detention will be provided within the basin during all storm events which will draw down over a period of 13.6hrs. Considering the above and that all peak flows will be attenuated to less than pre-development levels, the downstream drainage conditions should see improvements from the existing condition.

Capacity calculations should be provided for the downstream cross culverts on 15 SR. At least one of them (an 800 mm diameter CSP) is smaller than the proposed outlet pipe from the SWM pond.

- The proposed 900mm outlet pipe from the SWM basin is a result of the available slope (1.0%). The downstream 800mm CSP has a slope of 4.0%. Regardless, it is important to note that all post-development peak flows will be reduced to less than that of the pre-development condition. As a result, our hydrologic and hydraulic analyses have been limited to the existing site outlet at the limit of the subject lands.

The Dry Detention Basin should have a sediment forebay to facilitate clean-out, particularly when the parking areas are gravel.

- A sediment forebay is proposed within the Dry Detention Basin.

Proposed Fill on Top of Ski Hill

Some of the submission makes passing reference to adding 25m of fill to the top of the existing ski hill. It is not clear whether or not this endeavor is still intended, as no details have been provided. Confirmation is required either way. If it is still intended then there will be a need to provide proposed elevations, indicate how drainage will be addressed and what measures will be required for erosion and sediment control. Sufficient details will be required to share with adjacent property owners. Construction details such as trucking routes for the fill, impact on roads, dust management etc. will need to be provided.

- A plan for the proposed Ski Hill Fill Area has been prepared by others and will be provided for your review.

Traffic Opinion Letter

The WMI letter of August 9, 2017 explains that there are 356 existing parking spaces provided at the site, and that a 2015 document entitled Mansfield Ski Club Master Plan has determined that such parking capacity is insufficient. (That document is not provided, nor is there any indication of the extent to which it was considered insufficient). As result of this determination, and in response to the proposed expansions contained within the subject proposal, an additional 4 parking spaces are proposed. In my opinion, this number is too small to matter and does not represent a solution to a stated deficiency. Surely the additional employees alone that will work in the commercial spaces and service the accommodation units will take up more than 4 spaces.

The letter then opines that any potential increase in traffic will be directly related to the increase in proposed parking spaces. In my opinion, that simply extends the flawed rationale for parking into another area of consideration. Fulsome analysis is required to determine whether or not upgrades are required for external roads in order to accommodate the proposed use.

- The Traffic Opinion Letter has been updated to reflect the recent discussions/clarification provided by the ski hill related to available parking, hill capacity constraints as well as the inherent traffic benefits the proposed re-development will provide.

Engineering Drawings

Overall Site Plan SP-1

This overall drawing is quite helpful
The area at the top of the ski hill contains a notation for a retaining wall, without any further design or grading detail. As noted previously it appears that raising the top of the ski hill is no longer part of the proposal.

- A plan for the proposed Ski Hill Fill Area has been prepared by others and will be provided for your review.

Site Plan SP-2

This drawing shows a future residence which does not appear in other drawings or background reports. It should either be removed from the drawings that are being put forward for approval or it should be appropriately described and supported.
There is a retaining wall detail provided for retaining walls up to 2.5m in height. It has been my experience that such walls require non-climbable fences at the top in order to comply with the Ontario Building Code. Fencing details should be provided on all retaining walls as part of the Site Plan approval.

- The Site Plan was prepared by others and has been updated accordingly.

  Fencing/Railing details will be provided at the building permit stage. A note has been added to the site plan drawings and the engineering drawings indicating this requirement.

Site Grading Plan North   SGRN

The Stormwater Management concept involves the diversion of runoff from Area 2 into Area 1. Much of this diversion area appears to be in the vicinity of the “Existing Mansfield Ski Chalet”. However, the concept does not appear to be well supported on the grading plan. There is a single catchbasin draining water to Area 1, and it is located on a side slope that does assist in the capture of water. There are other inconsistencies as well between the boundary reported in the stormwater report and that shown on the grading drawings.

- The single catch basin has been removed and the drainage areas have been updated to match that of the grading design.

Site Grading Plan South SGRS

It is proposed to pave the new driveway without replacement of the existing driveway culvert. It should be inspected and approved by the Director of Public Works prior to paving and replaced if deemed necessary.

- A note has been added to the SGRS plan.

Stormwater Management Facility Plan

Why is fill being added to raise the floor the ponds above existing ground elevations? The existing ground drains adequately to the proposed pond outlet, so at best filling seems to serve no purpose and it reduces the amount of storage provided. Our previous comment about the need for a sediment forebay should be considered in conjunction with the questioning of the fill.

- As per Gord Feniak’s email dated Monday October 26, 2020 this comment has been resolved.

Should you have any questions or require further clarification, please do not hesitate to contact the undersigned.

Respectfully submitted,

WMI & Associates Limited

Andrew Windrem

Andrew Windrem

Jeremy W. Lightheart, P. Eng.

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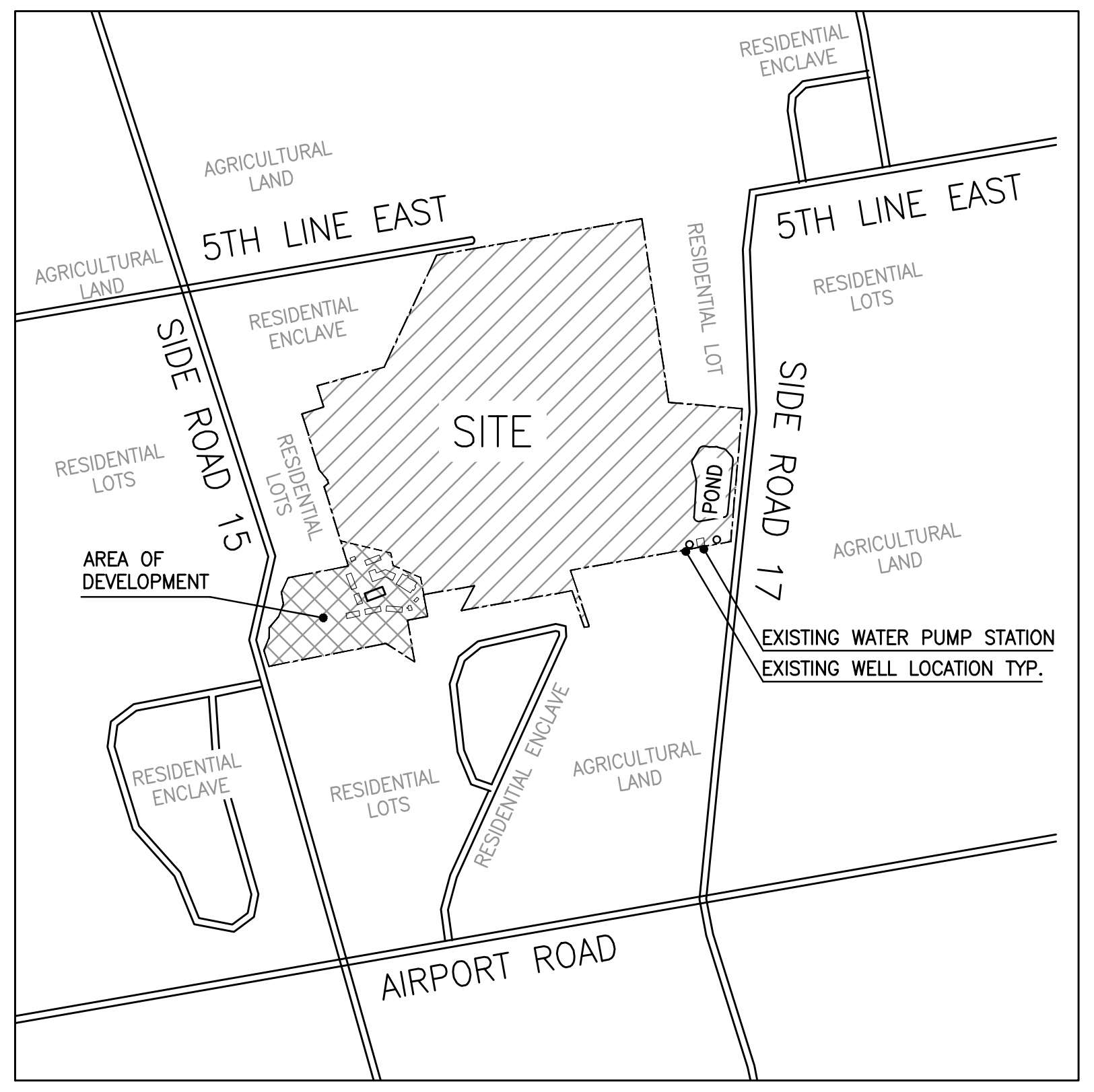
CONTEXT PLAN



MANSFIELD SKI CLUB

628213 SIDE ROAD 15
Mulmur, ON L9V 0T9

PROJECT TEAM

CLIENT

Mansfield Ski Club
628213 Side Road 15
Mulmur, ON L9V 0T9

ARCHITECT

+VG Architects
72 Stafford Street, Suite 200
Toronto, ON M6J 2R9

LANDSCAPE ARCHITECT

Fleisher Ridout Partnership Inc.
1877 Davenport Road
Toronto, ON M6N 1B9

CIVIL ENGINEER

WMI & Associates Limited
119 Collier Street
Barrie, ON L4M 1H5

ELECTRICAL ENGINEER

Runge Engineering
864 Hurontario Street
Collingwood, ON L9Y 3Z7

INDEX OF SHEETS

LEGEND

FLEISHER RIDOUT
PARTNERSHIP INC.
l.a.n.d.s.c.a.p.e a.r.c.h.i.t.e.c.t.s
1877 Davenport Road
Toronto, Ontario, M6N 1B9
T: (416) 533-4990

ISSUE	DATE	REMARKS
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2	AUGUST 14, 2020	ISSUED FOR 2ND SITE PLAN APPROVAL
1	FEBRUARY 4, 2020	ISSUED FOR SITE PLAN APPROVAL

ONTARIO ASSOCIATION OF LANDSCAPE ARCHITECTS
B.J. FLEISHER
MEMBER

N

Project Name:
MANSFIELD SKI CLUB
628213 SIDE ROAD 15
Mulmur, ON L9V 0T9

Drawing Title:
COVER SHEET

Drawn: JC	Design: BF	Date: JANUARY 2020
Checked: BF	Apprvd: BF	Scale: NTS
CADD File: 151352		Dwg. No.: SP.0

LEGEND

—··—··—	PROPERTY LINE
—·—·—·—	PROPOSED FIRE TRUCK ACCESS ROUTE
◀	ENTRANCE
⊙⊙	EXISTING TREE TO REMAIN
○	EXISTING TREE GROUPING TO REMAIN
——	TREE HOARDING

GENERAL NOTES:

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SNOW-MAKING POND NOTES:

1. EXISTING MELTWATER POND SUBJECT TO CERTIFICATE OF APPROVAL NO. 0065-5QEJDE.
2. MAINTENANCE TO BE PERFORMED ON EXISTING MELTWATER POND PRIOR TO COMPLETION OF PROPOSED SNOW-MAKING POND. MAINTENANCE TO INCLUDE SILT REMOVAL AND REMOVAL OF INVASIVE GRASSES AND SHRUBS (PHRAGMITES, ETC.) TO THE SATISFACTION OF THE OWNER AND NVCA. REGULAR MAINTENANCE SCHEDULE TO BE ESTABLISHED PRIOR TO COMPLETION OF CONSTRUCTION.

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B. J. FLEISHER
MEMBER

Project Name:
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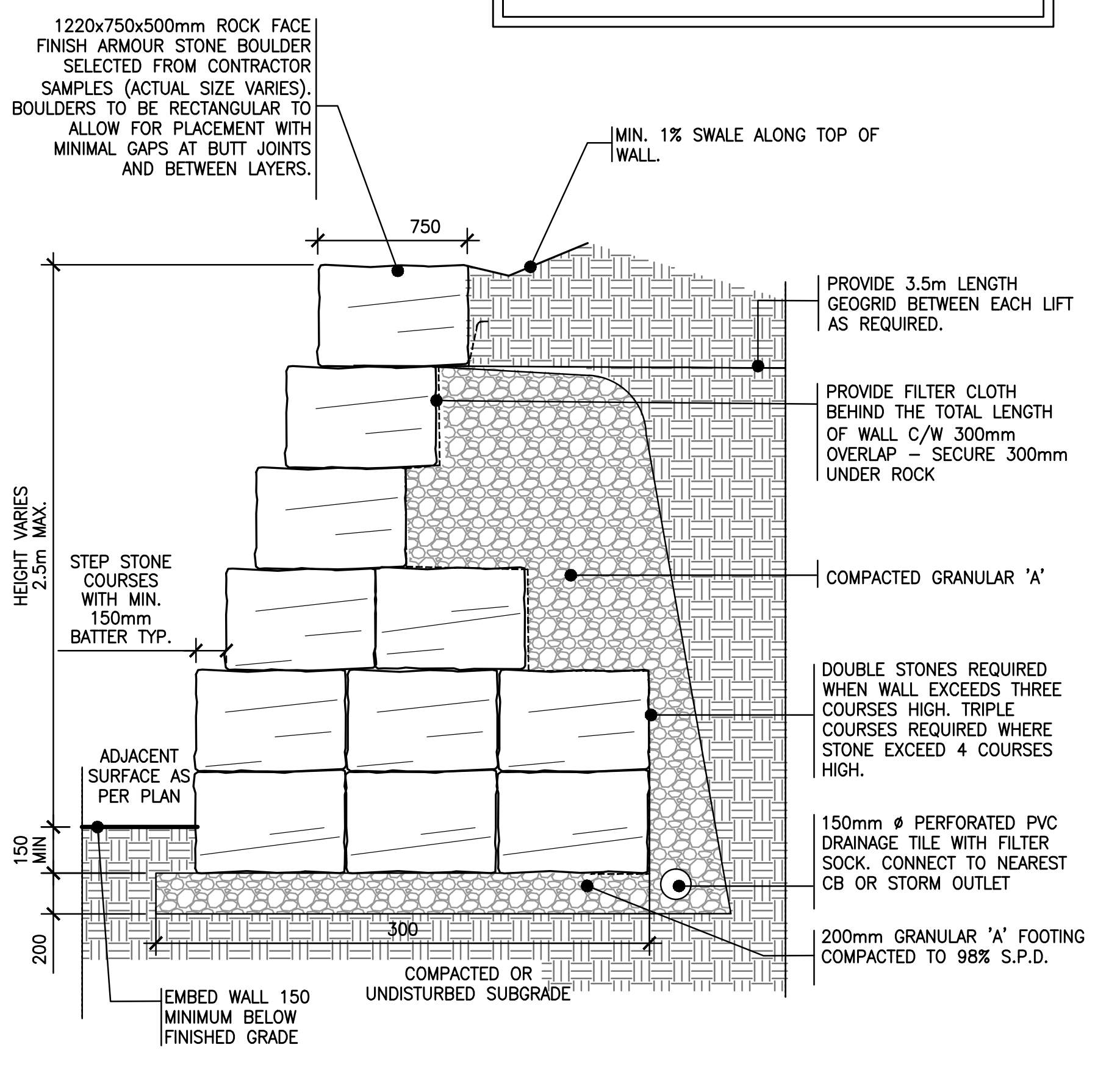
Mulmur, ON L9V 0T9

Drawing Title:
OVERALL SITE PLAN

Drawn: JC	Design: BF	Date: JANUARY 2020
Checked: BF	Apprvd: BF	Scale: NTS
CADD File: 151352		Dwg. No.: SP.1

NOTE:
RETAINING WALL DETAIL IS SCHEMATIC TO SHOW DESIGN INTENT FOR TENDER PRICING PURPOSES ONLY. THE AWARDED CONTRACTOR IS TO PROVIDE DETAILED AND COMPLETE SHOP DRAWINGS DESIGNED AND STAMPED BY A PROFESSIONAL ENGINEER REGISTERED IN THE PROVINCE OF ONTARIO FOR CONSULTANT REVIEW AND APPROVAL PRIOR TO INSTALLATION.



ARMOUR STONE WALL TO 2500mm 1:60

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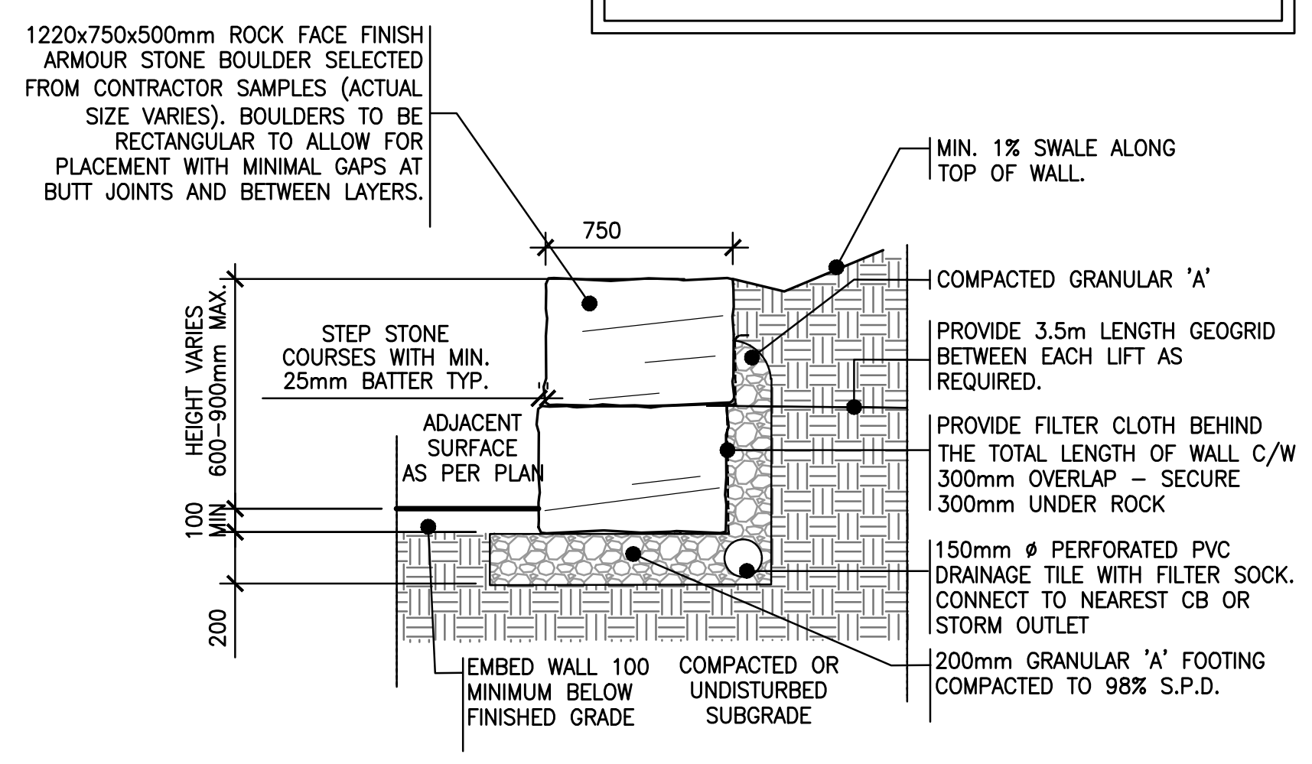
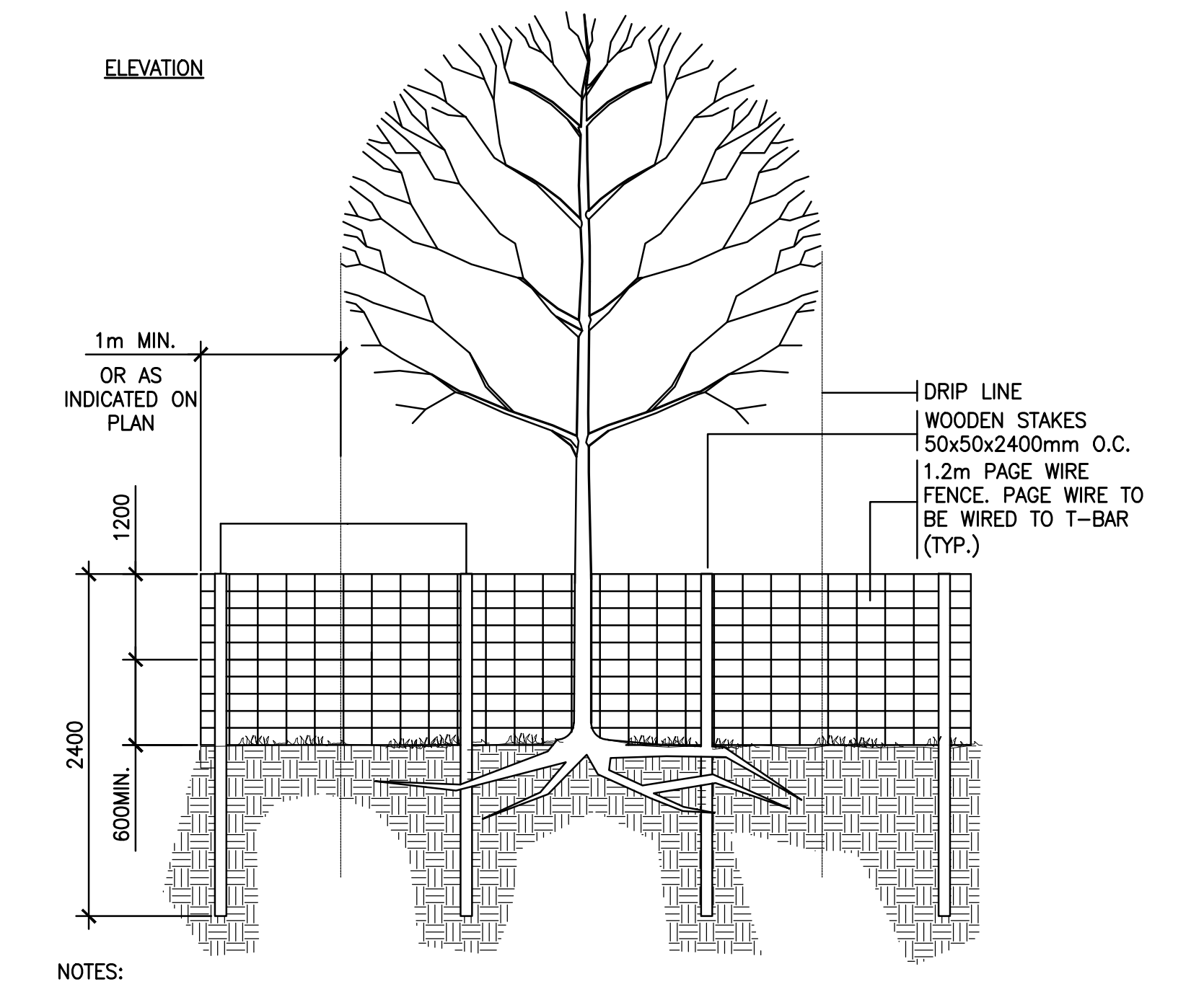
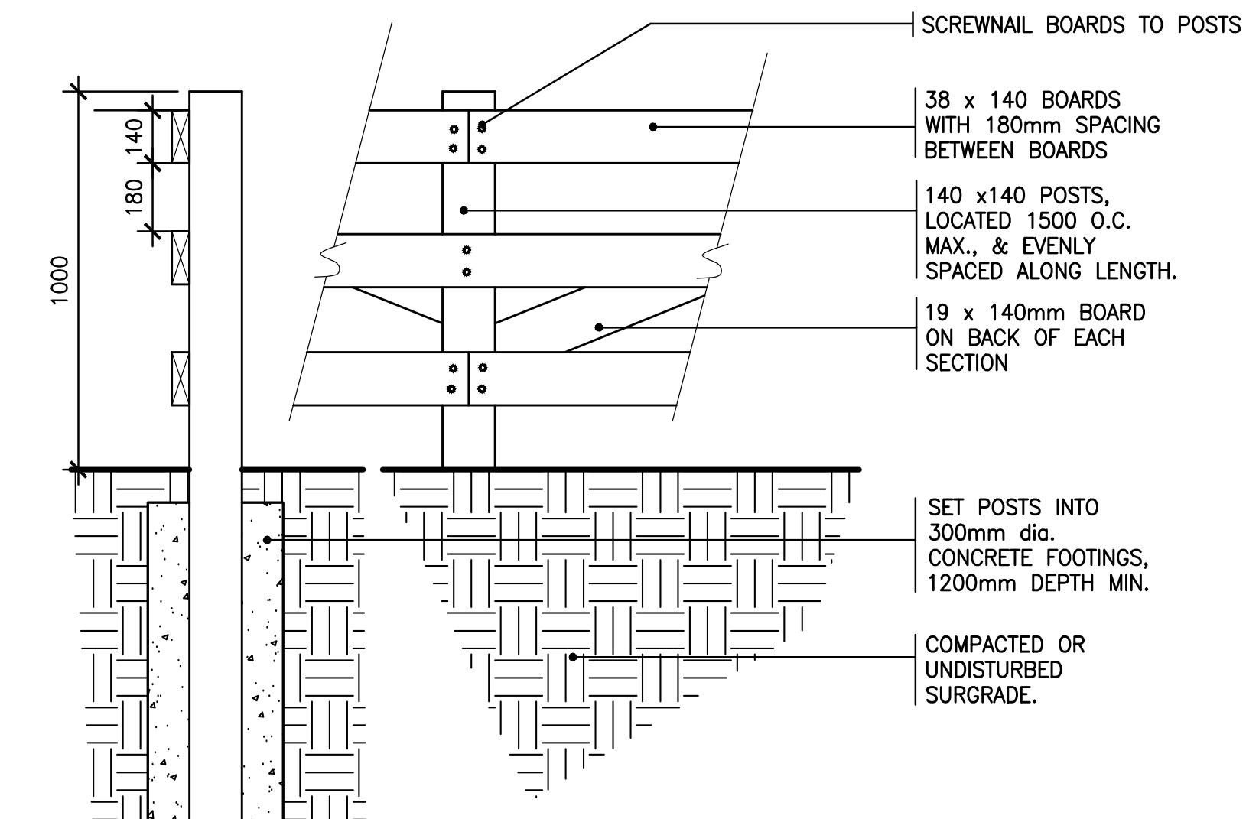


ARMOUR STONE WALL TO 900mm 1:30



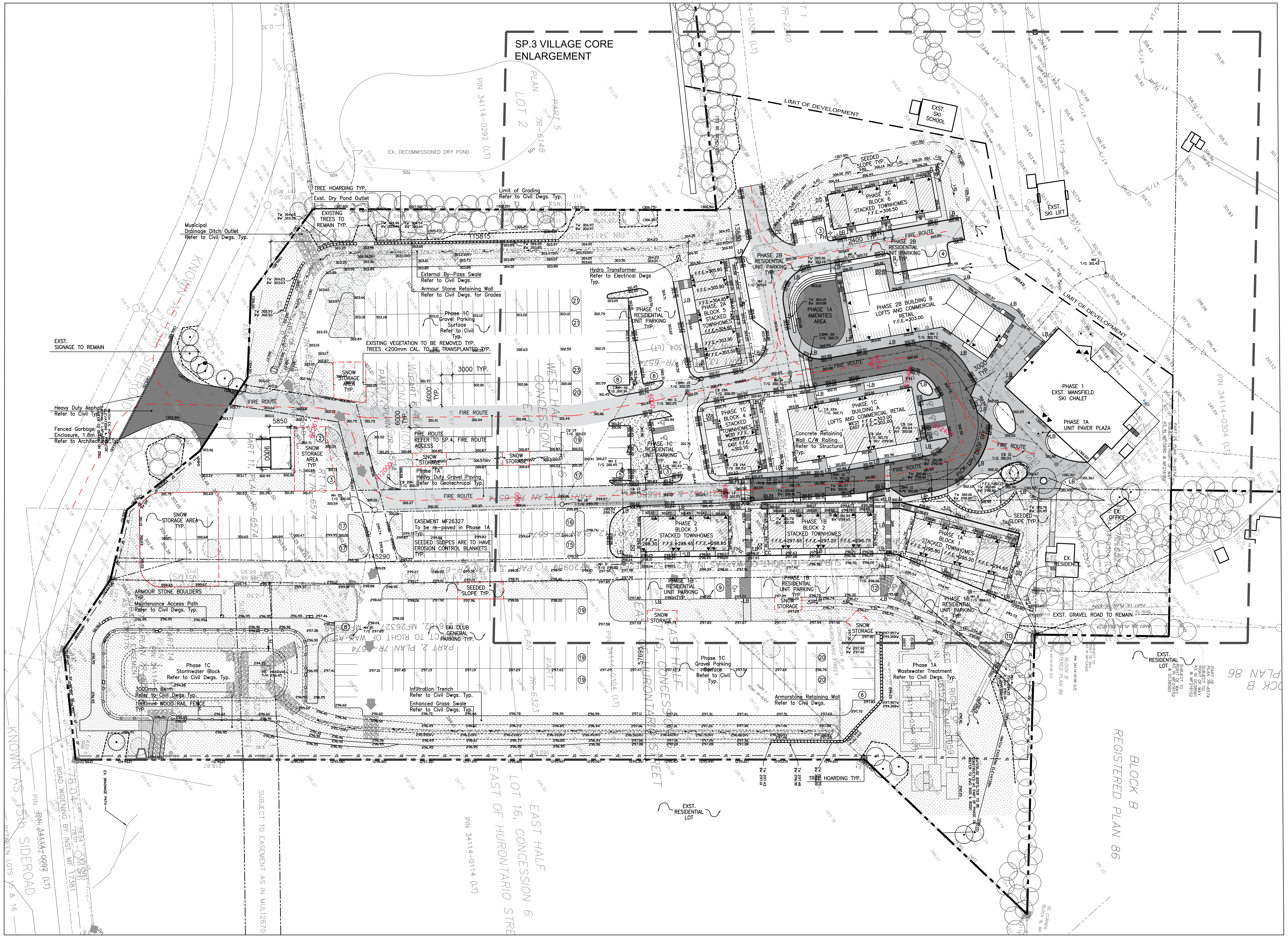
NOTES:
1. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
2. IT IS THE CONTRACTOR'S RESPONSIBILITY TO OBTAIN LOCATES OF ALL EXISITNG UTILITIES AND SERVICING PRIOR TO INSTALLING HOARDING.
3. DO NOT DAMAGE VISIBLE TREE ROOTS WHEN INSTALLING T-BARS.
4. HOARDING MUST BE MAINTAINED IN SOUND CONDITION THROUGH ALL PHASES OF CONSTRUCTION UNTIL APPROVAL TO REMOVE HOARDING IS OBTAINED FROM THE LANDSCAPE ARCHITECT.
5. ATTACHMENT OF FENCE TO TREES TO BE PRESERVED IS NOT ALLOWED.
6. ENSURE FENCE IS LOCATED BEYOND THE DRIPLINE OF TREES TO BE PRESERVED.
7. FENCING TO BE INSTALLED PRIOR TO START OF CONSTRUCTION.

TREE PROTECTION HOARDING 1:50



NOTES
1) WOOD TO BE NO.1 GRADE PRESSURE TREATED PINE.
2) ALL WOOD TO RECEIVE 2 COATS OF OLYMPIC SOLID COLOUR STAIN, WHITE.
3) ALL FASTENERS TO BE GALVANIZED.

1000mm WOOD RAIL FENCE 1:20



BUILDING STATISTICS

	BUILDING AREA	# OF RESIDENTIAL UNITS	RESIDENTIAL AREA	OFFICE AND PERSONAL SPACE	DEVELOPMENT PHASE
BUILDING 'A'	630.0m^2	10	1,260.0m^2	882.0m^2	1
BUILDING 'B'	780.0m^2	15	1,402.0m^2	938.0m^2	2
BLOCK-1	345.0m^2	12	1,170.0m^2		1
BLOCK-2	345.0m^2	12	1,170.0m^2		1
BLOCK-3	290.0m^2	10	972.0m^2		2
BLOCK-4	230.0m^2	8	780.0m^2		1
BLOCK-5	345.0m^2	12	1,170.0m^2		2
BLOCK-6	345.0m^2	12	1,170.0m^2		2
TOTAL	**3,310.0m^2**	**91**	**9,252.0m^2**	**1,725.0m^2**	

*NOTE: ALL BUILDING STATISTICS TO GROSS ALL AREAS UP BY 20% TO ACCOUNT FOR SERVICE AREAS

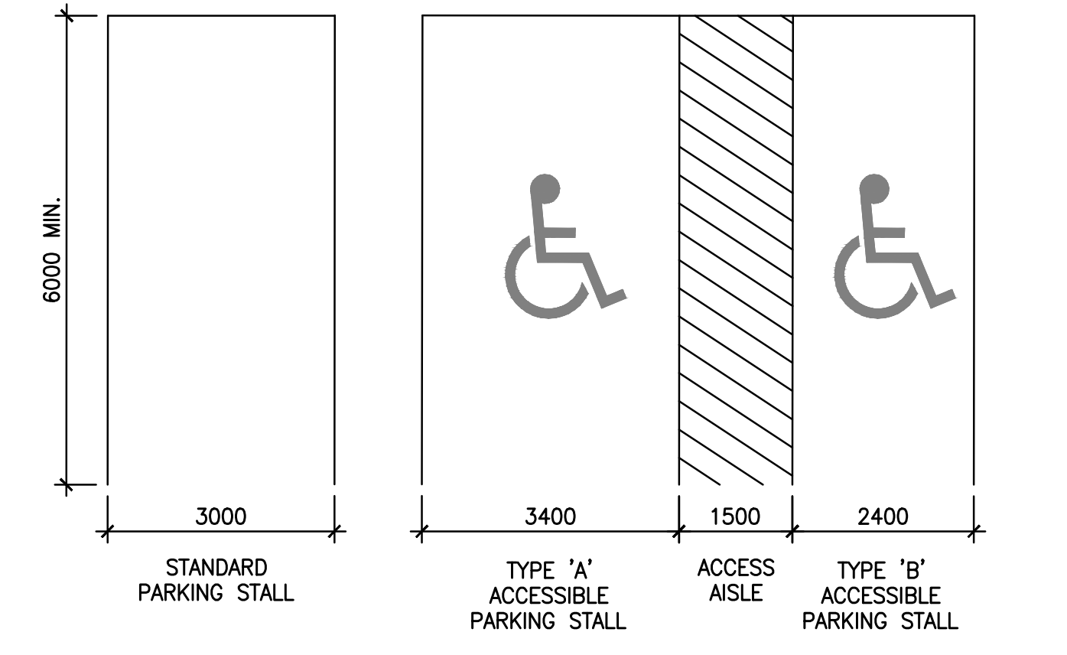
PARKING STATISTICS

TOTAL PROPOSED PARKING STALLS	371
TOTAL PROPOSED ACCESSIBLE PARKING STALLS	9

*NOTE: AISLES AND LANEWAYS ON–SITE ARE TO BE A MINIMUM OF 3m AND A MAXIMUM OF 9m IN WIDTH.

FIRE ROUTES ARE TO BE A MINIMUM OF 6m IN WIDTH. CENTRELINE RADIUS TO BE 12m MINIMUM.

PARKING STALL STANDARD DIMENSIONS



NOTE: IN PAVED AREAS, ACCESSIBLE STALLS ARE TO BE MARKED WITH HIGH–CONTRAST PAINTED LINES AND SIGNAGE.
SIGNAGE IS TO BE PROVIDED IN GRAVEL PARKING AREAS.

SIGNAGE FOR TYPE 'A' STALLS MUST IDENTIFY THE STALL AS 'VAN ACCESSIBLE.'

LEGEND

━ ▪ ▪ ━	PROPERTY LINE
FIRE ROUTE	PROPOSED FIRE TRUCK ACCESS ROUTE
—— v — — — ——	WATER SERVICE LINE
— SAN — SAN —	SANITARY SEWER LINE
➡	OVERLAND FLOW
◀	ENTRANCE
— x —— x —— x —	1M HT. FENCE
♿	ACCESSIBLE PARKING
▨	PAINTED LINES
▒	UNIT PAVING
░	CONCRETE SIDEWALK
▓	HEAVY DUTY ASPHALT
░	SOD
░	SEEDED AREA
8	NEW LIGHT STANDARD
⌖	NEW FIRE HYDRANT
◇	BOULDER
B	BOLLARD
CD	CURB DEPRESSION
CC	CURB CUT
⊠	NEW HYDRO TRANSFORMER
⊙	EXISTING TREE TO REMAIN
⊙	EXISTING TREE TO BE TRANSPLANTED ON SITE
○	EXISTING TREE GROUPING TO REMAIN
○	EXISTING TREE GROUPING TO BE REMOVED
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9. RETAINING WALLS EXCEEDING 1000mm TO HAVE HAND RAIL OR FENCE. RETAINING WALL AND HANDRAIL DETAIL TO BE INCLUDED IN BUILDING PERMIT APPLICATION.

FLEISHER RIDOUT PARTNERSHIP INC.
l.a.n.d.s.c.a.p.e a.r.c.h.i.t.e.c.t.s
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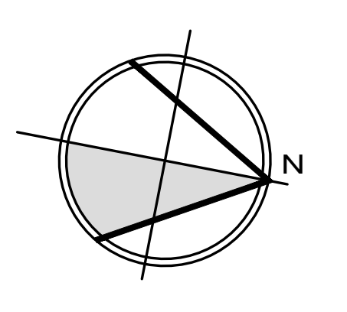
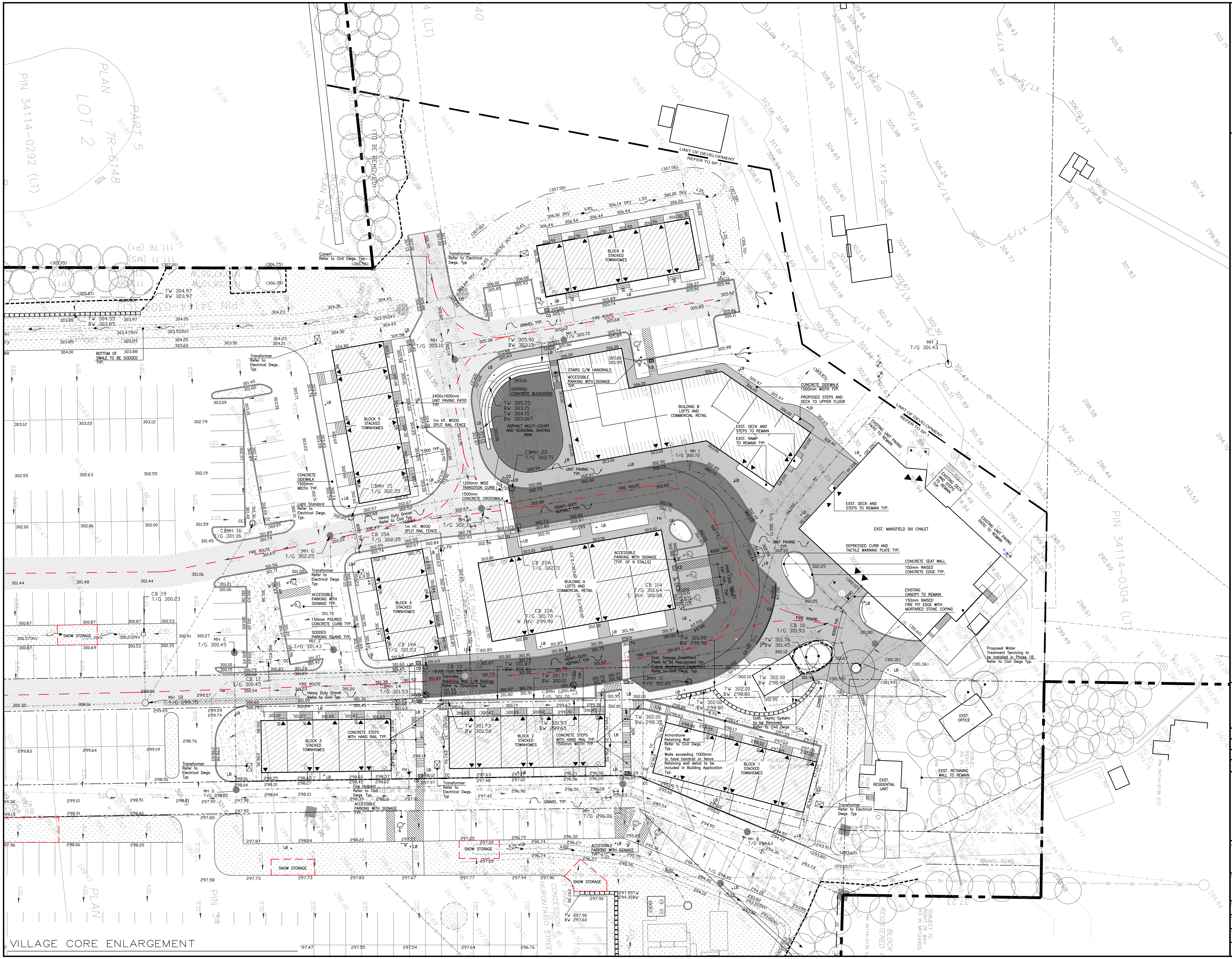
B. J. FLEISHER
MEMBER



Project Name:
MANSFIELD SKI CLUB
628213 SIDE ROAD 15
Mulmur, ON L9V 0T9

Drawing Title:
SITE PLAN

Drawn: JC
Design: BF
Date: JANUARY 2020
Checked: BF
Apprvd: BF
Scale: 1:500
CADD File: 151352
Dwg. No.: SP.2



VILLAGE CORE ENLARGEMENT

LEGEND

- PROPERTY LINE
- FIRE ROUTE — PROPOSED FIRE TRUCK ACCESS ROUTE
- WATER SERVICE LINE
- SANITARY SEWER LINE
- ◀ ENTRANCE
- 1M HT. WOOD SPLIT RAIL FENCE
- ♿ ACCESSIBLE PARKING
- ▨ PAINTED LINES
- UNIT PAVING
- CONCRETE SIDEWALK
- HEAVY DUTY ASPHALT
- SOD
- SEEDED AREA
- PROPOSED LIGHT STANDARD
- PROPOSED FIRE HYDRANT
- BOULDER
- LB LIGHT BOLLARD
- CD CURB DEPRESSION
- CC CURB CUT
- ☒ PROPOSED HYDRO TRANSFORMER Refer to Electrical
- EXISTING TREE TO REMAIN
- EXISTING TREE GROUPING TO REMAIN
- TREE HOARDING

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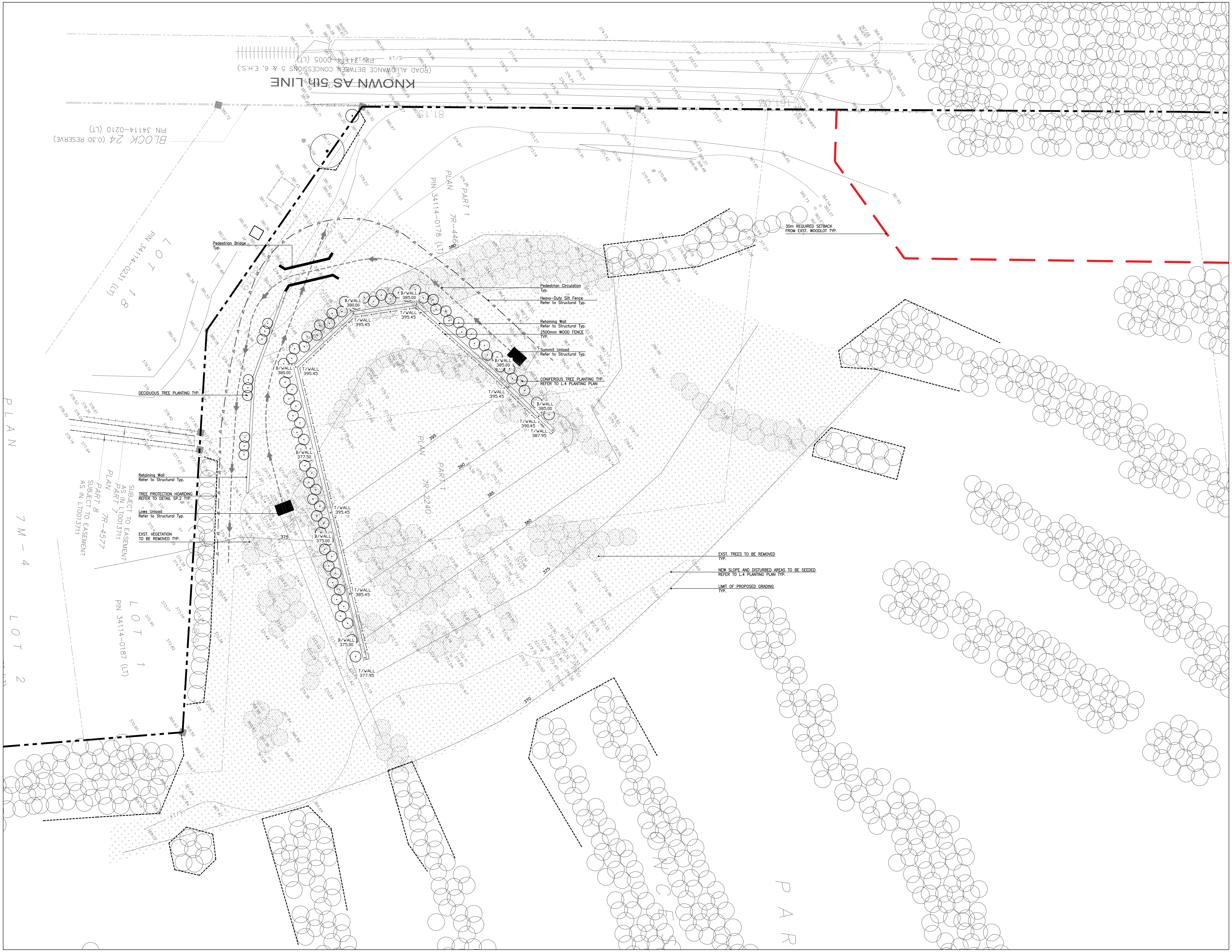
B.J. FLEISHER
ONTARIO ASSOCIATION OF LANDSCAPE ARCHITECTS MEMBER

N

Project Name:
MANSFIELD SKI CLUB
628213 SIDE ROAD 15
Mulmur, ON L9V 0T9

Drawing Title:
VILLAGE CORE SITE PLAN

Drawn: JC
Design: BF
Date: JANUARY 2020
Checked: BF
Apprvd: BF
Scale: 1:250
CADD File: 151352
Dwg. No.: SP.3



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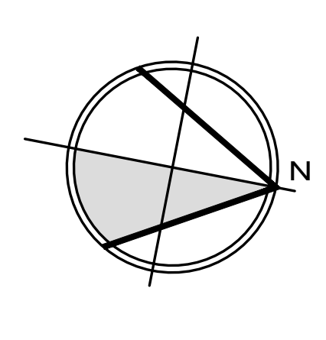
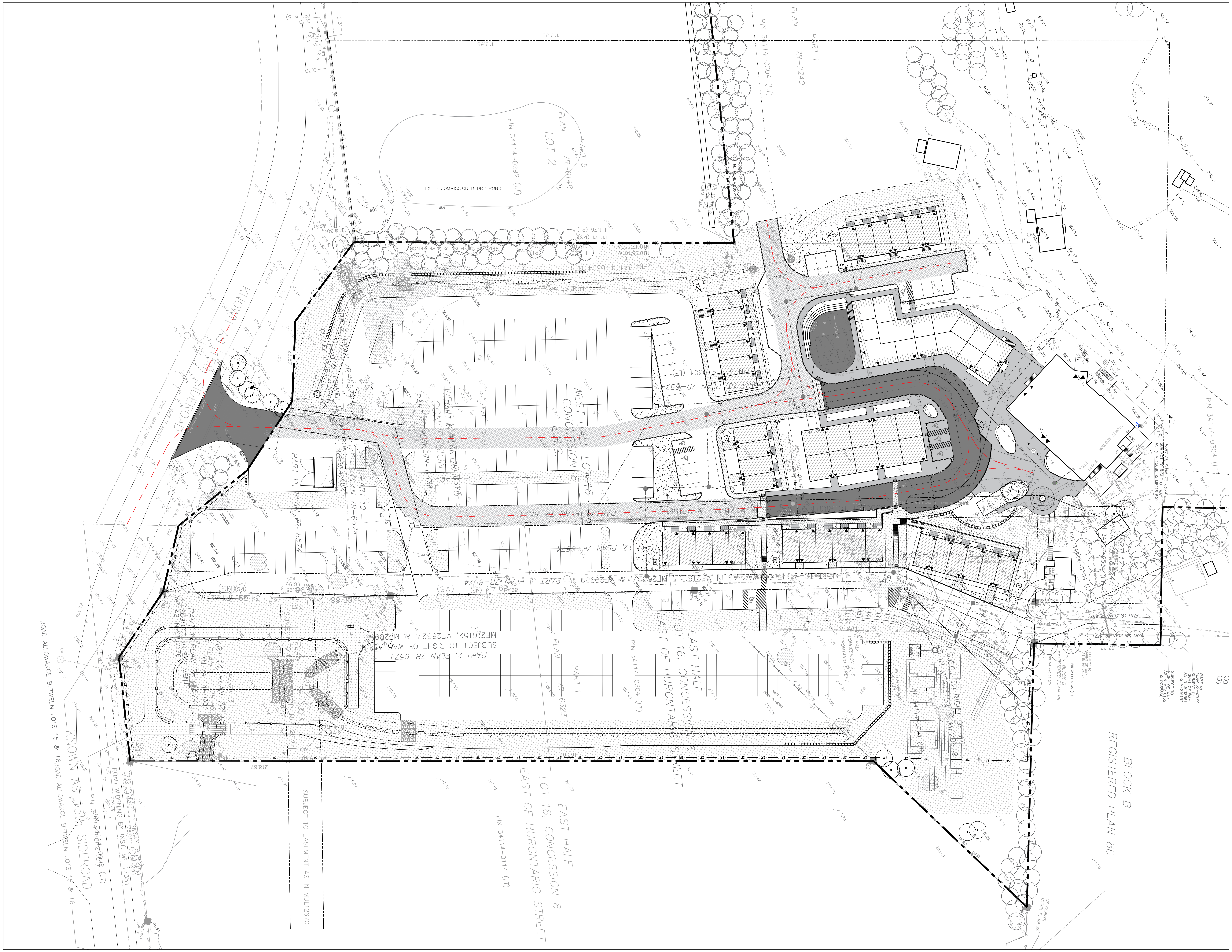
ONTARIO ASSOCIATION OF LANDSCAPE ARCHITECTS
MEMBER



Project Name:
MANSFIELD SKI CLUB
628213 SIDE ROAD 15
Mulmur, ON L9V 0T9

Drawing Title:
SKI HILL

Drawn: JC
Design: BF
Date: JANUARY 2020
Checked: BF
Apprvd: BF
Scale: 1:400
CADD File: 151352
Dwg. No.: SP.4



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7. CONTRACTOR TO ENSURE POSITIVE DRAINAGE FROM ALL STRUCTURES.
8. CONTRACTOR TO MAKE GOOD ALL DAMAGE TO ANY EXISTING OR ADJACENT CONDITIONS/ STRUCTURES DURING CONSTRUCTION TO THE SATISFACTION AND ACCEPTANCE OF THE CONSULTANT.

FLEISHER RIDOUT
PARTNERSHIP INC.
l.a.n.d.s.c.a.p.e a.r.c.h.i.t.e.c.t.s
1877 Davenport Road
Toronto, Ontario, M6N 1B9
T: (416) 533-4990

ISSUE	DATE	REMARKS
3	DECEMBER 10, 2020	ISSUED FOR 3RD SITE PLAN APPROVAL
2	AUGUST 14, 2020	ISSUED FOR 2ND SITE PLAN APPROVAL
1	FEBRUARY 4, 2020	ISSUED FOR SITE PLAN APPROVAL

B. J. FLEISHER
MEMBER

N

Project Name:
MANSFIELD SKI CLUB
628213 SIDE ROAD 15
Mulmur, ON L9V 0T9

Drawing Title:
FIRE ROUTE ACCESS

Drawn: JC	Design: BF	Date: JANUARY 2020
Checked: BF	Apprvd: BF	Scale: 1:400
CADD File: 151352		Dwg. No.: SP.5

FIRM NAME:
+VG ARCHITECTS
72 STAFFORD STREET, SUITE 200, TORONTO, ONTARIO, M6J 3L1
T:416-588-6370
F: 416-588-6327
CERTIFICATE OF PRACTICE NUMBER:
3356
Name of Project:
MANSFIELD SKI CLUB
Location: MULMUR TOWNSHIP – DUFFERIN COUNTY

PROJECT DESCRIPTION: NEW 3-STOREY, TWELVE-PLEX, DWELLING UNITS		O.B.C. REFERENCE:
BLOCK 1		PART 9 / PART 3
MAJOR OCCUPANCY(s):	RESIDENTIAL – GROUP C	9.10.2.1 & 3.2.2.47
BUILDING AREA (M^2) (FOOTPRINT):	GROUND FLOOR: TOTAL 345.0M^2	1.4.1.2
GROSS AREA (M^2):	BASEMENT FLOOR: 345.0M^2 GROUND FLOOR: 345.0M^2 SECOND FLOOR: 240.0M^2 THIRD FLOOR: 240.5M^2 TOTAL: 1,170.0M^2	1.4.1.2
NUMBER OF STOREYS	ABOVE GRADE: 3 BELOW GRADE: 1	1.4.1.2
HEIGHT OF BUILDING (M^2)	14M	1.4.1.2
NUMBER OF STREETS / ACCESS ROUTES:	ONE STREET	3.2.2.47
BUILDING CLASSIFICATION:	RESIDENTIAL, GROUP C, UP TO 3 STOREYS	3.2.2.47
SPRINKLER SYSTEM:	NOT REQUIRED	3.2.2.47
STANDPIPE:	NOT REQUIRED	3.2.9
FIRE ALARM:	NOT REQUIRED	9.10.18.2(2) & 3.2.4.1
WATER SERVICE / SUPPLY IS ADEQUATE:	YES	9.31.3 & 3.7.4
HIGH BUILDING	NO	3.2.6
CONSTRUCTION:	COMBUSTIBLE	3.2.2.47
MEZZANINE(S):	N/A	9.10.4.1 & 3.2.8
TOTAL OCCUPANCY LOAD:	GROUND FLOOR: 12 PERSONS FIRST FLOOR: 12 PERSONS SECOND FLOOR: 12 PERSONS THIRD FLOOR: 12 PERSONS TOTAL: 48 PERSONS	9.9.1.3 & 3.1.17
PLUMBING FACILITIES:	YES	9.31.4 & 3.7.4
BARRIER-FREE DESIGN:	YES	9.5.2.1(2) & 3.8.1.1
HAZARDOUS MATERIALS:	NO	9.10.1.3(4) & 3.3.1.2
TRAVEL DISTANCE:	EGRESS FROM DWELLING UNITS	9.9.9.1, 9.9.8.6 & 3.3.4.4
FIRE EXTINGUISHERS:	NOT REQUIRED	9.10.20.4 & 3.2.5.17
SMOKE ALARMS:	REQUIRED	9.10.19 & 3.2.4.22
CARBON MONOXIDE ALARMS:	REQUIRED	9.33.4
SPATIAL SEPARATION – CONSTRUCTION OF EXTERIOR WALLS		9.10.14 & 3.2.3.1

WALL	E.B.F. (LARGEST FIRE COMP.)	L.D (m)	L/H OR H/L	PERMITTED MAX % OF OPENINGS	PROPOSED % OF OPENINGS	F.R.R. (HOURS)	TYPE OF CONST.	TYPE OF CLADDING
NORTH	58.8 sq.m	4.2	LESS THAN 3:1	22	20	1HR	COMBUST. OR NONCOMBUST.	NONCOMBUST.
SOUTH	58.8 sq.m	4.5	LESS THAN 3:1	29	25	45MIN.	COMBUST. OR NONCOMBUST.	NONCOMBUST.
EAST	29.4 sq.m	4.3	LESS THAN 3:1	35	30	45MIN.	COMBUST. OR NONCOMBUST.	NONCOMBUST.
WEST	29.4 sq.m	12.8	LESS THAN 3:1	100	80	45MIN.	COMBUST. OR NONCOMBUST.	COMBUST. OR NONCOMBUST.

REQUIRED FIRE RESISTANCE RATING FOR STRUCTURAL MEMBERS AND ASSEMBLIES (FRR):		9.10.8, 9.10.9 & 3.2.2.47
HORIZONTAL ASSEMBLIES FRR (HOURS): FLOORS: ROOF: MEZZANINE:	45 MIN NOT REQUIRED N/A	(1Hr) ASSEMBLY No.F6h, O.B.C. SB-3
VERTICAL ASSEMBLIES FRR (HOURS): TYPICAL DEMISING WALLS: DEMISING WALLS AT STAIRS:	45 MIN 45 MIN	(1Hr) ASSEMBLY No.W9b, O.B.C. SB-3 (1Hr) ASSEMBLY No.W9b, O.B.C. SB-3
CORRIDOR FRR (HOURS):	N/A	3.3.1.4
SUITE SEPARATION FRR (HOURS):	1 HR	3.3.4.2

BLOCK 1

FIRM NAME:
+VG ARCHITECTS
72 STAFFORD STREET, SUITE 200, TORONTO, ONTARIO, M6J 3L1
T:416-588-6370
F: 416-588-6327
CERTIFICATE OF PRACTICE NUMBER:
3356
Name of Project:
MANSFIELD SKI CLUB
Location: MULMUR TOWNSHIP – DUFFERIN COUNTY

PROJECT DESCRIPTION: NEW 3-STOREY, TWELVE-PLEX, DWELLING UNITS		O.B.C. REFERENCE:
BLOCK 2		PART 9 / PART 3
MAJOR OCCUPANCY(s):	RESIDENTIAL – GROUP C	9.10.2.1 & 3.2.2.47
BUILDING AREA (M^2) (FOOTPRINT):	GROUND FLOOR: TOTAL 345.0M^2	1.4.1.2
GROSS AREA (M^2):	BASEMENT FLOOR: 345.0M^2 GROUND FLOOR: 345.0M^2 SECOND FLOOR: 240.0M^2 THIRD FLOOR: 240.0M^2 TOTAL: 1,170.0M^2	1.4.1.2
NUMBER OF STOREYS	ABOVE GRADE: 3 BELOW GRADE: 1	1.4.1.2
HEIGHT OF BUILDING (M^2)	14M	1.4.1.2
NUMBER OF STREETS / ACCESS ROUTES:	ONE STREET	3.2.2.47
BUILDING CLASSIFICATION:	RESIDENTIAL, GROUP C, UP TO 3 STOREYS	3.2.2.47
SPRINKLER SYSTEM:	NOT REQUIRED	3.2.2.47
STANDPIPE:	NOT REQUIRED	3.2.9
FIRE ALARM:	NOT REQUIRED	9.10.18.2(2) & 3.2.4.1
WATER SERVICE / SUPPLY IS ADEQUATE:	YES	9.31.3 & 3.7.4
HIGH BUILDING	NO	3.2.6
CONSTRUCTION:	COMBUSTIBLE	3.2.2.47
MEZZANINE(S):	N/A	9.10.4.1 & 3.2.8
TOTAL OCCUPANCY LOAD:	BASEMENT FLOOR: 12 PERSONS GROUND FLOOR: 12 PERSONS SECOND FLOOR: 12 PERSONS THIRD FLOOR: 12 PERSONS TOTAL: 48 PERSONS	9.9.1.3 & 3.1.17
PLUMBING FACILITIES:	YES	9.31.4 & 3.7.4
BARRIER-FREE DESIGN:	YES	9.5.2.1(2) & 3.8.1.1
HAZARDOUS MATERIALS:	NO	9.10.1.3(4) & 3.3.1.2
TRAVEL DISTANCE:	EGRESS FROM DWELLING UNITS	9.9.9.1, 9.9.8.6 & 3.3.4.4
FIRE EXTINGUISHERS:	NOT REQUIRED	9.10.20.4 & 3.2.5.17
SMOKE ALARMS:	REQUIRED	9.10.19 & 3.2.4.22
CARBON MONOXIDE ALARMS:	REQUIRED	9.33.4
SPATIAL SEPARATION – CONSTRUCTION OF EXTERIOR WALLS		9.10.14 & 3.2.3.1

WALL	E.B.F. (LARGEST FIRE COMP.)	L.D (m)	L/H OR H/L	PERMITTED MAX % OF OPENINGS	PROPOSED % OF OPENINGS	F.R.R. (HOURS)	TYPE OF CONST.	TYPE OF CLADDING
NORTH	58.8 sq.m	4.5	LESS THAN 3:1	29	25	45MIN	COMBUST. OR NONCOMBUST.	NONCOMBUST.
SOUTH	58.8 sq.m	5.5	LESS THAN 3:1	41	40	45MIN.	COMBUST. OR NONCOMBUST.	NONCOMBUST.
EAST	29.4 sq.m	4.8	LESS THAN 3:1	58	55	45MIN.	COMBUST. OR NONCOMBUST.	NONCOMBUST.
WEST	29.4 sq.m	6	LESS THAN 3:1	83	80	45MIN.	COMBUST. OR NONCOMBUST.	COMBUST. OR NONCOMBUST.

REQUIRED FIRE RESISTANCE RATING FOR STRUCTURAL MEMBERS AND ASSEMBLIES (FRR):		9.10.8, 9.10.9 & 3.2.2.47
HORIZONTAL ASSEMBLIES FRR (HOURS): FLOORS: ROOF: MEZZANINE:	45 MIN NOT REQUIRED N/A	(1Hr) ASSEMBLY No.F6h, O.B.C. SB-3
VERTICAL ASSEMBLIES FRR (HOURS): TYPICAL DEMISING WALLS: DEMISING WALLS AT STAIRS:	45 MIN 45 MIN	(1Hr) ASSEMBLY No.W9b, O.B.C. SB-3 (1Hr) ASSEMBLY No.W9b, O.B.C. SB-3
CORRIDOR FRR (HOURS):	N/A	3.3.1.4
SUITE SEPARATION FRR (HOURS):	1 HR	3.3.4.2

BLOCK 2

FIRM NAME:
+VG ARCHITECTS
72 STAFFORD STREET, SUITE 200, TORONTO, ONTARIO, M6J 3L1
T:416-588-6370
F: 416-588-6327
CERTIFICATE OF PRACTICE NUMBER:
3356
Name of Project:
MANSFIELD SKI CLUB
Location: MULMUR TOWNSHIP – DUFFERIN COUNTY

PROJECT DESCRIPTION: NEW 3-STOREY, TEN-PLEX, DWELLING UNITS		O.B.C. REFERENCE:
BLOCK 3		PART 9 / PART 3
MAJOR OCCUPANCY(s):	RESIDENTIAL – GROUP C	9.10.2.1 & 3.2.2.47
BUILDING AREA (M^2) (FOOTPRINT):	GROUND FLOOR: TOTAL 290.0M^2	1.4.1.2
GROSS AREA (M^2):	BASEMENT FLOOR: 290.0M^2 GROUND FLOOR: 290.0M^2 SECOND FLOOR: 196.0M^2 THIRD FLOOR: 196.0M^2 TOTAL: 972.0M^2	1.4.1.2
NUMBER OF STOREYS	ABOVE GRADE: 3 BELOW GRADE: 1	1.4.1.2
HEIGHT OF BUILDING (M^2)	14M	1.4.1.2
NUMBER OF STREETS / ACCESS ROUTES:	TWO STREET	3.2.2.47
BUILDING CLASSIFICATION:	RESIDENTIAL, GROUP C, UP TO 3 STOREYS	3.2.2.47
SPRINKLER SYSTEM:	NOT REQUIRED	3.2.2.47
STANDPIPE:	NOT REQUIRED	3.2.9
FIRE ALARM:	NOT REQUIRED	9.10.18.2(2) & 3.2.4.1
WATER SERVICE / SUPPLY IS ADEQUATE:	YES	9.31.3 & 3.7.4
HIGH BUILDING	NO	3.2.6
CONSTRUCTION:	COMBUSTIBLE	3.2.2.47
MEZZANINE(S):	N/A	9.10.4.1 & 3.2.8
TOTAL OCCUPANCY LOAD:	BASEMENT FLOOR: 10 PERSONS GROUND FLOOR: 10 PERSONS SECOND FLOOR: 10 PERSONS THIRD FLOOR: 10 PERSONS TOTAL: 40 PERSONS	9.9.1.3 & 3.1.17
PLUMBING FACILITIES:	YES	9.31.4 & 3.7.4
BARRIER-FREE DESIGN:	YES	9.5.2.1(2) & 3.8.1.1
HAZARDOUS MATERIALS:	NO	9.10.1.3(4) & 3.3.1.2
TRAVEL DISTANCE:	EGRESS FROM DWELLING UNITS	9.9.9.1, 9.9.8.6 & 3.3.4.4
FIRE EXTINGUISHERS:	NOT REQUIRED	9.10.20.4 & 3.2.5.17
SMOKE ALARMS:	REQUIRED	9.10.19 & 3.2.4.22
CARBON MONOXIDE ALARMS:	REQUIRED	9.33.4
SPATIAL SEPARATION – CONSTRUCTION OF EXTERIOR WALLS		9.10.14 & 3.2.3.1

WALL	E.B.F. (LARGEST FIRE COMP.)	L.D (m)	L/H OR H/L	PERMITTED MAX % OF OPENINGS	PROPOSED % OF OPENINGS	F.R.R. (HOURS)	TYPE OF CONST.	TYPE OF CLADDING
NORTH	58.8 sq.m	5	LESS THAN 3:1	32	30	45MIN	COMBUST. OR NONCOMBUST.	NONCOMBUST.
SOUTH	58.8 sq.m	6.5	LESS THAN 3:1	57.6	50	45MIN.	COMBUST. OR NONCOMBUST.	NONCOMBUST.
EAST	29.4 sq.m	4.6	LESS THAN 3:1	51.5	45	45MIN.	COMBUST. OR NONCOMBUST.	NONCOMBUST.
WEST	29.4 sq.m	5.5	LESS THAN 3:1	76	70	45MIN.	COMBUST. OR NONCOMBUST.	COMBUST. OR NONCOMBUST.

REQUIRED FIRE RESISTANCE RATING FOR STRUCTURAL MEMBERS AND ASSEMBLIES (FRR):		9.10.8, 9.10.9 & 3.2.2.47
HORIZONTAL ASSEMBLIES FRR (HOURS): FLOORS: ROOF: MEZZANINE:	45 MIN NOT REQUIRED N/A	(1Hr) ASSEMBLY No.F6h, O.B.C. SB-3
VERTICAL ASSEMBLIES FRR (HOURS): TYPICAL DEMISING WALLS: DEMISING WALLS AT STAIRS:	45 MIN 45 MIN	(1Hr) ASSEMBLY No.W9b, O.B.C. SB-3 (1Hr) ASSEMBLY No.W9b, O.B.C. SB-3
CORRIDOR FRR (HOURS):	N/A	3.3.1.4
SUITE SEPARATION FRR (HOURS):	1 HR	3.3.4.2

BLOCK 3

FIRM NAME:
+VG ARCHITECTS
72 STAFFORD STREET, SUITE 200, TORONTO, ONTARIO, M6J 3L1
T:416-588-6370
F: 416-588-6327
CERTIFICATE OF PRACTICE NUMBER:
3356
Name of Project:
MANSFIELD SKI CLUB
Location: MULMUR TOWNSHIP – DUFFERIN COUNTY

PROJECT DESCRIPTION: NEW 3-STOREY, EIGHT-PLEX, DWELLING UNITS		O.B.C. REFERENCE:
BLOCK 4		PART 9 / PART 3
MAJOR OCCUPANCY(s):	RESIDENTIAL – GROUP C	9.10.2.1 & 3.2.2.47
BUILDING AREA (M^2) (FOOTPRINT):	GROUND FLOOR: TOTAL 230.0M^2	1.4.1.2
GROSS AREA (M^2):	BASEMENT FLOOR: 230.0M^2 GROUND FLOOR: 230.0M^2 SECOND FLOOR: 160.0M^2 THIRD FLOOR: 160.0M^2 TOTAL: 780.0M^2	1.4.1.2
NUMBER OF STOREYS	ABOVE GRADE: 3 BELOW GRADE: 1	1.4.1.2
HEIGHT OF BUILDING (M^2)	14M	1.4.1.2
NUMBER OF STREETS / ACCESS ROUTES:	THREE STREETS	3.2.2.47
BUILDING CLASSIFICATION:	RESIDENTIAL, GROUP C, UP TO 3 STOREYS	3.2.2.47
SPRINKLER SYSTEM:	NOT REQUIRED	3.2.2.47
STANDPIPE:	NOT REQUIRED	3.2.9
FIRE ALARM:	NOT REQUIRED	9.10.18.2(2) & 3.2.4.1
WATER SERVICE / SUPPLY IS ADEQUATE:	YES	9.31.3 & 3.7.4
HIGH BUILDING	NO	3.2.6
CONSTRUCTION:	COMBUSTIBLE	3.2.2.47
MEZZANINE(S):	N/A	9.10.4.1 & 3.2.8
TOTAL OCCUPANCY LOAD:	BASEMENT FLOOR: 8 PERSONS GROUND FLOOR: 8 PERSONS SECOND FLOOR: 8 PERSONS THIRD FLOOR: 8 PERSONS TOTAL: 32 PERSONS	9.9.1.3 & 3.1.17
PLUMBING FACILITIES:	YES	9.31.4 & 3.7.4
BARRIER-FREE DESIGN:	YES	9.5.2.1(2) & 3.8.1.1
HAZARDOUS MATERIALS:	NO	9.10.1.3(4) & 3.3.1.2
TRAVEL DISTANCE:	EGRESS FROM DWELLING UNITS	9.9.9.1, 9.9.8.6 & 3.3.4.4
FIRE EXTINGUISHERS:	NOT REQUIRED	9.10.20.4 & 3.2.5.17
SMOKE ALARMS:	REQUIRED	9.10.19 & 3.2.4.22
CARBON MONOXIDE ALARMS:	REQUIRED	9.33.4
SPATIAL SEPARATION – CONSTRUCTION OF EXTERIOR WALLS		9.10.14 & 3.2.3.1

WALL	E.B.F. (LARGEST FIRE COMP.)	L.D (m)	L/H OR H/L	PERMITTED MAX % OF OPENINGS	PROPOSED % OF OPENINGS	F.R.R. (HOURS)	TYPE OF CONST.	TYPE OF CLADDING
NORTH	58.8 sq.m	5	LESS THAN 3:1	32	30	45MIN	COMBUST. OR NONCOMBUST.	NONCOMBUST.
SOUTH	58.8 sq.m	8.6	LESS THAN 3:1	100	80	45MIN.	COMBUST. OR NONCOMBUST.	NONCOMBUST.
EAST	29.4 sq.m	4.8	LESS THAN 3:1	53.8	50	45MIN.	COMBUST. OR NONCOMBUST.	NONCOMBUST.
WEST	29.4 sq.m	5	LESS THAN 3:1	56	50	45MIN.	COMBUST. OR NONCOMBUST.	COMBUST. OR NONCOMBUST.

REQUIRED FIRE RESISTANCE RATING FOR STRUCTURAL MEMBERS AND ASSEMBLIES (FRR):		9.10.8, 9.10.9 & 3.2.2.47
HORIZONTAL ASSEMBLIES FRR (HOURS): FLOORS: ROOF: MEZZANINE:	45 MIN NOT REQUIRED N/A	(1Hr) ASSEMBLY No.F6h, O.B.C. SB-3
VERTICAL ASSEMBLIES FRR (HOURS): TYPICAL DEMISING WALLS: DEMISING WALLS AT STAIRS:	45 MIN 45 MIN	(1Hr) ASSEMBLY No.W9b, O.B.C. SB-3 (1Hr) ASSEMBLY No.W9b, O.B.C. SB-3
CORRIDOR FRR (HOURS):	N/A	3.3.1.4
SUITE SEPARATION FRR (HOURS):	1 HR	3.3.4.2

BLOCK 4

FIRM NAME:
+VG ARCHITECTS
72 STAFFORD STREET, SUITE 200, TORONTO, ONTARIO, M6J 3L1
T:416-588-6370
F: 416-588-6327
CERTIFICATE OF PRACTICE NUMBER:
3356
Name of Project:
MANSFIELD SKI CLUB
Location: MULMUR TOWNSHIP – DUFFERIN COUNTY

PROJECT DESCRIPTION: NEW 3-STOREY, TWELVE-PLEX, DWELLING UNITS		O.B.C. REFERENCE:
BLOCK 5		PART 9 / PART 3
MAJOR OCCUPANCY(s):	RESIDENTIAL – GROUP C	9.10.2.1 & 3.2.2.47
BUILDING AREA (M^2) (FOOTPRINT):	GROUND FLOOR: TOTAL 345.0M^2	1.4.1.2
GROSS AREA (M^2):	BASEMENT FLOOR: 345.0M^2 GROUND FLOOR: 345.0M^2 SECOND FLOOR: 240.0M^2 THIRD FLOOR: 240.0M^2 TOTAL: 1,170.0M^2	1.4.1.2
NUMBER OF STOREYS	ABOVE GRADE: 3 BELOW GRADE: 1	1.4.1.2
HEIGHT OF BUILDING (M^2)	14M	1.4.1.2
NUMBER OF STREETS / ACCESS ROUTES:	THREE STREETS	3.2.2.47
BUILDING CLASSIFICATION:	RESIDENTIAL, GROUP C, UP TO 3 STOREYS	3.2.2.47
SPRINKLER SYSTEM:	NOT REQUIRED	3.2.2.47
STANDPIPE:	NOT REQUIRED	3.2.9
FIRE ALARM:	NOT REQUIRED	9.10.18.2(2) & 3.2.4.1
WATER SERVICE / SUPPLY IS ADEQUATE:	YES	9.31.3 & 3.7.4
HIGH BUILDING	NO	3.2.6
CONSTRUCTION:	COMBUSTIBLE	3.2.2.47
MEZZANINE(S):	N/A	9.10.4.1 & 3.2.8
TOTAL OCCUPANCY LOAD:	BASEMENT FLOOR: 12 PERSONS GROUND FLOOR: 12 PERSONS SECOND FLOOR: 12 PERSONS THIRD FLOOR: 12 PERSONS TOTAL: 48 PERSONS	9.9.1.3 & 3.1.17
PLUMBING FACILITIES:	YES	9.31.4 & 3.7.4
BARRIER-FREE DESIGN:	YES	9.5.2.1(2) & 3.8.1.1
HAZARDOUS MATERIALS:	NO	9.10.1.3(4) & 3.3.1.2
TRAVEL DISTANCE:	EGRESS FROM DWELLING UNITS	9.9.9.1, 9.9.8.6 & 3.3.4.4
FIRE EXTINGUISHERS:	NOT REQUIRED	9.10.20.4 & 3.2.5.17
SMOKE ALARMS:	REQUIRED	9.10.19 & 3.2.4.22
CARBON MONOXIDE ALARMS:	REQUIRED	9.33.4
SPATIAL SEPARATION – CONSTRUCTION OF EXTERIOR WALLS		9.10.14 & 3.2.3.1

WALL	E.B.F. (LARGEST FIRE COMP.)	L.D (m)	L/H OR H/L	PERMITTED MAX % OF OPENINGS	PROPOSED % OF OPENINGS	F.R.R. (HOURS)	TYPE OF CONST.	TYPE OF CLADDING
NORTH	58.8 sq.m	11	LESS THAN 3:1	100	80	45MIN	COMBUST. OR NONCOMBUST.	NONCOMBUST.
SOUTH	58.8 sq.m	8.4	LESS THAN 3:1	85	80	45MIN.	COMBUST. OR NONCOMBUST.	NONCOMBUST.
EAST	29.4 sq.m	5	LESS THAN 3:1	56	50	45MIN.	COMBUST. OR NONCOMBUST.	NONCOMBUST.
WEST	29.4 sq.m	13.8	LESS THAN 3:1	100	80	45MIN.	COMBUST. OR NONCOMBUST.	COMBUST. OR NONCOMBUST.

REQUIRED FIRE RESISTANCE RATING FOR STRUCTURAL MEMBERS AND ASSEMBLIES (FRR):		9.10.8, 9.10.9 & 3.2.2.47
HORIZONTAL ASSEMBLIES FRR (HOURS): FLOORS: ROOF: MEZZANINE:	45 MIN NOT REQUIRED N/A	(1Hr) ASSEMBLY No.F6h, O.B.C. SB-3
VERTICAL ASSEMBLIES FRR (HOURS): TYPICAL DEMISING WALLS: DEMISING WALLS AT STAIRS:	45 MIN 45 MIN	(1Hr) ASSEMBLY No.W9b, O.B.C. SB-3 (1Hr) ASSEMBLY No.W9b, O.B.C. SB-3
CORRIDOR FRR (HOURS):	N/A	3.3.1.4
SUITE SEPARATION FRR (HOURS):	1 HR	3.3.4.2

BLOCK 5

FIRM NAME:
+VG ARCHITECTS
72 STAFFORD STREET, SUITE 200, TORONTO, ONTARIO, M6J 3L1
T:416-588-6370
F: 416-588-6327
CERTIFICATE OF PRACTICE NUMBER:
3356
Name of Project:
MANSFIELD SKI CLUB
Location: MULMUR TOWNSHIP – DUFFERIN COUNTY

PROJECT DESCRIPTION: NEW 3-STOREY, TWELVE-PLEX, DWELLING UNITS		O.B.C. REFERENCE:
BLOCK 6		PART 9 / PART 3
MAJOR OCCUPANCY(s):	RESIDENTIAL – GROUP C	9.10.2.1 & 3.2.2.47
BUILDING AREA (M^2) (FOOTPRINT):	GROUND FLOOR: TOTAL 345.0M^2	1.4.1.2
GROSS AREA (M^2):	BASEMENT FLOOR: 345.0M^2 GROUND FLOOR: 345.0M^2 SECOND FLOOR: 240.0M^2 THIRD FLOOR: 240.0M^2 TOTAL: 1,170.0M^2	1.4.1.2
NUMBER OF STOREYS	ABOVE GRADE: 3 BELOW GRADE: 1	1.4.1.2
HEIGHT OF BUILDING (M^2)	14M	1.4.1.2
NUMBER OF STREETS / ACCESS ROUTES:	THREE STREETS	3.2.2.47
BUILDING CLASSIFICATION:	RESIDENTIAL, GROUP C, UP TO 3 STOREYS	3.2.2.47
SPRINKLER SYSTEM:	NOT REQUIRED	3.2.2.47
STANDPIPE:	NOT REQUIRED	3.2.9
FIRE ALARM:	NOT REQUIRED	9.10.18.2(2) & 3.2.4.1
WATER SERVICE / SUPPLY IS ADEQUATE:	YES	9.31.3 & 3.7.4
HIGH BUILDING	NO	3.2.6
CONSTRUCTION:	COMBUSTIBLE	3.2.2.47
MEZZANINE(S):	N/A	9.10.4.1 & 3.2.8
TOTAL OCCUPANCY LOAD:	BASEMENT FLOOR: 12 PERSONS GROUND FLOOR: 12 PERSONS SECOND FLOOR: 12 PERSONS THIRD FLOOR: 12 PERSONS TOTAL: 48 PERSONS	9.9.1.3 & 3.1.17
PLUMBING FACILITIES:	YES	9.31.4 & 3.7.4
BARRIER-FREE DESIGN:	YES	9.5.2.1(2) & 3.8.1.1
HAZARDOUS MATERIALS:	NO	9.10.1.3(4) & 3.3.1.2
TRAVEL DISTANCE:	EGRESS FROM DWELLING UNITS	9.9.9.1, 9.9.8.6 & 3.3.4.4
FIRE EXTINGUISHERS:	NOT REQUIRED	9.10.20.4 & 3.2.5.17
SMOKE ALARMS:	REQUIRED	9.10.19 & 3.2.4.22
CARBON MONOXIDE ALARMS:	REQUIRED	9.33.4
SPATIAL SEPARATION – CONSTRUCTION OF EXTERIOR WALLS		9.10.14 & 3.2.3.1

WALL	E.B.F. (LARGEST FIRE COMP.)	L.D (m)	L/H OR H/L	PERMITTED MAX % OF OPENINGS	PROPOSED % OF OPENINGS	F.R.R. (HOURS)	TYPE OF CONST.	TYPE OF CLADDING
NORTH	58.8 sq.m	6.7	LESS THAN 3:1	60	65	45MIN	COMBUST. OR NONCOMBUST.	NONCOMBUST.
SOUTH	58.8 sq.m	20	LESS THAN 3:1	100	80	45MIN.	COMBUST. OR NONCOMBUST.	NONCOMBUST.
EAST	29.4 sq.m	6	LESS THAN 3:1	83	80	45MIN.	COMBUST. OR NONCOMBUST.	NONCOMBUST.
WEST	29.4 sq.m	13.5	LESS THAN 3:1	100	80	45MIN.	COMBUST. OR NONCOMBUST.	COMBUST. OR NONCOMBUST.

REQUIRED FIRE RESISTANCE RATING FOR STRUCTURAL MEMBERS AND ASSEMBLIES (FRR):		9.10.8, 9.10.9 & 3.2.2.47
HORIZONTAL ASSEMBLIES FRR (HOURS): FLOORS: ROOF: MEZZANINE:	45 MIN NOT REQUIRED N/A	(1Hr) ASSEMBLY No.F6h, O.B.C. SB-3
VERTICAL ASSEMBLIES FRR (HOURS): TYPICAL DEMISING WALLS: DEMISING WALLS AT STAIRS:	45 MIN 45 MIN	(1Hr) ASSEMBLY No.W9b, O.B.C. SB-3 (1Hr) ASSEMBLY No.W9b, O.B.C. SB-3
CORRIDOR FRR (HOURS):	N/A	3.3.1.4
SUITE SEPARATION FRR (HOURS):	1 HR	3.3.4.2

BLOCK 6

FIRM NAME:
+VG ARCHITECTS
72 STAFFORD STREET, SUITE 200, TORONTO, ONTARIO, M6J 3L1
T:416-588-6370
F: 416-588-6327
CERTIFICATE OF PRACTICE NUMBER:
3356
Name of Project:
MANSFIELD SKI CLUB
Location: MULMUR TOWNSHIP – DUFFERIN COUNTY

PROJECT DESCRIPTION: NEW 3-STOREY, TEN-PLEX, DWELLING UNITS & RETAIL UNITS		O.B.C. REFERENCE:
BUILDING A		PART 9 / PART 3
MAJOR OCCUPANCY(s):	RESIDENTIAL – GROUP C OFFICE OR PERSONAL BUSINESS – GROUP D	9.10.2.1 / 3.2.2.47 & 3.2.2.53
BUILDING AREA (M^2) (FOOTPRINT):	GROUND FLOOR: TOTAL 630.0M^2	1.4.1.2
GROSS AREA (M^2):	GROUND FLOOR (SEE NOTE 1): 630.0M^2 MEZZANINE FLOOR (SEE NOTE 1): 252.0M^2 SECOND FLOOR (RESIDENTIAL): 630.0M^2 THIRD FLOOR (RESIDENTIAL): 630.0M^2 TOTAL: 2,142.0M^2	1.4.1.2 NOTE 1: ANCILLARY USES TO EXISTING SKI LODGE I.E. ADMINISTRATIVE OFFICES, SKI LOCKERS & TUNING ROOMS, ETC.
NUMBER OF STOREYS	ABOVE GRADE: 3 BELOW GRADE: N/A	1.4.1.2
HEIGHT OF BUILDING (M^2)	14M	1.4.1.2
NUMBER OF STREETS / ACCESS ROUTES:	THREE STREETS	3.2.2.47 & 3.2.2.53
BUILDING CLASSIFICATION:	OFFICE OR PERS. BUSINESS, GROUP D, UP TO 3 STOREYS RESIDENTIAL, GROUP C, UP TO 3 STOREYS	3.2.2.53 9.10.2.1 & 3.2.2.47
SPRINKLER SYSTEM:	NOT REQUIRED	3.2.2.47 & 3.2.2.53
STANDPIPE:	NOT REQUIRED	3.2.9
FIRE ALARM:	NOT REQUIRED	9.10.18.2(2) & 3.2.4.1
WATER SERVICE / SUPPLY IS ADEQUATE:	YES	9.31.3 & 3.7.4
HIGH BUILDING	NO	3.2.6
CONSTRUCTION:	COMBUSTIBLE OR NON COMBUSTIBLE	3.2.2.47 & 3.2.2.53
MEZZANINE(S):	YES	9.10.4.1 & 3.2.8
TOTAL OCCUPANCY LOAD:	GROUND FLOOR (GROUP D): 137 PERSONS MEZZANINE FLOOR (GROUP D): 55 PERSONS SECOND FLOOR (RESIDENTIAL): 20 PERSONS THIRD FLOOR (RESIDENTIAL): 20 PERSONS TOTAL: 232 PERSONS	9.9.1.3 & 3.1.17
PLUMBING FACILITIES:	YES	9.31.4 & 3.7.4
BARRIER-FREE DESIGN:	YES	9.5.2.1(2) & 3.8.1.1
HAZARDOUS MATERIALS:	NO	9.10.1.3(4) & 3.3.1.2
TRAVEL DISTANCE:	EGRESS FROM DWELLING UNITS	9.9.9.1, 9.9.8.6 & 3.3.4.4
FIRE EXTINGUISHERS:	NOT REQUIRED	9.10.20.4 & 3.2.5.17
SMOKE ALARMS:	REQUIRED	9.10.19 & 3.2.4.22
CARBON MONOXIDE ALARMS:	REQUIRED	9.33.4
SPATIAL SEPARATION – CONSTRUCTION OF EXTERIOR WALLS		9.10.14 & 3.2.3.1

WALL	E.B.F. (LARGEST FIRE COMP.)	L.D (m)	L/H OR H/L	PERMITTED MAX % OF OPENINGS	PROPOSED % OF OPENINGS	F.R.R. (HOURS)	TYPE OF CONST.	TYPE OF CLADDING
NORTH	45 sq.m	10	LESS THAN 3:1	76	70	45MIN	COMBUST. OR NONCOMBUST.	NONCOMBUST.
SOUTH	45 sq.m	5	LESS THAN 3:1	18	15	45MIN.	COMBUST. OR NONCOMBUST.	NONCOMBUST.
EAST	42 sq.m	8	LESS THAN 3:1	59	55	45MIN.	COMBUST. OR NONCOMBUST.	NONCOMBUST.
WEST	42 sq.m	9.3	LESS THAN 3:1	76	70	45MIN.	COMBUST. OR NONCOMBUST.	COMBUST. OR NONCOMBUST.

REQUIRED FIRE RESISTANCE RATING FOR STRUCTURAL MEMBERS AND ASSEMBLIES (FRR):		9.10.8, 9.10.9 & 3.2.2.47
HORIZONTAL ASSEMBLIES FRR (HOURS): FLOORS: ROOF: MEZZANINE: SEPARATION OF MAJOR OCCUPANCIES:	45 MIN 45 MIN 45 MIN 1 HRS	(1Hr) ASSEMBLY No.F6h, O.B.C. SB-3
VERTICAL ASSEMBLIES FRR (HOURS): TYPICAL DEMISING WALLS: DEMISING WALLS AT STAIRS:	45 MIN 45 MIN	(1Hr) ASSEMBLY No.W9b, O.B.C. SB-3 (1Hr) ASSEMBLY No.W9b, O.B.C. SB-3
CORRIDOR FRR (HOURS):	45 MIN	3.3.1.4
SUITE SEPARATION FRR (HOURS):	1 HR	3.3.4.2

BUILDING A

FIRM NAME:
+VG ARCHITECTS
72 STAFFORD STREET, SUITE 200, TORONTO, ONTARIO, M6J 3L1
T:416-588-6370
F: 416-588-6327
CERTIFICATE OF PRACTICE NUMBER:
3356
Name of Project:
MANSFIELD SKI CLUB
Location: MULMUR TOWNSHIP – DUFFERIN COUNTY

PROJECT DESCRIPTION: NEW 3-STOREY, FIFTEEN-PLEX, DWELLING UNITS & RETAIL UNITS		O.B.C. REFERENCE:
BUILDING B		PART 9 / PART 3
MAJOR OCCUPANCY(s):	RESIDENTIAL – GROUP C OFFICE OR PERSONAL BUSINESS – GROUP D	9.10.2.1 / 3.2.2.47 & 3.2.2.53
BUILDING AREA (M^2) (FOOTPRINT):	GROUND FLOOR: TOTAL 780.0M^2	1.4.1.2
GROSS AREA (M^2):	GROUND FLOOR (SEE NOTES 1 & 3): 780.0M^2 SECOND FLOOR (SEE NOTES 2 & 3): 158.0M^2 SECOND FLOOR (RESIDENTIAL): 622.0M^2 THIRD FLOOR (RESIDENTIAL): 780.0M^2 TOTAL: 2,340.0M^2	NOTE 1: EXISTING GROUP "D", NO CHANGE IN USE. EXISTING USES ARE ADMINISTRATIVE OFFICES, SKI LOCKERS, SKI TUNING ROOMS. NOTE 2: EXISTING GROUP "D", NO CHANGE IN USE. EXISTING USE IS ADMINISTRATIVE OFFICES. NOTE 3: BUILDING B GROUND AND PART. 2ND FLOOR AREAS ARE INCLUDED IN THE EXISTING MAIN CHALET, ADMIN BUILDING, GM OFFICE, AND SKI HOUSE.
NUMBER OF STOREYS	ABOVE GRADE: 3 BELOW GRADE: N/A	1.4.1.2
HEIGHT OF BUILDING (M^2)	14M	1.4.1.2
NUMBER OF STREETS / ACCESS ROUTES:	TWO STREETS	3.2.2.47 & 3.2.2.53
BUILDING CLASSIFICATION:	OFFICE OR PERS. BUSINESS GROUP D, UP TO 3 STOREYS RESIDENTIAL, GROUP C, UP TO 3 STOREYS	3.2.2.53 9.10.2.1 & 3.2.2.47
SPRINKLER SYSTEM:	NOT REQUIRED	3.2.2.47 & 3.2.2.53
STANDPIPE:	NOT REQUIRED	3.2.9
FIRE ALARM:	NOT REQUIRED	9.10.18.2(2) & 3.2.4.1
WATER SERVICE / SUPPLY IS ADEQUATE:	YES	9.31.3 & 3.7.4
HIGH BUILDING	NO	3.2.6
CONSTRUCTION:	COMBUSTIBLE OR NON COMBUSTIBLE	3.2.2.47 & 3.2.2.53
MEZZANINE(S):	NO	9.10.4.1 & 3.2.8
TOTAL OCCUPANCY LOAD:	GROUND FLOOR (GROUP D): 168 PERSONS MEZZANINE FLOOR (GROUP D): 34 PERSONS SECOND FLOOR (RESIDENTIAL): 30 PERSONS THIRD FLOOR (RESIDENTIAL): 30 PERSONS TOTAL: 262 PERSONS	9.9.1.3 & 3.1.17
PLUMBING FACILITIES:	YES	9.31.4 & 3.7.4
BARRIER-FREE DESIGN:	YES	9.5.2.1(2) & 3.8.1.1
HAZARDOUS MATERIALS:	NO	9.10.1.3(4) & 3.3.1.2
TRAVEL DISTANCE:	EGRESS FROM DWELLING UNITS	9.9.9.1, 9.9.8.6 & 3.3.4.4
FIRE EXTINGUISHERS:	NOT REQUIRED	9.10.20.4 & 3.2.5.17
SMOKE ALARMS:	REQUIRED	9.10.19 & 3.2.4.22
CARBON MONOXIDE ALARMS:	REQUIRED	9.33.4
SPATIAL SEPARATION – CONSTRUCTION OF EXTERIOR WALLS		9.10.14 & 3.2.3.1

WALL	E.B.F. (LARGEST FIRE COMP.)	L.D (m)	L/H OR H/L	PERMITTED MAX % OF OPENINGS	PROPOSED % OF OPENINGS	F.R.R. (HOURS)	TYPE OF CONST.	TYPE OF CLADDING
NORTH	36 sq.m	8.8	LESS THAN 3:1	74.3	70	45MIN	COMBUST. OR NONCOMBUST.	NONCOMBUST.
SOUTH	48 sq.m	20	LESS THAN 3:1	100	90	45MIN.	COMBUST. OR NONCOMBUST.	NONCOMBUST.
EAST	62.4 sq.m	6.45	LESS THAN 3:1	28.6	25	45MIN.	COMBUST. OR NONCOMBUST.	NONCOMBUST.
WEST	36 sq.m	6	LESS THAN 3:1	32	30	45MIN.	COMBUST. OR NONCOMBUST.	COMBUST. OR NONCOMBUST.

REQUIRED FIRE RESISTANCE RATING FOR STRUCTURAL MEMBERS AND ASSEMBLIES (FRR):		9.10.8, 9.10.9 & 3.2.2.47
HORIZONTAL ASSEMBLIES FRR (HOURS): FLOORS: ROOF: MEZZANINE: SEPARATION OF MAJOR OCCUPANCIES:	45 MIN 45 MIN 45 MIN 1 HRS	(1Hr) ASSEMBLY No.F6h, O.B.C. SB-3
VERTICAL ASSEMBLIES FRR (HOURS): TYPICAL DEMISING WALLS: DEMISING WALLS AT STAIRS:	45 MIN 45 MIN	(1Hr) ASSEMBLY No.W9b, O.B.C. SB-3 (1Hr) ASSEMBLY No.W9b, O.B.C. SB-3
CORRIDOR FRR (HOURS):	45 MIN	3.3.1.4
SUITE SEPARATION FRR (HOURS):	1 HR	3.3.4.2

BUILDING B

LEGEND

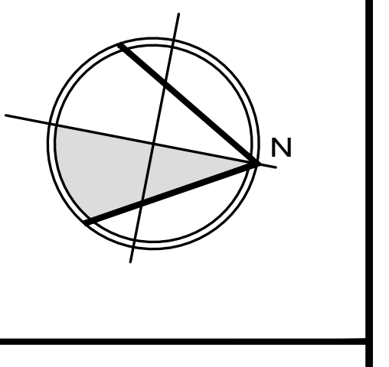
GENERAL NOTES:

1. MATRICES PREPARED BY +VG ARCHITECTS LTD. AND CORRESPOND WITH ARCHITECTURAL PLANS PREPARED BY +VG ARCHITECTS LTD.

FLEISHER RIDOUT
PARTNERSHIP INC.
l.a.n.d.s.c.a.p.e a.r.c.h.i.t.e.c.t.s
1877 Davenport Road
Toronto, Ontario, M6N 1B9
T: (416) 533-4990

ISSUE	DATE	REMARKS
3	DECEMBER 10, 2020	ISSUED FOR 3RD SITE PLAN APPROVAL
2	AUGUST 14, 2020	ISSUED FOR 2ND SITE PLAN APPROVAL
1	FEBRUARY 4, 2020	ISSUED FOR SITE PLAN APPROVAL

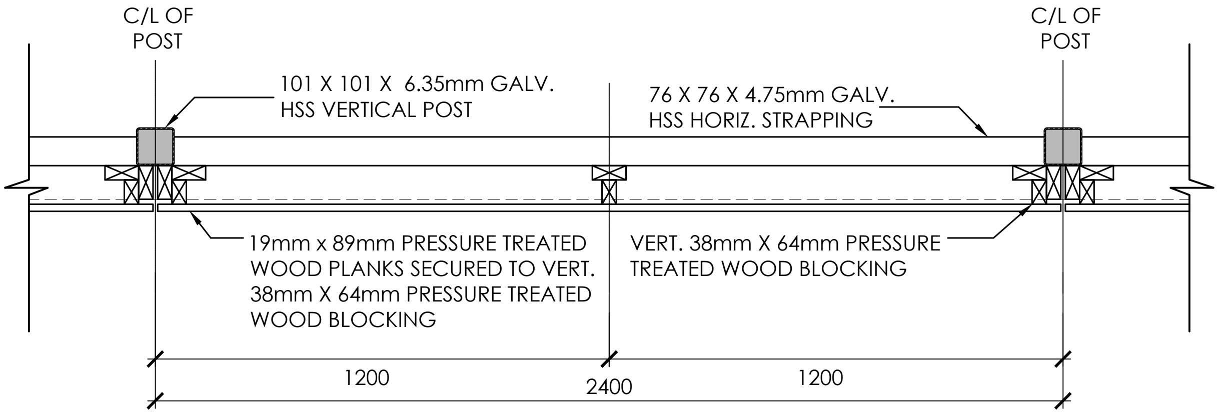
ONTARIO ASSOCIATION OF LANDSCAPE ARCHITECTS
B. J. FLEISHER
MEMBER



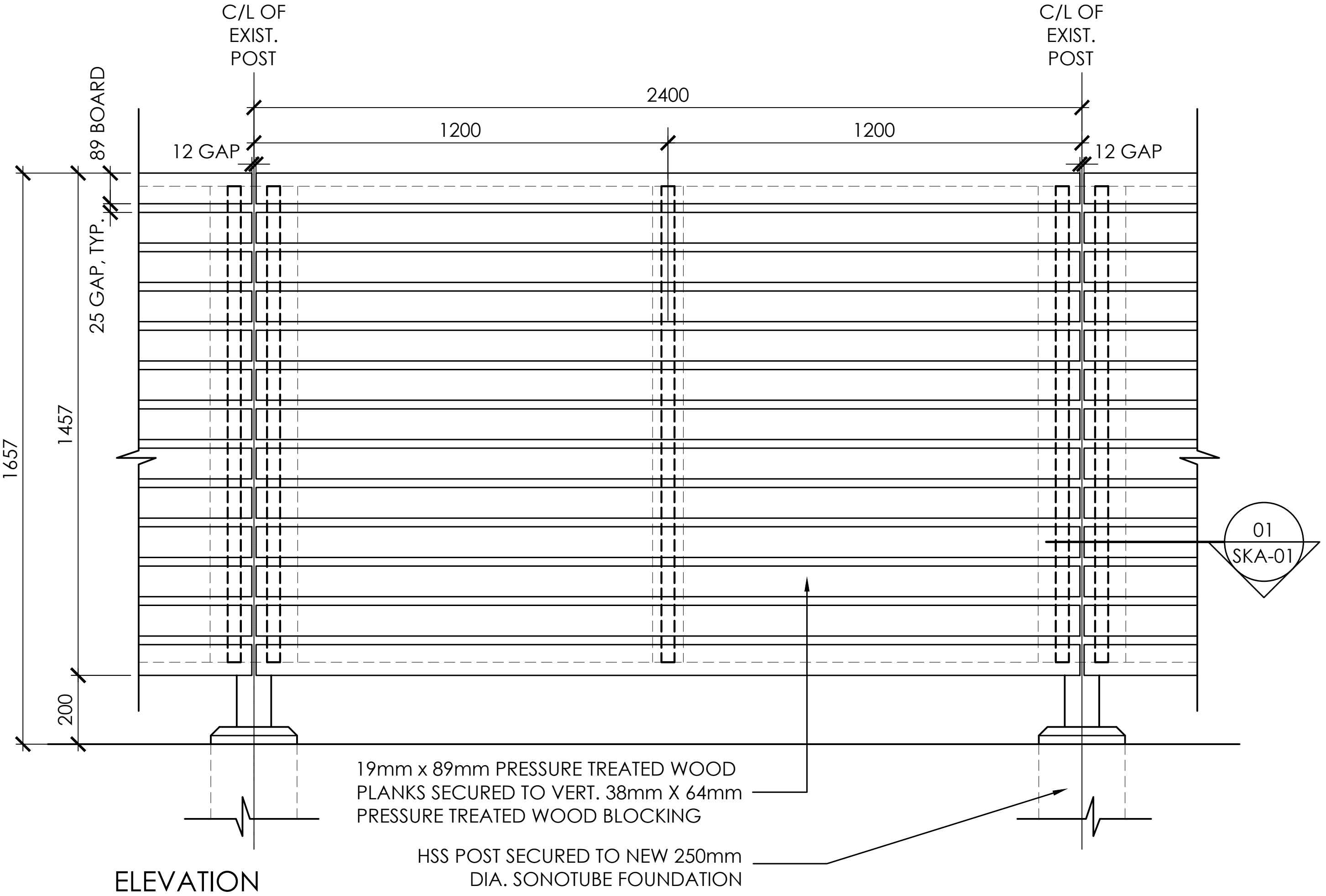
Project Name:
MANSFIELD SKI CLUB
628213 SIDE ROAD 15
Mulmur, ON L9V 0T9

Drawing Title:
ONTARIO BUILDING CODE MATRICES

Drawn: JC	Design: BF	Date: JANUARY 2020
Checked: BF	Apprvd: BF	Scale: NTS
CADD File: 151352		Dwg. No.: SP.6



PLAN VIEW
1/SKA-01



ELEVATION
2/SKA-01

Plot Date: Apr 08, 2020 - 3:23pm By: pfren

Filename: C:\Users\pfren\Desktop\MANSFIELD\Fence Detail\21945 - SKA_01.dwg

+VG ARCHITECTS
THE VENTIN GROUP LTD

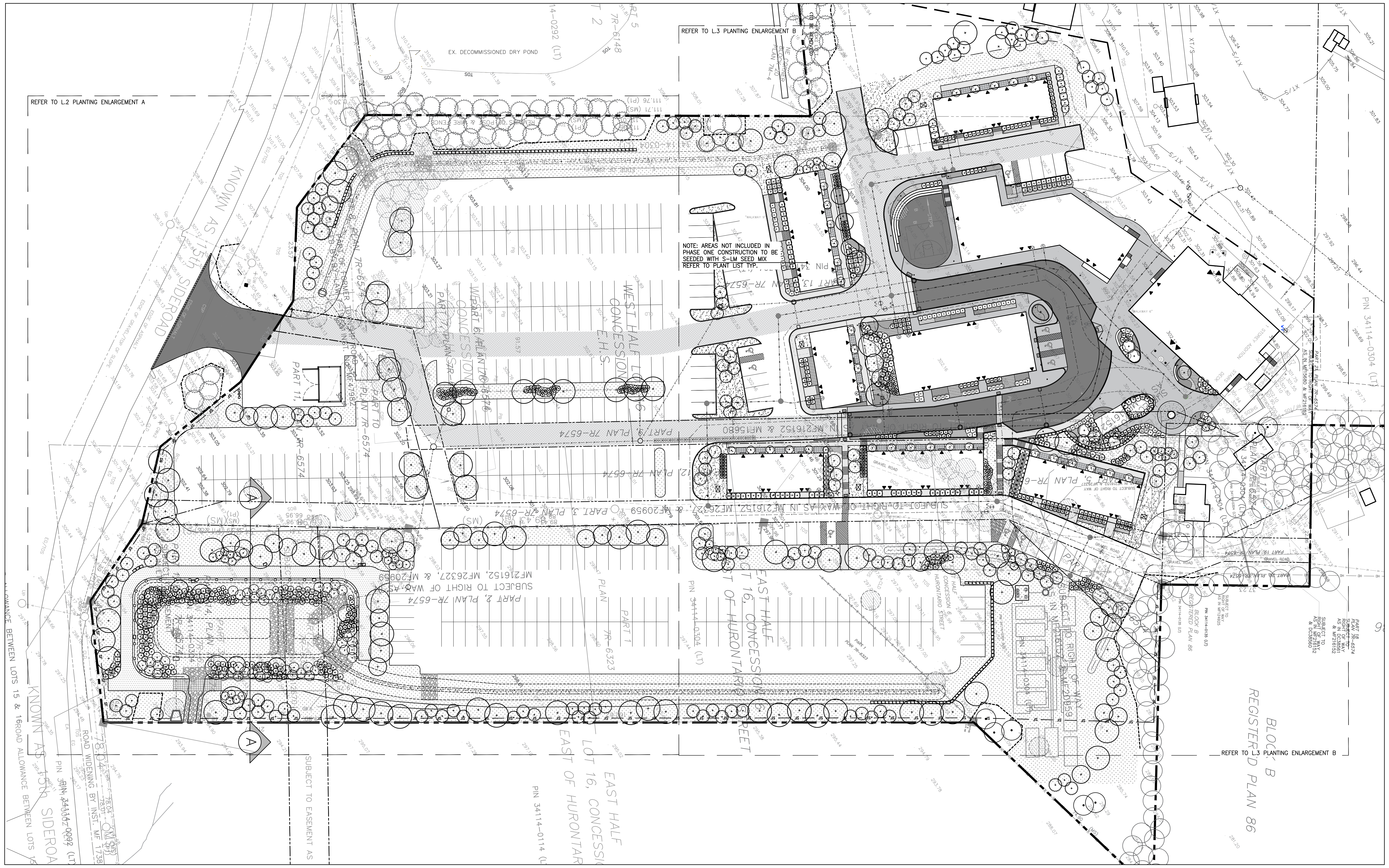
DESCRIPTION:
ENCLOSURE FOR OUTDOOR GARBAGE AREA
PART ELEVATION, PLAN & DETAIL

DATE:	2020.04.06	**SCALE:**	NTS
DWG. REF. NO.:	N/A	**ISSUED FOR:**	SITE PLAN
PROJECT NO:	21945		

MANSFIELD SKI CLUB - VILLAGE CENTRE

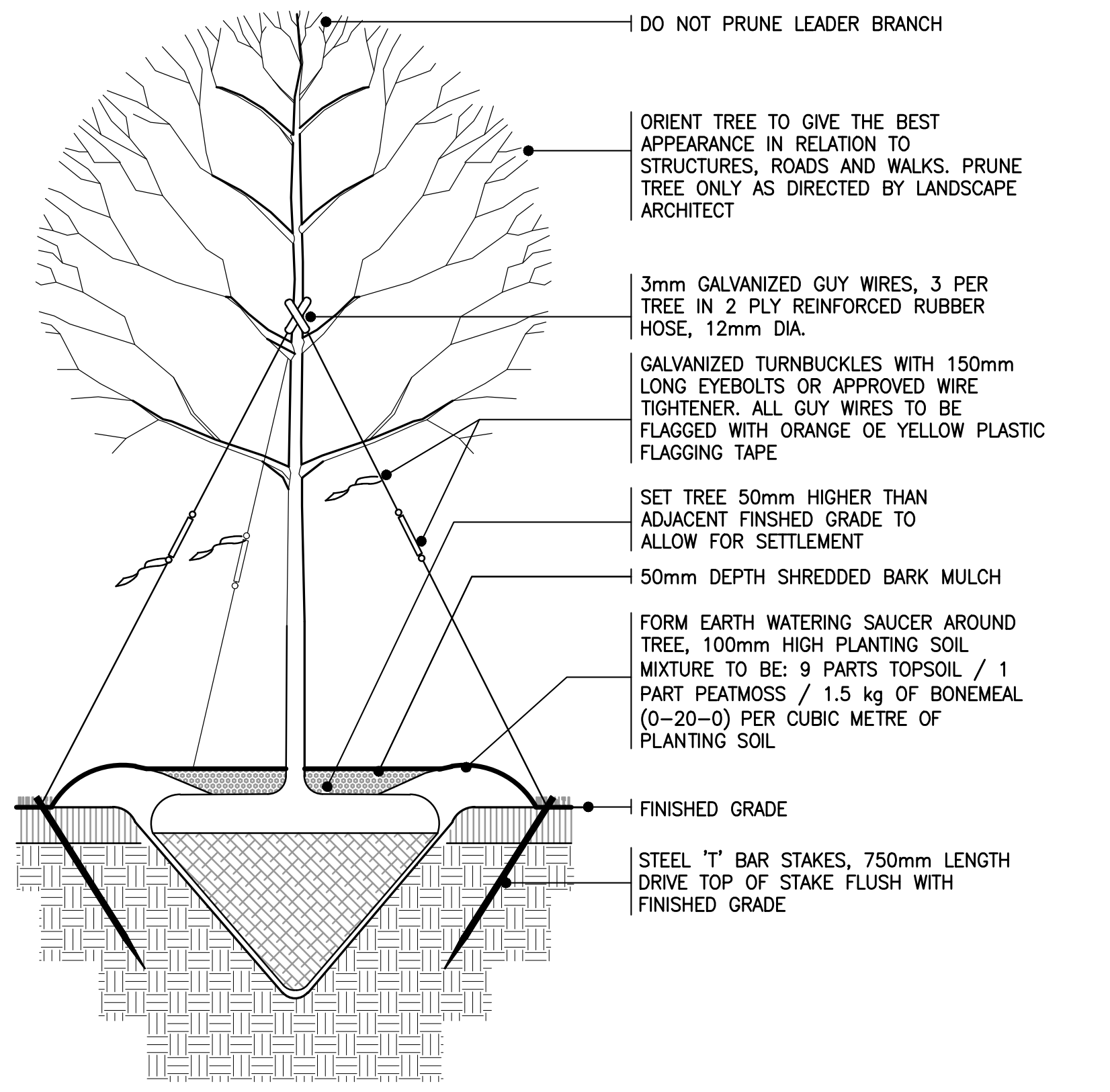
DRAWN BY: PF
CHECKED BY: PB

SKA-01



PLANTING NOTES:

1. ALL PLANT MATERIAL IS TO MEET THE STANDARDS AS OUTLINED IN THE CANADIAN STANDARDS FOR NURSERY STOCK, CURRENT EDITION.
2. FOR ALL CONTRACTOR PURCHASED MATERIALS PLANT SIZES WILL BE AS MEASURED ON SITE. NURSERY WAYBILLS WILL NOT BE ACCEPTABLE FOR DETERMINATION OF PLANT SIZES.
3. PROTECT PLANT MATERIAL FROM FROST, EXCESSIVE HEAT, WIND AND SUN DURING TRANSPORTATION. ALL WILTED OR WIND DAMAGED PLANT MATERIAL WILL BE REJECTED.
4. CONTRACTOR TO LAYOUT ALL PLANT MATERIAL AS PER PLANTING PLANS PRIOR TO INSTALLATION FOR LANDSCAPE ARCHITECT REVIEW AND APPROVAL.
5. WARRANTY PERIOD FOR ALL PLANTING IS ONE YEAR FROM SUBSTANTIAL COMPLETION. WARRANTY REPLACEMENTS OF ALL PLANT MATERIAL WILL BE UNDERTAKEN BY THE CONTRACTOR AS REQUESTED BY THE LANDSCAPE ARCHITECT AT ANY TIME DURING THE WARRANTY PERIOD.
6. FOR BURLAPPED ROOT BALLS, CUT AWAY TOP ONE THIRD OF WRAPPING AND WIRE BASKET WITHOUT DAMAGING ROOT BALL. DO NOT PULL BURLAP OR ROPE FROM UNDER ROOT BALL. FOR POTTED PLANTS REMOVE ENTIRE CONTAINER.
7. BACKFILL SOIL IN 150mm LIFTS. TAMP EACH LIFT TO ELIMINATE AIR POCKETS. WHEN TWO THIRDS OF DEPTH OF PLANTING PIT HAS BEEN BACKFILLED, FILL REMAINING SPACE WITH WATER. AFTER WATER HAS PENETRATED INTO SOIL, BACKFILL TO FINISH GRADE.
8. PLANTS SHOWN IN GROUPS ARE TO BE PLANTED IN CONTINUOUS PLANT BEDS AS SHOWN ON PLANTING DETAIL.
9. PLANT MATERIAL INSTALLED FOLLOWING LEAF DROP IN THE FALL WILL BE ACCEPTED AFTER THE START OF THE NEXT GROWING SEASON PROVIDED THAT ACCEPTANCE CONDITIONS ARE FULFILLED.
10. ANY PLANTING OR LANDSCAPING WORK THAT IS REJECTED AT THE FINAL INSPECTION WILL BE CORRECTED IN A TIMELY MANNER AT CONTRACTOR'S EXPENSE.
10. REJECTED PLANT MATERIAL MUST BE REMOVED FROM THE SITE WITHIN ONE WORKING DAY.
11. WATER TREES ONCE A WEEK FOR FIRST 4 WEEKS AND THEN SUFFICIENTLY THERE AFTER TO MAINTAIN OPTIMUM GROWING WITHIN THE FIRST 2 YEARS AFTER PLANTING. APPLY SUFFICIENT WATER PER APPLICATION TO OBTAIN MOISTURE PENETRATION OF 75–100MM. ENSURE ADEQUATE MOISTURE IN ROOT ZONE AT FREEZE–UP.
12. ALL TOPSOIL TO BE NEW. TOPSOIL TO BE FRIABLE, SOIL TEXTURE TO CONSIST OF 45% SAND, 35% SILT, AND 20% CLAY AND CONTAIN A MAXIMUM OF 5% ORGANIC MATTER. TOPSOIL MUST BE FREE FROM SUBSOIL, ROOTS, GRASS, WEEDS, TOXIC MATERIALS, STONES, FOREIGN OBJECTS AND WITH AN ACIDITY RANGE (PH) OF 5.5 TO 7.5.
13. SOIL MIXTURE FOR PLANTING TO BE 50% SANDY TOPSOIL, 25% PEATMOSS, 25% WELL ROTTED MANURE, AND 500G BONEMEAL PER CUBIC METRE OF PLANTING SOIL.
14. ALL SEEDED SLOPES 4:1 AND OVER TO UTILIZE EROSION MATS.
15. CONTRACTOR TO CHECK QUANTITIES AND REPORT ANY DISCREPANCIES TO THE THE LANDSCAPE ARCHITECT IMMEDIATELY. PLANT QUANTITIES INDICATED ON THE PLAN SUPERCEDE THE TOTALS IN THE PLANT LIST.
16. ALL AREAS LIMITED TO PHASE TWO CONSTRUCTION TO BE SEEDED. REFER TO PLANTING PLAN AND SEED MIX SCHEDULE.



NOTES:

1. USE MECHANICAL TREE SPADE FOR ALL TRANSPLANTING. SIZE TO BE APPROVED BY LANDSCAPE ARCHITECT.
2. WHERE SUBGRADE IS IMPERMEABLE INSTALL DRAINAGE TILE CONNECTED TO STORM DRAIN

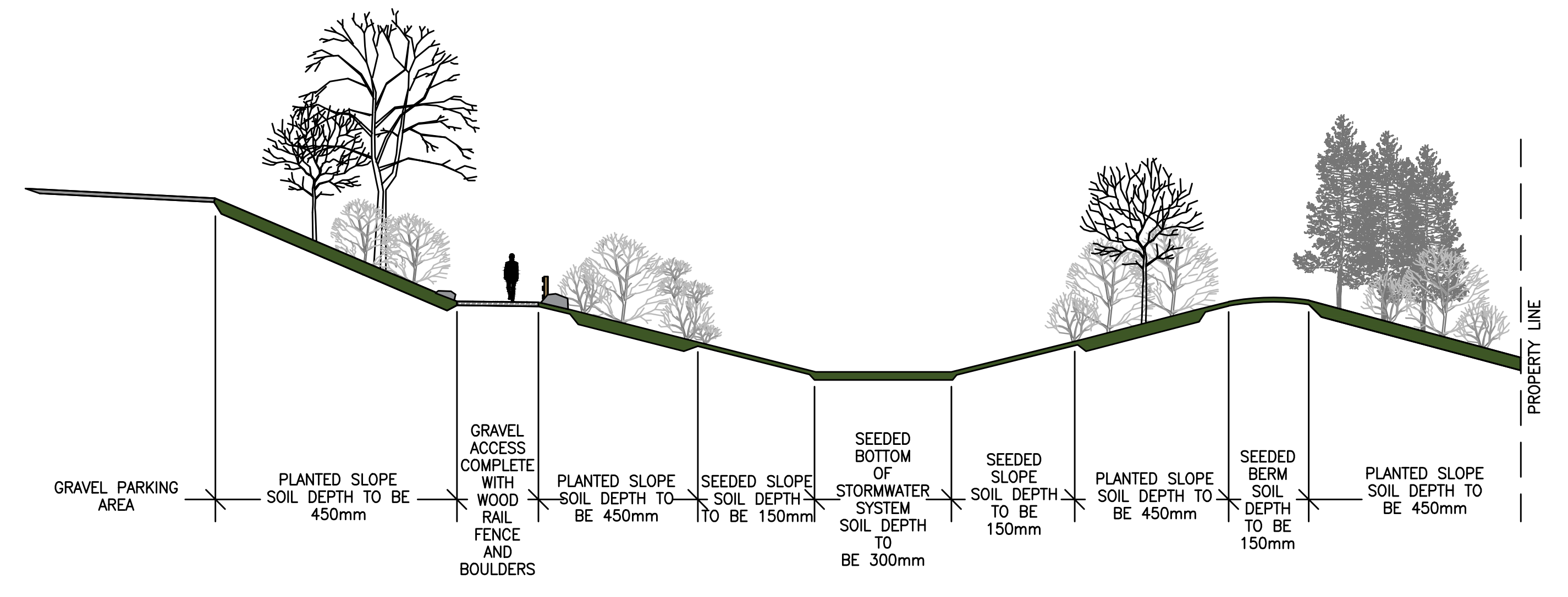
TREE TRANSPLANTING NTS

LEGEND

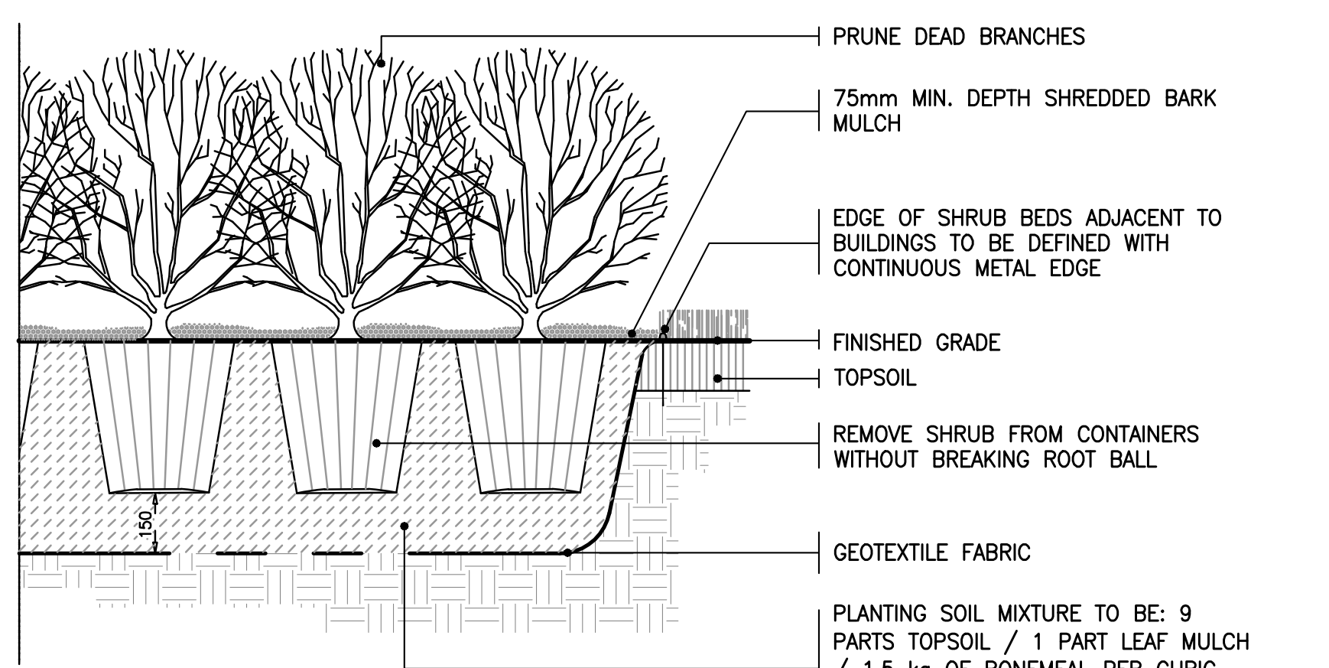
- PROPERTY LINE
- PROPOSED FIRE TRUCK ACCESS ROUTE
- WATER SERVICE LINE
- SANITARY SEWER LINE
- ENTRANCE
- 1M HT. WOOD SPLIT RAIL FENCE
- UNIT PAVING
- CONCRETE SIDEWALK
- HEAVY DUTY ASPHALT
- SOD
- SEEDED AREA
- PROPOSED FIRE HYDRANT
- BOULDER
- PROPOSED HYDRO TRANSFORMER Refer to Electrical
- EXISTING TREE TO REMAIN
- EXISTING TREE GROUPING TO REMAIN
- TREE HOARDING
- PROPOSED DECIDUOUS TREE
- PROPOSED CONIFEROUS TREE
- SHRUB BED

GENERAL NOTES:

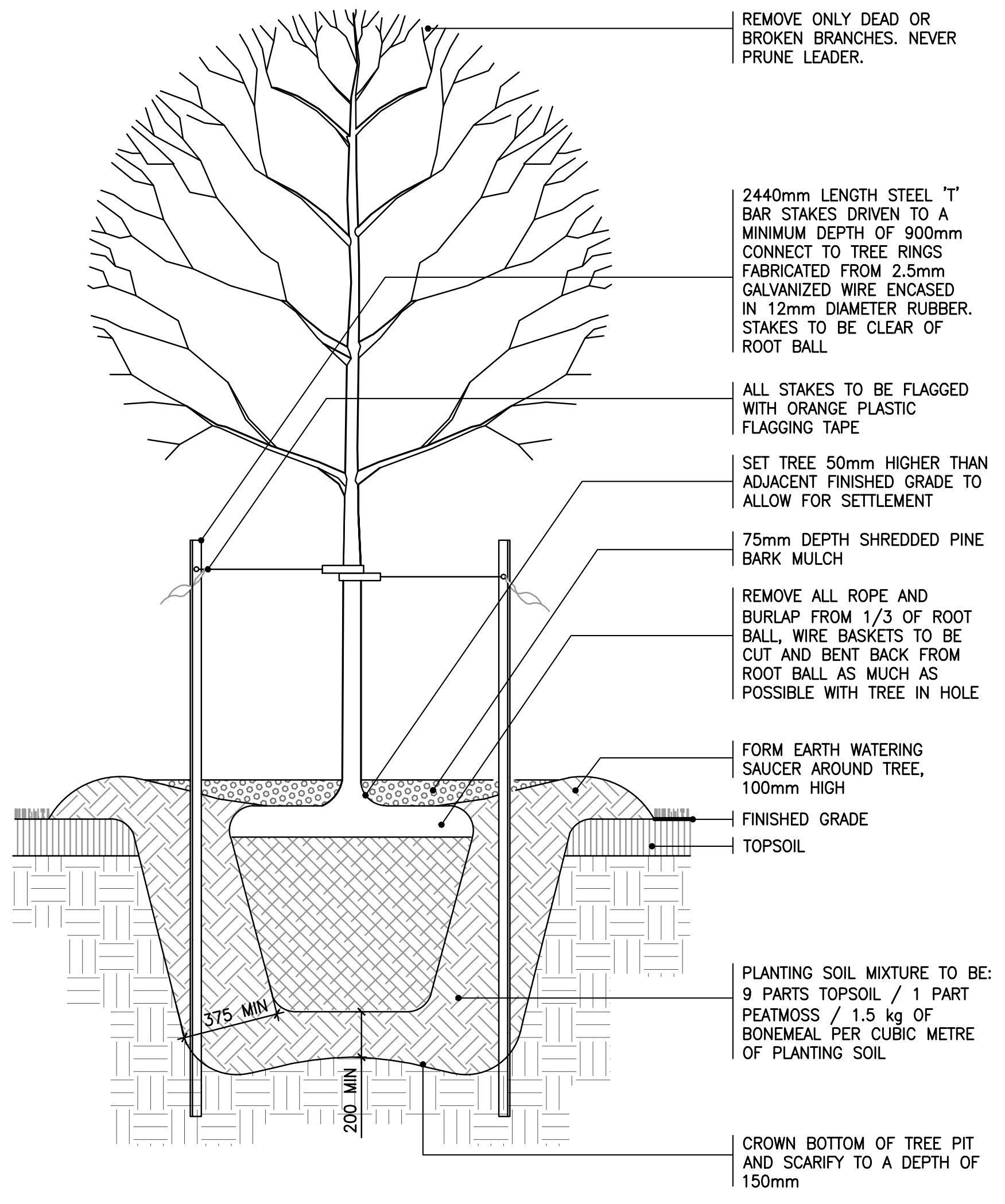
1. ALL CONSTRUCTION HOARDING AND TREE PROTECTION TO BE INSTALLED PRIOR TO START OF OPERATIONS.
2. EXISTING CONDITIONS PLAN OF SURVEY BY RODNEY GEYER, O.L.S. INC. DATED FEBRUARY 16, 2016.
3. CONTRACTOR TO VERIFY ALL SITE CONDITIONS AND REPORT ANY DISCREPANCIES TO THE CONSULTANT IMMEDIATELY.
4. LAYOUT ALL WORK FOR INSPECTION AND APPROVAL BY CONSULTANT PRIOR TO COMMENCEMENT OF CONSTRUCTION.
5. CONTRACTOR RESPONSIBLE FOR ANY AND ALL UNDERGROUND UTILITIES.
6. CONTRACTOR TO LAY OUT ALL SITE FURNISHINGS FOR CONSULTANT / OWNER REVIEW AND FINAL FIELD ADJUSTMENT PRIOR TO CONTRACTOR AFFIXING SITE FURNISHINGS TO HARD SURFACES.
7. CONTRACTOR TO ENSURE POSITIVE DRAINAGE FROM ALL STRUCTURES.
8. CONTRACTOR TO MAKE GOOD ALL DAMAGE TO ANY EXISTING OR ADJACENT CONDITIONS/ STRUCTURES DURING CONSTRUCTION TO THE SATISFACTION AND ACCEPTANCE OF THE CONSULTANT.



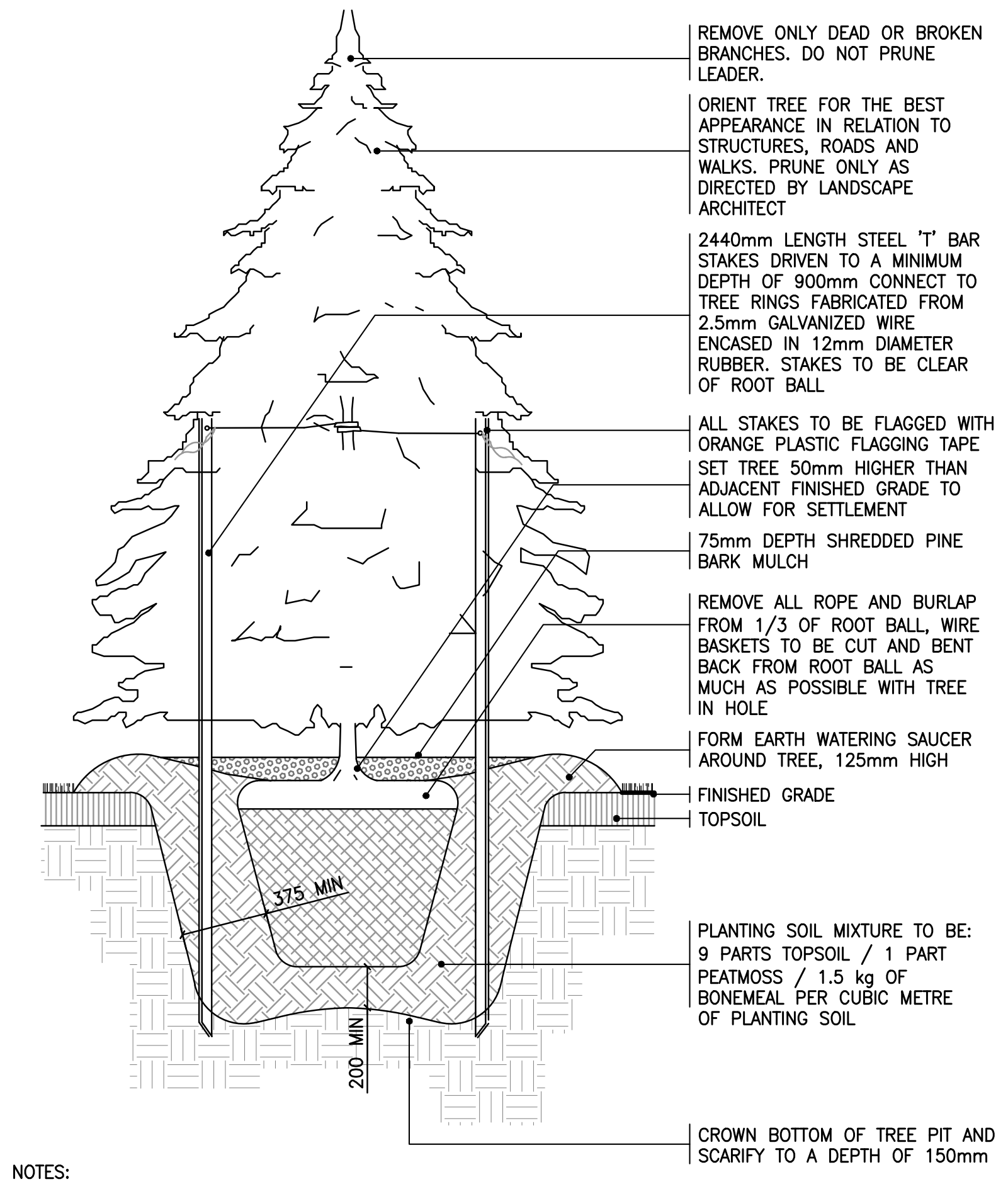
SECTION A – STORMWATER SYSTEM PLANTING SCHEMATIC 1:200



SHRUB AND PERENNIAL PLANTING NTS



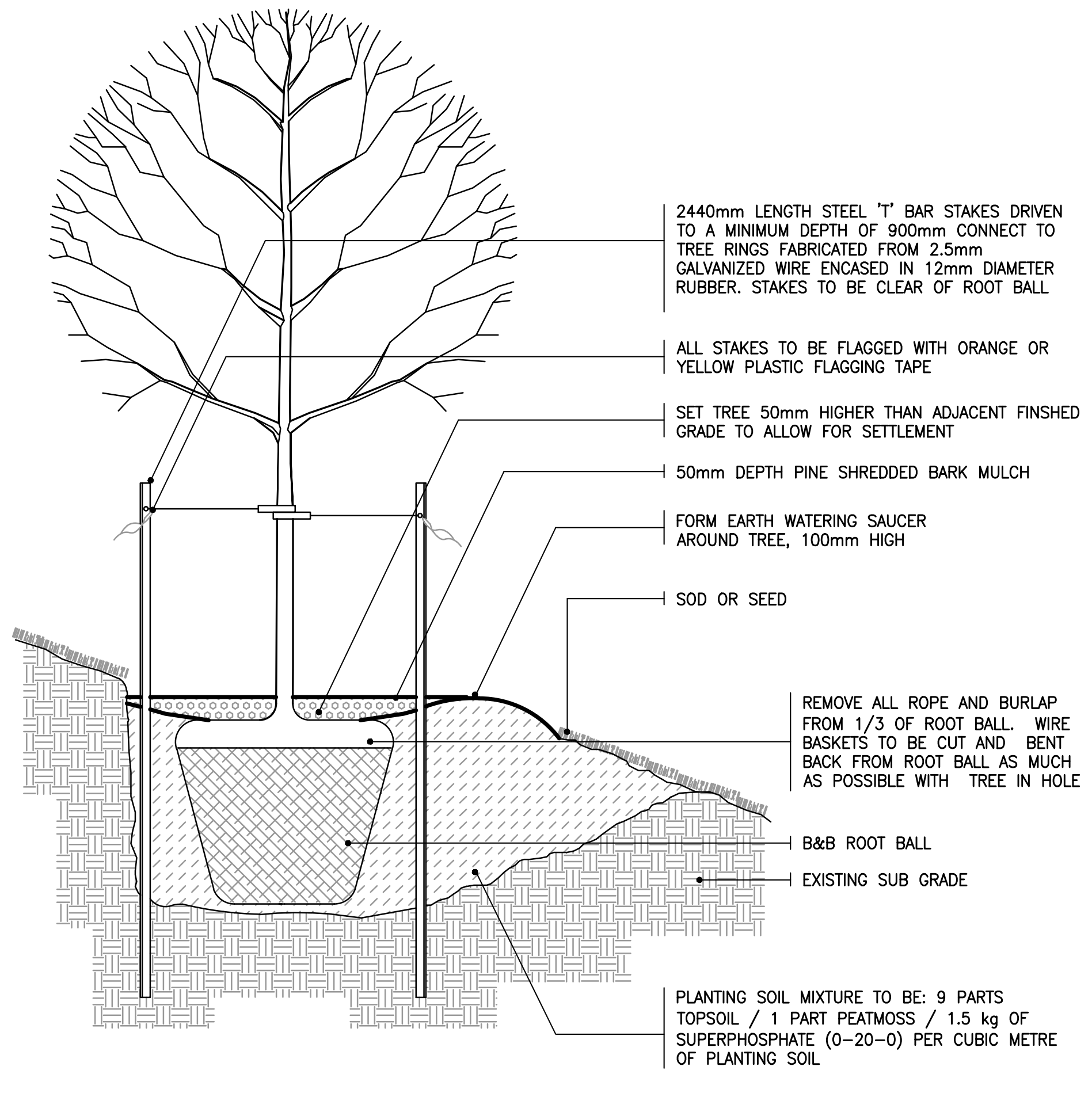
DECIDUOUS TREE PLANTING NTS



NOTES:

1. THE ABOVE DETAIL DOES NOT REPRESENT ANY PARTICULAR SPECIES.
2. SOIL MIXTURE SHOULD BE FIRMLY COMPACTED AND WASHED INTO SPACES AROUND ROOTBALL TO ELIMINATE AIR POCKETS AND PREVENT SETTLEMENT.

CONIFEROUS TREE PLANTING NTS



TREE PLANTING ON SLOPE NTS

FLEISHER RIDOUT PARTNERSHIP INC.
l.a.n.d.s.c.a.p.e a.r.c.h.i.t.e.c.t.s
1877 Davenport Road
Toronto, Ontario, M6N 1B9
T: (416) 533–4990

ISSUE	DATE	REMARKS
3	DECEMBER 10, 2020	ISSUED FOR 3RD SITE PLAN APPROVAL
2	AUGUST 14, 2020	ISSUED FOR 2ND SITE PLAN APPROVAL
1	FEBRUARY 4, 2020	ISSUED FOR SITE PLAN APPROVAL

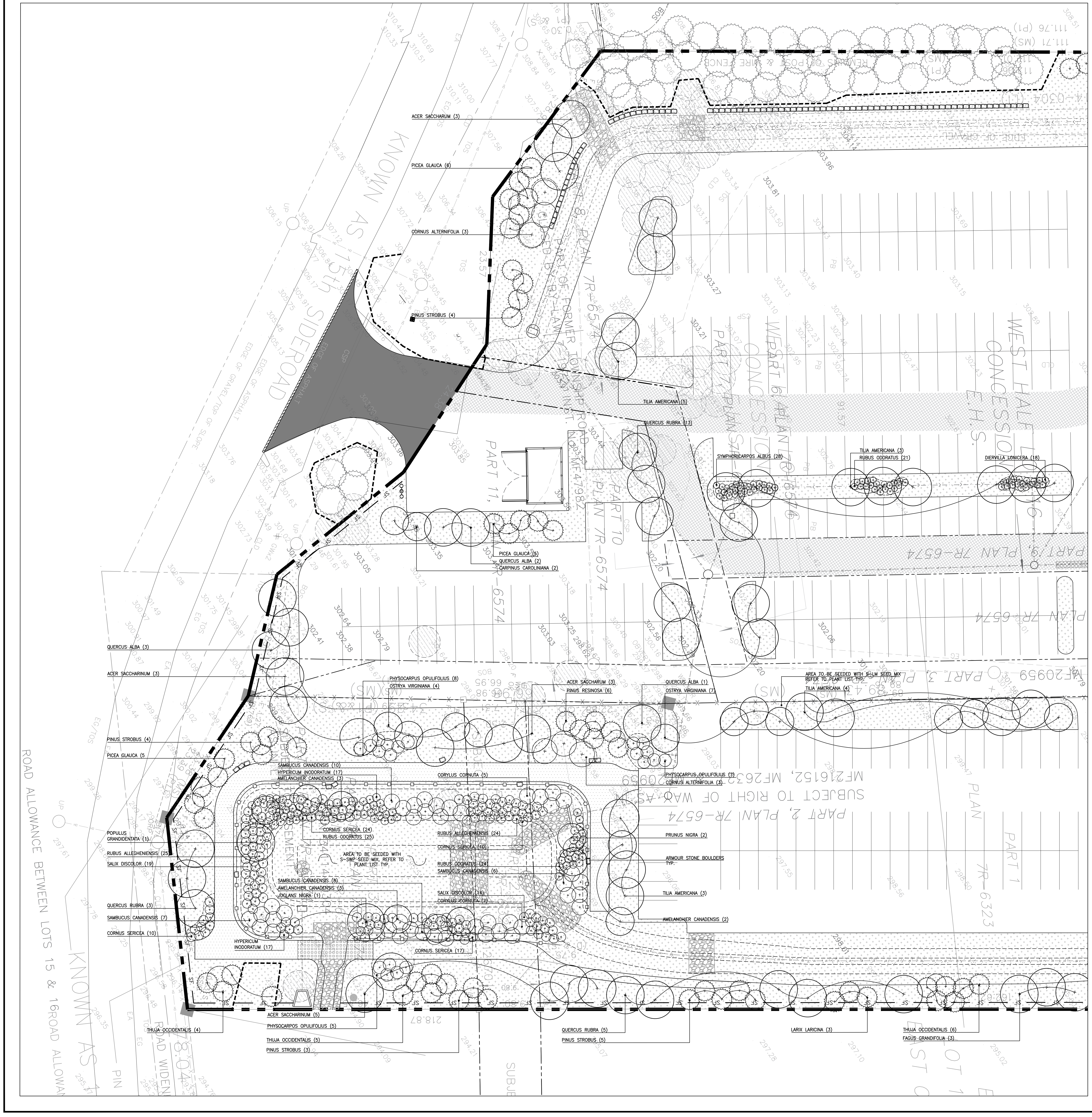
ONTARIO ASSOCIATION OF LANDSCAPE ARCHITECTS
B. J. FLEISHER
MEMBER

N

Project Name:
MANSFIELD SKI CLUB
628213 SIDE ROAD 15
Mulmur, ON L9V 0T9

Drawing Title:
OVERALL PLANTING PLAN

Drawn: JC
Design: BF
Date: JANUARY 2020
Checked: BF
Apprvd: BF
Scale: 1:500
CADD File: 151352
Dwg. No.: L.1



PLANT LIST

BOTANICAL NAME	COMMON NAME	QUANTITY	SIZE	CONDITION	COMMENTS
TREES					
Acer saccharinum	Silver Maple	16	70 mm	B.B.	
Acer saccharum	Sugar Maple	7	70 mm	B.B.	
Amelanchier canadensis	Canadian Serviceberry	24	70 mm	B.B.	Multistem
Carpinus caroliniana	Blue Beech	10	45 mm	B.B.	
Fagus grandifolia	American Beech	6	70 mm	B.B.	
Larix laricena	Tamarack	20	1.8 m	W.B.	
Juglans nigra	Black Walnut	4	70 mm	B.B.	
Ostrya virginiana	Ironwood	15	70 mm	B.B.	
Picea glauca	White Spruce	83	1.8 m	W.B.	
Pinus resinosa	Red Pine	42	1.8 m	W.B.	
Pinus strobus	White Pine	63	1.8 m	W.B.	
Populus grandidentata	Large-tooth Aspen	1	70 mm	B.B.	
Prunus nigra	Black Cherry	2	45 mm	B.B.	
Quercus alba	White Oak	12	70 mm	B.B.	
Quercus rubra	Red Oak	23	70 mm	B.B.	
Thuja occidentalis	White Cedar	37	70 mm	B.B.	
Tilia americana	Basswood	21	70 mm	B.B.	
Tsuga canadensis	Hemlock	13	1.8 m	W.B.	
SHRUBS					
Amelanchier canadensis	Saskatoon Berry	42	7 gal.	potted	Multistem
Aronia melanocarpa	Black Chokeberry	94	3 gal.	potted	
Ceanothus americanus	New Jersey Tea	35	3 gal.	potted	
Cornus alternifolia	Pagoda Dogwood	12	15 gal.	B.B.	
Cornus sericea	Red Osier Dogwood	290	3 gal.	potted	
Corylus cornuta	Beaked Hazel	20	3 gal.	potted	
Diervilla lonicera	Bush Honeysuckle	105	3 gal.	potted	
Hypericum inodorum	St. John's Wort	50	3 gal.	potted	
Juniperus horizontalis	Spreading Juniper	213	3 gal.	potted	
Physocarpus opulifolius	Common Ninebark	95	3 gal.	potted	
Salix discolor	Pussy Willow	70	3 gal.	potted	
Sambucus canadensis	Elderberry	63	3 gal.	potted	
Symphoricarpos albus	Snowberry	59	3 gal.	potted	
Rubus allegheniensis	Alleghany Blackberry	81	3 gal.	potted	
Rubus odoratus	Flowering Raspberry	128	3 gal.	potted	
PERENNIALS					
Achillia millefolium	Common Yarrow	165	1 gal.	potted	
Agastache foeniculum	Anise Hyssop	200	1 gal.	potted	
Asclepias tuberosa	Butterflyweed	250	1 gal.	potted	
Echinacea purpurea	Purple Coneflower	945	1 gal.	potted	
Rudbeckia hirta	Black-eyed Susan	280	1 gal.	potted	
GRASSES					
Andropogen gerardii	Big Blue Stem	50	1 gal.	potted	
Panicum virgatum	Switch Grass	245	1 gal.	potted	
Schizachyrium scoparium	Little Bluestem	360	1 gal.	potted	

SEED MIX

S-SWP	Stormwater Pond Mix Contains: Fox Sedge, Virginia Wild Rye, Canada Bluegrass, Indian Grass, Black Eyed Susan, New England Aster, Grass Leafed Golden Rod
S-FACW	Wetland Mixture Contains: Bebb's Sedge, Blue Lobelia, Blue Vervain, Blunt Broom Sedge, Boneset, Fox Sedge, Green Bulrush, Heath Aster, Lurid Sedge, New
S-LM	No Maintenance Eco-Lawn Mix Contains: Creeping Red Fescue, Ecostar Hard Fescue, Chewings Fescue and Perennial Rye.

LEGEND

- PROPERTY LINE
- FIRE ROUTE — PROPOSED FIRE TRUCK ACCESS ROUTE
- WATER SERVICE LINE
- SANITARY SEWER LINE
- ENTRANCE
- 1M HT. WOOD SPLIT RAIL FENCE
- UNIT PAVING
- CONCRETE SIDEWALK
- HEAVY DUTY ASPHALT
- SOD
- SEEDED AREA
- PROPOSED FIRE HYDRANT
- BOULDER
- PROPOSED HYDRO TRANSFORMER Refer to Electrical
- EXISTING TREE TO REMAIN
- EXISTING TREE GROUPING TO REMAIN
- TREE HOARDING

GENERAL NOTES:

1. ALL CONSTRUCTION HOARDING AND TREE PROTECTION TO BE INSTALLED PRIOR TO START OF OPERATIONS.
2. EXISTING CONDITIONS PLAN OF SURVEY BY RODNEY GEYER, O.L.S. INC. DATED FEBRUARY 16, 2016.
3. CONTRACTOR TO VERIFY ALL SITE CONDITIONS AND REPORT ANY DISCREPANCIES TO THE CONSULTANT IMMEDIATELY.
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7. CONTRACTOR TO ENSURE POSITIVE DRAINAGE FROM ALL STRUCTURES.
8. CONTRACTOR TO MAKE GOOD ALL DAMAGE TO ANY EXISTING OR ADJACENT CONDITIONS/ STRUCTURES DURING CONSTRUCTION TO THE SATISFACTION AND ACCEPTANCE OF THE CONSULTANT.

FLEISHER RIDOUT
PARTNERSHIP INC.
l.a.n.d.s.c.a.p.e a.r.c.h.i.t.e.c.t.s
1877 Davenport Road
Toronto, Ontario, M6N 1B9
T: (416) 533-4990

ISSUE	DATE	REMARKS
3	DECEMBER 10, 2020	ISSUED FOR 3RD SITE PLAN APPROVAL
2	AUGUST 14, 2020	ISSUED FOR 2ND SITE PLAN APPROVAL
1	FEBRUARY 4, 2020	ISSUED FOR SITE PLAN APPROVAL

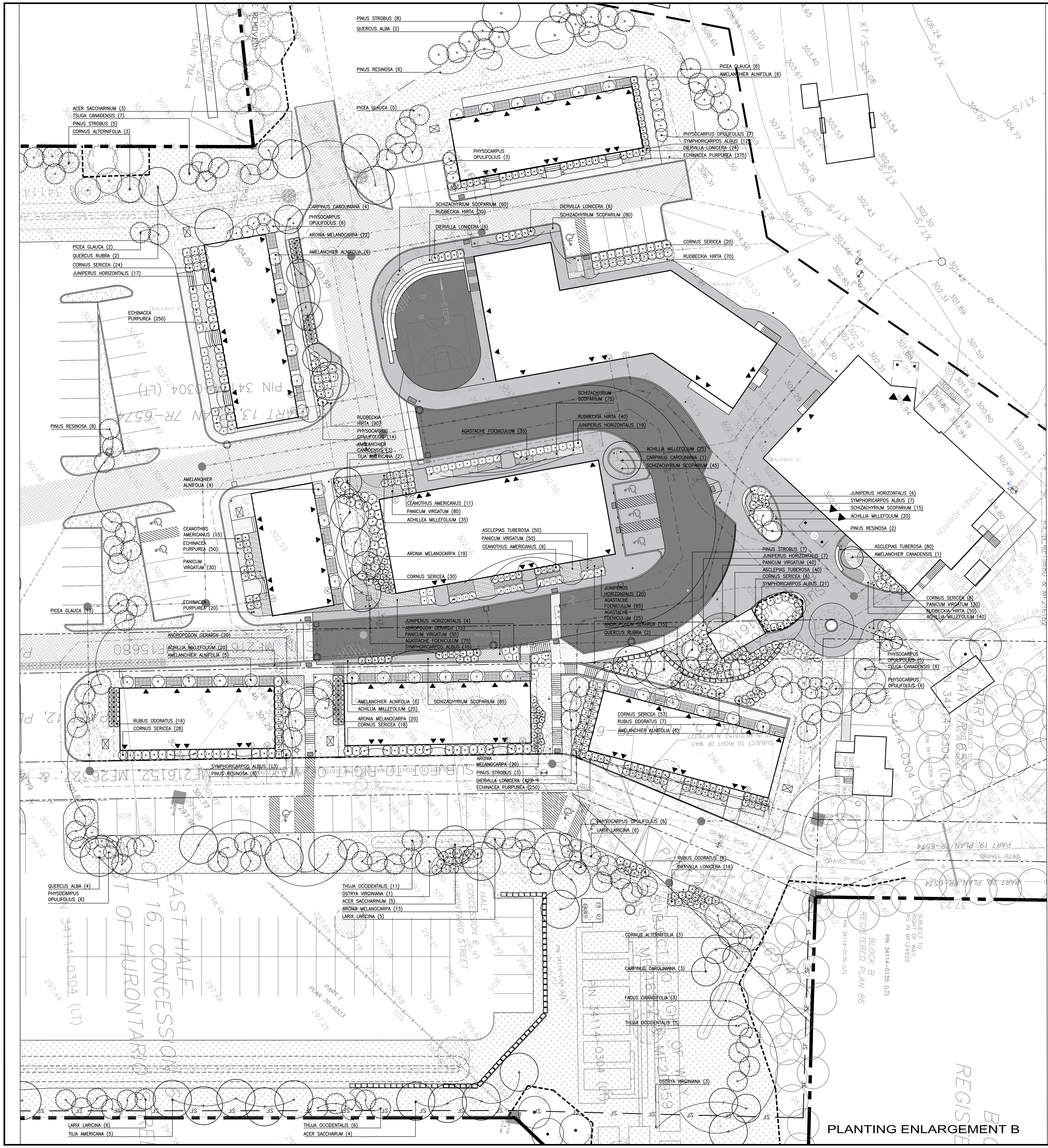
ONTARIO ASSOCIATION OF LANDSCAPE ARCHITECTS
B. J. FLEISHER
MEMBER

N

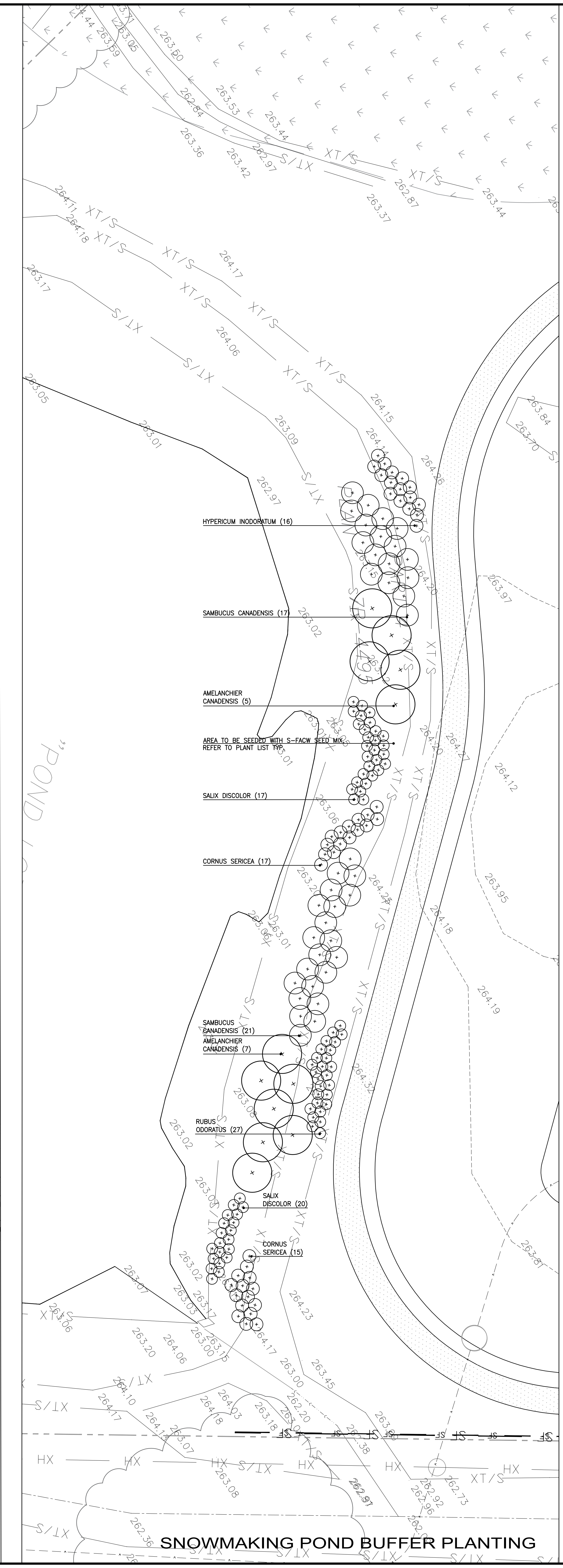
Project Name:
MANSFIELD SKI CLUB
628213 SIDE ROAD 15
Mulmur, ON L9V 0T9

Drawing Title:
PLANTING ENLARGEMENT A

Drawn: JC	Design: BF	Date: JANUARY 2020
Checked: BF	Apprvd: BF	Scale: 1:250
CADD File: 151352		Dwg. No.: L.2



PLANTING ENLARGEMENT B



SNOWMAKING POND BUFFER PLANTING

LEGEND

- PROPERTY LINE
- FIRE ROUTE — PROPOSED FIRE TRUCK ACCESS ROUTE
- WATER SERVICE LINE
- SANITARY SEWER LINE
- ◀ ENTRANCE
- 1M HT. WOOD SPLIT RAIL FENCE
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- SOD
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- EXISTING TREE TO REMAIN
- EXISTING TREE GROUPING TO REMAIN
- TREE HOARDING
- PROPOSED DECIDUOUS TREE
- PROPOSED CONIFEROUS TREE
- SHRUB BED

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ONTARIO ASSOCIATION OF LANDSCAPE ARCHITECTS
B. J. FLEISHER
MEMBER

N

Project Name:
MANSFIELD SKI CLUB
628213 SIDE ROAD 15
Mulmur, ON L9V 0T9

Drawing Title:
PLANTING ENLARGEMENT B

Drawn: JC	Design: BF	Date: JANUARY 2020
Checked: BF	Apprvd: BF	Scale: 1:250
CADD File: 151352		Dwg. No.: L.3

LEGEND

- PROPERTY LINE
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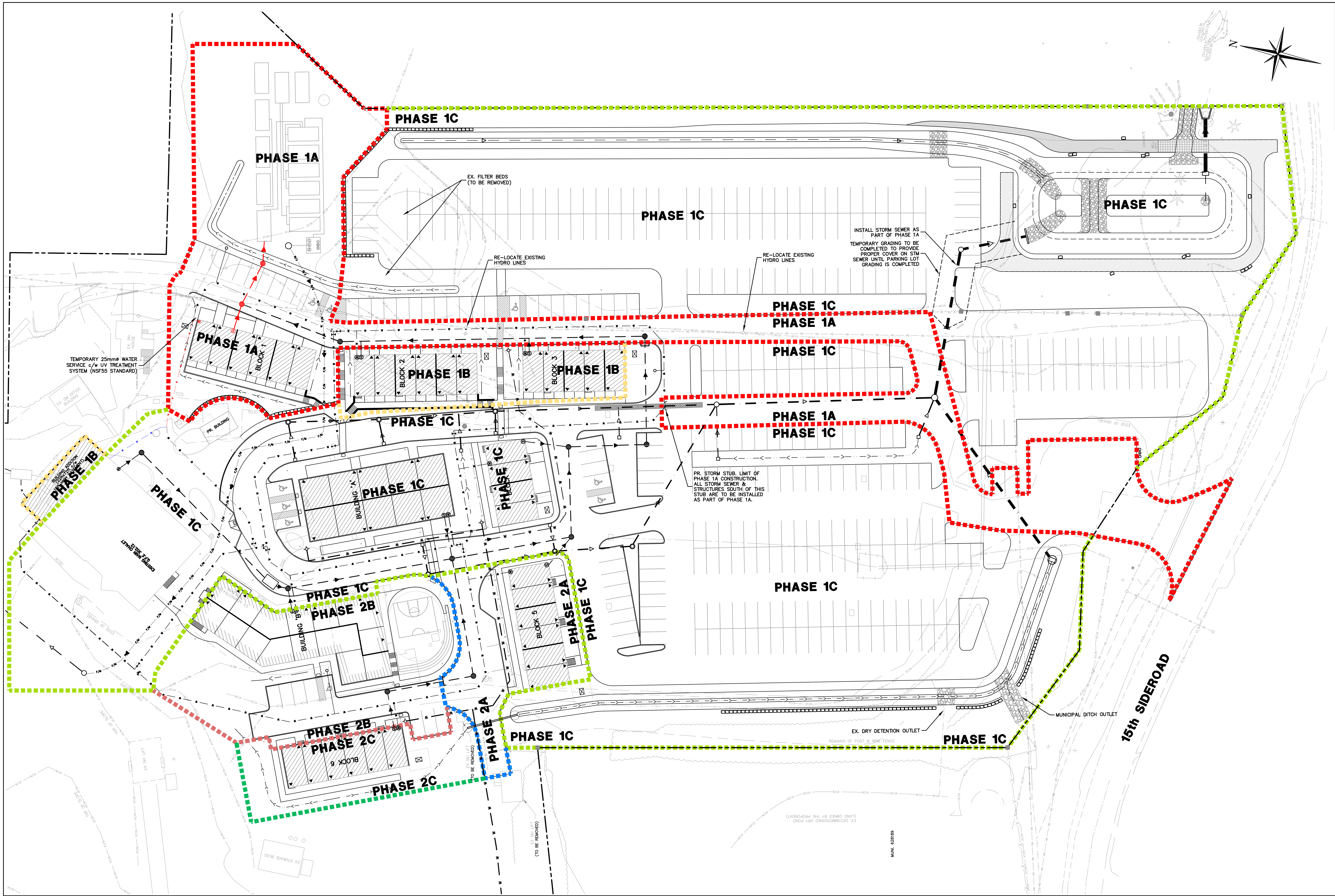
B. J. FLEISHER
MEMBER

N

Project Name:
MANSFIELD SKI CLUB
628213 SIDE ROAD 15
Mulmur, ON L9V 0T9

Drawing Title:
SKI HILL PLANTING PLAN

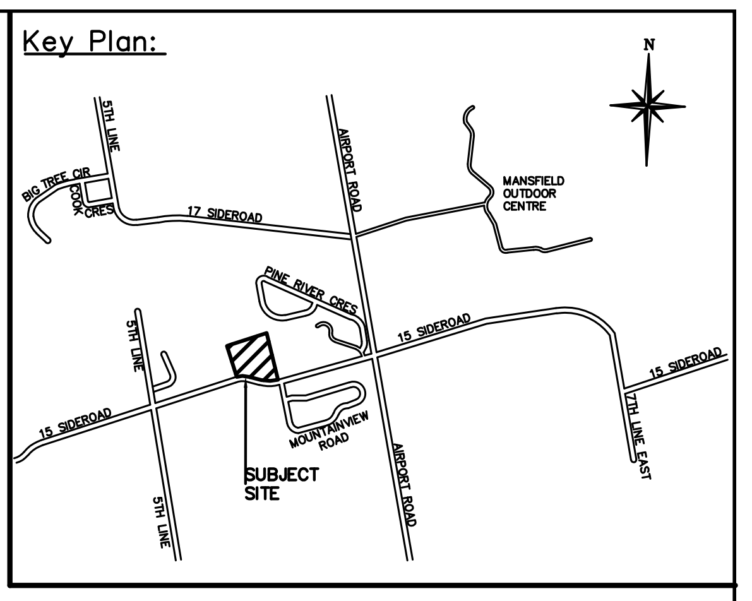
Drawn: JC	Design: BF	Date: JANUARY 2020
Checked: BF	Apprvd: BF	Scale: 1:250
CADD File: 151352		Dwg. No.: L.4



CAUTION

CONTRACTOR TO DETERMINE LOCATION OF EXISTING UTILITIES PRIOR TO CONSTRUCTION.

Key Plan:



Legend:

EXISTING FEATURES (EX)

- EX SIB — EX STD IRON BAR
- EX IB — EX IRON BAR
- EX UP — EX UTILITY POLE
- ☒ — EX BELL PED
- EX WS — EX WATER SERVICE
- EX HYD — EX FIRE HYD.
- NS — EX ST NAME SIGN
- SS — EX STOP SIGN
- x 123.45 — EX ELEVATION
- EX FENCE
- GAS — EX U/G GASMAIN
- XB — EX U/G BELL
- XH — EX HYDRO
- XB/S — EX BOTTOM OF SLOPE
- XT/S — EX TOP OF SLOPE
- EX WV — EX WATERMAIN & VALVE
- EX SAN @ 0.0% — EX SAN SEWER & MH
- EX STM @ 0.0% — EX STM SEWER & MH

PROPOSED FEATURES (PR)

- NS — PR STREET NAME SIGN
- SS — PR STOP SIGN
- SF — PR SILT FENCE
- PR LEGAL PART LOTS
- PR LEGAL BOUNDARY
- Ⓛ — PR STREET LIGHT
- Ⓦ — PR WATER SERVICE
- Ⓢ — PR SAN SERVICE
- PR HYDRO TRANSFORMER
- 00mmø W/M — PR WATERMAIN
- 00mmø W/M — PR TEMPORARY WATERMAIN FOR PHASE 1A
- 00mmø W/M — PR PERMANENT WATERMAIN FOR PHASE 1A
- PR FIRE HYDRANT
- PR WATER VALVE
- 0m–00mmø SAN @ 0.0% — PR SAN SEWER
- PR PERMANENT SAN SEWER FOR PHASE 1A
- MH K — PR SANITARY MANHOLE
- 0m–00mmø STM @ 0.0% — PR STM SEWER
- MH 4 — PR CATCHBASIN MANHOLE
- MH 4 — PR MANHOLE
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- x 000.00 — PROPOSED ELEVATION
- x (000.00) — PR. MATCH EXISTING ELEVATION (INTERPOLATED)
- PR SWALE
- ▨ — PR HEAVY DUTY ASPHALT
- ▨ — PR UNIT PAVING
- ▨ — PR BERM
- ▨ — PR FIRE ACCESS
- U.F.E — UPPER FLOOR ELEVATION
- G.F.E — GROUND FLOOR ELEVATION

Phasing Legend:

- 🟥 — PHASE 1A
- 🟨 — PHASE 1B
- 🟩 — PHASE 1C
- 🟦 — PHASE 2A
- 🟥 — PHASE 2B
- 🟩 — PHASE 2C

Notes:

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Benchmark: 463.937m

ELEVATIONS SHOWN HEREON ARE GEODETIC AND ARE DERIVED FROM CANNET NETWORK BASE STATION ORVL HAVING A PUBLISHED ELEVATION OF 463.937m

No.	Issue / Revision	Date
1	SPA FIRST SUBMISSION	AUG. 17, 2020
2	SPA SECOND SUBMISSION	DEC. 15, 2020

Mansfield Ski Club

PHASING PLAN

Client:

Mansfield Ski Club

628213 15th Sideroad
PO Box 75 RPO Mansfield,
Mulmur, Ontario
L9V 3M6

WMI & Associates Limited
119 Collier Street
Barrie, Ontario
L4M 1H5
Ph 705-797-2027
www.wmiengineering.ca

Drawn By AW	Checked By JWL	Drawing No. PHA
Scale 1:400	Project No. 15–319	

RETAINING WALL NOTE:

ALL RETAINING WALL DESIGNS ARE TO BE COMPLETED BY OTHERS AS PART OF THE BUILDING PERMIT APPROVAL STAGE. ALL WALLS OVER 1.0m HIGH WILL REQUIRE RAILINGS/FENCING AS PER OBC.

EXTERNAL BY-PASS SWALE (TYP.)
CROSS SECTION A-A
N.T.S.

CAUTION

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J.W.LIGHTHEART
100140403
DEC. 15, 2020

No.	Issue / Revision	Date
1	SPA FIRST SUBMISSION	AUG. 17, 2020
2	SPA SECOND SUBMISSION	DEC. 15, 2020

Mansfield Ski Club

SITE GRADING PLAN NORTH

Client:
Mansfield Ski Club
628213 15th Sideroad
PO Box 75 RPO Mansfield,
Mulmur, Ontario
L9V 3M6

WMI & Associates Limited
119 Collier Street
Barrie, Ontario
L4M 1H5
Ph 705-797-2027
www.wmiengineering.ca

Drawn By AW
Checked By JWL
Drawing No. SGRN
Scale 1:300
Project No. 15-319

NORTH ENHANCED GRASS SWALE DETAIL

N.T.S.

SOUTH ENHANCED GRASS SWALE DETAIL

N.T.S.

EXTERNAL BY-PASS SWALE (TYP.) CROSS SECTION B–B

N.T.S.

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CAUTION

CONTRACTOR TO DETERMINE LOCATION OF EXISTING UTILITIES PRIOR TO CONSTRUCTION.

Legend:

EXISTING FEATURES (EX)

EX SIB	EX STD IRON BAR
EX IB	EX IRON BAR
EX UP	EX UTILITY POLE
☒	EX BELL PED
EX WS	EX WATER SERVICE
EX HYD	EX FIRE HYD.
NS	EX ST NAME SIGN
SS	EX STOP SIGN
x 123.45	EX ELEVATION
	EX FENCE
GAS	EX U/G GASMAIN
XB	EX U/G BELL
XH	EX HYDRO
XB/S	EX BOTTOM OF SLOPE
XT/S	EX TOP OF SLOPE
EX WV	EX WATERMAIN & VALVE
EX SAN @ 0.0%	EX SAN SEWER & MH
EX STM @ 0.0%	EX STM SEWER & MH

PROPOSED FEATURES (PR)

NS	PR STREET NAME SIGN
SS	PR STOP SIGN
SF	PR SILT FENCE
	PR LEGAL PART LOTS
	PR LEGAL BOUNDARY
Ⓛ	PR STREET LIGHT
Ⓦ	PR WATER SERVICE
Ⓢ	PR SAN SERVICE
	PR HYDRO TRANSFORMER
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	PR PERMANENT SAN SEWER FOR PHASE 1A
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0m–00mmø STM @ 0.0%	PR STM SEWER
MH 4	PR CATCHBASIN MANHOLE
MH 4	PR MANHOLE
□	PR CATCHBASIN
x 000.00	PROPOSED ELEVATION
x (000.00)	PR. MATCH EXISTING ELEVATION (INTERPOLATED)
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▩	PR HEAVY DUTY ASPHALT
▩	PR UNIT PAVING
▩	PR BERM
▨	PR FIRE ACCESS
U.F.E	UPPER FLOOR ELEVATION
G.F.E	GROUND FLOOR ELEVATION
➡	EXTERNAL BY-PASS SPILLWAY

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Mansfield Ski Club

SITE GRADING PLAN SOUTH

Client:

Mansfield Ski Club
628213 15th Sideroad
PO Box 75 RPO Mansfield,
Mulmur, Ontario
L9V 3M6

WMI & Associates Limited
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Drawn By AW	Checked By JWL	Drawing No.
Scale 1:300	Project No. 15–319	SGRS

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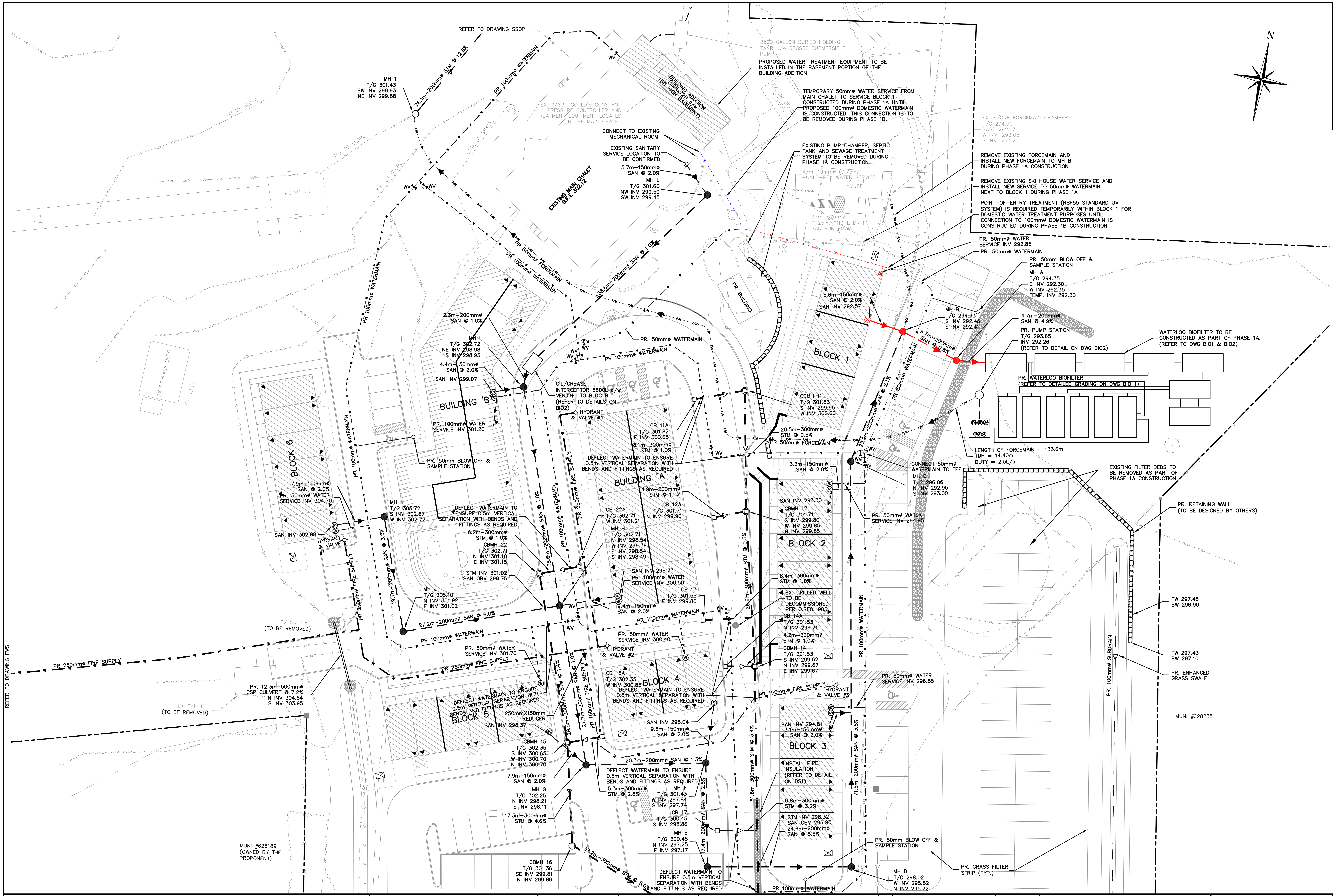
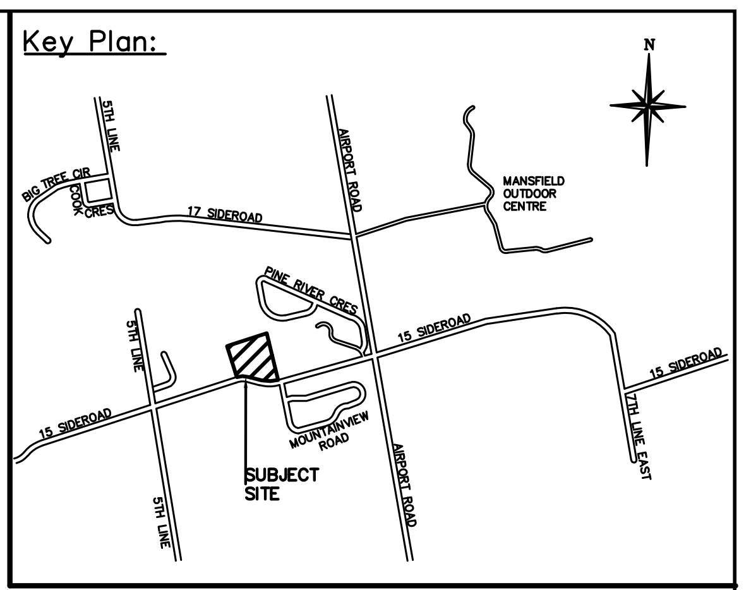


Key Plan:



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WATERMAIN NOTE:
1. THE PROPOSED BUILDINGS ARE NOT SPRINKLERED. NO SIAMESE CONNECTIONS ARE REQUIRED.

SANITARY NOTE:
1. ALL BUILDINGS THAT HAVE RESTAURANT USES WILL REQUIRE AN OIL/GREASE INTERCEPTOR PRIOR TO DISCHARGING INTO THE SANITARY SEWER SYSTEM.

CAUTION
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J.W.LIGHTHEART
100140403
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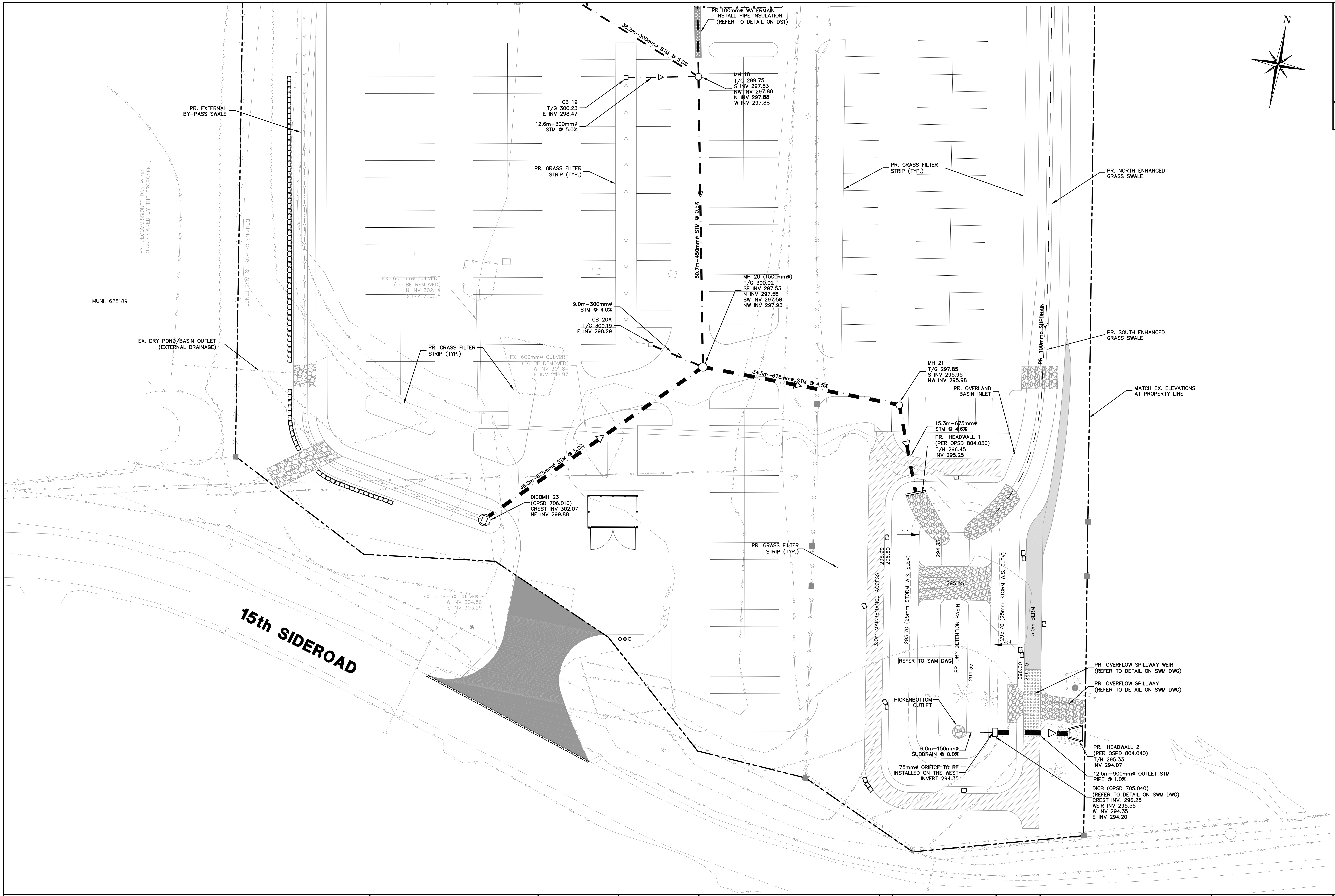
Mansfield Ski Club

GENERAL SERVICING
PLAN NORTH

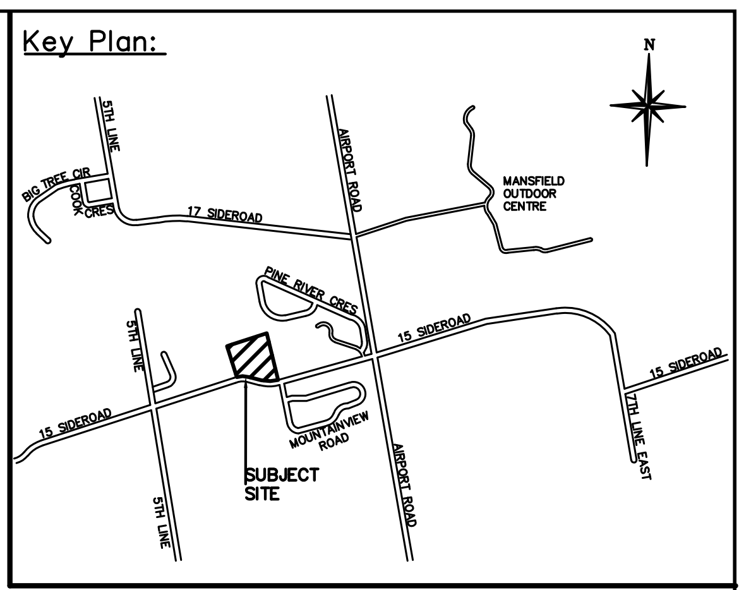
Client:
Mansfield Ski Club
628213 15th Sideroad
PO Box 75 RPO Mansfield,
Mulmur, Ontario
L9V 3M6

WMI & Associates Limited
119 Collier Street
Barrie, Ontario
L4M 1H5
Ph 705-797-2027
www.wmiengineering.ca

Drawn By AW
Checked By JWL
Drawing No. GENN
Scale 1:300
Project No. 15-319



Key Plan:



Legend:

EXISTING FEATURES (EX)

▪ EX SIB	EX STD IRON BAR
▪ EX IB	EX IRON BAR
○ EX UP	EX UTILITY POLE
☒	EX BELL PED
Ⓦ EX WS	EX WATER SERVICE
EX HYD	EX FIRE HYD.
NS	EX ST NAME SIGN
SS	EX STOP SIGN
x 123.45	EX ELEVATION
	EX FENCE
GAS GAS GAS	EX U/G GASMAIN
XB	EX U/G BELL
XH XH XH XH	EX HYDRO
XB/S XB/S XB/S XB/S	EX BOTTOM OF SLOPE
XT/S XT/S XT/S XT/S	EX TOP OF SLOPE
EX WV	EX WATERMAIN & VALVE
EX SAN @ 0.0%	EX SAN SEWER & MH
EX STM @ 0.0%	EX STM SEWER & MH

PROPOSED FEATURES (PR)

NS	PR STREET NAME SIGN
SS	PR STOP SIGN
SF SF SF	PR SILT FENCE
	PR LEGAL PART LOTS
	PR LEGAL BOUNDARY
Ⓛ	PR STREET LIGHT
Ⓦ	PR WATER SERVICE
Ⓢ	PR SAN SERVICE
	PR HYDRO TRANSFORMER
00mmø W/M	PR WATERMAIN
00mmø W/M	PR TEMPORARY WATERMAIN FOR PHASE 1A
00mmø W/M	PR PERMANENT WATERMAIN FOR PHASE 1A
	PR FIRE HYDRANT
	PR WATER VALVE
0m–00mmø SAN @ 0.0%	PR SAN SEWER
	PR PERMANENT SAN SEWER FOR PHASE 1A
● MH K	PR SANITARY MANHOLE
0m–00mmø STM @ 0.0%	PR STM SEWER
MH 4	PR CATCHBASIN MANHOLE
○ MH 4	PR MANHOLE
□	PR CATCHBASIN
x 000.00	PROPOSED ELEVATION
x (000.00)	PR. MATCH EXISTING ELEVATION (INTERPOLATED)
	PR SWALE
▨	PR HEAVY DUTY ASPHALT
▨	PR UNIT PAVING
▨	PR BERM
▨	PR FIRE ACCESS
U.F.E	UPPER FLOOR ELEVATION
G.F.E	GROUND FLOOR ELEVATION

CAUTION

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Benchmark: 463.937m

ELEVATIONS SHOWN HEREON ARE GEODETIC AND ARE DERIVED FROM CANNET NETWORK BASE STATION ORVL HAVING A PUBLISHED ELEVATION OF 463.937m

J.W.LIGHTHEART
100140403
DEC. 15, 2020

No.	Issue / Revision	Date
1	SPA FIRST SUBMISSION	AUG. 17, 2020
2	SPA SECOND SUBMISSION	DEC. 15, 2020

Mansfield Ski Club

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PLAN SOUTH

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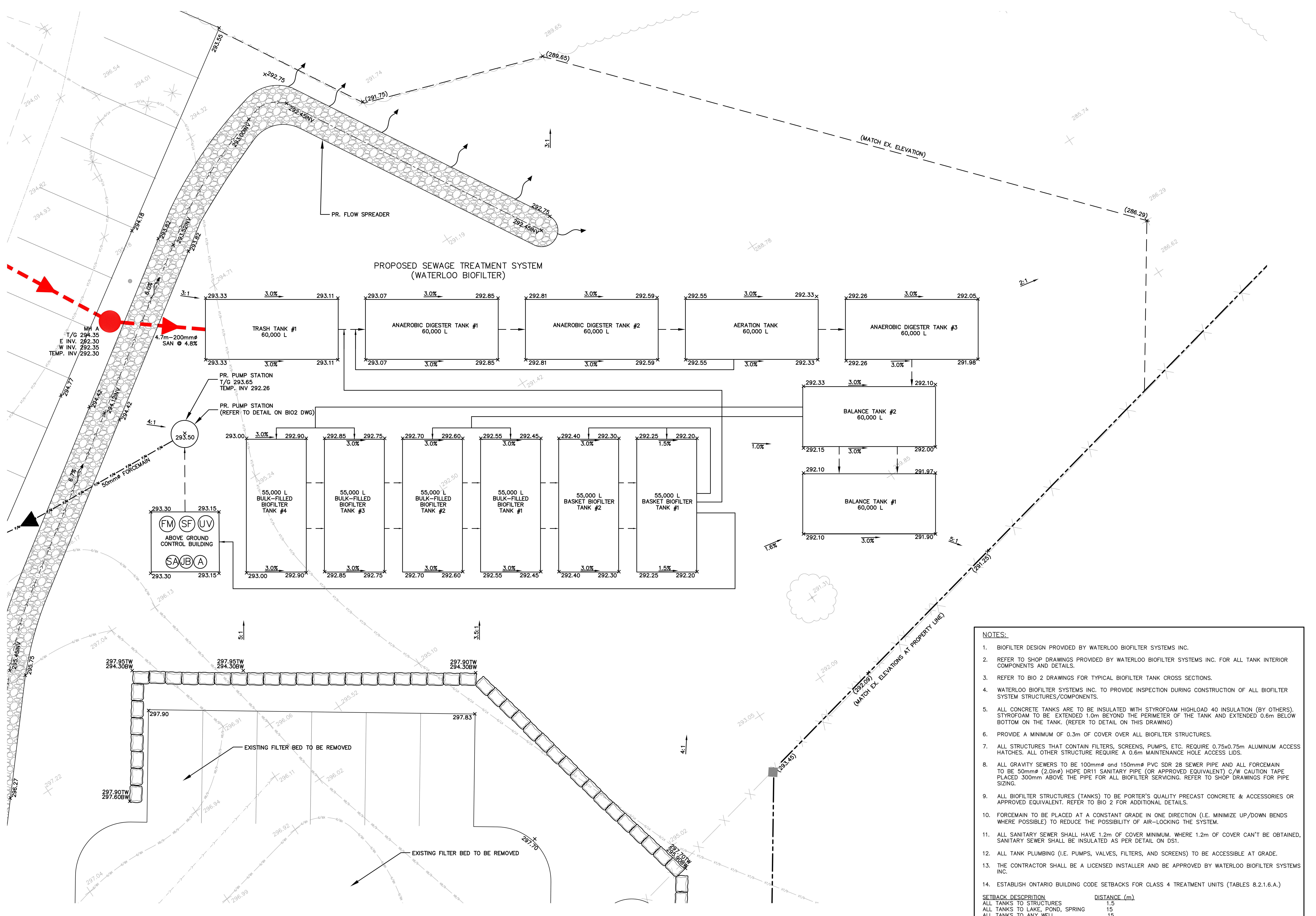
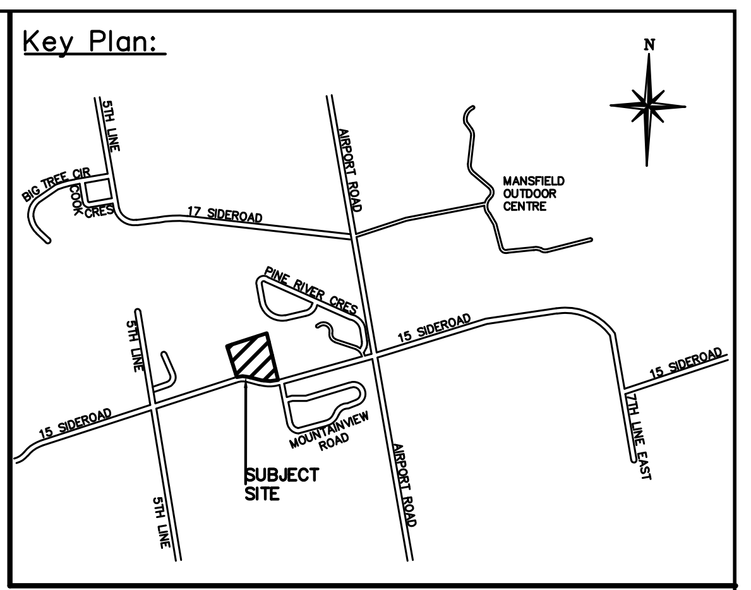
\\WMI–SERVER\wmi–server\Data\Projects\2015\15–319\CAD\WMI\Issue_No2\201210_Baseplan_15–319.dwg, GENS, 1:1





Legend:

- PR. FORCEMAIN
- PR. GRAVITY SEWER
- 104.90 PR. ELEVATION
- (104.90) MATCH EXISTING ELEVATIONS

BIOFILTER TANK	GROUND ELEV.	TOP OF STRUCTURE ELEV.	INLET ELEV.	OUTLET ELEV.
TRASH TANK	293.33	292.42	292.07	292.02
ANAEROBIC DIGESTER TANK #1	293.07	292.19	291.84	291.79
ANAEROBIC DIGESTER TANK #2	292.81	291.96	291.61	291.56
AERATION TANK	292.55	291.73	291.38	291.33
ANAEROBIC DIGESTER TANK #3	292.26	291.48	291.13	291.08
BALANCE TANK #2	292.00	291.38	291.03 (G)	287.82 (G) 290.68 (F)
BALANCE TANK #1	291.90	291.32	287.82 (G)	287.82 (G)
BULK-FILLED BIOFILTER TANK #4	293.00	292.08	292.70 (M)	290.10 (G)
BULK-FILLED BIOFILTER TANK #3	292.85	292.08	292.55 (M) 290.10 (G)	290.10 (G)
BULK-FILLED BIOFILTER TANK #2	292.70	291.93	292.40 (M) 289.95 (G)	289.95 (G)
BULK-FILLED BIOFILTER TANK #1	292.55	291.93	292.25 (M) 289.95 (G)	289.95 (G)
BASKET BIOFILTER TANK #2	292.40	291.78	292.10 (M) 289.80 (G)	289.80 (G)
BASKET BIOFILTER TANK #1	292.25	291.78	291.95 (M) 289.80 (G)	289.80 (F)
ABOVE GROUND CONTROL BUILDING	292.15	N/A	N/A	N/A
PUMP STATION	293.50	293.65	292.30	292.30

NOTES:

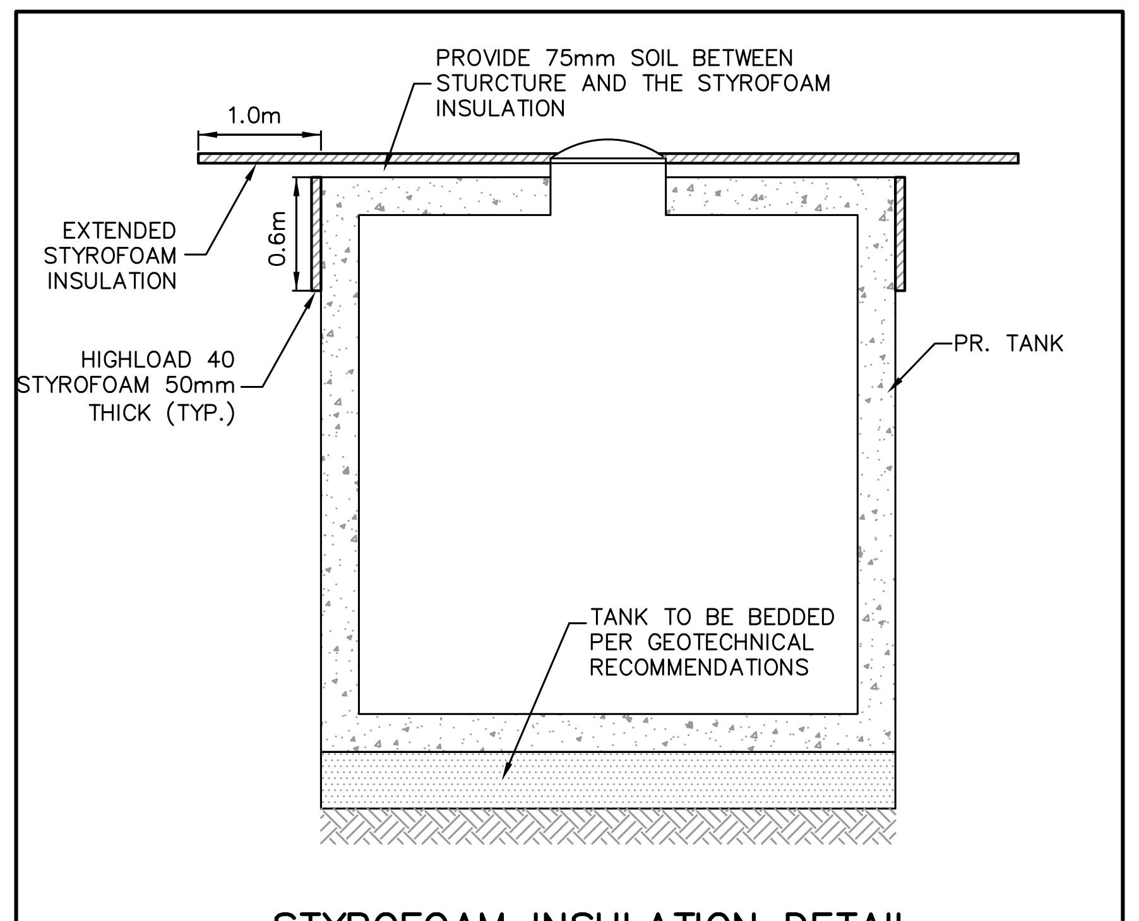
IF TANK HAS MULTIPLE INLETS AND/OR OUTLETS, ASSUME ALL INLETS ARE AT THE SAME ELEVATION AND ALL OUTLETS ARE AT THE SAME ELEVATION UNLESS OTHERWISE INDICATED.

(G) = GRAVITY SEWER
(F) = FORCEMAIN
(M) = 50mm FORCEMAIN SPRAY MANIFOLD THROUGH POLYLOK RISER

NOTES:

1. BIOFILTER DESIGN PROVIDED BY WATERLOO BIOFILTER SYSTEMS INC.
2. REFER TO SHOP DRAWINGS PROVIDED BY WATERLOO BIOFILTER SYSTEMS INC. FOR ALL TANK INTERIOR COMPONENTS AND DETAILS.
3. REFER TO BIO 2 DRAWINGS FOR TYPICAL BIOFILTER TANK CROSS SECTIONS.
4. WATERLOO BIOFILTER SYSTEMS INC. TO PROVIDE INSPECTION DURING CONSTRUCTION OF ALL BIOFILTER SYSTEM STRUCTURES/COMPONENTS.
5. ALL CONCRETE TANKS ARE TO BE INSULATED WITH STYROFOAM HIGHLOAD 40 INSULATION (BY OTHERS). STYROFOAM TO BE EXTENDED 1.0m BEYOND THE PERIMETER OF THE TANK AND EXTENDED 0.6m BELOW BOTTOM ON THE TANK. (REFER TO DETAIL ON THIS DRAWING)
6. PROVIDE A MINIMUM OF 0.3m OF COVER OVER ALL BIOFILTER STRUCTURES.
7. ALL STRUCTURES THAT CONTAIN FILTERS, SCREENS, PUMPS, ETC. REQUIRE 0.75x0.75m ALUMINUM ACCESS HATCHES. ALL OTHER STRUCTURE REQUIRE A 0.6m MAINTENANCE HOLE ACCESS LIDS.
8. ALL GRAVITY SEWERS TO BE 100mmø and 150mmø PVC SDR 28 SEWER PIPE AND ALL FORCEMAIN TO BE 50mmø (2.0inø) HDPE DR11 SANITARY PIPE (OR APPROVED EQUIVALENT) C/W CAUTION TAPE PLACED 300mm ABOVE THE PIPE FOR ALL BIOFILTER SERVICING. REFER TO SHOP DRAWINGS FOR PIPE SIZING.
9. ALL BIOFILTER STRUCTURES (TANKS) TO BE PORTER'S QUALITY PRECAST CONCRETE & ACCESSORIES OR APPROVED EQUIVALENT. REFER TO BIO 2 FOR ADDITIONAL DETAILS.
10. FORCEMAIN TO BE PLACED AT A CONSTANT GRADE IN ONE DIRECTION (I.E. MINIMIZE UP/DOWN BENDS WHERE POSSIBLE) TO REDUCE THE POSSIBILITY OF AIR-LOCKING THE SYSTEM.
11. ALL SANITARY SEWER SHALL HAVE 1.2m OF COVER MINIMUM. WHERE 1.2m OF COVER CAN'T BE OBTAINED, SANITARY SEWER SHALL BE INSULATED AS PER DETAIL ON DS1.
12. ALL TANK PLUMBING (I.E. PUMPS, VALVES, FILTERS, AND SCREENS) TO BE ACCESSIBLE AT GRADE.
13. THE CONTRACTOR SHALL BE A LICENSED INSTALLER AND BE APPROVED BY WATERLOO BIOFILTER SYSTEMS INC.
14. ESTABLISH ONTARIO BUILDING CODE SETBACKS FOR CLASS 4 TREATMENT UNITS (TABLES 8.2.1.6.A.)

SETBACK DESCPRITION	DISTANCE (m)
ALL TANKS TO STRUCTURES	1.5
ALL TANKS TO LAKE, POND, SPRING	15
ALL TANKS TO ANY WELL	15
ALL TANKS TO PROPERTY LINE	3



STYROFOAM INSULATION DETAIL

N.T.S.

CAUTION
CONTRACTOR TO DETERMINE LOCATION OF EXISTING UTILITIES PRIOR TO CONSTRUCTION.

NOTE: CONTRACTOR TO ARRANGE WITH HYDRO RE: METERING REQUIREMENTS, METERING CABINET, MOUNTING & FINAL CONNECTION AT CONTROL PANEL. CONTRACTOR TO COORDINATE BELL CONNECTION FOR ALARM FOR PROPOSED SEWAGE PUMPING STATION

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J.W.LIGHTHEART
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DEC. 15, 2020

No.	Issue / Revision	Date
1	SPA FIRST SUBMISSION	AUG. 17, 2020
2	SPA SECOND SUBMISSION	DEC. 15, 2020

Mansfield Ski Club

BIOFILTER PLAN 1

Client:
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Drawn By	Checked By	Drawing No.
AW	JWL	BIO1
Scale 1:100	Project No. 15-319	

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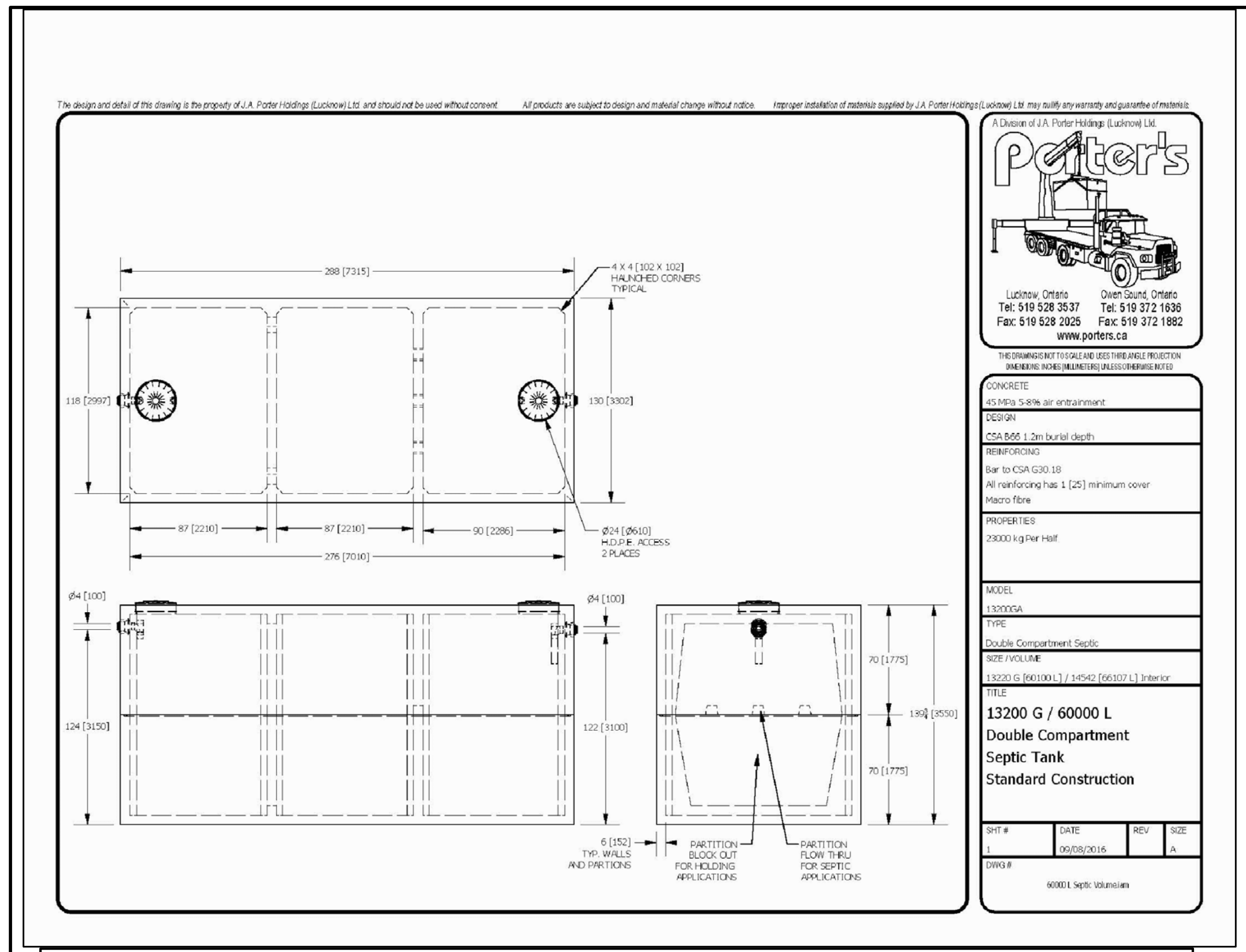
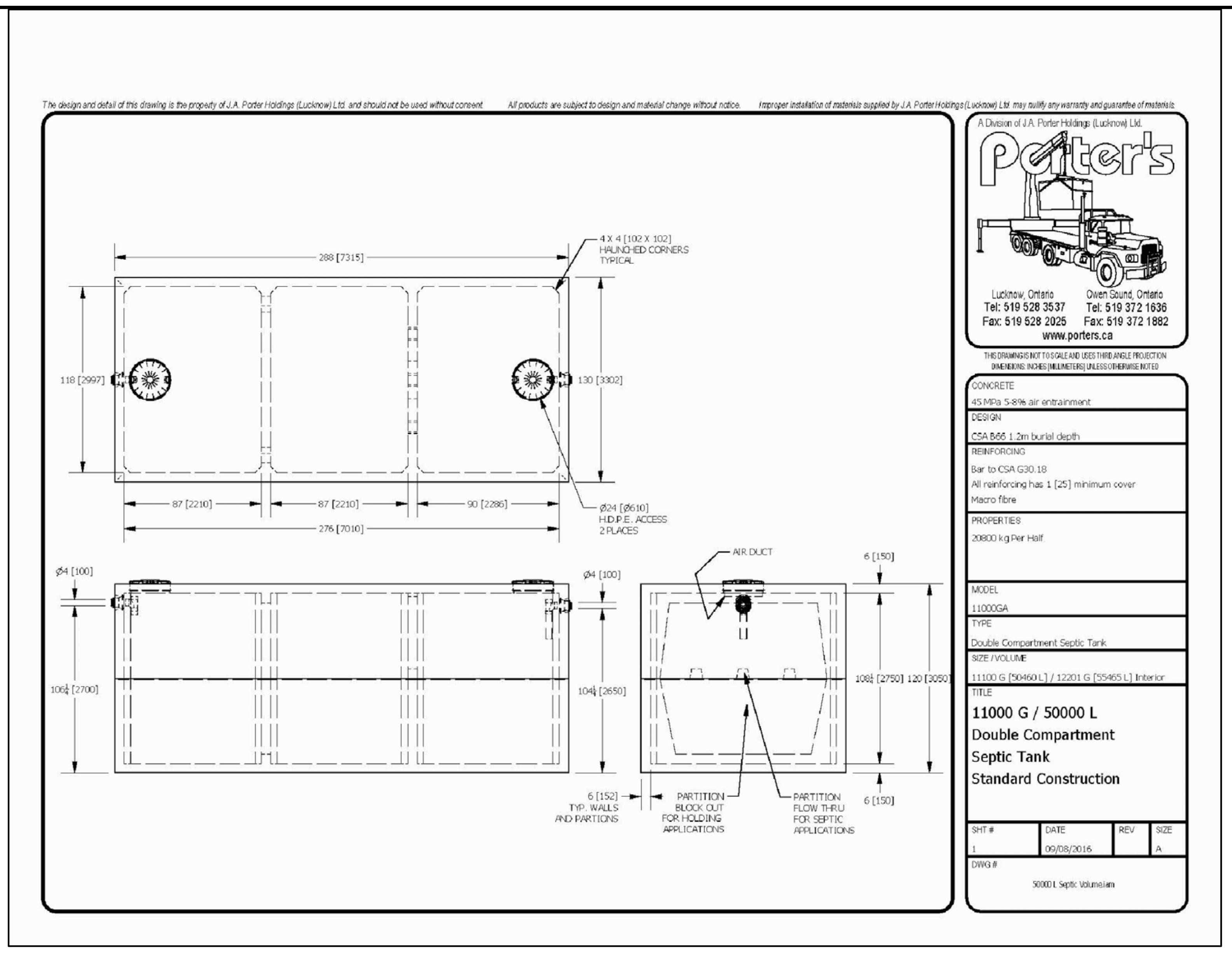
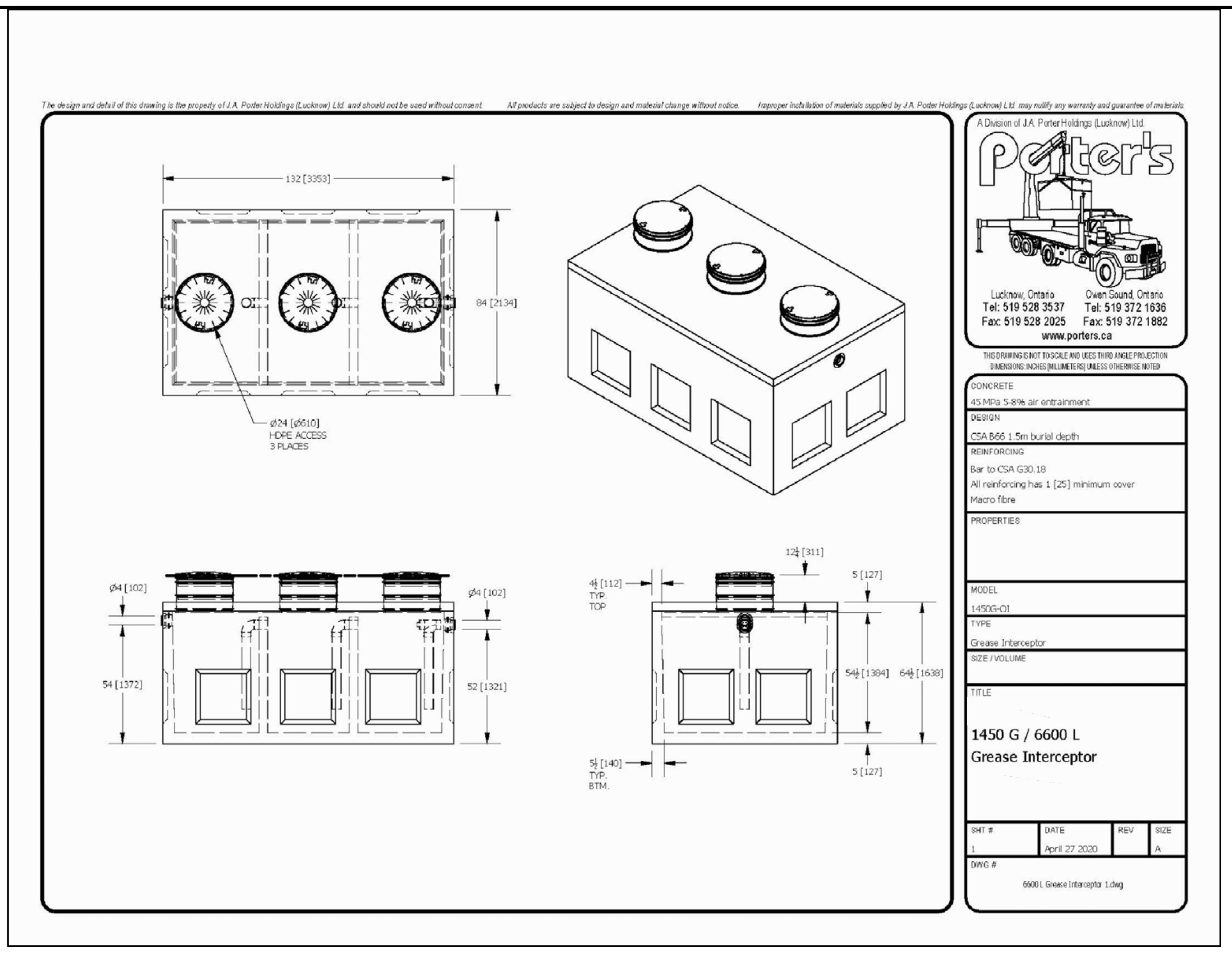
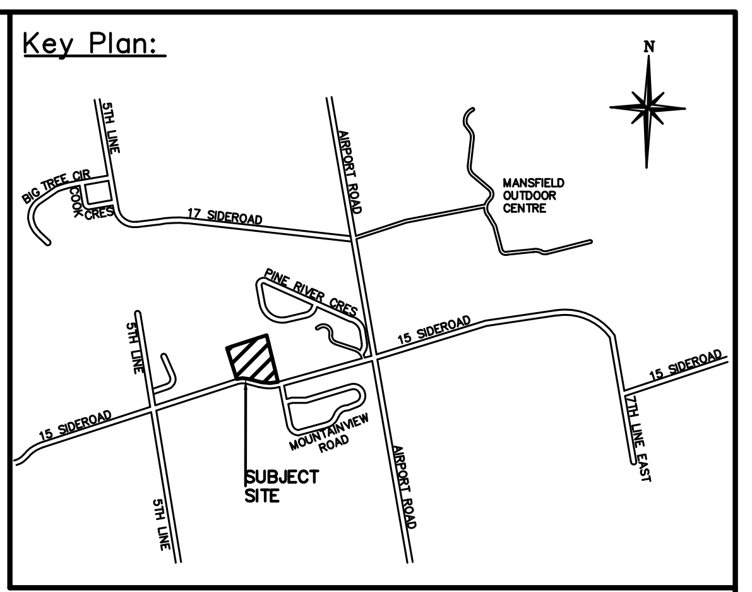








CAUTION
CONTRACTOR TO DETERMINE LOCATION OF EXISTING UTILITIES PRIOR TO CONSTRUCTION.

BIOFILTER SYSTEM NOTES PROVIDED BY WATERLOO BIOFILTER SYSTEMS INC.:

1. THIS IS A PRELIMINARY PROCESS DESCRIPTION FOR A WATERLOO BIOFILTER SEWAGE TREATMENT SYSTEM.
2. THE TOTAL DAILY SANITARY SEWAGE DESIGN FLOW FOR THIS FACILITY IS 118,950 L/day.
3. THE RAW SEWAGE IS EXPECTED TO HAVE THE FOLLOWING TYPICAL CONCENTRATIONS:

BOD = 250 mg/L
TSS = 210 mg/L
TP = 7 mg/L
TKN = 60 mg/L

4. WASTEWATER FROM THE RESTAURANT KITCHEN SINKS FLOWS BY GRAVITY INTO A 6,600 L OIL/GREASE INTERCEPTOR. THE INTERCEPTOR IS VENTED AS PER MANUFACTURER'S RECOMMENDATIONS.
5. THE INTERCEPTOR EFFLUENT AND ALL SANITARY SEWAGE FROM THE FACILITY FLOWS BY GRAVITY INTO A 60,000 L SINGLE COMPARTMENT TRASH TANK. THE INLET AND OUTLET OF THE TANK ARE EQUIPPED WITH BAFFLES.
6. THE TRASH TANK EFFLUENT FLOWS BY GRAVITY THROUGH TWO (2) 60,000 L SINGLE COMPARTMENT ANAEROBIC DIGESTER TANKS (#1 & #2) ARRANGED IN SERIES. THE INLET OF EACH TANK IS EQUIPPED WITH AN INNERTUBE AND THE OUTLET IS EQUIPPED WITH A BAFFLE.
7. ANAEROBIC DIGESTER TANK #2 EFFLUENT FLOWS BY GRAVITY INTO A 60,000 L DOUBLE COMPARTMENT AERATION TANK. THE INLET OF THE TANK IS EQUIPPED WITH A BAFFLE. THE AERATION TANK HOUSES TWO (2) AERATORS. THE OUTLET OF THE TANK IS EQUIPPED WITH A BAFFLE.
8. THE AERATION TANK EFFLUENT FLOWS BY GRAVITY INTO A 60,000 L SINGLE COMPARTMENT ANAEROBIC DIGESTER TANK (#3). THE INLET OF THE TANK IS EQUIPPED WITH AN INNERTUBE. A SUBMERSIBLE PUMP RECIRCULATES A PORTION OF THE EFFLUENT TO THE INLET OF THE TRASH TANK. THE OUTLET OF THE TANK IS EQUIPPED WITH SIX (6) EFFLUENT FILTERS.
9. THE ANAEROBIC DIGESTER TANK #3 EFFLUENT FLOWS BY GRAVITY INTO A 60,000 L SINGLE COMPARTMENT BALANCING TANK #2 WHICH IS CONNECTED BY BOTTOM DRAINS WITH A 60,000 L SINGLE COMPARTMENT BALANCING TANK #1. BALANCING TANK #2 IS EQUIPPED WITH TWO (2) PAIRS OF SUBMERSIBLE PUMPS, WITH EACH PAIR OPERATING ON AN ALTERNATING TIMER.
10. EACH PAIR OF PUMPS IN BALANCING TANK #2 DOSES TWO (2) 55,000 L SINGLE COMPARTMENT BULK–FILLED BIOFILTER TANKS EACH FILLED WITH 55 m^3 OF BIOFILTER MEDIUM (220 m^3 TOTAL). THE SEWAGE IS EVENLY DISTRIBUTED OVER THE SURFACE OF THE MEDIUM AND TREATED AS IT TRICKLES THROUGH THE INTERIOR OF THE MEDIUM. SMALL, LOW VOLTAGE AIR FANS AND PASSIVE VENTING PROMOTE AEROBIC CONDITIONS. THE BULK–FILLED BIOFILTER TANKS ARE CONNECTED BY BOTTOM DRAINS.
11. BULK–FILLED BIOFILTER TANK #1 IS CONNECTED BY BOTTOM DRAINS TO A 55,000 L SINGLE COMPARTMENT BASKET BIOFILTER TANK #2 WHICH IN TURN IS CONNECTED BY BOTTOM DRAINS TO A 55,000 L BASKET BIOFILTER TANK #1. BASKET BIOFILTER TANK #1 IS EQUIPPED WITH THREE (3) SUBMERSIBLE PUMPS OPERATING ON SEPARATE TIMERS AND TWO (2) SUBMERSIBLE PUMPS OPERATING ON ALTERNATING DEMAND.
12. THE FIRST SIMPLEX PUMP IN BASKET BIOFILTER TANK #1 PUMPS A MAXIMUM OF 43,000 L/day TO THREE (3) BASKETS LOCATED IN EACH OF BASKET BIOFILTER TANK #1 & #2. EACH BASKET IS FILLED WITH 10 m^3 OF BIOFILTER MEDIUM (60 m^3 TOTAL). THE SEWAGE IS EVENLY DISTRIBUTED OVER THE SURFACE OF THE MEDIUM AND TREATED AS IT TRICKLES THROUGH THE INTERIOR OF THE MEDIUM. SMALL, LOW VOLTAGE AIR FANS AND PASSIVE VENTING PROMOTE AEROBIC CONDITIONS. THE EFFLUENT FROM THE BASKETS MIXES WITH THE EFFLUENT FROM THE BULK–FILLED BIOFILTER TANKS.
13. THE SECOND SIMPLEX PUMP IN BASKET BIOFILTER TANK #1 RECIRCULATES A PORTION OF THE EFFLUENT (PERCENTAGE IS ADJUSTABLE) TO THE INLET OF THE TRASH TANK.
14. THE THIRD SIMPLEX PUMP IN BASKET BIOFILTER TANK #1 PUMPS A PORTION OF THE EFFLUENT (PERCENTAGE IS ADJUSTABEL) TO TWO (2) SAND FILTERS LOCATED IN AN ABOVE GROUND CONTROL BUILDING. THE EFFLUENT FROM THE SAND FILTERS DRAINS BY GRAVITY BACK TO BASKET BIOFILTER TANK #1.
15. THE PAIR OF PUMPS IN BASKET BIOFILTER TANK #1 PUMP THE EFFLUENT THROUGH A FLOW METER AND FOUR (4) UV DISINFECTION UNITS LOCATED IN THE ABOVE GROUND CONTROL BUILDING.
16. THE CONTROL BUILDING ALSO HOUSES THREE (3) METERING PUMPS. THE FIRST TO DOSE SODIUM ALUMINATE INTO THE TRASH TANK AND/OR ANAEROBIC DIGESTER TANK #3, THE SECOND TO DOSE AN ALKALINITY CHEMICAL INTO ANAEROBIC DIGESTER TANK #3, AND THE THIRD TO DOSE BENEFICIAL BACTERIA TO THE INLET OF BALANCING TANK #1.
17. THE UV EFFLUENT CONTINUES TO A PUMP STATION SUPPLIED BY JOHN BROOKS COMPANY LIMITED.
18. ALL PUMPS ARE RUN BY A WATERLOO SMART PANEL(S). THE WATERLOO SMART PANEL PROVIDES REMOTE MONITORING, CONTROL, AND DATA LOGGING OVER A STABLE WIRELESS CELLULAR NETWORK. THIS FUNCTIONALITY ALLOWS FOR REAL TIME OPERATIONAL ADJUSTMENTS TO OPTIMIZE SYSTEM PERFORMANCE. THE WATERLOO SMART PANEL ALSO IMMEDIATELY NOTIFIES THE SERVICE PROVIDER OF A PUMP FAILURE OR HIGH LEVEL ALARM, PROVIDING THEM WITH VITAL INFORMATION TO LIMIT SITE VISITS WHILE KEEPING THE SYSTEM OPERATING PROPERLY.
19. ADHERENCE TO BEST MANAGEMENT PRACTICES (PROVIDING THE APPROPRIATE STRENGTH SEWAGE, PERFORMING ROUTINE MAINTENANCE, LIMITING TOXINS ENTERING THE SYSTEM, ETC.) IS NECESSARY FOR OPTIMAL PERFORMANCE OF THE WATERLOO BIOFILTER TREATMENT SYSTEM OUTLINED IN THIS SCHEMATIC, WHICH IS DESIGNED FOR THE FOLLOWING EFFLUENT OBJECTIVES (LIMITS) (LOADING LIMITS):

cBOD = 10.0 mg/L (15.0 mg/L) (1.8 kg/day)
TSS = 10.0 mg/L (15.0 mg/L) (1.8 kg/day)
TP = 0.5 mg/L (1.0 mg/L) (0.12 kg/day)
TAN = 3.0 mg/L (5.0 mg/L) (0.6 kg/day)
E.Coli = 100 cfu/100 mL (200 cfu/100 mL)
pH = 6.5 to 8.5 (6.0 to 9.0)

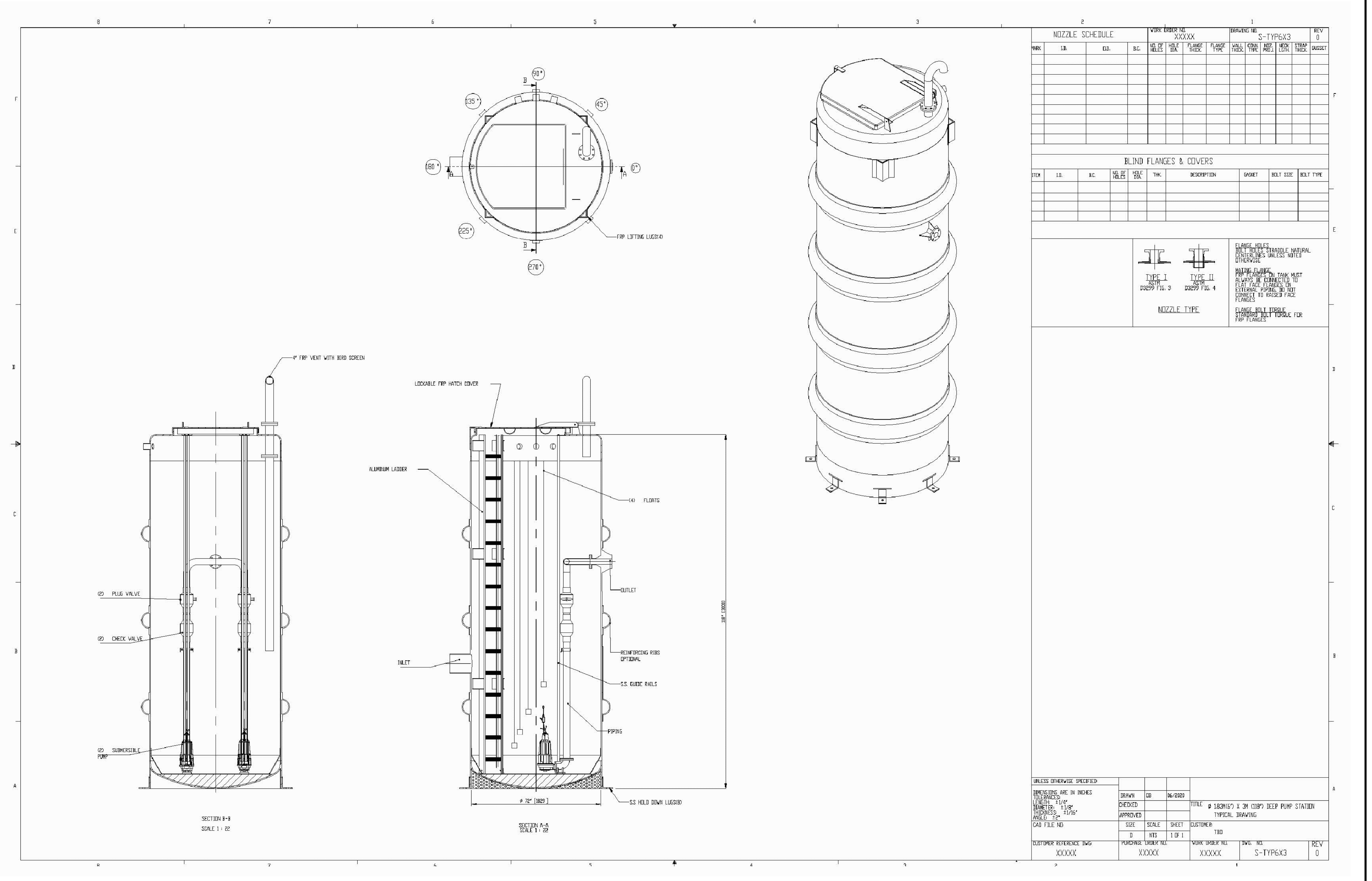
PUMP STATION NOTES:

1. THE CONTRACTOR SHALL TAKE PRECAUTIONS TO PREVENT UPLIFT DURING CONSTRUCTION.
2. ELECTRICAL CONDUITS SHALL BE BURIED 0.9m MIN. BELOW FINISHED GRADE C/W TRACING WIRE.
3. DUTY POINT: 2.5 L/S @ 14.40m TDH

ONE (1) JOHN BROOKS DUPLEX SUBMERSIBLE PUMP STATION WITH THE FOLLOWING COMPONENTS:

- (2) TWO SUBMERSIBLE SEWAGE GRINDER PUMP
- (2) TWO 10FT GALV LIFTING CHAIN PACKAGES
- (1) ONE STAINLESS STEEL LEVEL CONTROL BRACKET #10–0253
- (1) ONE NEMA 4X DUPLEX CONTROL PANEL WITH HWA & AUX CONTACT (#10–1044).
- (4) FOUR #10–0744 LEVEL CONTROLS ONE
- (4) FOUR FLOATATION WEIGHTS
- (2) JUNCTION BOX (WIRING BY OTHERS)
- (1) ONE FIBERGLASS BASIN (1800mmø X 3.0m DEEP) WITH QUICK DISCONNECTS, PVC DISCHARGE PIPING, GUIDE RAILS, FIBERGLASS COVER AND HATCHES
- (2) TWO 2x2 EZ–OUT ASSEMBLY WITH UPPER GUIDE BRACKET #39–0083
- (2) TWO #30–0152 2" CAST IRON FULL FLOW CHECK VALVE
- (2) TWO SHUT OFF VALVES
- (2) TWO VENTS
- UNLOADING AND INSTALLATION TO BE COMPLETED BY THE CONTRACTOR
- **ANTI–FLOAT CONCRETE BLOCK REQUIRED**
  (PUMP STATION BALLAST TO BE DONE BY OTHERS)
- SUITABLE CONDUIT SEALS ARE TO BE SUPPLIED AND INSTALLED BETWEEN THE JUNCTION BOX AND THE PANEL AS REQUIRED BY THE CANADIAN ELECTRICAL CODE, THE ENGINEER OR THE AUTHORITY HAVING JURISDICTION

4. VENT PIPE ASSEMBLY AS PER DETAIL ON BROOKS DRAWING
5. ELECTRICAL WORK AND EQUIPMENT IN WET WELL TO COMPLY WITH THE CURRENT ONTARIO ELECTRICAL CODE



NOTE: THIS DRAWING IS FOR SCHEMATIC PURPOSES ONLY AND FINAL SHOP DRAWINGS ARE TO BE PROVIDED BY JOHN BROOKS COMPANY PRIOR TO CONSTRUCTION.

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2	SPA SECOND SUBMISSION	DEC. 15, 2020

Mansfield Ski Club

BIOFILTER PLAN 2

Client:
Mansfield Ski Club
628213 15th Sideroad
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Mulmur, Ontario
L9V 3M6

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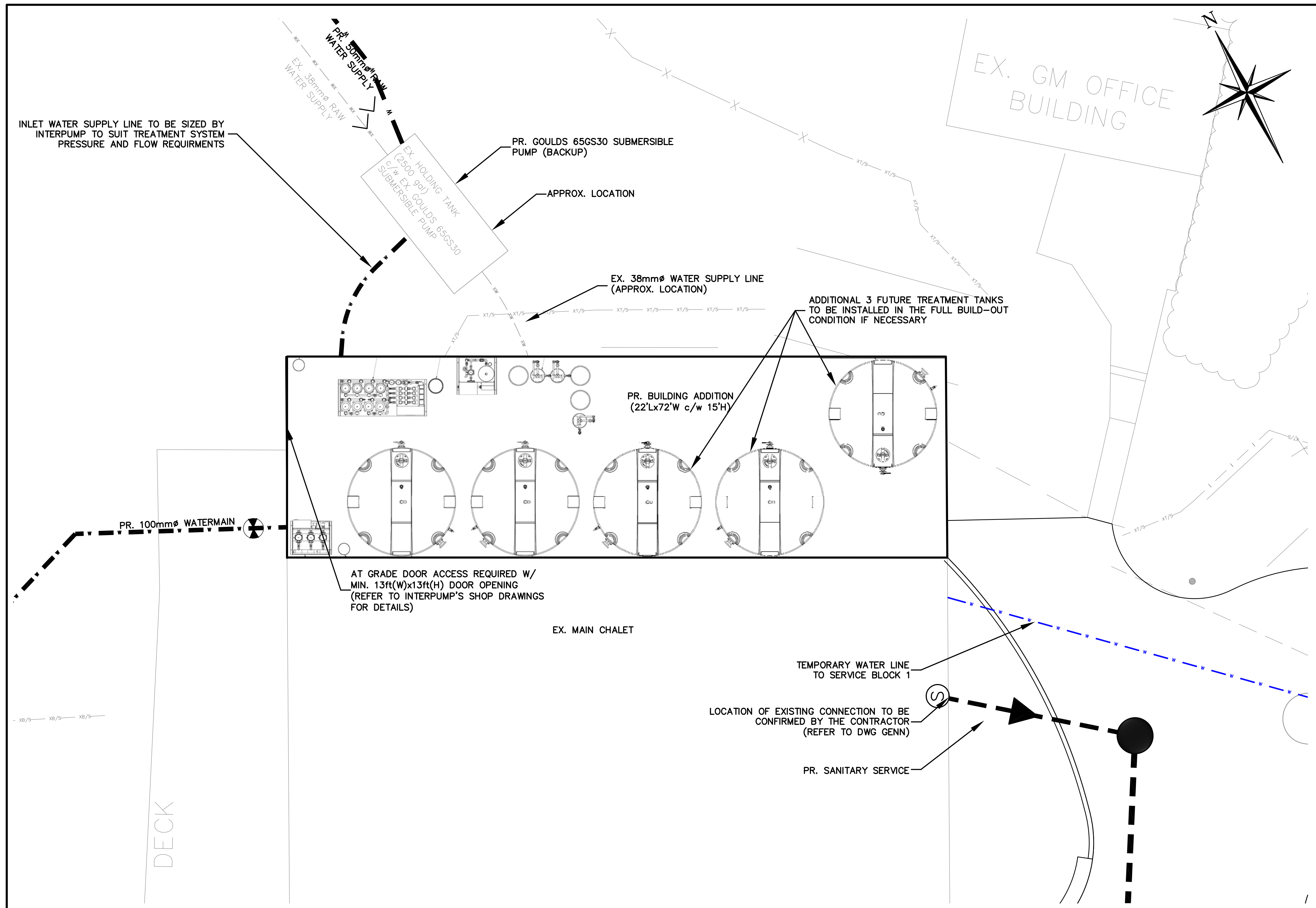
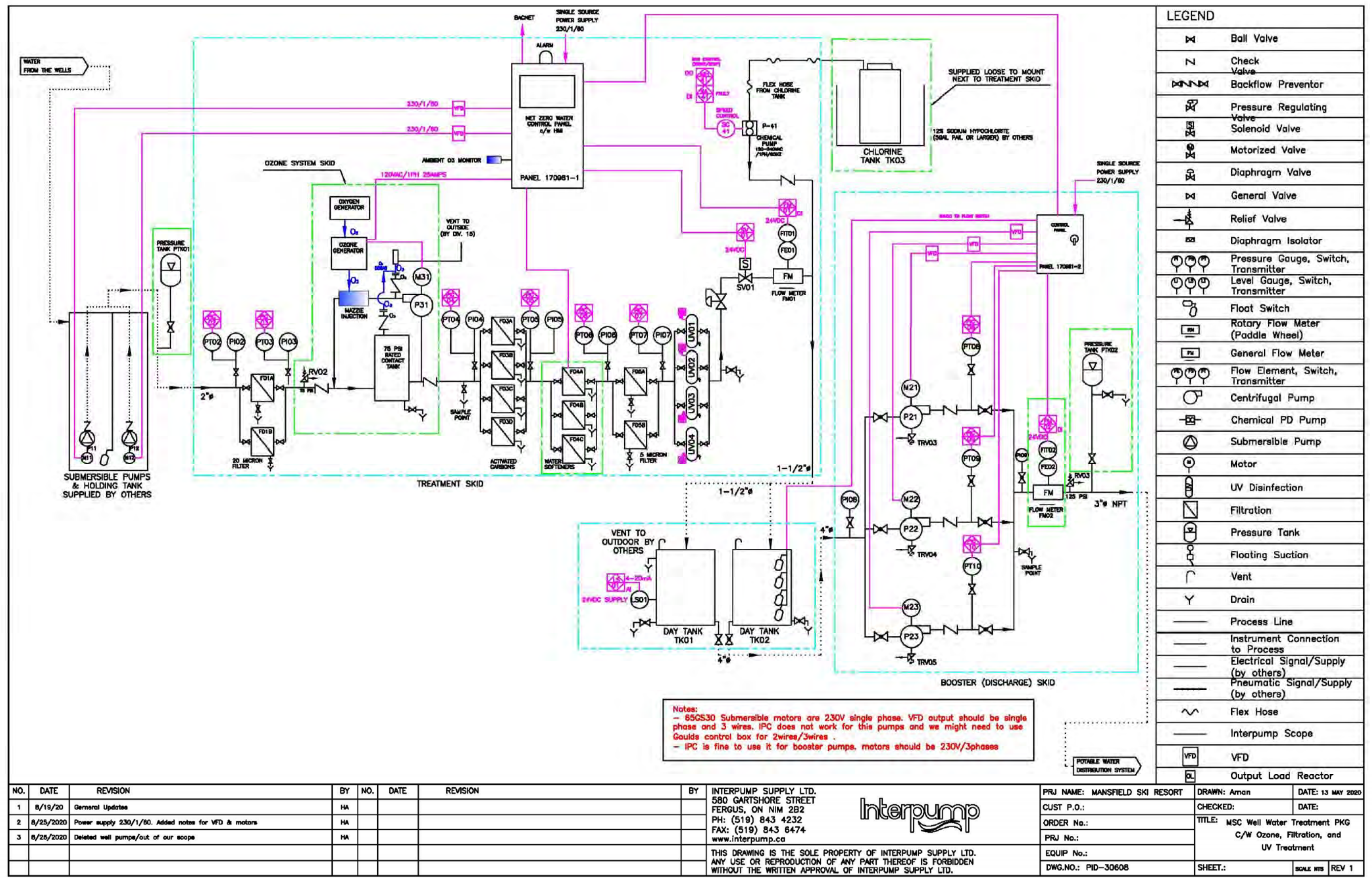
Drawn By AW
Checked By JWL
Drawing No. BIO2
Scale 1:100
Project No. 15–319





Notes:
- 65GS30 Submersible motors are 230V single phase. VFD output should be single phase and 3 wires. IPC does not work for this pumps and we might need to use Goulds control box for 2wires/3wires .
- IPC is fine to use it for booster pumps, motors should be 230V/3phases

NO.	DATE	REVISION	BY	NO.	DATE	REVISION	BY
1	8/19/20	General Updates	HA				
2	8/25/2020	Power supply 230/1/60. Added notes for VFD & motors	HA				
3	8/26/2020	Deleted well pumps/out of our scope	HA				

INTERPUMP SUPPLY LTD.
580 GARTSHORE STREET
FERGUS, ON NIM 2B2
PH: (519) 843 4232
FAX: (519) 843 6474
www.interpump.ca

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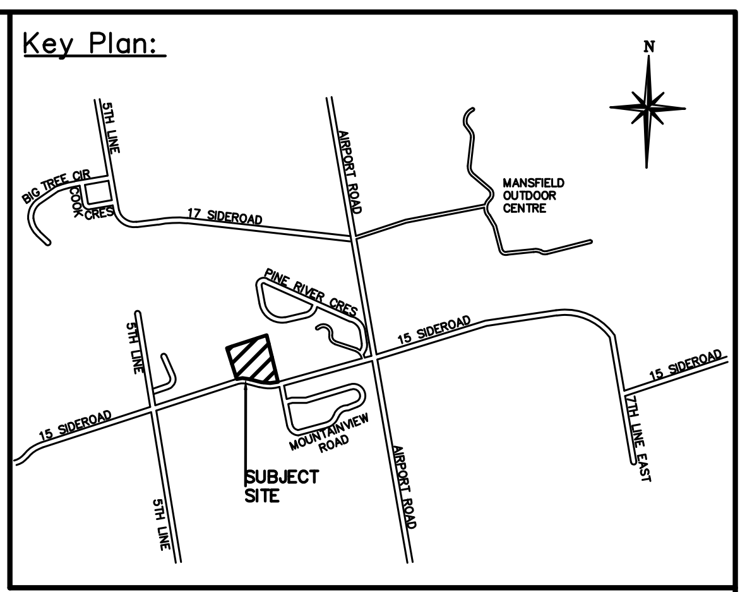
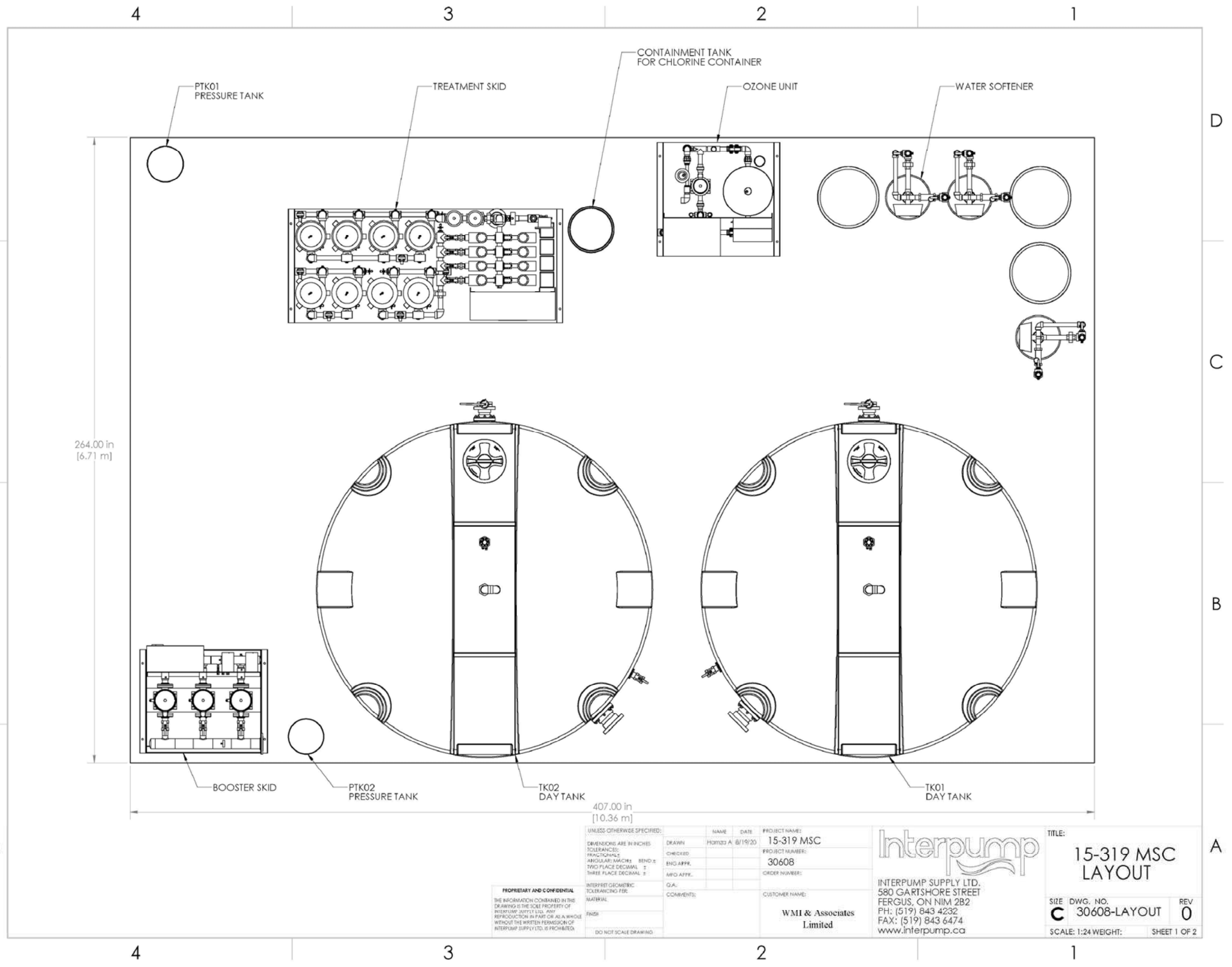
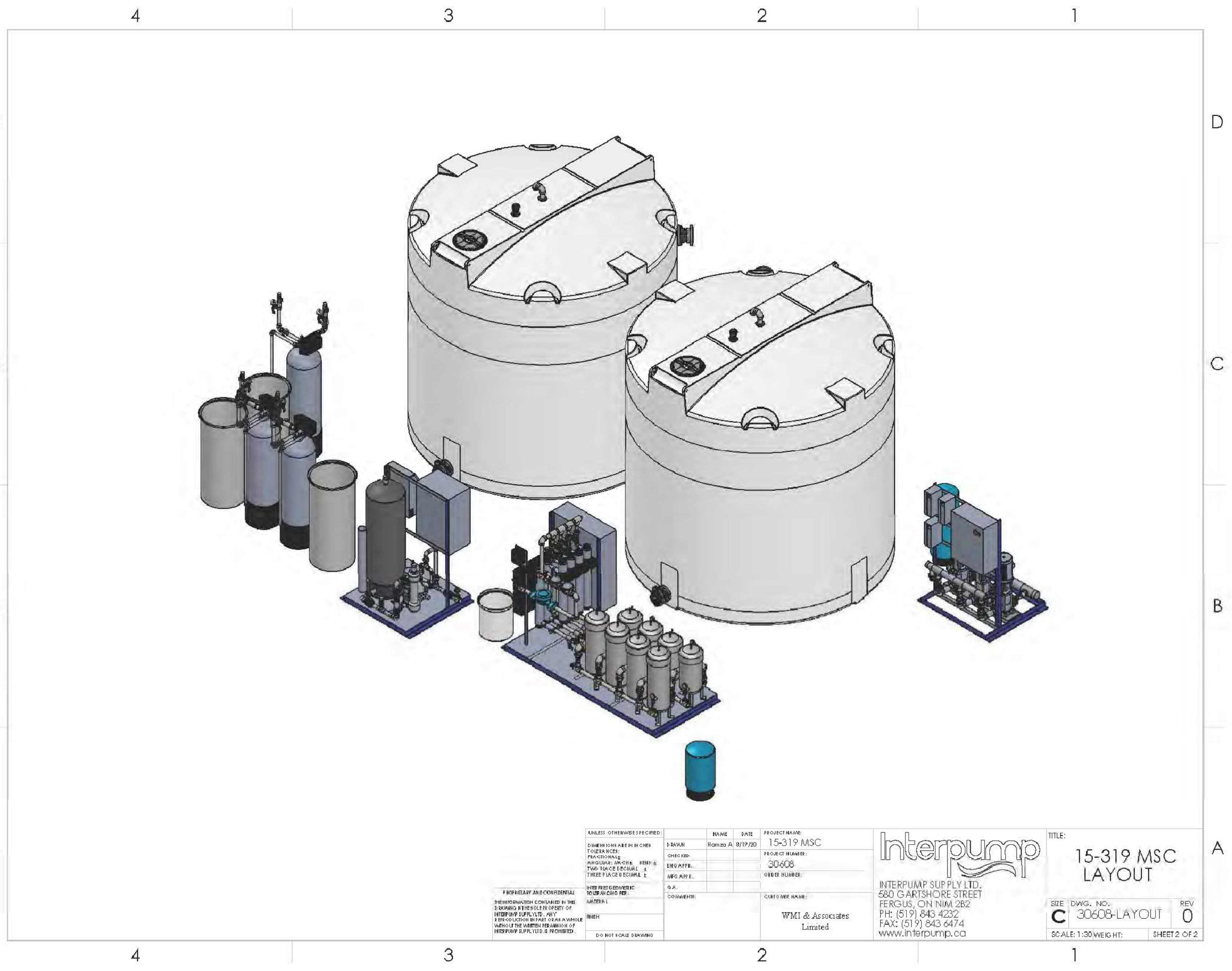
PRJ NAME: MANSFIELD SKI RESORT
CUST P.O.:
ORDER No.:
PRJ No.:
EQUIP No.:
DWG.NO.: PID-30608
DRAWN: Aman
DATE: 13 MAY 2020
CHECKED:
DATE:
TITLE: MSC Well Water Treatment PKG C/W Ozone, Filtration, and UV Treatment
SHEET.:
SCALE NTS
REV 1

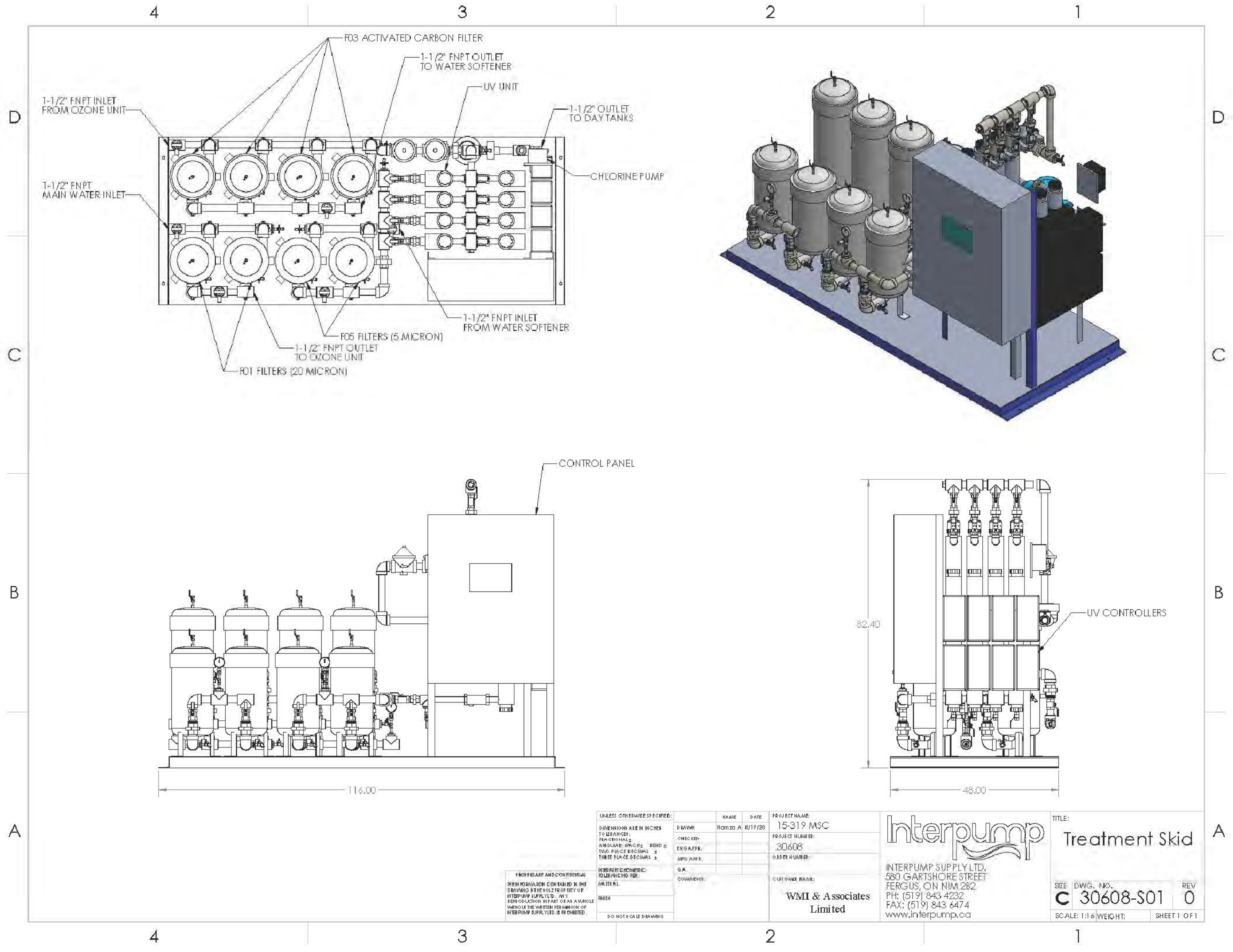
Key Plan:



CAUTION
CONTRACTOR TO DETERMINE LOCATION OF EXISTING UTILITIES PRIOR TO CONSTRUCTION.







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Benchmark: 463.937m

ELEVATIONS SHOWN HEREON ARE GEODETIC AND ARE DERIVED FROM CANNET NETWORK BASE STATION ORVL HAVING A PUBLISHED ELEVATION OF 463.937m

J.W.LIGHTHEART
100140403
DEC. 15, 2020

No.	Issue / Revision	Date
1	SPA FIRST SUBMISSION	AUG. 17, 2020
2	SPA SECOND SUBMISSION	DEC. 15, 2020

Mansfield Ski Club

WATER TREATMENT FACILITY

Client:

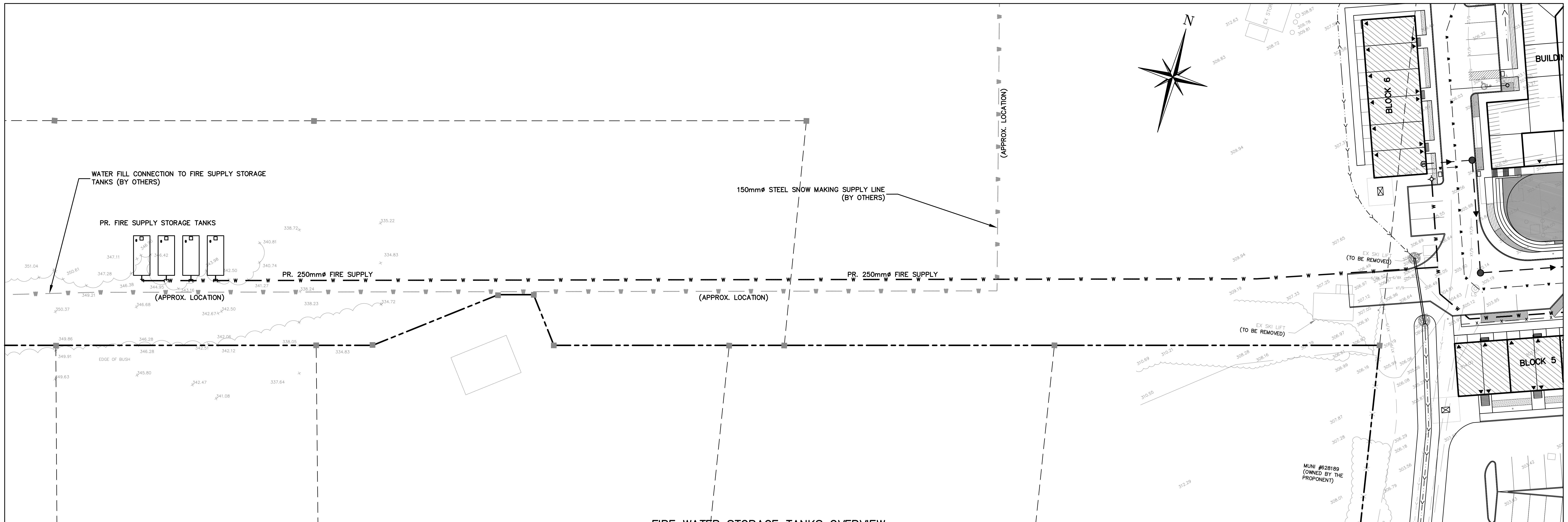
Mansfield Ski Club

628213 15th Sideroad
PO Box 75 RPO Mansfield,
Mulmur, Ontario
L9V 3M6

WMI & Associates Limited
119 Collier Street
Barrie, Ontario
L4M 1H5
Ph 705-797-2027
www.wmiengineering.ca

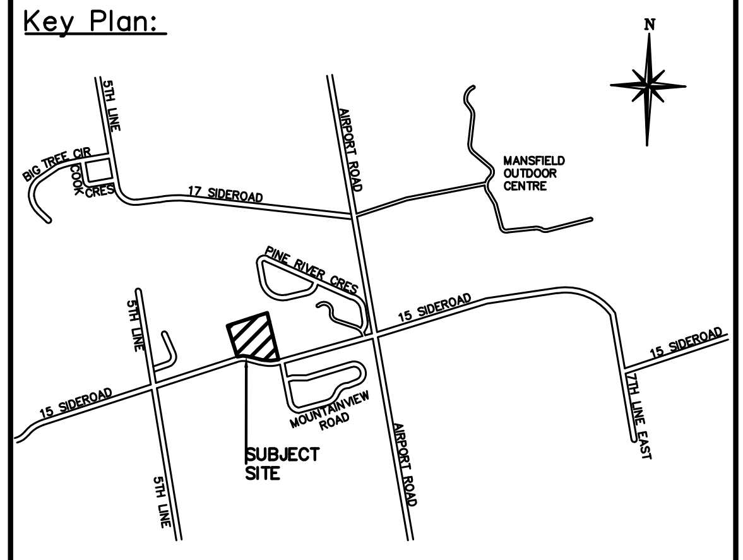
Drawn By AW
Checked By JWL
Drawing No. WF
Scale 1:100
Project No. 15-319

\\WMI-SERVER\wmi-server\Data\Projects\2015\15-319\CAD\WMI\Issue_No2\201210_Baseplan_15-319.dwg, WF, 1:1



FIRE WATER STORAGE TANKS OVERVIEW

SCALE 1:400



CAUTION

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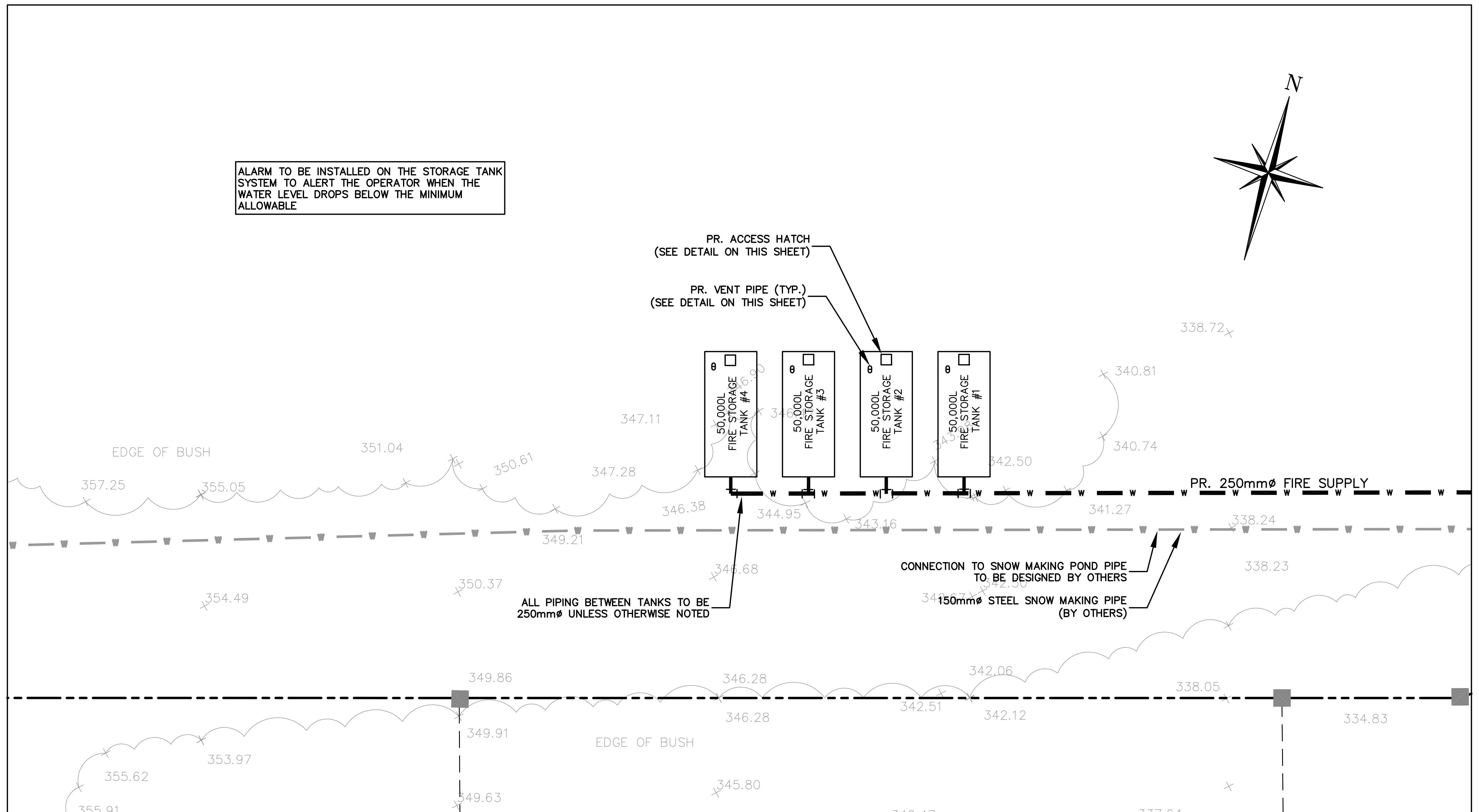


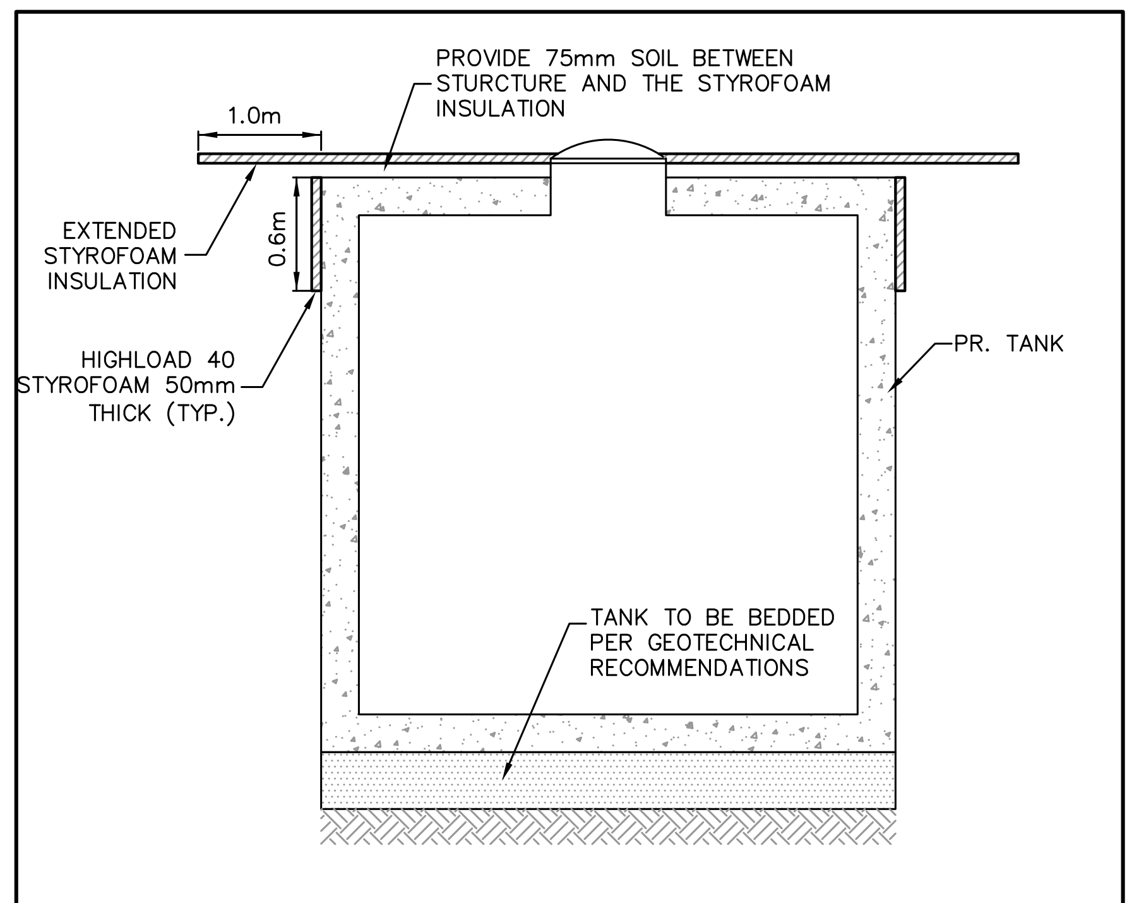
FIRE WATER STORAGE TANKS DETAIL

SCALE 1:200

WATER TANK	GROUND ELEV.	TOP OF STRUCTURE ELEV.	OUTLET ELEV.
FIRE STORAGE TANK #1	343.50	342.15	339.45
FIRE STORAGE TANK #2	344.00	342.65	339.95
FIRE STORAGE TANK #3	345.50	344.15	341.45
FIRE STORAGE TANK #4	346.90	345.55	342.85

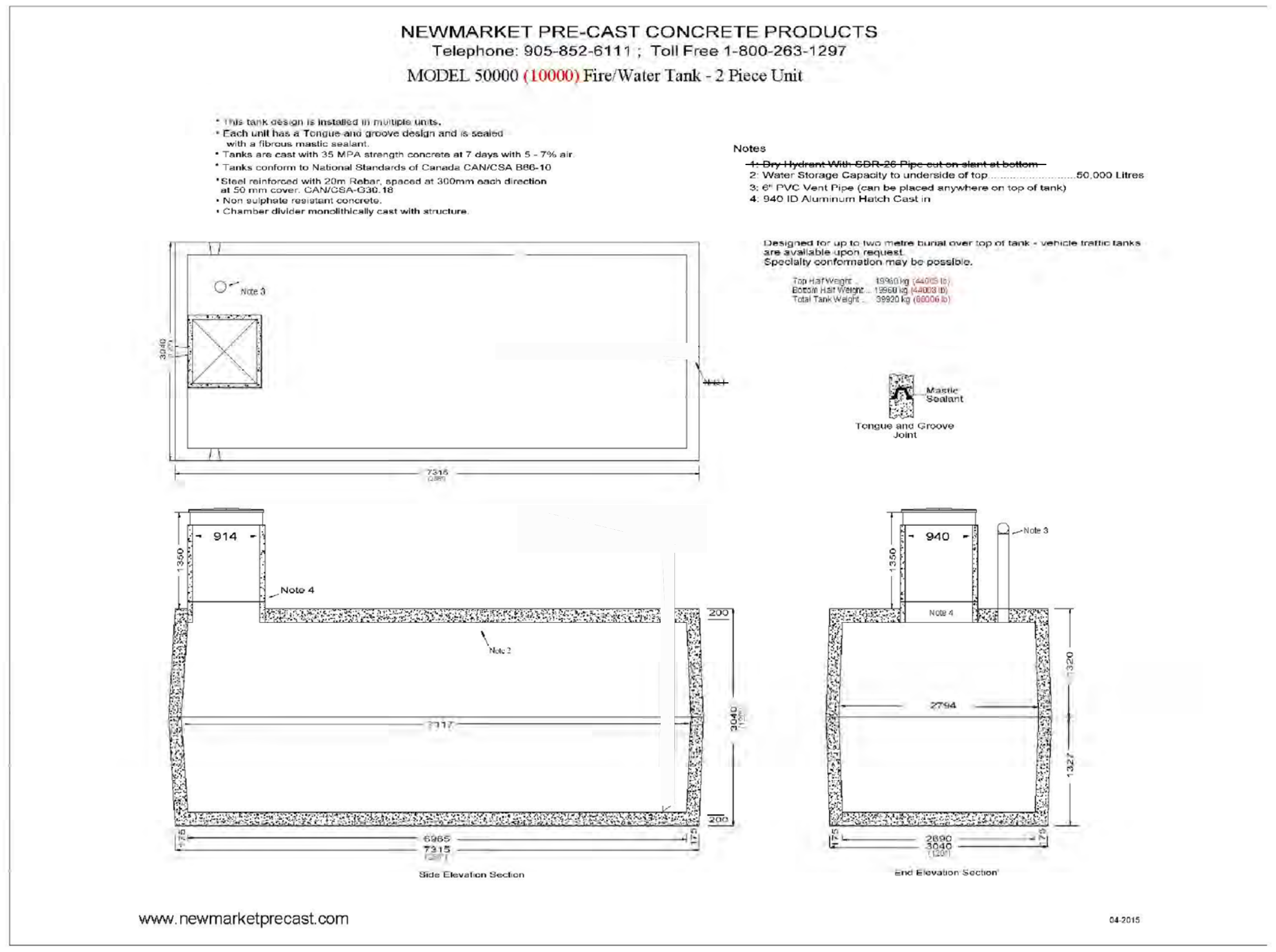
NOTES:

1. TANK ACCESS MUST BE PROVIDED VIA LOCKED WATER CHUTE ACCESS HATCH COMPLETE WITH LADDER RUNGS.
2. ALL CONNECTIONS TO THE STORAGE TANKS ARE TO BE WATER TIGHT.
3. TANK IS TO BE BEDDED AS PER GEOTECHNICAL RECOMMENDATIONS.
4. REFER TO DRAWING ON THIS SHEET FOR 50,000L TANK CROSS SECTION DETAILS.
5. ALL CONCRETE TANKS ARE TO HAVE 1.2m COVER (MIN.) OR TO BE INSULATED (REFER TO DETAIL ON THIS SHEET)
6. ALL STRUCTURES (TANKS) TO BE NEWMARKET PRE-CAST CONCRETE PRODUCTS OR APPROVED EQUIVALENT. REFER TO THIS DRAWING FOR TANK DETAILS.



STYROFOAM INSULATION DETAIL

N.T.S.



NEWMARKET PRE-CAST CONCRETE PRODUCTS
Telephone: 905-852-6111 ; Toll Free 1-800-263-1297

MODEL 50000 (10000) Fire/Water Tank - 2 Piece Unit

- This tank design is installed in multiple units.
- Each unit has a Tongue and groove design and is sealed with a fibrous mastic sealant.
- Tanks are cast with 35 MPA strength concrete at 7 days with 5 - 7% air.
- Tanks conform to National Standards of Canada CAN/CSA B66-10
- Steel reinforced with 20m Rebar, spaced at 300mm each direction at 50 mm cover. CAN/CSA-G30.18
- Non sulphate resistant concrete.
- Chamber divider monolithically cast with structure.

Notes

~~1: Dry Hydrant With SDR-26 Pipe cut on slant at bottom~~
2: Water Storage Capacity to underside of top ....50,000 Litres
3: 6" PVC Vent Pipe (can be placed anywhere on top of tank)
4: 940 ID Aluminum Hatch Cast in

Designed for up to two metre burial over top of tank - vehicle traffic tanks are available upon request.
Specialty conformation may be possible.

Top Half Weight ...	19960 kg (44003 lb)
Bottom Half Weight ...	19960 kg (44003 lb)
Total Tank Weight ...	39920 kg (88006 lb)

www.newmarketprecast.com

04-2015

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Benchmark: 463.937m

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J.W.LIGHTHEART
100140403
DEC. 15, 2020

No.	Issue / Revision	Date
1	SPA FIRST SUBMISSION	AUG. 17, 2020
2	SPA SECOND SUBMISSION	DEC. 15, 2020

Mansfield Ski Club

FIRE WATER STORAGE

Client:

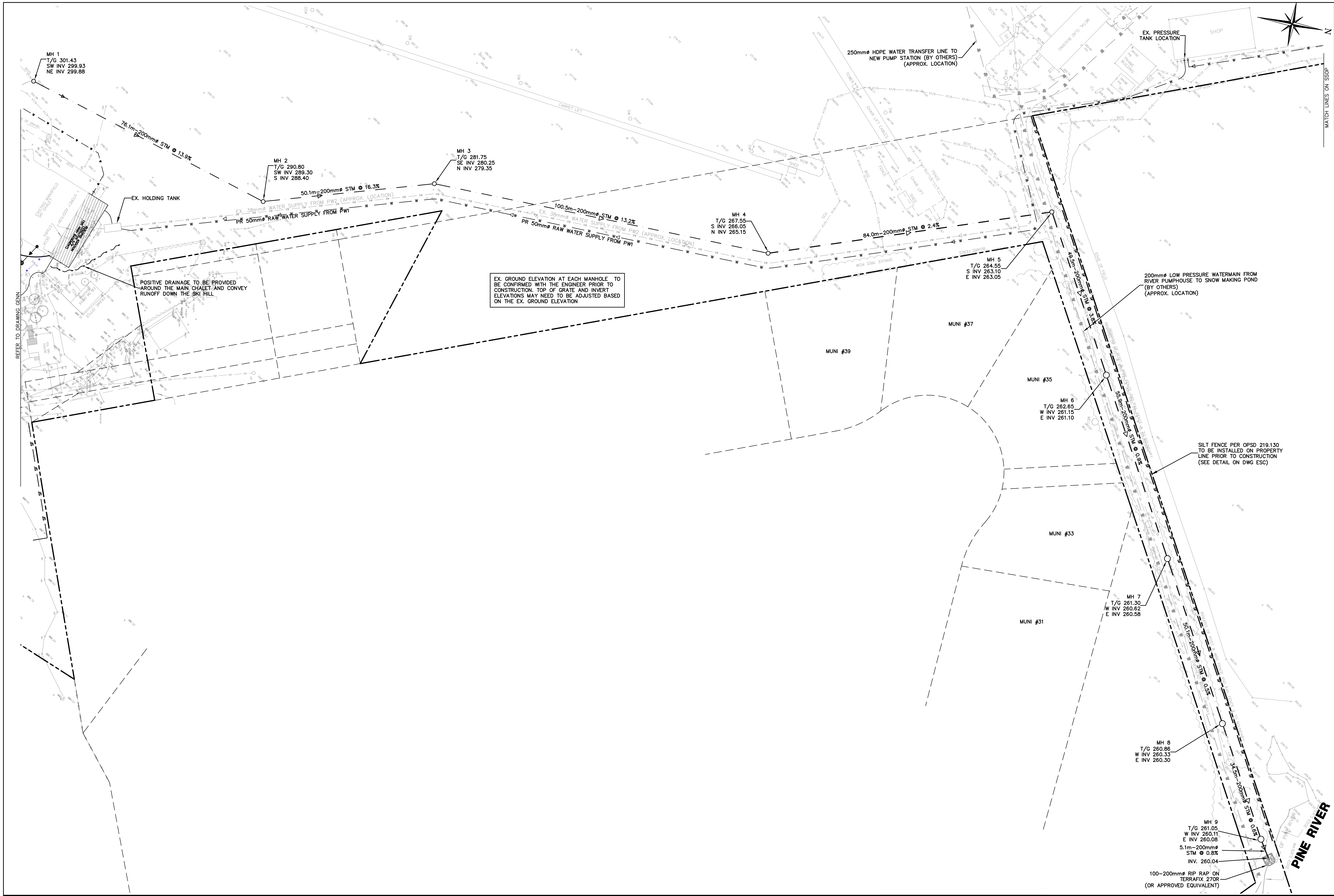
Mansfield Ski Club

628213 15th Sideroad
PO Box 75 RPO Mansfield,
Mulmur, Ontario
L9V 3M6

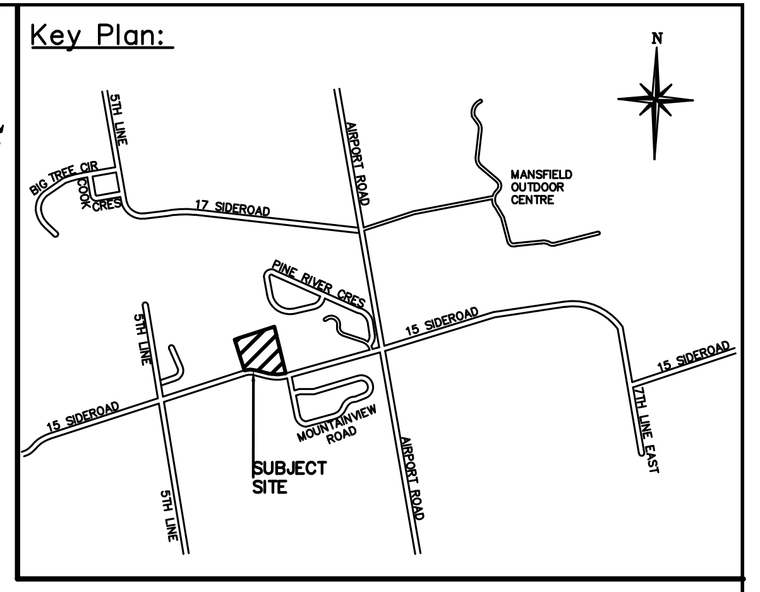
WMI & Associates Limited
119 Collier Street
Barrie, Ontario
L4M 1H5
Ph 705-797-2027
www.wmiengineering.ca

Drawn By AW
Checked By JWL
Drawing No. FWS
Scale AS SHOWN
Project No. 15-319

\\WMI-SERVER\wmi-server\Data\Projects\2015\15-319\CAD\WMI\Issue_No2\201210_Baseplan_15-319.dwg, FWS, 1:1



Key Plan:



Legend:

EXISTING FEATURES (EX)

- EX SIB — EX STD IRON BAR
- EX IB — EX IRON BAR
- EX UP — EX UTILITY POLE
- EX BELL PED
- EX WS — EX WATER SERVICE
- EX HYD — EX FIRE HYD.
- NS — EX ST NAME SIGN
- SS — EX STOP SIGN
- x123.45 — EX ELEVATION
- EX FENCE
- GAS — EX U/G GASMAIN
- XB — EX U/G BELL
- XH — EX HYDRO
- XB/S — EX BOTTOM OF SLOPE
- XT/S — EX TOP OF SLOPE
- EX WV — EX WATERMAIN & VALVE
- EX SAN @ 0.0% — EX SAN SEWER & MH
- EX STM @ 0.0% — EX STM SEWER & MH

PROPOSED FEATURES (PR)

- NS — PR STREET NAME SIGN
- SS — PR STOP SIGN
- SF — PR SILT FENCE
- PR LEGAL PART LOTS
- PR LEGAL BOUNDARY
- Ⓛ — PR STREET LIGHT
- Ⓦ — PR WATER SERVICE
- Ⓢ — PR SAN SERVICE
- PR HYDRO TRANSFORMER
- 00mmø W/M — PR WATERMAIN
- 00mmø W/M — PR TEMPORARY WATERMAIN FOR PHASE 1A
- 00mmø W/M — PR PERMANENT WATERMAIN FOR PHASE 1A
- PR FIRE HYDRANT
- PR WATER VALVE
- 0m–00mmø SAN @ 0.0% — PR SAN SEWER
- PR PERMANENT SAN SEWER FOR PHASE 1A
- MH K — PR SANITARY MANHOLE
- 0m–00mmø STM @ 0.0% — PR STM SEWER
- MH 4 — PR CATCHBASIN MANHOLE
- MH 4 — PR MANHOLE
- ☐ — PR CATCHBASIN
- x000.00 — PROPOSED ELEVATION
- x(000.00) — PR. MATCH EXISTING ELEVATION (INTERPOLATED)
- PR SWALE
- ▨ — PR HEAVY DUTY ASPHALT
- ▨ — PR UNIT PAVING
- ▨ — PR BERM
- ▨ — PR FIRE ACCESS
- U.F.E — UPPER FLOOR ELEVATION
- G.F.E — GROUND FLOOR ELEVATION
- W — WATERMAIN BY OTHERS

CAUTION

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J.W.LIGHTHEART
100140403
DEC. 15, 2020

No.	Issue / Revision	Date
1	SPA FIRST SUBMISSION	AUG. 17, 2020
2	SPA SECOND SUBMISSION	DEC. 15, 2020

Mansfield Ski Club

SITE SERVICING OUTLET PLAN

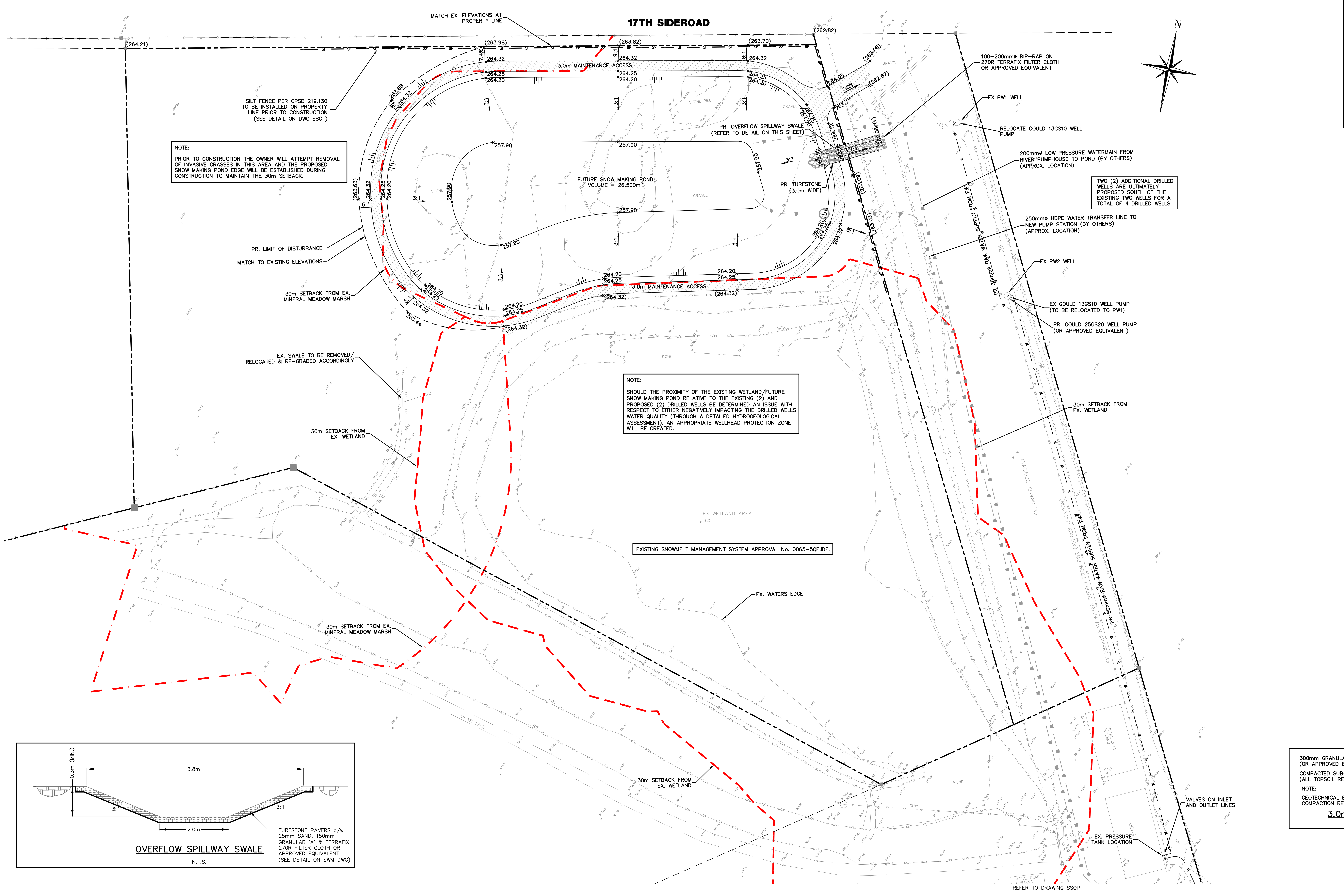
Client:

Mansfield Ski Club

628213 15th Sideroad
PO Box 75 RPO Mansfield,
Mulmur, Ontario
L9V 3M6

WMI & Associates Limited
119 Collier Street
Barrie, Ontario
L4M 1H5
Ph 705-797-2027
www.wmiengineering.ca

Drawn By	Checked By	Drawing No.
AW	JWL	SSOP
Scale 1:500	Project No. 15–319	



NOTE:

PRIOR TO CONSTRUCTION THE OWNER WILL ATTEMPT REMOVAL OF INVASIVE GRASSES IN THIS AREA AND THE PROPOSED SNOW MAKING POND EDGE WILL BE ESTABLISHED DURING CONSTRUCTION TO MAINTAIN THE 30m SETBACK.

NOTE:

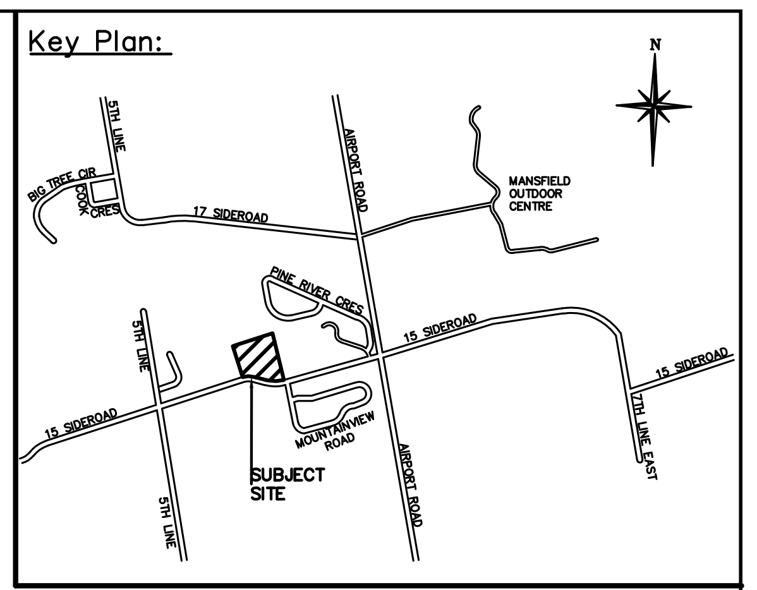
SHOULD THE PROXIMITY OF THE EXISTING WETLAND/FUTURE SNOW MAKING POND RELATIVE TO THE EXISTING (2) AND PROPOSED (2) DRILLED WELLS BE DETERMINED AN ISSUE WITH RESPECT TO EITHER NEGATIVELY IMPACTING THE DRILLED WELLS WATER QUALITY (THROUGH A DETAILED HYDROGEOLOGICAL ASSESSMENT), AN APPROPRIATE WELLHEAD PROTECTION ZONE WILL BE CREATED.

EXISTING SNOWMELT MANAGEMENT SYSTEM APPROVAL No. 0065-5QEJDE.

OVERFLOW SPILLWAY SWALE

N.T.S.

Key Plan:



Legend:

EXISTING FEATURES (EX)

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- SS — EX STOP SIGN
- x 123.45 — EX ELEVATION
- EX FENCE
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- XB — EX U/G BELL
- XH — EX HYDRO
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- 0m–00mmø STM @ 0.0% — PR STM SEWER
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- U.F.E — UPPER FLOOR ELEVATION
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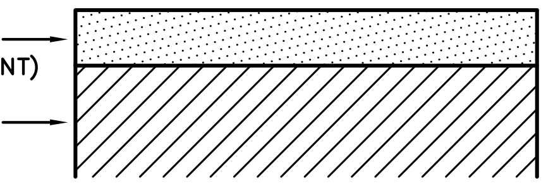
- W — WATERMAIN BY OTHERS



NOTE:

GEOTECHNICAL ENGINEER TO CONFIRM MATERIAL THICKNESS AND COMPACTION REQUIREMENTS.

3.0m MAINTENANCE ACCESS

N.T.S.

CAUTION

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REGISTERED PROFESSIONAL ENGINEER
J.W.LIGHTHEART
100140403
DEC. 15, 2020
PROVINCE OF ONTARIO

No.	Issue / Revision	Date
1	SPA FIRST SUBMISSION	AUG. 17, 2020
2	SPA SECOND SUBMISSION	DEC. 15, 2020

Mansfield Ski Club

PROPOSED SNOW MAKING POND & WELL LOCATION PLAN

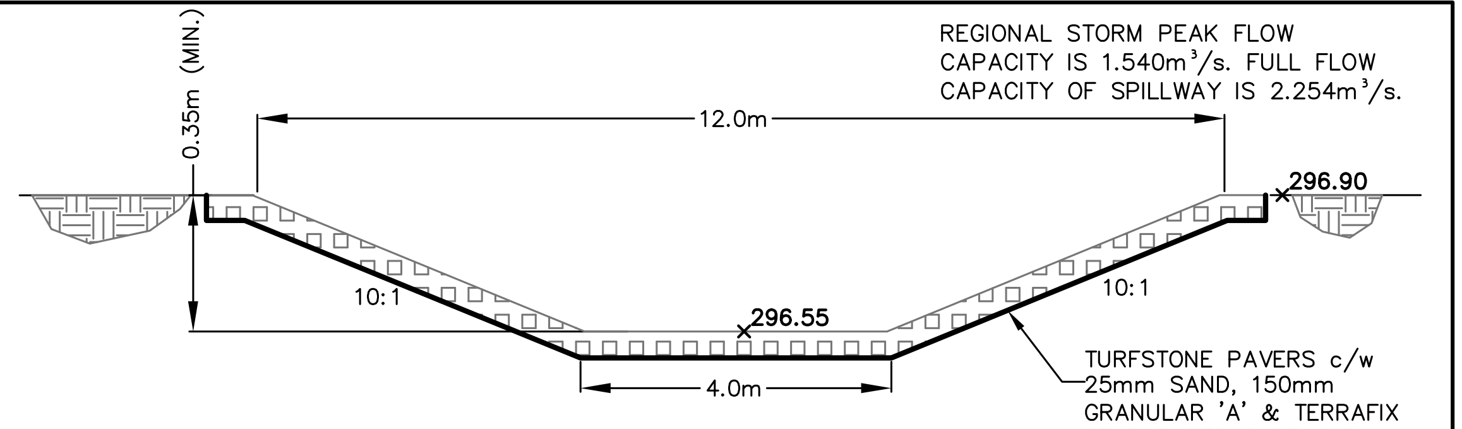
Client:

Mansfield Ski Club

628213 15th Sideroad
PO Box 75 RPO Mansfield,
Mulmur, Ontario
L9V 3M6

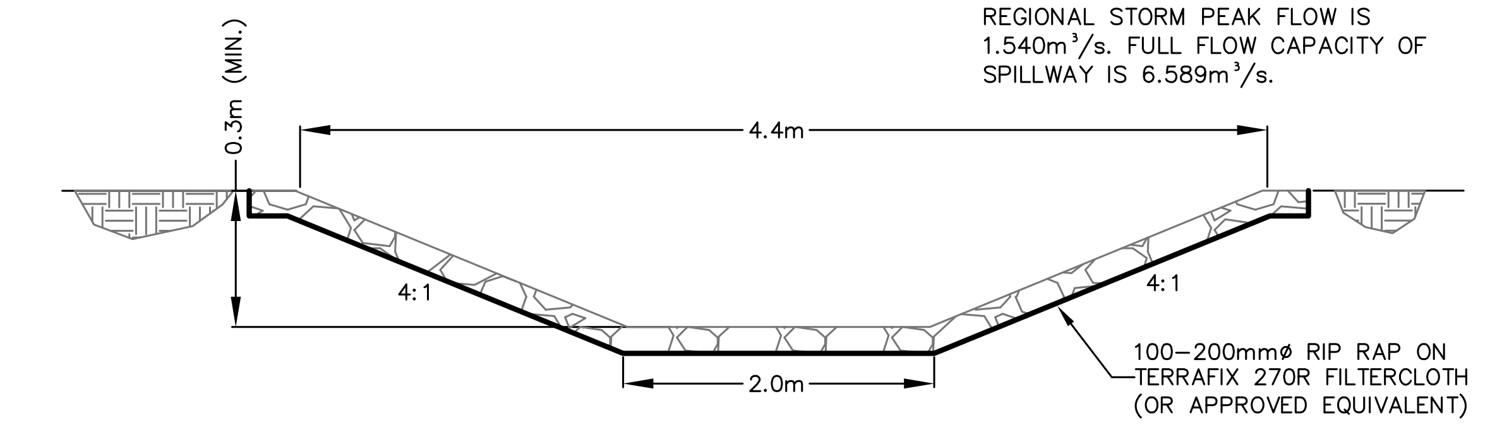
WMI & Associates Limited
119 Collier Street
Barrie, Ontario
L4M 1H5
Ph 705-797-2027
www.wmiengineering.ca

Drawn By	Checked By	Drawing No.
AW	JWL	SMPLP
Scale 1:500	Project No. 15-319	



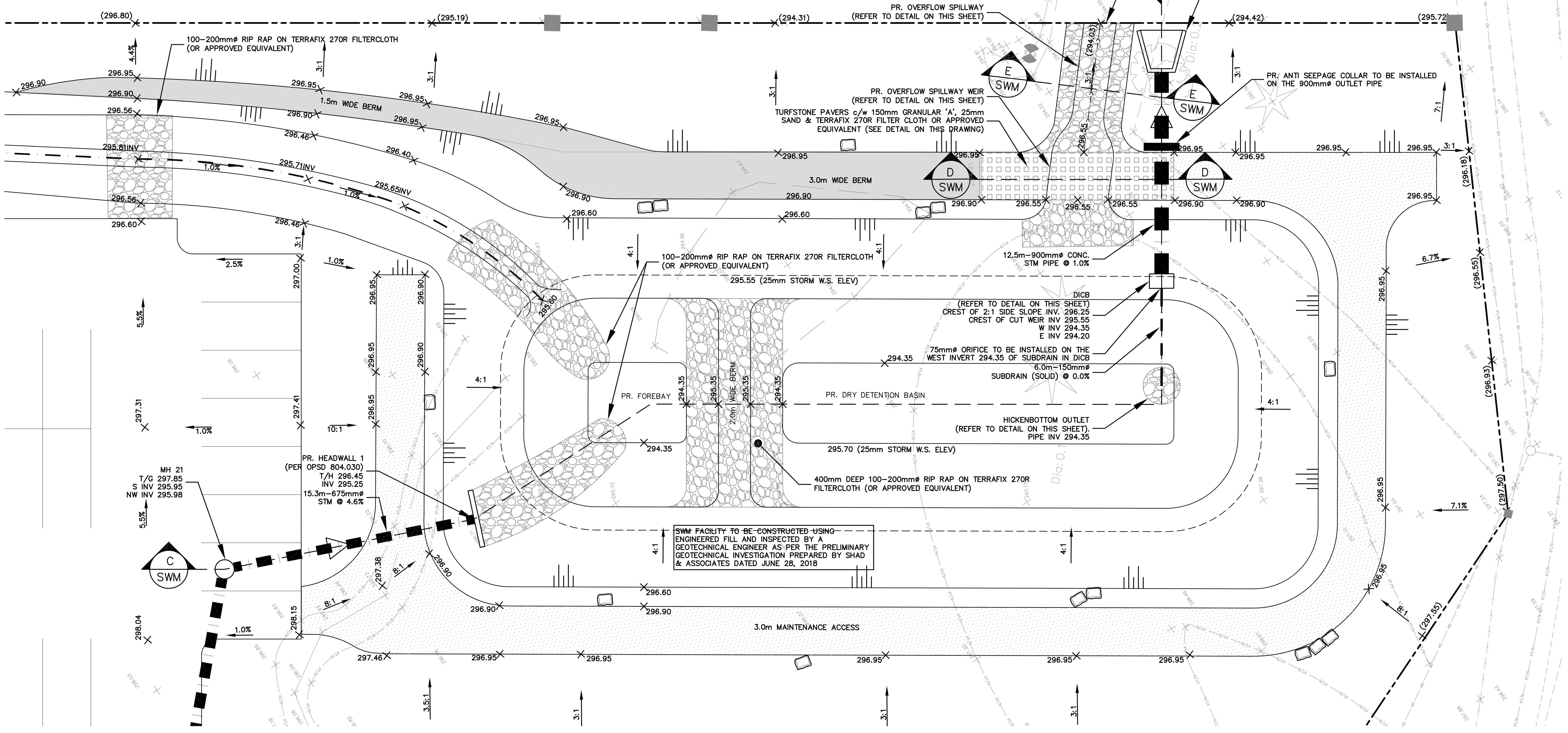
OVERFLOW SPILLWAY WEIR SECTION D–D

N.T.S.

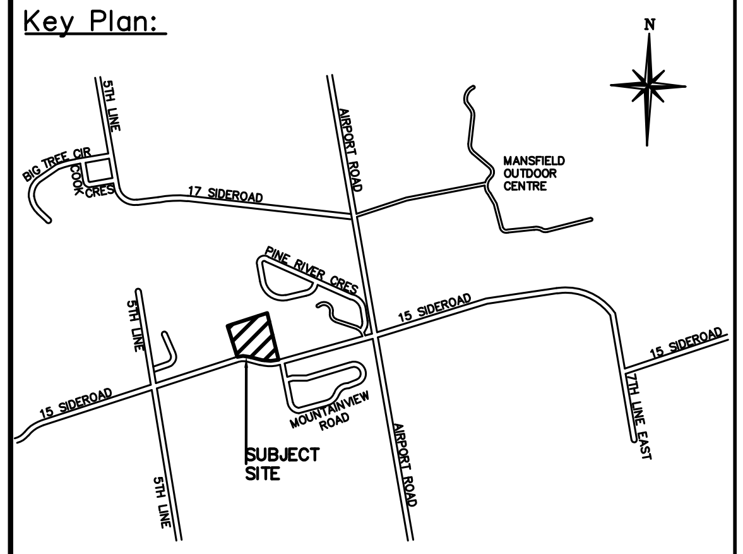


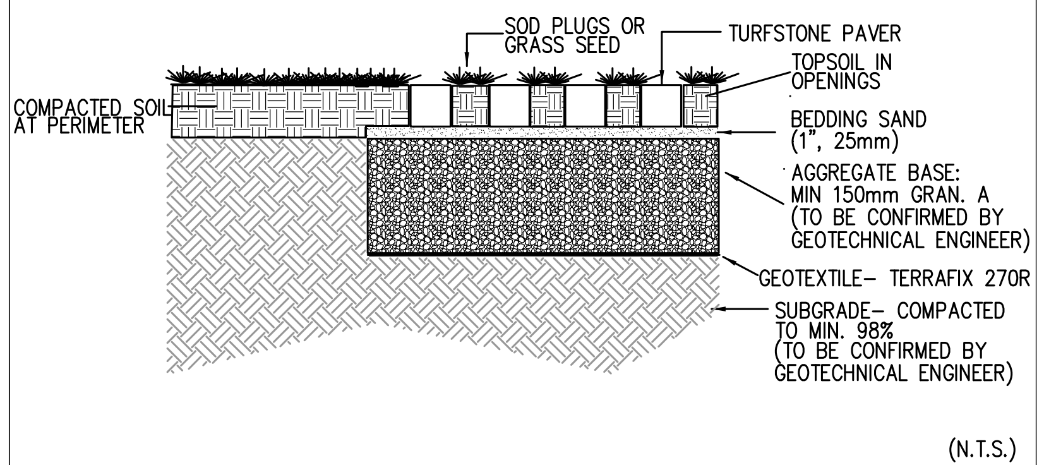
OVERFLOW SPILLWAY SECTION E–E

N.T.S.



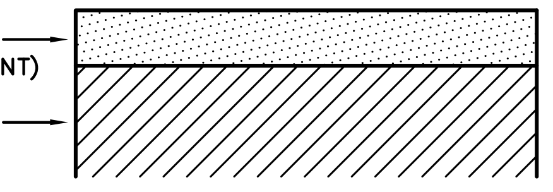
FEATURE	ELEVATION	VOLUME
BASE OF BASIN	294.35m	0.0m³
(ACTIVE STORAGE VOLUMES)		
25mm HWL	295.70	443m³
2 YR HWL	296.12	742m³
5 YR HWL	296.32	922m³
REGIONAL STORM HWL	296.48	1080m³
25 YR HWL	296.56	1158m³
100 YR HWL	296.61	1364m³
TOP OF BASIN	296.90	1772m³





(N.T.S.)

OVERFLOW SPILLWAY WEIR **Turfstone Paver**	UNILOCK® *Designed to be a step ahead* 1•800•UNILOCK www.unilock.com	PAVER DETAIL Cross Section **SWM.DWG**

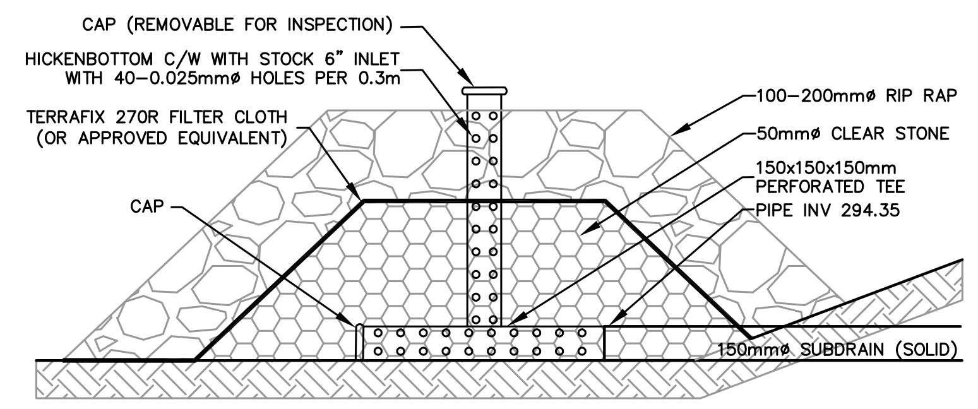


NOTE:

GEOTECHNICAL ENGINEER TO CONFIRM MATERIAL THICKNESS AND COMPACTION REQUIREMENTS.

3.0m MAINTENANCE ACCESS

N.T.S.



HICKENBOTTOM OUTLET DETAIL

N.T.S.

Legend:

EXISTING FEATURES (EX)

■ EX SIB	EX STD IRON BAR
■ EX IB	EX IRON BAR
○ EX UP	EX UTILITY POLE
☒	EX BELL PED
Ⓦ EX WS	EX WATER SERVICE
EX HYD	EX FIRE HYD.
NS	EX ST NAME SIGN
SS	EX STOP SIGN
X 123.45	EX ELEVATION
—o—o—o—	EX FENCE
— GAS — GAS — GAS —	EX U/G GASMAIN
— XB —	EX U/G BELL
— XH — XH — XH — XH —	EX HYDRO
— XB/S — XB/S —	EX BOTTOM OF SLOPE
— XT/S — XT/S —	EX TOP OF SLOPE
— — EX WV —	EX WATERMAIN & VALVE
EX SAN @ 0.0% ●	EX SAN SEWER & MH
EX STM @ 0.0% ○	EX STM SEWER & MH

PROPOSED FEATURES (PR)

NS	PR STREET NAME SIGN
SS	PR STOP SIGN
— SF — SF — SF —	PR SILT FENCE
— — — — —	PR LEGAL PART LOTS
—— - - —— - - ——	PR LEGAL BOUNDARY
Ⓛ	PR STREET LIGHT
——Ⓦ	PR WATER SERVICE
——Ⓢ	PR SAN SERVICE
▼	PR HYDRO TRANSFORMER
00mmø W/M	PR WATERMAIN
00mmø W/M	PR TEMPORARY WATERMAIN FOR PHASE 1A
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⌖	PR FIRE HYDRANT
⊗	PR WATER VALVE
0m–00mmø SAN @ 0.0%	PR SAN SEWER
— — — —	PR PERMANENT SAN SEWER FOR PHASE 1A
● MH K	PR SANITARY MANHOLE
0m–00mmø STM @ 0.0%	PR STM SEWER
▣ MH 4	PR CATCHBASIN MANHOLE
○ MH 4	PR MANHOLE
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x 000.00	PROPOSED ELEVATION
x (000.00)	PR. MATCH EXISTING ELEVATION (INTERPOLATED)
⁓→	PR SWALE
▓	PR HEAVY DUTY ASPHALT
▒	PR UNIT PAVING
░	PR BERM
▨	PR FIRE ACCESS
U.F.E	UPPER FLOOR ELEVATION
G.F.E	GROUND FLOOR ELEVATION

CAUTION

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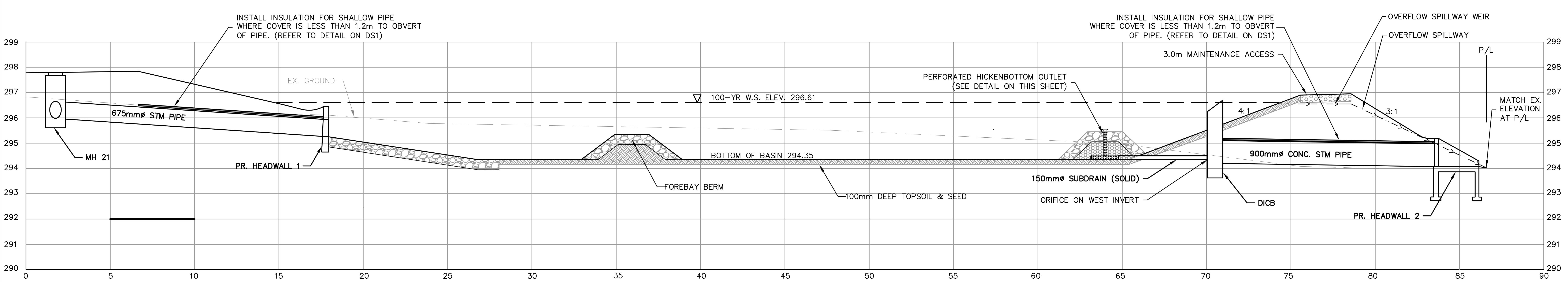
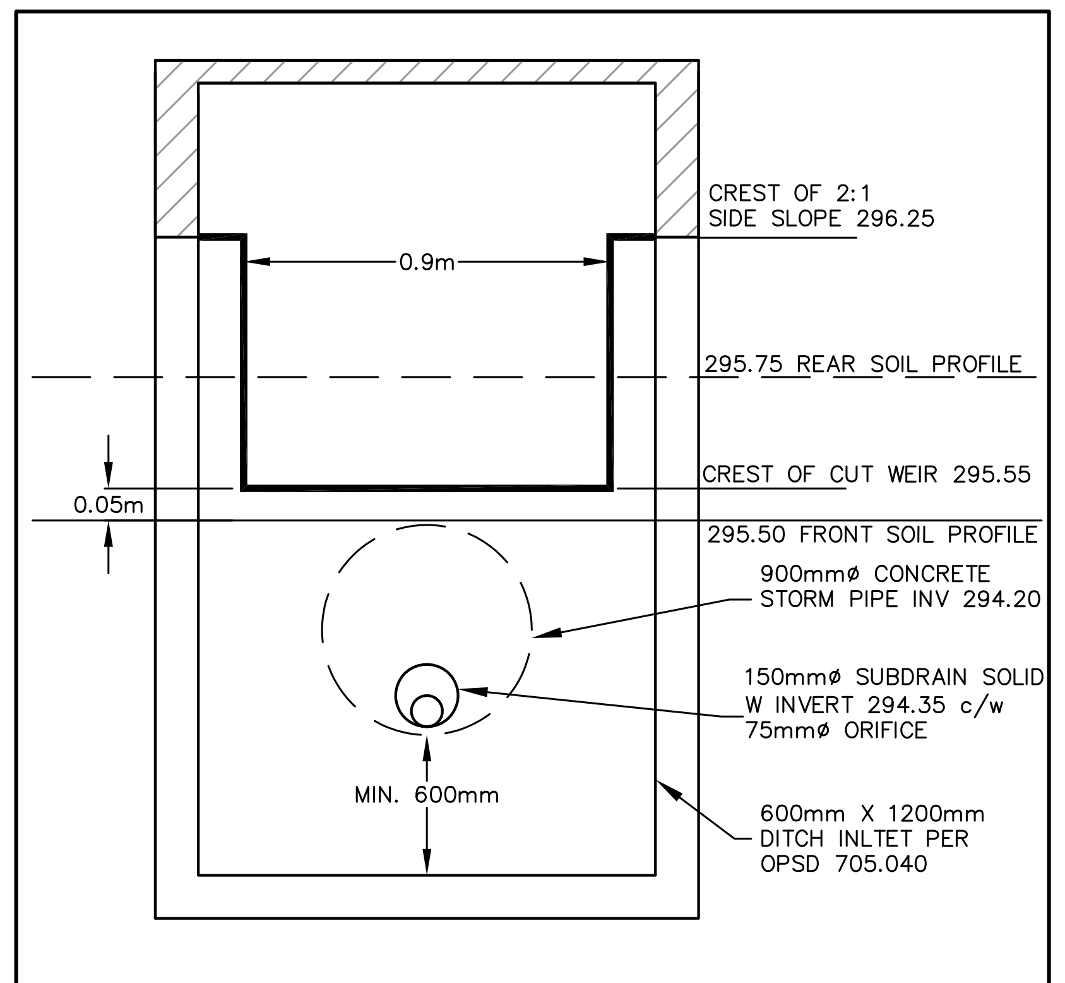


SECTION C–C

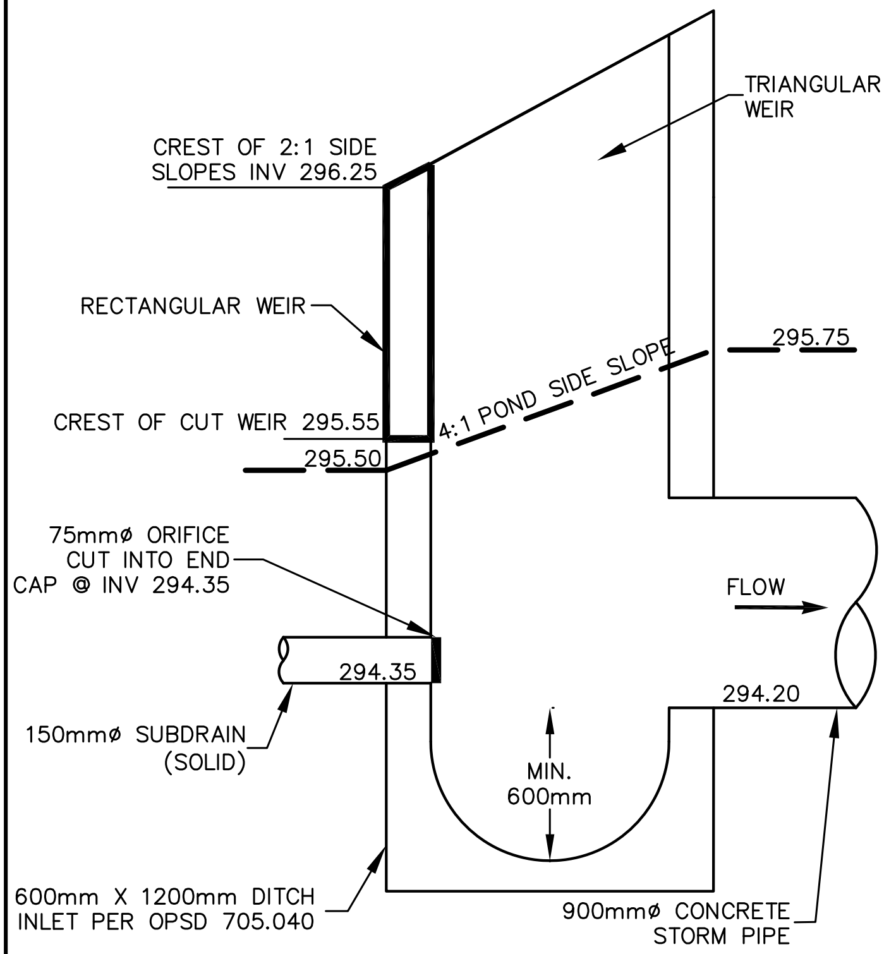
C SWM

H 1:150 V 1:100



DICB WEIR DETAIL A

N.T.S.



DICB WEIR DETAIL B

N.T.S.

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100140403
DEC. 15, 2020

No.	Issue / Revision	Date
1	SPA FIRST SUBMISSION	AUG. 17, 2020
2	SPA SECOND SUBMISSION	DEC. 15, 2020

Mansfield Ski Club

STORMWATER MANAGEMENT FACILITY PLAN

Client:

Mansfield Ski Club

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PO Box 75 RPO Mansfield,
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Drawn By	Checked By	Drawing No.
AW	JWL	SWM
Scale 1:150	Project No. 15–319	

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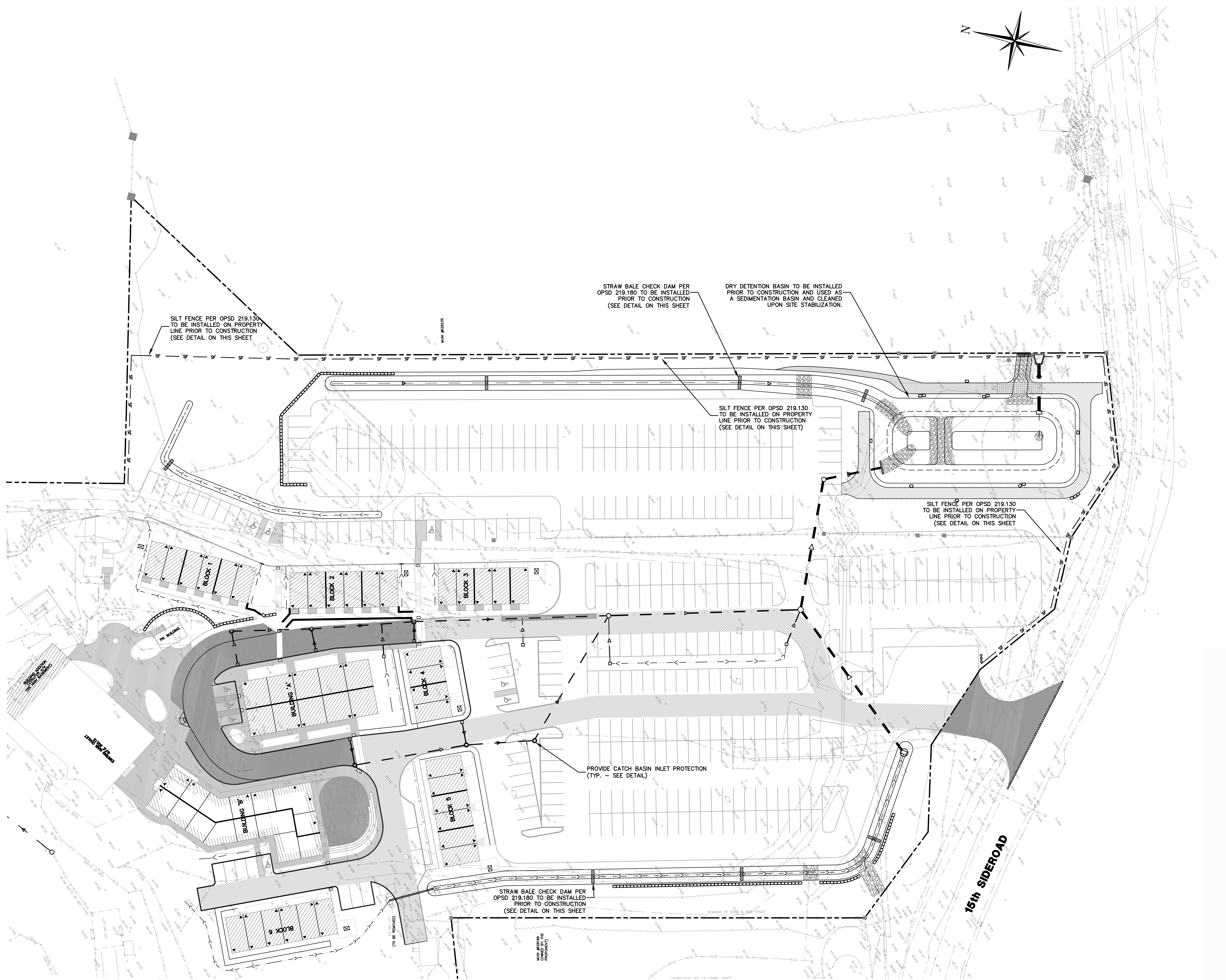


SILT FENCE PER OPSD 219.130 TO BE INSTALLED ON PROPERTY LINE PRIOR TO CONSTRUCTION (SEE DETAIL ON THIS SHEET

STRAW BALE CHECK DAM PER OPSD 219.180 TO BE INSTALLED PRIOR TO CONSTRUCTION (SEE DETAIL ON THIS SHEET

DRY DETENTION BASIN TO BE INSTALLED PRIOR TO CONSTRUCTION AND USED AS A SEDIMENTATION BASIN AND CLEANED UPON SITE STABILIZATION.

SILT FENCE PER OPSD 219.130 TO BE INSTALLED ON PROPERTY LINE PRIOR TO CONSTRUCTION (SEE DETAIL ON THIS SHEET)

SILT FENCE PER OPSD 219.130 TO BE INSTALLED ON PROPERTY LINE PRIOR TO CONSTRUCTION (SEE DETAIL ON THIS SHEET

PROVIDE CATCH BASIN INLET PROTECTION (TYP. – SEE DETAIL)

STRAW BALE CHECK DAM PER OPSD 219.180 TO BE INSTALLED PRIOR TO CONSTRUCTION (SEE DETAIL ON THIS SHEET

NOTES

EROSION CONTROL WORKS TO BE INSPECTED REGULARLY AFTER EVERY RAINFALL AND REPAIRED/REPLACED AS REQUIRED BY THE MUNICIPALITY OR DEVELOPER'S ENGINEER.

ALL DISTURBED AREAS TO BE RESTORED USING TOPSOIL AND SEED IMMEDIATELY UPON ESTABLISHING FINAL GRADES.

EROSION CONTROL WORKS TO BE MAINTAINED UNTIL THE SITE HAS STABILIZED AND REMOVAL IS DIRECTED BY THE MUNICIPALITY OR DEVELOPER'S ENGINEER.

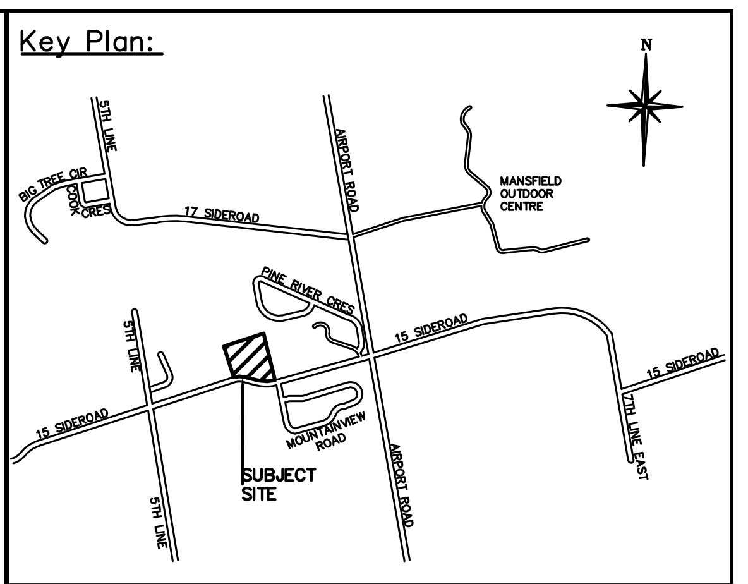
SILT FENCE TO BE MAINTAINED ON THE DOWNSTREAM SIDE OF ALL STOCK PILES.

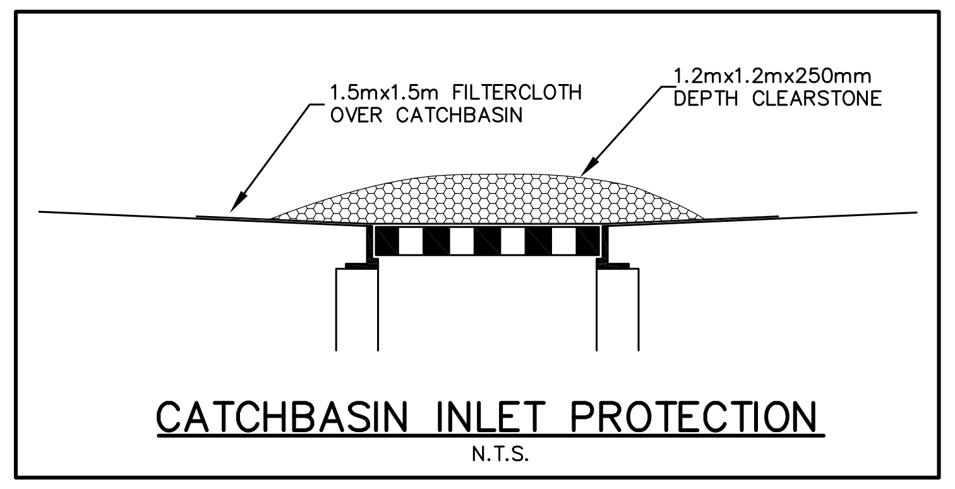
SILT FENCE IS TO BE CONSTRUCTED/INSTALLED AS INDICATED PRIOR TO CONSTRUCTION COMMENCEMENT.

ALL SWALES c/w STRAW BALE CHECK DAMS (REFER TO DETAIL ON ON THIS SHHET) TO BE POSITIONED AND INSTALLED BY THE CONTRACTOR PRIOR TO ANY SITE DISTURBANCE.

STORM OUTLET STRUCTURES, DITCHES/SWALES, CULVERTS AND THE DRY DETENTION BASIN ARE TO BE CLEANED UPON COMPLETION OF THE SITE GRADING AND SITE STABILIZATION WORKS.

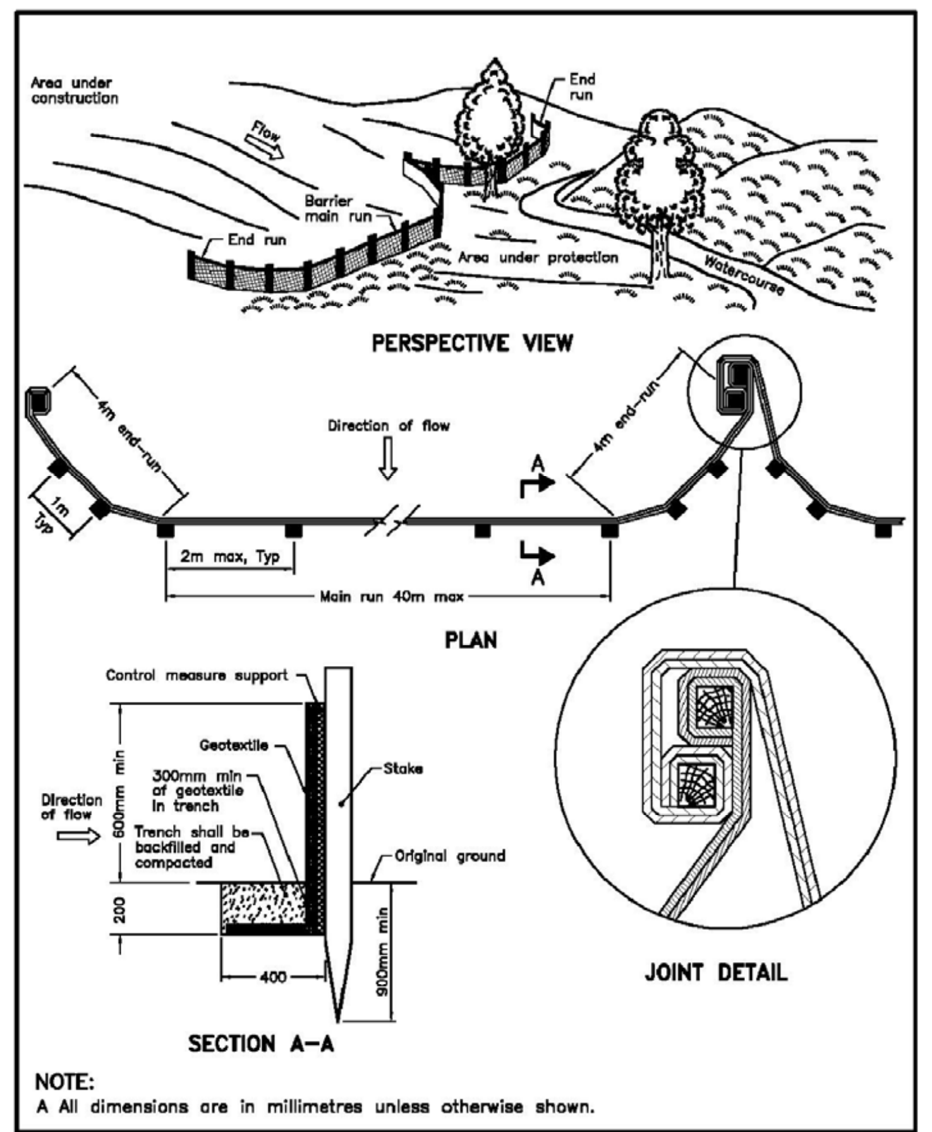
Key Plan:





CATCHBASIN INLET PROTECTION

N.T.S.

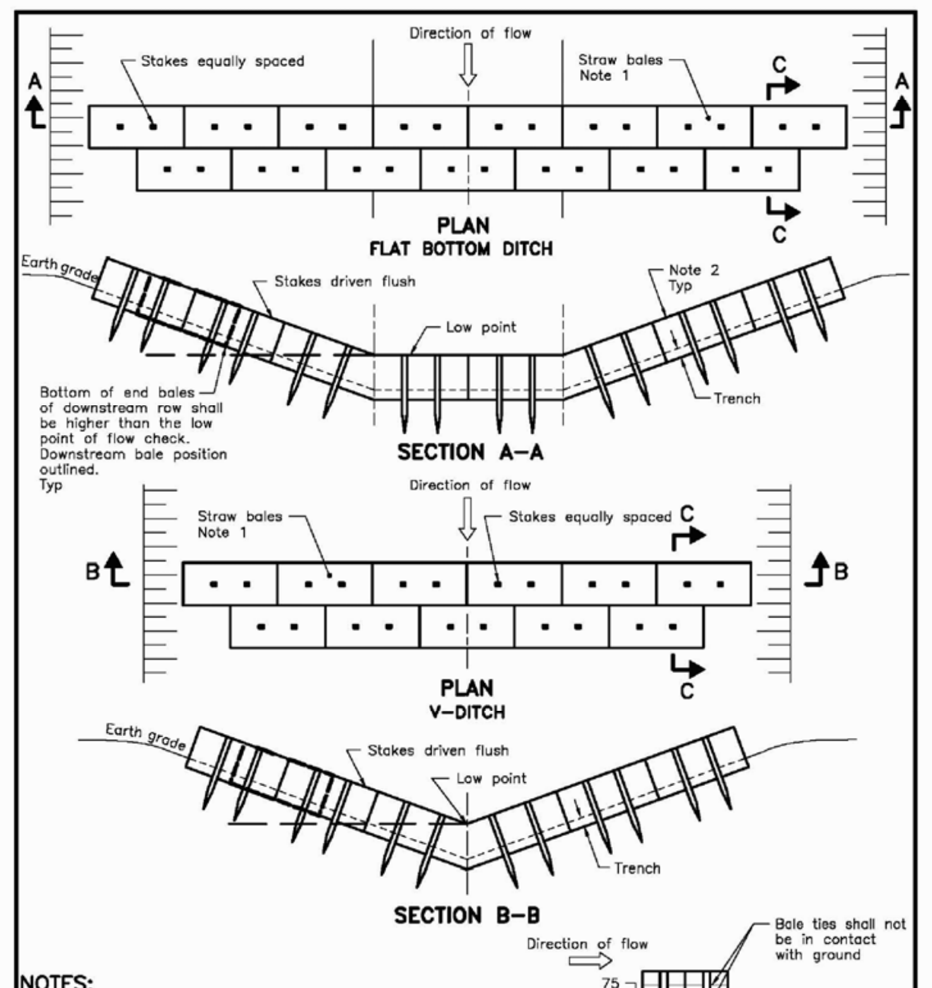


NOTE:
A All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING | Nov 2015 | Rev 2

HEAVY–DUTY SILT FENCE BARRIER

OPSD 219.130



NOTES:
1 Number of bales varies and shall suit ditch.
2 Straw bales shall be butted tightly against adjoining bales and shaped to conform to the sides of the ditch to prevent water flow through barrier.
A All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING | Nov 2015 | Rev 2

STRAW BALE FLOW CHECK DAM

OPSD 219.180

Legend:

EXISTING FEATURES (EX)

- ■ EX SIB — EX STD IRON BAR
- ■ EX IB — EX IRON BAR
- ○ EX UP — EX UTILITY POLE
- ☒ — EX BELL PED
- Ⓦ EX WS — EX WATER SERVICE
- EX HYD — EX FIRE HYD.
- NS — EX ST NAME SIGN
- SS — EX STOP SIGN
- x 123.45 — EX ELEVATION
- EX FENCE
- GAS — EX U/G GASMAIN
- XB — EX U/G BELL
- XH — EX HYDRO
- XB/S — EX BOTTOM OF SLOPE
- XT/S — EX TOP OF SLOPE
- EX WV — EX WATERMAIN & VALVE
- EX SAN @ 0.0% — EX SAN SEWER & MH
- EX STM @ 0.0% — EX STM SEWER & MH

PROPOSED FEATURES (PR)

- NS — PR STREET NAME SIGN
- SS — PR STOP SIGN
- SF — PR SILT FENCE
- PR LEGAL PART LOTS
- PR LEGAL BOUNDARY
- Ⓛ — PR STREET LIGHT
- Ⓦ — PR WATER SERVICE
- Ⓢ — PR SAN SERVICE
- PR HYDRO TRANSFORMER
- 00mmø W/M — PR WATERMAIN
- 00mmø W/M — PR TEMPORARY WATERMAIN FOR PHASE 1A
- 00mmø W/M — PR PERMANENT WATERMAIN FOR PHASE 1A
- PR FIRE HYDRANT
- PR WATER VALVE
- 0m–00mmø SAN @ 0.0% — PR SAN SEWER
- PR PERMANENT SAN SEWER FOR PHASE 1A
- ● MH K — PR SANITARY MANHOLE
- 0m–00mmø STM @ 0.0% — PR STM SEWER
- MH 4 — PR CATCHBASIN MANHOLE
- ○ MH 4 — PR MANHOLE
- □ — PR CATCHBASIN
- x 000.00 — PROPOSED ELEVATION
- x (000.00) — PR. MATCH EXISTING ELEVATION (INTERPOLATED)
- PR SWALE
- ▨ — PR HEAVY DUTY ASPHALT
- ▨ — PR UNIT PAVING
- ▨ — PR BERM
- ▨ — PR FIRE ACCESS
- U.F.E — UPPER FLOOR ELEVATION
- G.F.E — GROUND FLOOR ELEVATION
- ▨ — PR STRAW BALE CHECK DAM

CAUTION

CONTRACTOR TO DETERMINE LOCATION OF EXISTING UTILITIES PRIOR TO CONSTRUCTION.

Notes:

1. Unless noted otherwise, the measurements and distances shown on this drawing are shown in meters.
2. Do not scale drawings.
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Benchmark: 463.937m

ELEVATIONS SHOWN HEREON ARE GEODETIC AND ARE DERIVED FROM CANNET NETWORK BASE STATION ORVL HAVING A PUBLISHED ELEVATION OF 463.937m

REGISTERED PROFESSIONAL ENGINEER
J.W.LIGHTHEART
100140403
DEC. 15, 2020
PROVINCE OF ONTARIO

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Mansfield Ski Club

EROSION & SEDIMENT CONTROL PLAN

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Scale 1:500	Project No. 15–319	

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GENERAL – CONSTRUCTION

1. ALL MEASUREMENTS ARE IN METRES, PIPE SIZES IN MILLIMETRES, UNLESS OTHERWISE NOTED.
2. ALL CONSTRUCTION SHALL BE IN ACCORDANCE WITH CURRENT MUNICIPAL STANDARDS AND THE MOST CURRENT ONTARIO PROVINCIAL STANDARD DRAWINGS AND SPECIFICATIONS (IN THAT ORDER UNLESS NOTED OTHERWISE). IF A DISCREPANCY ARISES THE MUNICIPAL STANDARDS ARE TO GOVERN.
3. LOCATIONS OF EXISTING SERVICES ARE NOT GUARANTEED. CONTRACTOR TO CONFIRM EXISTING UTILITY LOCATIONS AND ELEVATIONS PRIOR TO CONSTRUCTION. THE CONTRACTOR IS REQUIRED TO NOTIFY THE VARIOUS UTILITY COMPANIES 48 HOURS PRIOR TO THE COMMENCEMENT OF ANY WORK.
4. THE CONTRACTOR SHALL INFORM THE MUNICIPALITY AND ENGINEER A MINIMUM OF 48 HOURS IN ADVANCE OF COMMENCING ANY WORK. THE CONTRACTOR IS RESPONSIBLE FOR COORDINATING INSPECTION FOR ALL CIVIL WORKS WITH THE ENGINEER IN ORDER TO PROVIDE SUFFICIENT CERTIFICATION AS REQUIRED BY THE MUNICIPALITY.
5. ALL DIMENSIONS AND ELEVATIONS ARE TO BE CHECKED AND VERIFIED BY THE CONTRACTOR. ANY DISCREPANCIES ARE TO BE REPORTED TO THE ENGINEER.
6. TRAFFIC CONTROLS TO CONFORM TO THE LATEST REVISION OF THE MANUAL OF UNIFORM TRAFFIC CONTROL DEVICES AND ONTARIO TRAFFIC MANUAL TEMPORARY CONDITIONS (BOOK 7).
7. STREET AND TRAFFIC SIGNS – M.T.O. STANDARDS
8. FILTER FABRIC – TERRAFIX 270R OR APPROVED EQUAL.
9. DEWATERING TO BE CARRIED OUT IN ACCORDANCE WITH OPSS–517 AND 518 TO MAINTAIN ALL TRENCHES IN A DRY CONDITION, CONTRACTOR IS RESPONSIBLE FOR OBTAINING NECESSARY PERMITS FOR DEWATERING.
10. ALL DISTURBED AREAS WITHIN EXISTING RIGHT–OF–WAYS ARE TO BE REINSTATED TO THEIR ORIGINAL CONDITION OR BETTER AS DETERMINED BY THE MUNICIPALITY (MIN 300mm TOPSOIL AND NURSERY SOD).
11. ALL SEWER SYSTEMS INCLUDING SERVICE CONNECTIONS TO THE SEWER MAINS AS WELL AS CATCHBASINS AND MANHOLES SHALL BE THOROUGHLY FLUSHED AND/OR CLEANED OF DEBRIS AND ALL PIPES SHALL BE TESTED IN ACCORDANCE WITH OPS AND SHALL BE INSPECTED BY AN APPROVED VIDEO CAMERA TESTING COMPANY AND THE ENGINEER SHALL BE PROVIDED A COPY OF APPROPRIATE DATA UPON COMPLETION OF CONSTRUCTION AND PRIOR TO FINAL APPROVAL. ANY SECTIONS OF SEWER OR SERVICE CONNECTIONS THAT FAIL TO MEET THE REQUIREMENTS SHALL BE REPAIRED OR REPLACED AT THE DIRECTION OF THE ENGINEER. ONLY CHEMICAL PRESSURE GROUTING REPAIR TECHNIQUES WILL BE CONSIDERED ACCEPTABLE.
12. THESE ENGINEERING DRAWINGS ARE TO BE READ IN CONJUNCTION WITH THE LATEST VERSION OF THE GEOTECHNICAL INVESTIGATION. GEOTECHNICAL INSPECTION & MATERIALS TESTING TO BE PROVIDED DURING ALL SERVICING, PARKING LOT SUB–GRADE, PARKING LOT BASE, PAVEMENT, SWM POND, BERMING AND CONCRETE WORKS.
13. FOR SPECIFIC DIMENSIONS AND BUILDING INFORMATION REFER TO SITE PLAN/ARCHITECTURAL DRAWINGS.
14. PIPE DEFLECTION SHOULD BE USED WHEREVER POSSIBLE TO MINIMIZE THE USE OF BENDS, WHEREVER IT IS NECESSARY TO DEFLECT FROM A STRAIGHT LINE, EITHER IN THE VERTICAL OR HORIZONTAL PLANE. THE AMOUNT OF DEFLECTION SHALL NOT EXCEED THE MANUFACTURER'S SPECIFICATIONS.

ABOVE GROUND WORKS:

1. SUB–GRADE PREPARATION TO BE COMPLETED IN ACCORDANCE WITH THE GEOTECHNICAL INVESTIGATIONS RECOMMENDATIONS.
2. ASPHALT SURFACES TO BE CONSTRUCTED AS SHOWN ON THE PAVEMENT CROSS–SECTIONS DETAIL.
3. ENTRANCE CONNECTIONS TO CONSIST OF GRINDING EXISTING ASPHALT AND PROVIDE 0.3m WIDE OVERLAP JOINT AS SHOWN ON THE PAVEMENT LAP JOINT DETAIL.
4. CONCRETE CURB ON THE PROPERTY TO BE AS PER OPSD–600.110 BARRIER CURB. .
5. SIDEWALKS TO BE CONSTRUCTED AS PER OPSD 310.010, 310.020, & 310.030.
6. CONCRETE STRENGTH FOR CURB AND SIDEWALK IS TO BE 30MPa AT 28 DAYS.
7. A ROAD OCCUPANCY PERMIT IS REQUIRED PRIOR TO COMMENCEMENT OF WORK IN ANY MUNICIPAL RIGHT–OF–WAY.
8. A SITE ALTERATION PERMIT MAY BE REQUIRED FROM THE MUNICIPALITY PRIOR TO THE COMMENCEMENT OF EARTHWORKS.

SANITARY SEWER:

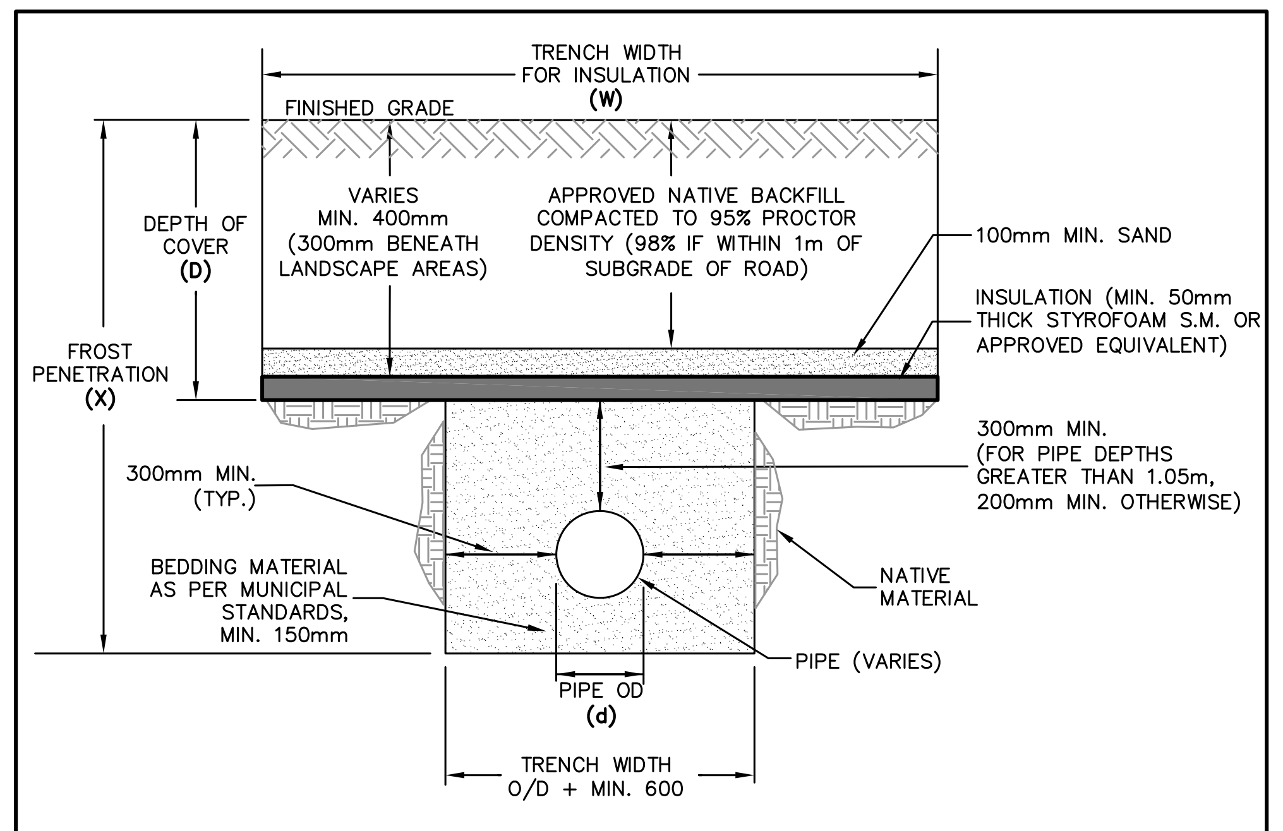
1. SANITARY MANHOLES TO BE 1200mmø AS PER OPSD 701.010 WITH BENCHING ACCORDING TO OPSD–701.021.
2. ALL SANITARY SEWERS TO BE PVC SDR–35 (OR APPROVED EQUIVALENT). ALL SANITARY SERVICES TO BE PVC SDR–28. BEDDING TO BE IN ACCORDANCE WITH OPSD 1006.020 AND 802.010.
3. PROVIDE SANITARY SEWER CLEANOUTS AS REQUIRED BY THE ONTARIO BUILDING CODE.
4. ALL SANITARY MANHOLES SHALL BE COMPLETED WITH FROST STRAPS PER OPSD 701.100.
5. MODULAR ADJUSTMENT UNITS FOR MANHOLES TO BE PROVIDED IN ACCORDANCE WITH OPSD 704.010. MAXIMUM THICKNESS OF ADJUSTMENTS UNITS IS 300mm.
6. WATER TIGHT COVERS TO BE PROVIDED FOR SANITARY MANHOLES LOCATED IN PONDING AREAS.
7. TESTING INCLUDING BUT NOT LIMITED TO DEFLECTION AND CCTV ARE TO BE COMPLETED AS PER MUNICIPAL STANDARDS AND OPSS.

STORM SEWER:

1. ALL SITE DRAINAGE POSSIBLE, INCLUDING ALL ROOF AND ASPHALT DRAINAGE, IS TO BE DIRECTED TO THE STORMWATER MANAGEMENT SYSTEM.
2. STORM SEWER 450mmø OR LESS: PVC CERTIFIED TO C.S.A. STANDARDS 182.2 AND 182.4.
   STORM SEWER GREATER THAN 450mmø: REINFORCED CONCRETE WITH A MINIMUM STRENGTH OF 50 N/m/mm CERTIFIED TO C.S.A. STANDARD A257.2, CLASS 50–D
3. STORM SEWER TO BE MINIMUM 300mm DIAMETER WITH JOINTS CONFORMING TO C.S.A. STANDARD A257.3.
4. MODULAR ADJUSTMENT UNITS FOR MANHOLES TO BE PROVIDED IN ACCORDANCE WITH OPSD 704.010. MAXIMUM THICKNESS OF ADJUSTMENTS UNITS IS 300mm.
5. STORM SEWER BEDDING AS PER OPSD 802.010 (FLEXIBLE PIPE) OR 802.030 (RIGID PIPE).
6. MANHOLES AND CATCHBASINS ARE TO BE IN ACCORDANCE WITH OPSD STANDARDS. CATCHBASIN MANHOLES ARE TO HAVE SUMPS.
7. CATCHBASIN LEADS – 300mmø. DOUBLE CATCHBASIN LEADS – 300mmø UNLESS OTHERWISE NOTED.
8. STORM SEWER COVER LESS THAN 1.2m TO PIPE OBVERT WILL REQUIRE FROST PROTECTION INSULATION, SEE INSULATION FOR SHALLOW PIPE DETAIL.
9. ALL STORM MANHOLES SHALL BE COMPLETED WITH FROST STRAPS AS PER OPSD 701.100.
10. TESTING INCLUDING BUT NOT LIMITED TO DEFLECTION AND CCTV ARE TO BE COMPLETED AS PER MUNICIPAL STANDARDS AND OPSS.

WATERMAINS:

1. WATERMAIN PIPES, FITTINGS, HYDRANTS, SERVICE PIPE TYPES & MANUFACTURERS ARE TO BE IN ACCORDANCE WITH MUNICIPAL STANDARDS.
2. WATERMAINS SHALL BE MINIMUM 100mmø, DR18. FIRE SUPPLY (250mmø) SHALL BE POLYVINYL CHLORIDE (PVC) CLASS 235 (DR18) OR APPROVED EQUIVALENT. TRACER WIRE (#12 STRANDED COPPER WIRE WITH OUTER PLASTIC COATING) SHALL BE INSTALLED ALONG THE ENTIRE LENGTH OF PVC WATERMAIN, SECURED TO FITTINGS AT INTERVALS NOT EXCEEDING 3m, AND BROUGHT UP AND LOOPED AT EACH VALVE BOX, CHAMBER AND HYDRANT SUCH THAT CONTINUITY IS MAINTAINED. TAPE IS TO BE USED TO AFFIX THE WIRE TO THE PIPE.
3. 50mmø WATER SUPPLY LINE FROM WELL PW1 IS TO BE 50mmø MUNICIPLEX (OR APPROVED EQUIVALENT).
4. WATERMAIN BEDDING AS PER OPSD 802.010 (FLEXIBLE PIPE) OR 802.030 (RIGID PIPE) AND AS PER TOWN STANDARDS.
5. HYDRANT INSTALLATION AS PER MUNICIPAL STANDARD.
6. THE MINIMUM HORIZONTAL SEPARATION BETWEEN THE WATERMAIN / WATER SERVICES AND THE SANITARY / STORM SEWER IS TO BE 2.5m.
7. A MINIMUM OF 0.5m VERTICAL CLEARANCE BETWEEN THE WATERMAIN / WATER SERVICES AND ALL UTILITIES SHALL BE MAINTAINED, WHILE MAINTAINING A MINIMUM DEPTH OF COVER AT ALL TIMES. WATERMAIN & WATER SERVICE TO BE INSULATED WITH HI–40 INSULATION AND/OR CONCRETE ENCASED AT THE ENGINEER'S DISCRETION WHERE 0.5m SEPARATION CANNOT BE MAINTAINED.
8. WATERMAIN / WATER SERVICE COVER LESS THAN 1.7m BELOW FINISHED GROUND SURFACE OR 1.9m BELOW ROAD CENTRELINE, WHICHEVER IS GREATER TO PIPE OBVERT WILL REQUIRE FROST PROTECTION, SEE INSULATION FOR SHALLOW PIPE DETAIL.
9. VALVE, VALVE BOXES AND CHAMBERS SHALL BE INSTALLED IN ACCORDANCE WITH OPSD STANDARDS.
10. 50mm BLOW–OFF WITH SAMPLING PORT TO BE MUELLER CO. HYDRO–GUARD BSS–02 (OR APPROVED EQUIVALENT).
11. CONTRACTOR IS RESPONSIBLE FOR ALL TIE–INS INCLUDING MATERIALS, EXCAVATION AND BACKFILL AS REQUIRED TO FACILITATE THE SWABBING AND TESTING OF THE NEW WATERMAINS UNDER THE SUPERVISION OF THE ENGINEER.
12. FIRE HYDRANTS AND VALVES SHALL ONLY BE OPERATED BY MUNICIPAL WATER DEPARTMENT STAFF.
13. MECHANICAL JOINT RESTRAINTS ARE TO BE INSTALLED AT ALL TEES, HORIZONTAL BENDS, VERTICAL BENDS, HYDRANTS, END OF MAINS AND VALVES. CONCRETE THRUST BLOCKS ARE NOT PERMITTED UNLESS APPROVED BY THE ENGINEER. ALL MECHANICAL RESTRAINT SYSTEMS SHALL BE INSTALLED WITH CATHODIC PROTECTION AS PER THE TOWN STANDARD AND TREATED WITH DENSO TAPE.
14. THE CONTRACTOR SHALL SWAB, PRESSURE TEST, CHLORINATE AND FLUSH THE NEW WATERMAINS. ANY SWABBING, PRESSURE TESTING, CHLORINATING AND FLUSHING BEYOND THE INITIAL PROCEDURE WILL BE THE CONTRACTORS' RESPONSIBILITY. TESTING PROCEDURES TO BE IN ACCORDANCE WITH MUNICIPALITY STANDARDS.
15. ALL EXISTING WELLS LOCATED ON THE PROPOSED DEVELOPMENT LANDS ARE TO BE ABANDONED AND DECOMMISSIONED IN ACCORDANCE WITH ONTARIO REGULATION 903 UPON FINAL TESTING AND APPROVAL BY THE HYDROGEOLOGIST.

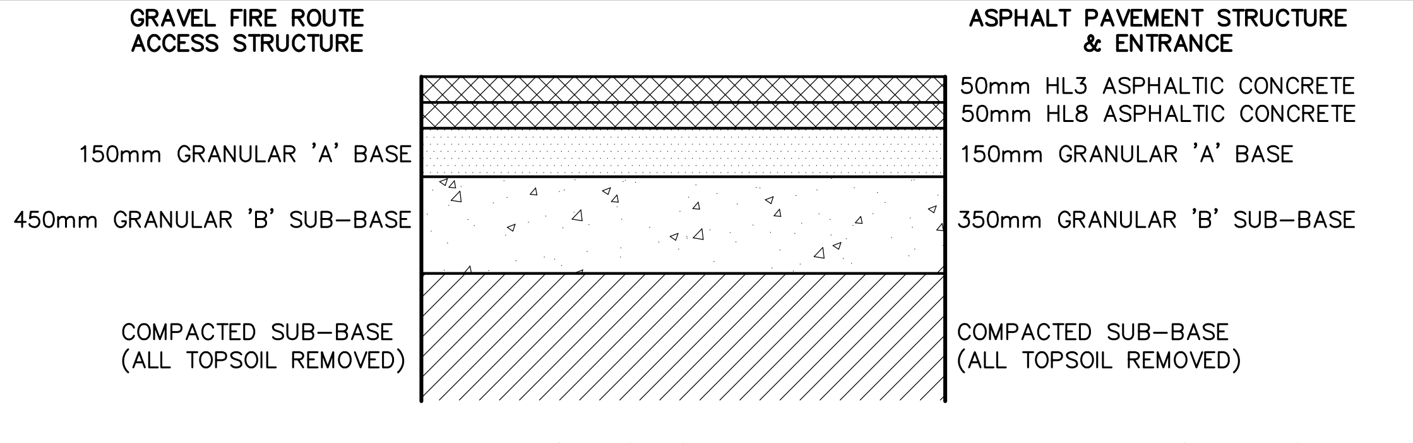


IN DETERMINING THE WIDTH OF SLAB REQUIRED, THE MINISTRY RECOMMENDS THAT THE FOLLOWING FORMULA BE USED;
W=2(X–D)+d, WHERE:

W = WIDTH OF SLAB IN METERS
X = FROST PENETRATION DEPTH IN METERS
D = DEPTH OF COVER OVER INSULATION IN METERS
d = OUTSIDE DIAMETER OF PIPE IN METERS

NOTES:
- –INSULATION SHALL BE PLACED WITH ENDS CLOSELY BUTTED TOGETHER. ALL JOINT ENDS SHALL BE STAGGERED WHEN MORE THAN ONE LAYER OF INSULATION IS BEING INSTALLED.
- –FORMULA TAKEN FROM MOE GUIDELINES FOR SERVICING IN AREAS SUBJECT TO ADVERSE CONDITIONS DATED JANUARY 1985.
- –FOR EVERY 300mm REDUCTION IN FROST COVER USE 25mm OF EXTRUDED POLYSTYRENE INSULATION.

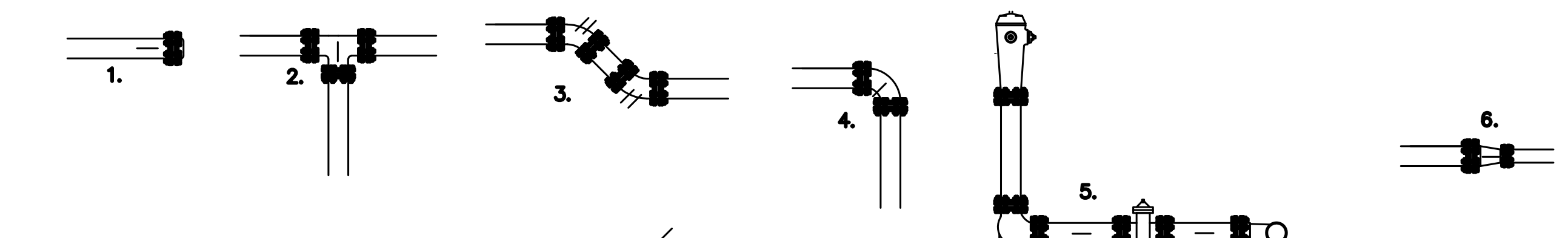
INSULATION FOR SHALLOW PIPES

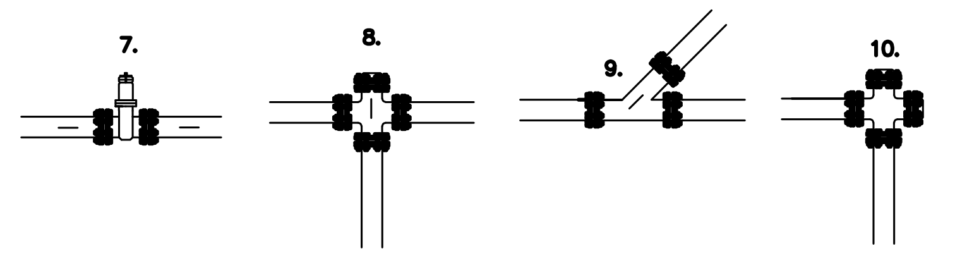


NOTE: – REFER TO THE ADDENDUM GEOTECHNICAL REPORT PREPARED BY SHAD & ASSOCIATES INC. DATED APRIL 22, 2020 FOR FURTHER PAVEMENT DETAILS. ALSO REFER TO THE RECOMMENDED GRAVEL FIRE ROUTE PAVEMENT THICKNESS PREPARED BY SHAD & ASSOCIATES DATED MARCH 20, 2020.

PAVEMENT CROSS–SECTIONS

N.T.S.



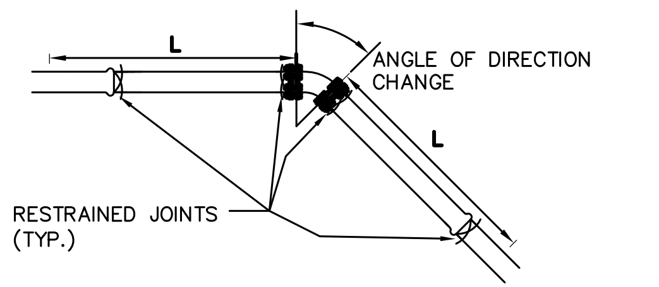


FITTING ARRANGEMENTS
1. DEAD END (CAP/PLUG)
2. TEES
3. HYDRANT RUNOUT
4. VERTICAL OFFSET
5. HORIZONTAL BEND
6. REDUCER
7. INLINE VALVE
8. THRU LINE CONNECTION, CROSS USED AS TEE
9. THRU LINE CONNECTION, WYE
10. DIRECTION CHANGE, CROSS USED AS ELBOW

TABLE 1.0

PIPE DIA.	L – MIN. LENGTH TO BE RESTRAINED ON EACH SIDE OF FITTING ARRANGEMENTS (M)						
	ELBOWS (DEG.) FITTING ARRANGEMENT No. 3 & 4				INLINE VALVES, Y's & TEES. FITTING ARRANGEMENTS No. 2, 7 & 9	DEADENDS FITTING ARRANGEMENTS No. 1, 5, 8 & 10	REDUCER FITTING ARRANGEMENTS No. 6
	11 1/4	22 1/2	45	90			
mm							
100	8.0	8.0	8.0	8.0	8.0	12.4	8.0
150	8.0	8.0	8.0	8.0	8.0	17.8	9.2
200	8.0	8.0	8.0	8.0	8.7	23.1	9.5
250	8.0	8.0	8.0	8.7	13.6	28.3	9.7
300	8.0	8.0	8.0	10.2	18.0	33.5	9.8
350	8.0	8.0	8.0	11.7	23.7	38.7	9.9
400	8.0	8.0	8.0	13.3	28.6	43.6	10

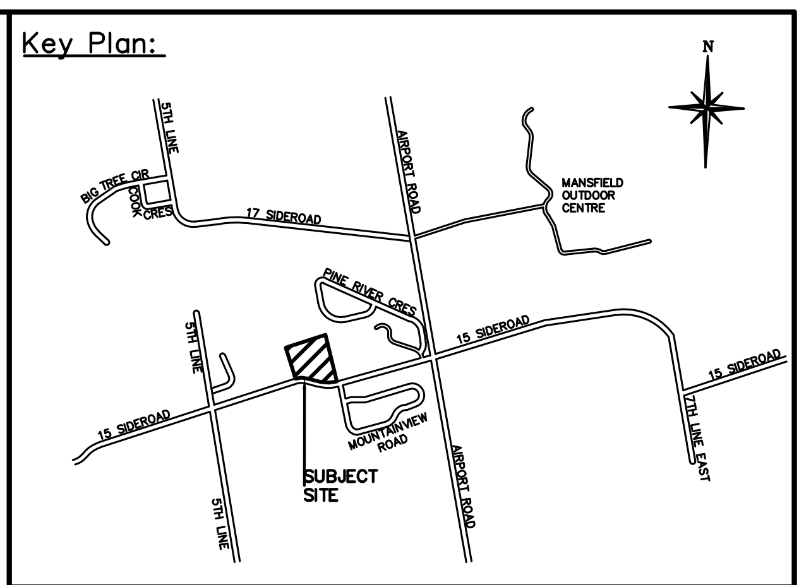
* NOTE THE MINIMUM LENGTH OF PIPE ALLOWED ON EACH SIDE OF THE FITTING (BEFORE NEXT FITTING) TO BE 1.5m

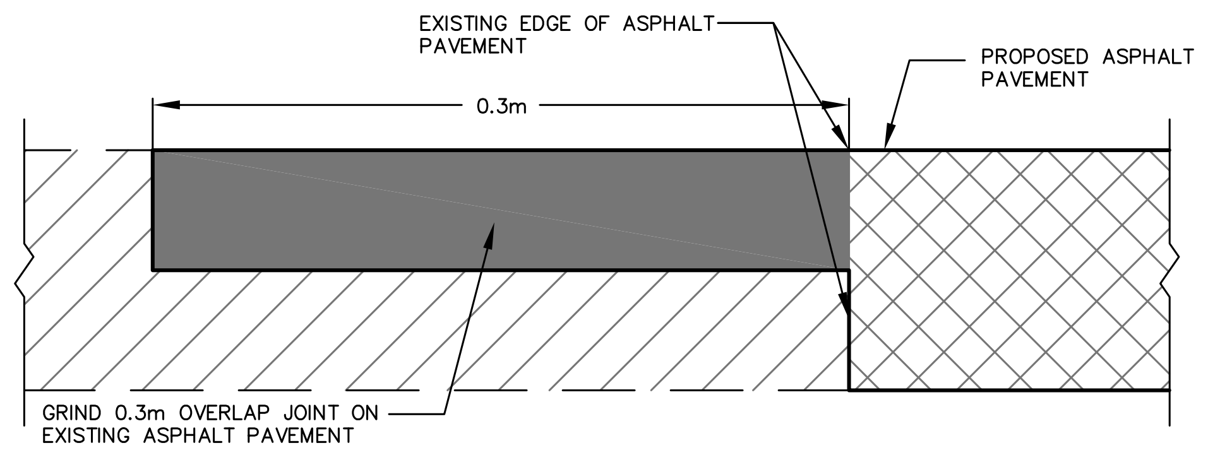


NOTE:
- ALL JOINTS MUST BE RESTRAINED IN ALL APPLICATIONS. TABLE 1 SHOWS RESTRAINED JOINTS REQUIRED ON BOTH SIDE OF THE RESTRAINED FITTINGS
- WHERE CONNECTING TO EXISTING WATERMAIN, EXCAVATE AND INSTALL RESTRAINTS ON EXISTING WATERMAIN FOR LENGTHS IDENTIFIED IN TABLE 1.0
- LENGTHS TO BE RESTRAINED SHOWN IN TABLE 1.0 ARE MINIMUMS. CONTRACTOR TO CONFIRM WITH RESTRAINT AND/OR PIPE SUPPLIER THE NEED FOR ADDITIONAL RESTRAINT. MINIMUM FACTOR OF SAFETY TO BE USED IS 2.5 FOR A TEST PRESSURE OF 1034kPa (150 psi)

RESTRAINED JOINTS DETAIL

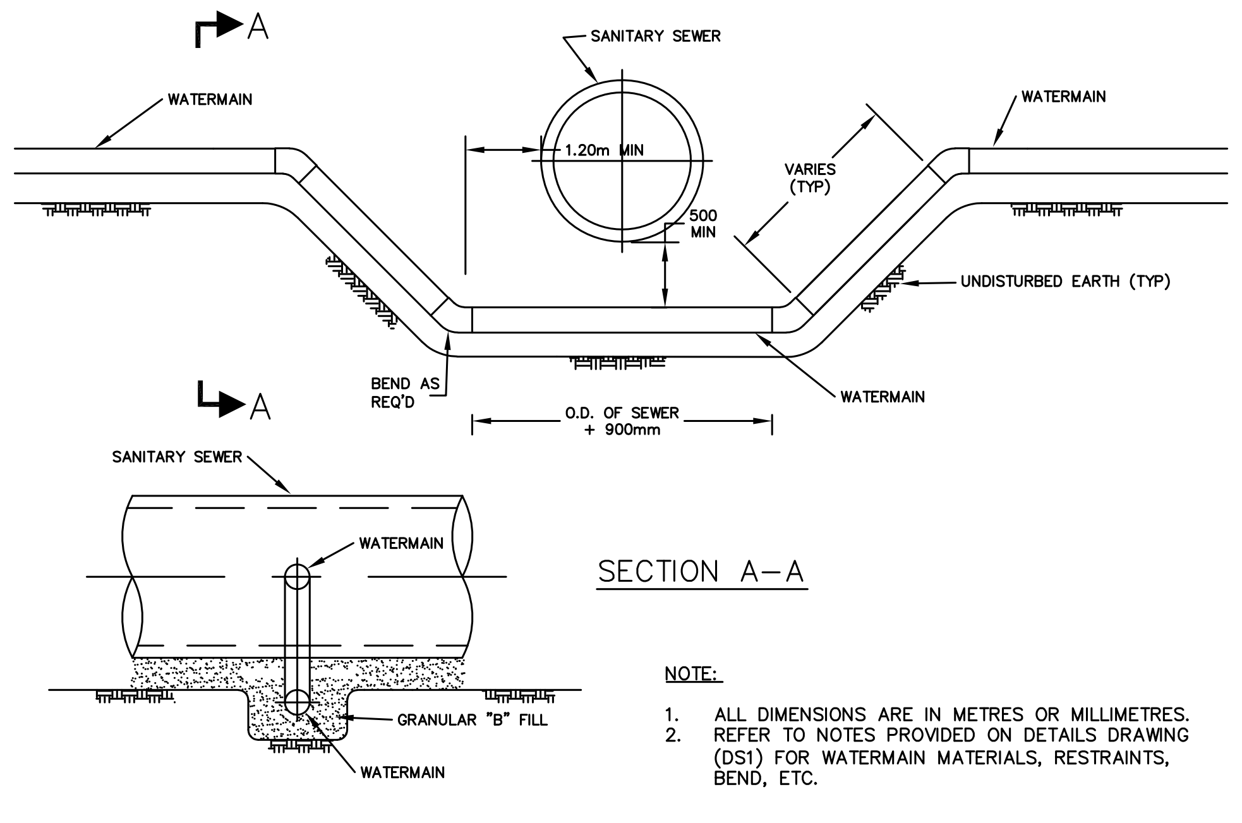
N.T.S.





PAVEMENT LAP JOINT

N.T.S.



NOTE:
1. ALL DIMENSIONS ARE IN METRES OR MILLIMETRES.
2. REFER TO NOTES PROVIDED ON DETAILS DRAWING (DS1) FOR WATERMAIN MATERIALS, RESTRAINTS, BEND, ETC.

TYPICAL WATERMAIN DEFLECTION DETAIL

N.T.S.

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100140403
DEC. 15, 2020
PROVINCE OF ONTARIO

No.	Issue / Revision	Date
1	SPA FIRST SUBMISSION	AUG. 17, 2020
2	SPA SECOND SUBMISSION	DEC. 15, 2020

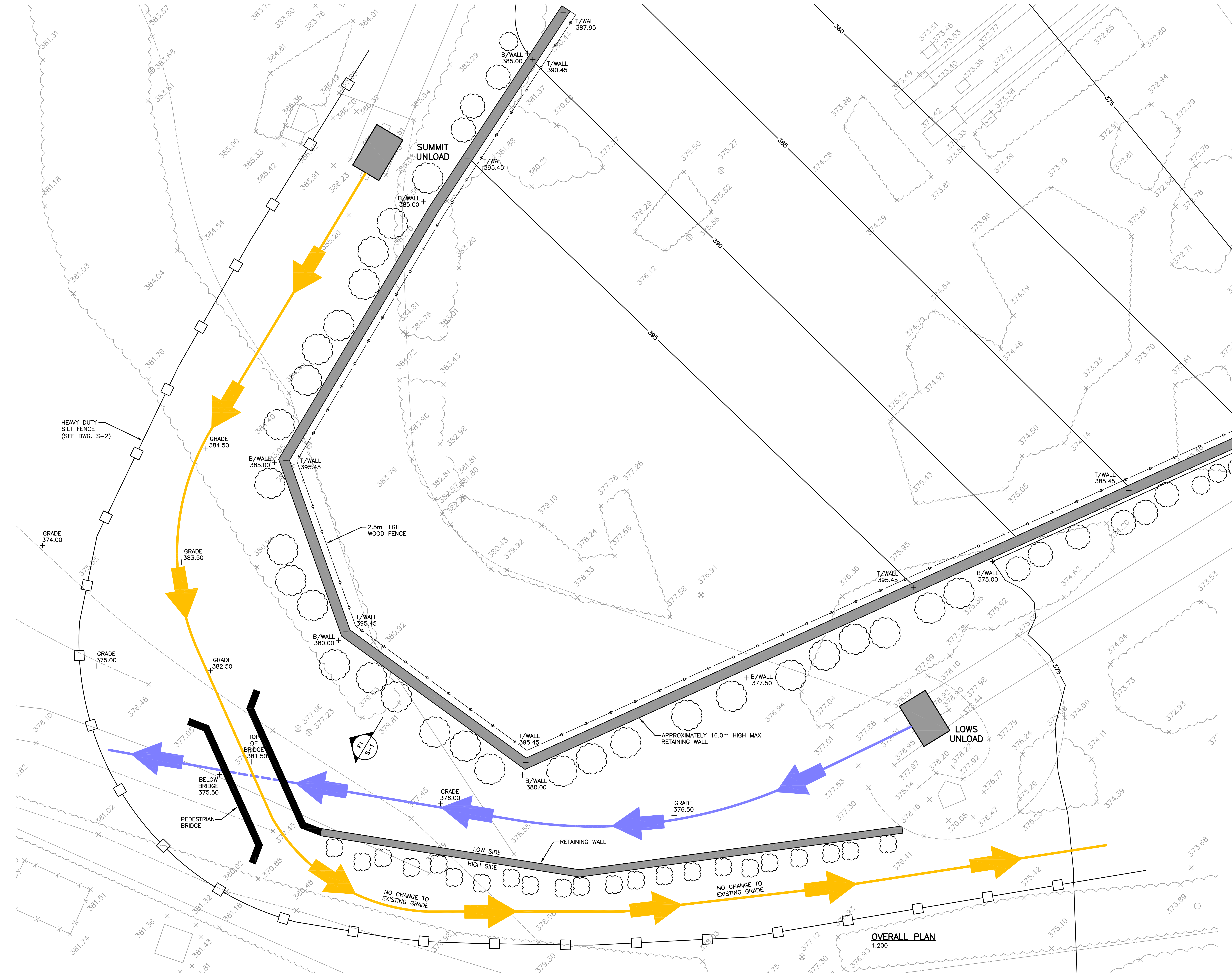
Mansfield Ski Club

DETAIL SHEET 1

Client:
Mansfield Ski Club
628213 15th Sideroad
PO Box 75 RPO Mansfield,
Mulmur, Ontario
L9V 3M6

WMI & Associates Limited
119 Collier Street
Barrie, Ontario
L4M 1H5
Ph 705-797-2027
www.wmiengineering.ca

Drawn By AW
Checked By JWL
Drawing No. DS1
Scale N.T.S.
Project No. 15–319



OVERALL PLAN
1:200

MSE WALL

SEGMENTAL RETAINING WALL

DISCLAIMER AND COPYRIGHT

CONTRACTOR MUST VERIFY ALL DIMENSIONS AND BE RESPONSIBLE FOR SAME. ANY DISCREPANCIES MUST BE REPORTED TO THE ENGINEER BEFORE COMMENCING WORK. DRAWINGS ARE NOT TO BE SCALED.

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BENCHMARKS

NOTES

No.	REVISION DESCRIPTION	DATE
1.	ISSUED FOR CLIENT REVIEW	NOV 5/20
2.	RE-ISSUED FOR CLIENT REVIEW	NOV 11/20

ENGINEER STAMP

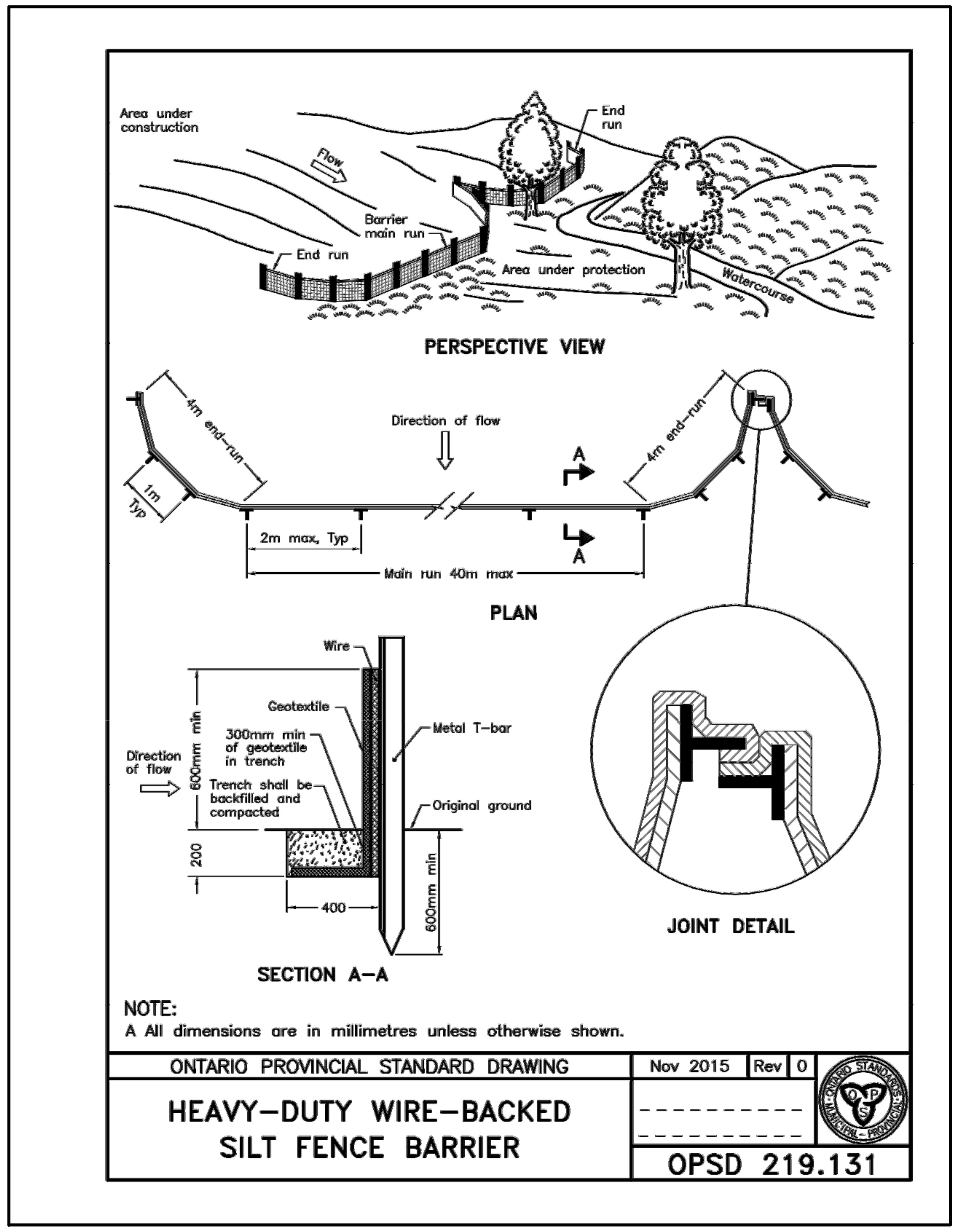
MANSFIELD SKI CLUB
SKI HILL RETAINING WALL
MULMUR HILLS

OVERALL PLAN

TATHAM
ENGINEERING

DESIGN: JJ	FILE: 119040	DWG:
DRAWN: WHG	DATE: JUL/20	**S-1**
CHECK: JJ	SCALE: AS NOTED	

Drawing Name: 119040 — S001.dwg, Plotted: Nov 11, 2020

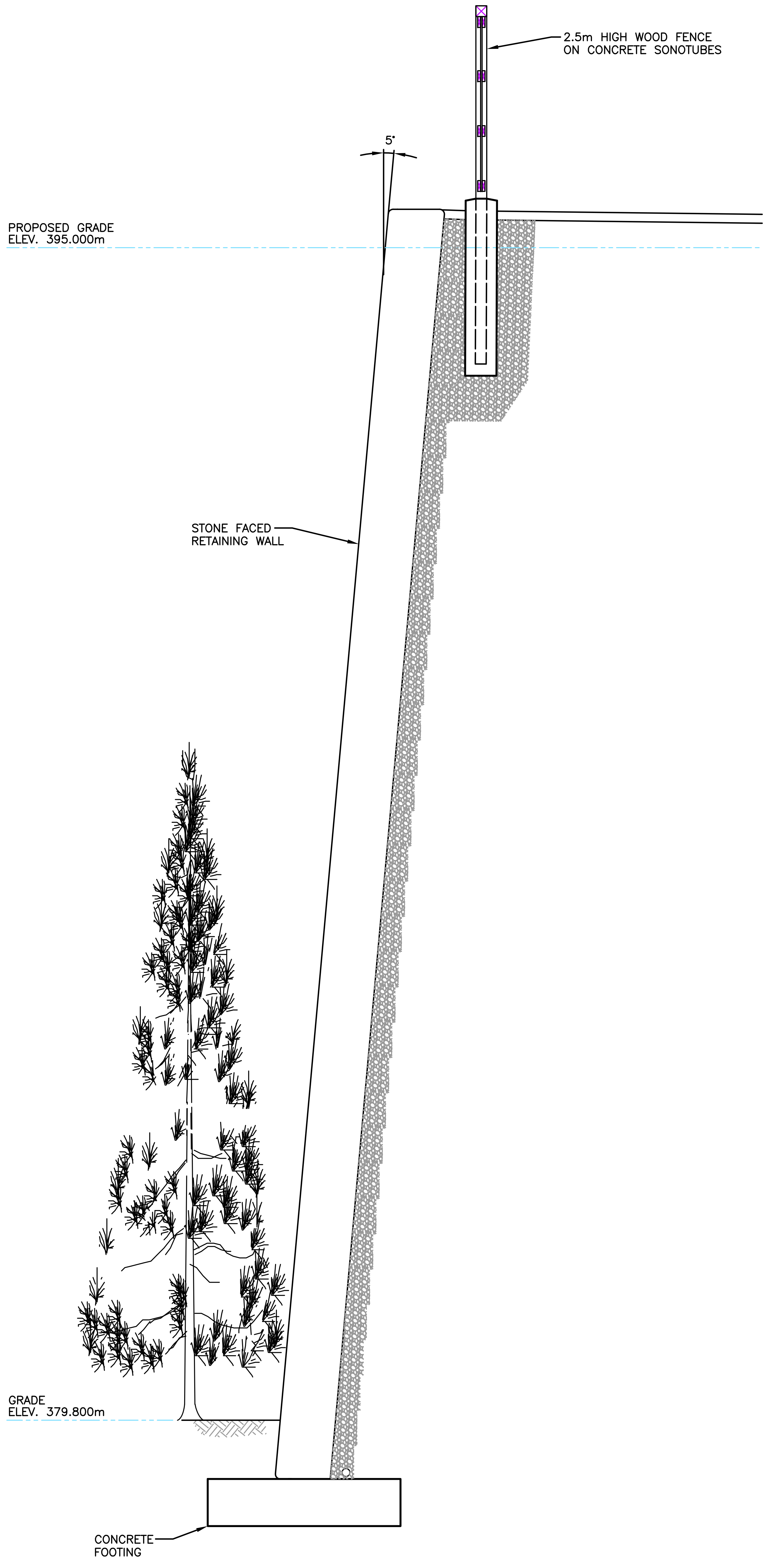


NOTE:
A All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING | Nov 2015 | Rev 0

HEAVY–DUTY WIRE–BACKED SILT FENCE BARRIER

OPSD 219.131



F1 S–2 SECTION
1:50

GENERAL NOTES

1. ALL WORK SHALL CONFORM TO THE REQUIREMENTS OF THE 2012 ONTARIO BUILDING CODE (OBC 2012) AND THE OCCUPATIONAL HEALTH AND SAFETY ACT OF ONTARIO.
2. ALL DIMENSIONS ARE IN METRIC UNLESS NOTED OTHERWISE. THE CONTRACTOR SHALL EXAMINE ALL DRAWINGS, CONFIRM ALL DIMENSIONS, COORDINATE AND REPORT ANY DISCREPANCIES TO THE ENGINEER PRIOR TO COMMENCING WORK.
3. THE CONTRACTOR SHALL ESTABLISH ALL LEGAL PROPERTY BOUNDARIES PRIOR TO CONSTRUCTION.
4. THE LOCATION OF EXISTING UTILITIES MUST BE VERIFIED PRIOR TO CONSTRUCTION. THE CONTRACTOR SHALL NOTIFY THE ENGINEER OF ANY CONFLICTS.
5. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ALL TEMPORARY FENCING, BARRICADES, AND TRAFFIC CONTROL TO MAINTAIN ADEQUATE CARE AND CONTROL OF THE SITE.
6. THE CONTRACTOR SHALL BE RESPONSIBLE FOR SAFETY ON THE JOB SITE AND FOR THE DESIGN, INSTALLATION, AND SUPERVISION OF ALL TEMPORARY BRACING AND FALSEWORK TO SUIT THEIR CONSTRUCTION METHODS.
7. THE CONTRACTOR SHALL COMPLETE SITE RESTORATION TO THE APPROVAL OF THE OWNER/CLIENT.

DISCLAIMER AND COPYRIGHT

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ENGINEER STAMP

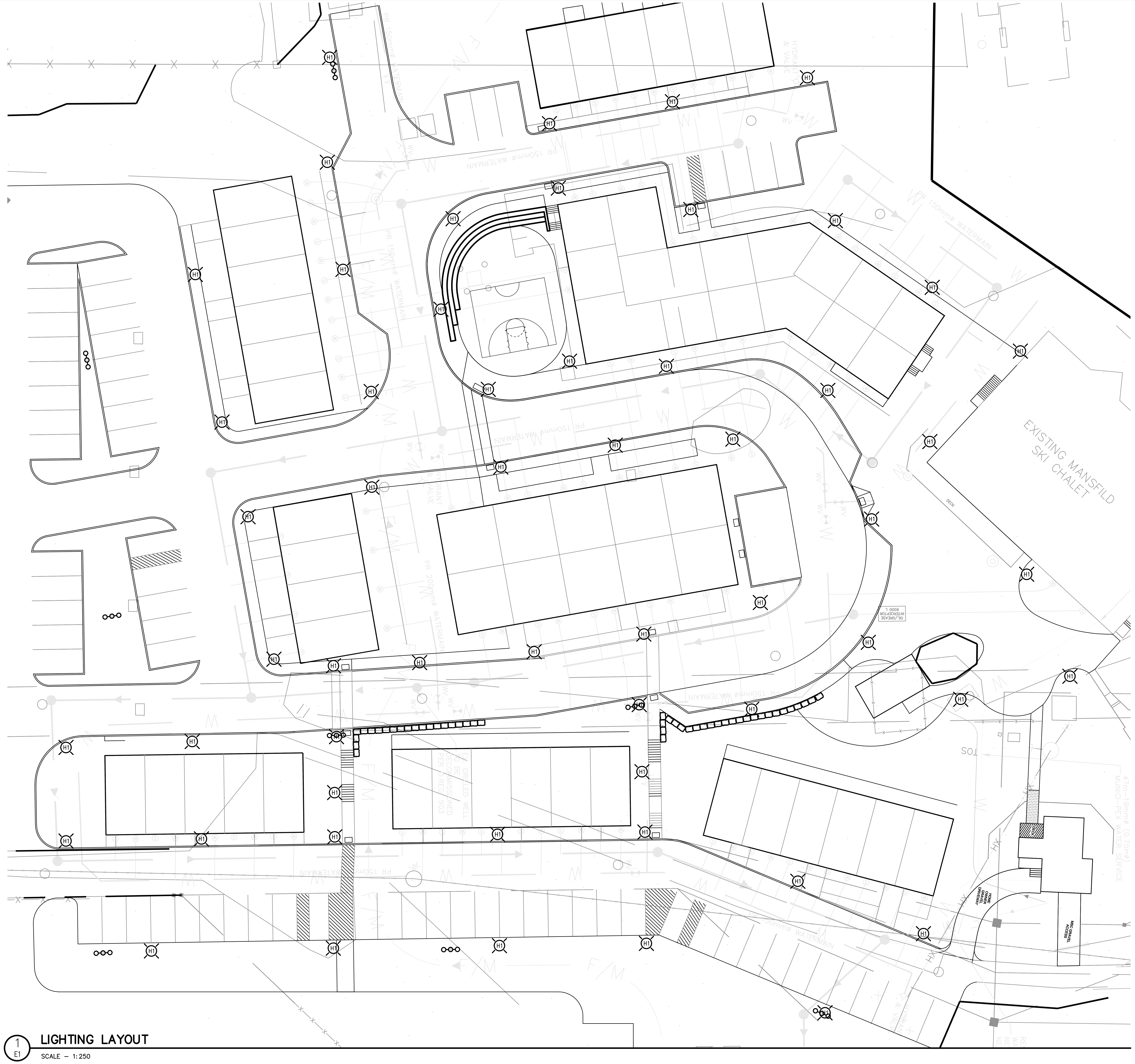
MANSFIELD SKI CLUB
SKI HILL RETAINING WALL
MULMUR HILLS

DETAILS

TATHAM
ENGINEERING

DESIGN: JJ	FILE: 119040	DWG:
DRAWN: WHG	DATE: JUL/20	**S-2**
CHECK: JJ	SCALE: AS NOTED	

Drawing Name: 119040 – S001.dwg, Plotted: Nov 11, 2020



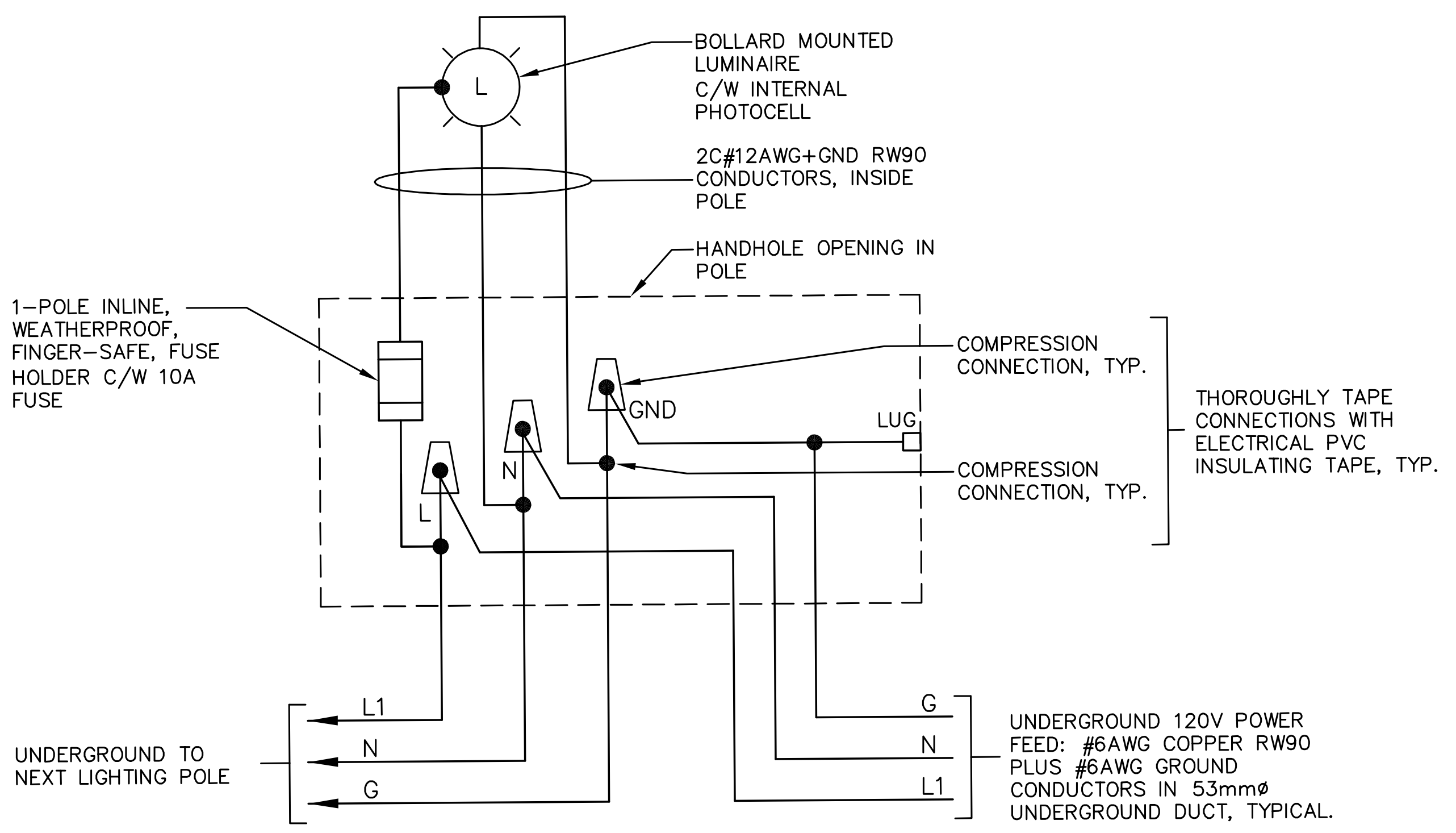
LIGHTING LAYOUT

1 E1

SCALE – 1:250

LEGEND:

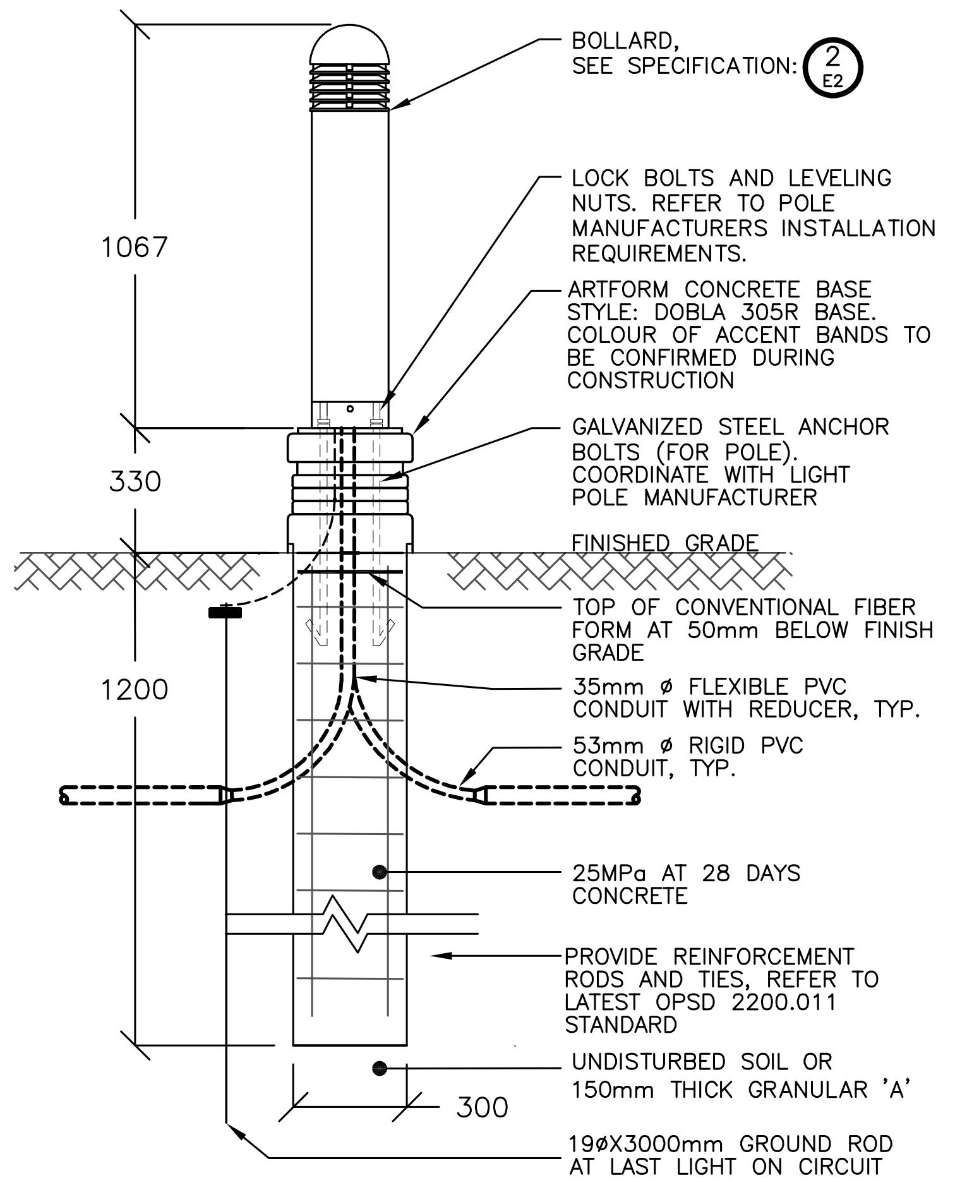
H1	PROPOSED BOLLARD LIGHT. SEE DETAIL 3/E1 AND 2/E2



LIGHTING WIRING DIAGRAM

4 E1

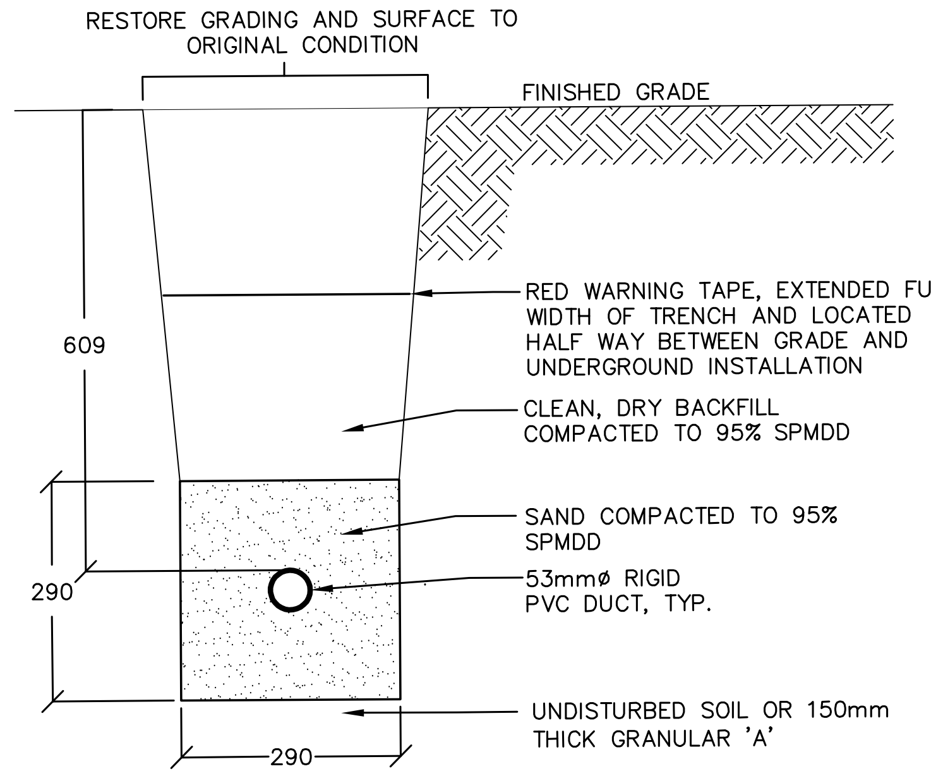
– NTS



BOLLARD LIGHTING TYPICAL INSTALLATION

3 E1

– NTS
– FOR INSTALLATION DETAILS REFER TO OPSD 2200.041



TYPICAL LIGHTING DUCTBANK DETAIL

2 E1

NTS

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5. Architectural dimensions are approximate. Location of items shown or specified that are not fixed by dimensions are approximate only. The exact locations necessary to secure the best conditions and results must be determined on site. Review all revisions with the consultant.

A.DIXON
100223176
31JAN'20

G. G. RUNGE
31JAN'20

No.	ISSUE OR REVISION	DATE DD/MM/YY	ISSUER
1	ISSUED FOR CLIENT APPROVAL	30/01/20	AD
2	ISSUED FOR TOWN APPROVAL	31/01/20	AD

RUNGE ENGINEERING

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P.O. Box 387
Collingwood, ON L9Y 3Z7
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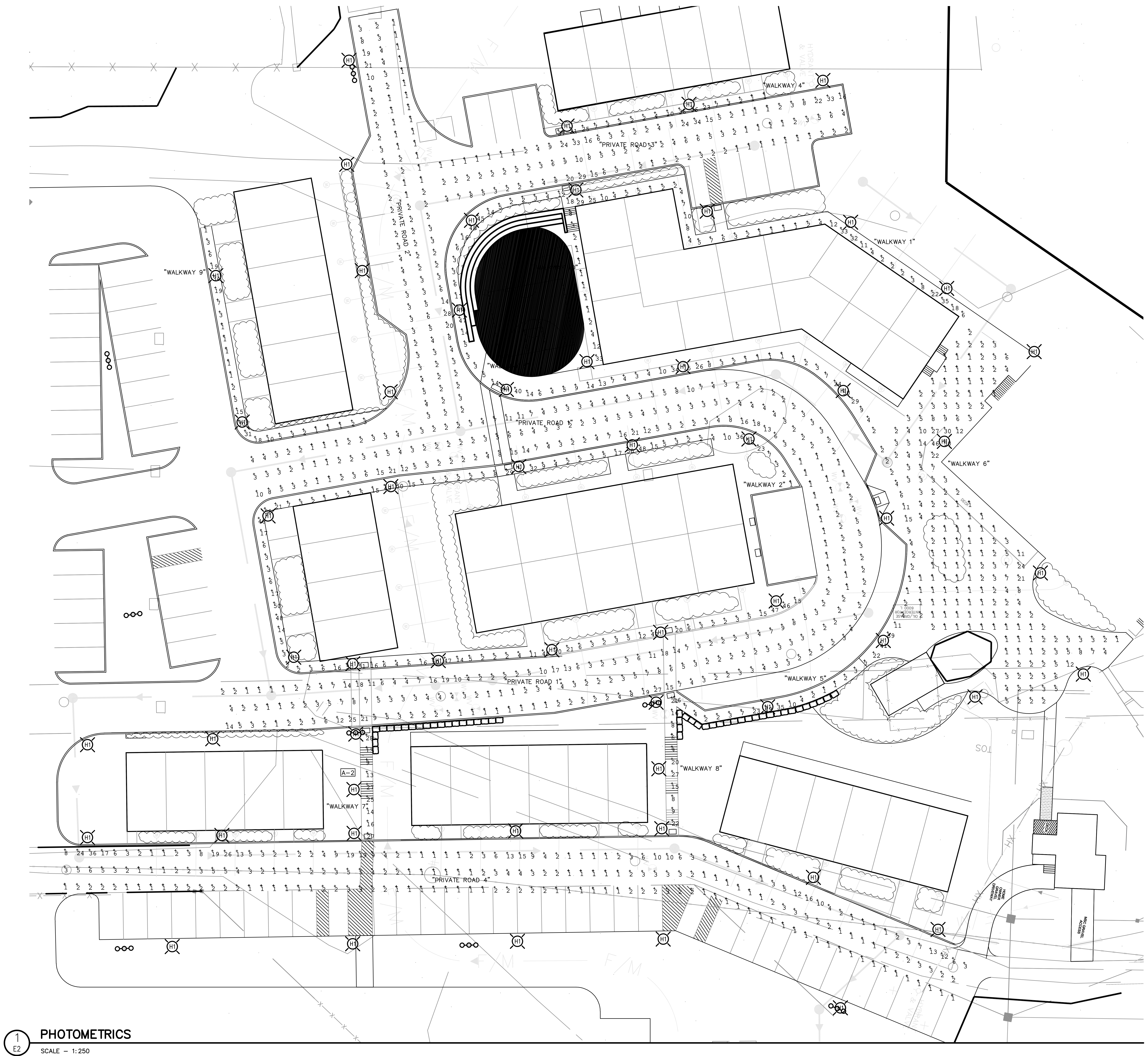
f: (705) 446-3588
www.raiengineers.ca

Client
MASNFIELD SKI CLUB
628213 SIDE ROAD 15
MULMUR, ONTARIO
L9V 0T9

Project Name
MANSFIELD SKI CLUB VILLAGE

Drawing Title
LIGHTING LAYOUT

Drawn By: AD
Checked By: GGR
Scale:
Project No.: 19179P
Drawing No.: E1

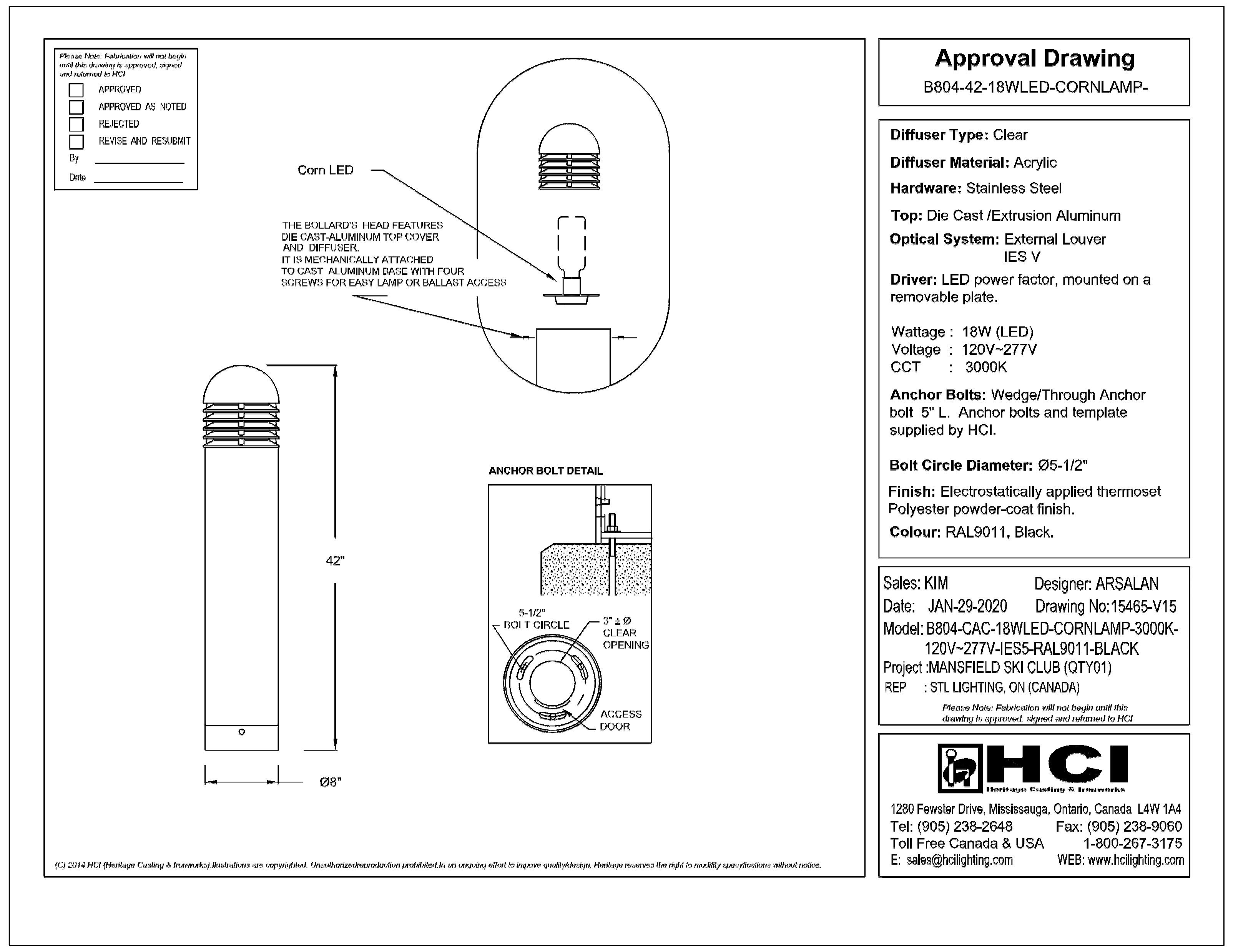


PHOTOMETRICS

1 E2

SCALE – 1:250

Calculation Summary						
Label	CalcType	Units	Avg	Max	Min	Avg/Min
Private Road 1	Illuminance	Lux	4.26	27	1	4.26
Private Road 2	Illuminance	Lux	3.52	28	1	3.52
Private Road 3	Illuminance	Lux	5.46	34	1	5.46
Private Road 4	Illuminance	Lux	3.25	36	1	3.25
Walkway 1	Illuminance	Lux	8.54	35	1	8.54
Walkway 10	Illuminance	Lux	6.29	33	1	6.29
Walkway 2	Illuminance	Lux	14.68	51	1	14.68
Walkway 3	Illuminance	Lux	12.70	50	1	12.70
Walkway 4	Illuminance	Lux	12.33	37	1	12.33
Walkway 5	Illuminance	Lux	9.68	49	1	9.68
Walkway 6	Illuminance	Lux	3.61	50	1	3.61
Walkway 7	Illuminance	Lux	19.11	28	9	2.12
Walkway 8	Illuminance	Lux	14.64	27	6	2.44
Walkway 9	Illuminance	Lux	8.07	34	1	8.07



Please Note: Fabrication will not begin until this drawing is approved, signed and returned to HCI

☐ APPROVED
☐ APPROVED AS NOTED
☐ REJECTED
☐ REVISE AND RESUBMIT
By ____________
Date ____________

THE BOLLARD'S HEAD FEATURES DIE CAST-ALUMINUM TOP COVER AND DIFFUSER. IT IS MECHANICALLY ATTACHED TO CAST ALUMINUM BASE WITH FOUR SCREWS FOR EASY LAMP OR BALLAST ACCESS

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Approval Drawing

B804-42-18WLED-CORNLAMP-

Diffuser Type: Clear

Diffuser Material: Acrylic

Hardware: Stainless Steel

Top: Die Cast /Extrusion Aluminum

Optical System: External Louver
IES V

Driver: LED power factor, mounted on a removable plate.

Wattage : 18W (LED)
Voltage : 120V~277V
CCT : 3000K

Anchor Bolts: Wedge/Through Anchor bolt 5" L. Anchor bolts and template supplied by HCI.

Bolt Circle Diameter: Ø5-1/2"

Finish: Electrostatically applied thermoset Polyester powder-coat finish.

Colour: RAL9011, Black.

Sales: KIM Designer: ARSALAN
Date: JAN-29-2020 Drawing No:15465-V15
Model: B804-CAC-18WLED-CORNLAMP-3000K-120V~277V-IES5-RAL9011-BLACK
Project :MANSFIELD SKI CLUB (QTY01)
REP : STL LIGHTING, ON (CANADA)

Please Note: Fabrication will not begin until this drawing is approved, signed and returned to HCI

HCI Heritage Casting & Ironworks
1280 Fewster Drive, Mississauga, Ontario, Canada L4W 1A4
Tel: (905) 238-2648 Fax: (905) 238-9060
Toll Free Canada & USA 1-800-267-3175
E: sales@hcilighting.com WEB: www.hcilighting.com

POLE ASSEMBLY DESCRIPTION AND CATALOG NUMBERS

TYPE H1 BOLLARD ASSEMBLY

BOLLARD: HCI LIGHTING
MODEL B805 SERIES
CATALOGUE NUMBER:
- 120VAC
- 18 WATTS
- 3000 DEG. CCT
- COLOUR BLACK
- FUSE
- 10kV SPD

LAMP: CORN BULB

FOR MODEL NUMBER INFORMATION REFER TO SPECIFICATIONS ON THIS DRAWING

LIGHTING SPECIFICATIONS

2 E2

– NTS

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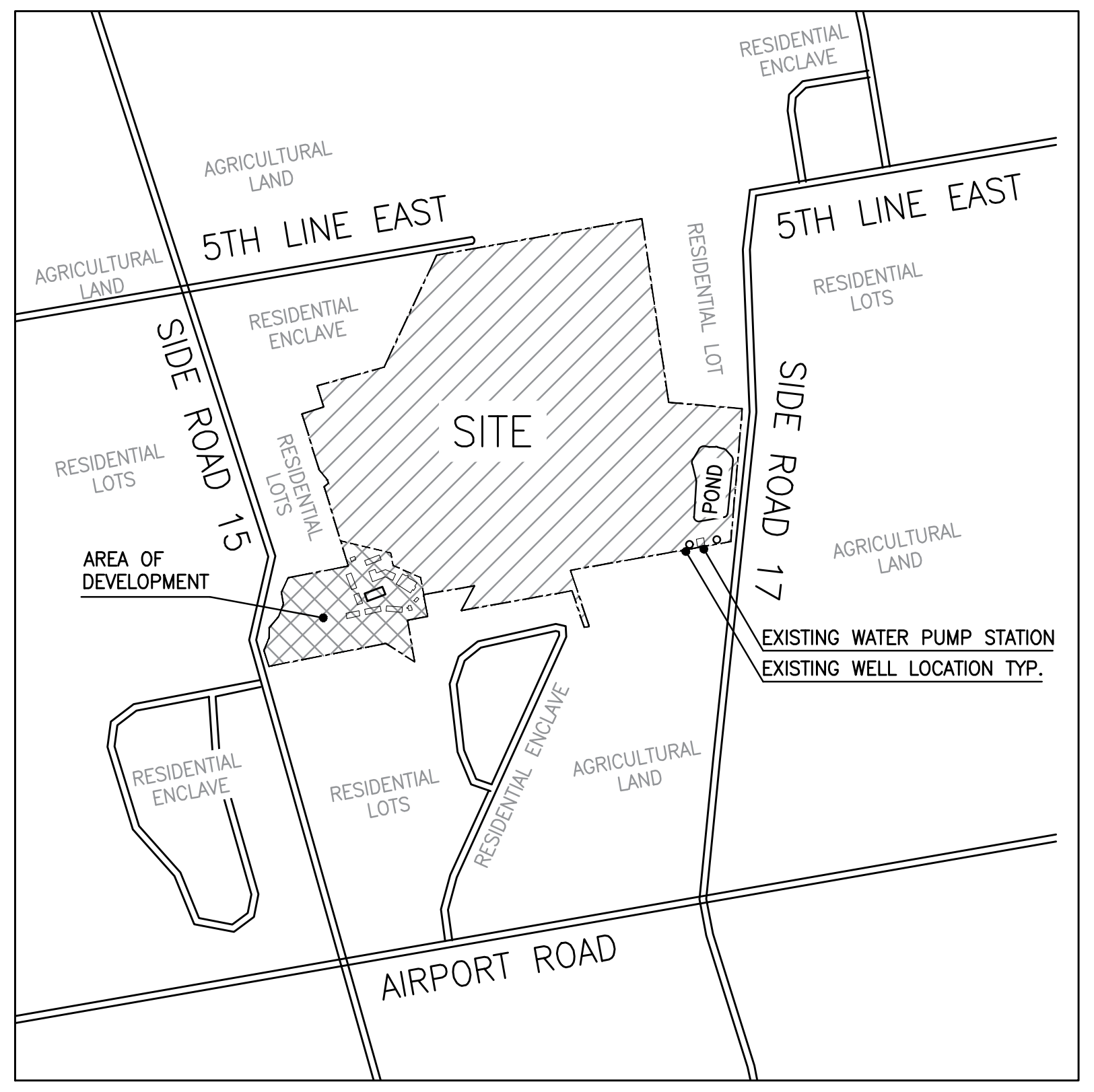
Client
MASNFIELD SKI CLUB
628213 SIDE ROAD 15
MULMUR, ONTARIO
L9V 0T9

Project Name
MANSFIELD SKI CLUB VILLAGE

Drawing Title
PHOTOMETRICS

Drawn By: AD
Checked By: GGR
Scale:
Project No.: 19179P
Drawing No.: E2

CONTEXT PLAN



MANSFIELD SKI CLUB

628213 SIDE ROAD 15
Mulmur, ON L9V 0T9

PROJECT TEAM

CLIENT
Mansfield Ski Club
628213 Side Road 15
Mulmur, ON L9V 0T9

ARCHITECT
+VG Architects
72 Stafford Street, Suite 200
Toronto, ON M6J 2R9

LANDSCAPE ARCHITECT
Fleisher Ridout Partnership Inc.
1877 Davenport Road
Toronto, ON M6N 1B9

CIVIL ENGINEER
WMI & Associates Limited
119 Collier Street
Barrie, ON L4M 1H5

ELECTRICAL ENGINEER
Runge Engineering
864 Hurontario Street
Collingwood, ON L9Y 3Z7

INDEX OF SHEETS

SP.0	COVER SHEET
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SP.2	SITE PLAN
SP.3	VILLAGE CORE SITE PLAN
SP.4	SKI HILL
SP.5	FIRE ROUTE ACCESS
SP.6	ONTARIO BUILDING CODE MATRICES
SKA-01	ENCLOSURE FOR OUTDOOR GARBAGE AREA
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L.2	PLANTING ENLARGEMENT A
L.3	PLANTING ENLARGEMENT B
L.4	SKI HILL PLANTING PLAN
PHA	PHASING PLAN
SGRN	SITE GRADING PLAN NORTH
SGRS	SITE GRADING PLAN SOUTH
GENN	GENERAL SERVICING PLAN NORTH
GENS	GENERAL SERVICING PLAN SOUTH
BIO1	BIOFILTER PLAN 1
BIO2	BIOFILTER PLAN 2
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FWS	FIRE WATER STORAGE
SSOP	SITE SERVICING OUTLET PLAN
SMPLP	PROPOSED SNOW MAKING POND & WELL LOCATION PLAN
SWM	STORMWATER MANAGEMENT FACILITY PLAN
ESC	EROSION & SEDIMENT CONTROL PLAN
DS1	DETAIL SHEET 1
S-1	SKI HILL RETAINING WALL OVERALL PLAN
S-2	SKI HILL RETAINING WALL DETAILS
E1	LIGHTING LAYOUT
E2	PHOTOMETRICS

LEGEND

FLEISHER RIDOUT
PARTNERSHIP INC.
l.a.n.d.s.c.a.p.e a.r.c.h.i.t.e.c.t.s
1877 Davenport Road
Toronto, Ontario, M6N 1B9
T: (416) 533-4990

ISSUE	DATE	REMARKS
3	DECEMBER 10, 2020	ISSUED FOR 3RD SITE PLAN APPROVAL
2	AUGUST 14, 2020	ISSUED FOR 2ND SITE PLAN APPROVAL
1	FEBRUARY 4, 2020	ISSUED FOR SITE PLAN APPROVAL

ONTARIO ASSOCIATION OF LANDSCAPE ARCHITECTS
B.J. FLEISHER
MEMBER

N

Project Name:
MANSFIELD SKI CLUB
628213 SIDE ROAD 15
Mulmur, ON L9V 0T9

Drawing Title:
COVER SHEET

Drawn: JC	Design: BF	Date: JANUARY 2020
Checked: BF	Apprvd: BF	Scale: NTS
CADD File: 151352		Dwg. No.: SP.0

LEGEND

—··—··—	PROPERTY LINE
—·—·—·—	PROPOSED FIRE TRUCK ACCESS ROUTE
◀	ENTRANCE
⊙⊙	EXISTING TREE TO REMAIN
○○	EXISTING TREE GROUPING TO REMAIN
--------	TREE HOARDING

GENERAL NOTES:

1. ALL CONSTRUCTION HOARDING AND TREE PROTECTION TO BE INSTALLED PRIOR TO START OF OPERATIONS.
2. EXISTING CONDITIONS PLAN OF SURVEY BY RODNEY GEYER, O.L.S. INC. DATED FEBRUARY 16, 2016.
3. CONTRACTOR TO VERIFY ALL SITE CONDITIONS AND REPORT ANY DISCREPANCIES TO THE CONSULTANT IMMEDIATELY.
4. LAYOUT ALL WORK FOR INSPECTION AND APPROVAL BY CONSULTANT PRIOR TO COMMENCEMENT OF CONSTRUCTION.
5. CONTRACTOR RESPONSIBLE FOR ANY AND ALL UNDERGROUND UTILITIES.
6. CONTRACTOR TO LAY OUT ALL SITE FURNISHINGS FOR CONSULTANT / OWNER REVIEW AND FINAL FIELD ADJUSTMENT PRIOR TO CONTRACTOR AFFIXING SITE FURNISHINGS TO HARD SURFACES.
7. CONTRACTOR TO ENSURE POSITIVE DRAINAGE FROM ALL STRUCTURES.
8. CONTRACTOR TO MAKE GOOD ALL DAMAGE TO ANY EXISTING OR ADJACENT CONDITIONS/ STRUCTURES DURING CONSTRUCTION TO THE SATISFACTION AND ACCEPTANCE OF THE CONSULTANT.

SNOW-MAKING POND NOTES:

1. EXISTING MELTWATER POND SUBJECT TO CERTIFICATE OF APPROVAL NO. 0065-5QEJDE.
2. MAINTENANCE TO BE PERFORMED ON EXISTING MELTWATER POND PRIOR TO COMPLETION OF PROPOSED SNOW-MAKING POND. MAINTENANCE TO INCLUDE SILT REMOVAL AND REMOVAL OF INVASIVE GRASSES AND SHRUBS (PHRAGMITES, ETC.) TO THE SATISFACTION OF THE OWNER AND NVCA. REGULAR MAINTENANCE SCHEDULE TO BE ESTABLISHED PRIOR TO COMPLETION OF CONSTRUCTION.

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PARTNERSHIP INC.
l.a.n.d.s.c.a.p.e a.r.c.h.i.t.e.c.t.s
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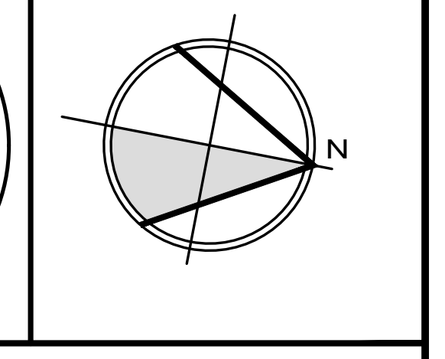
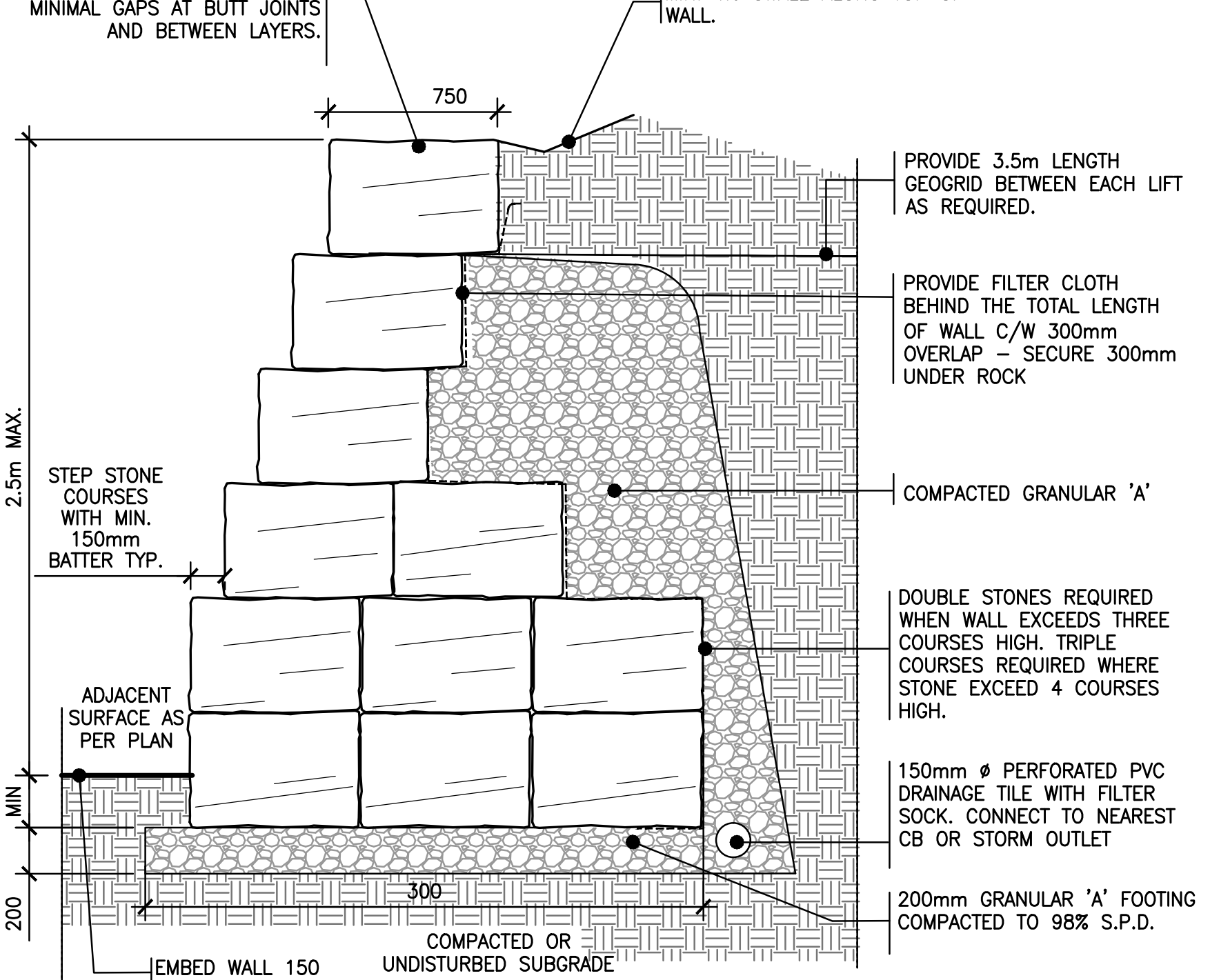
B.J. FLEISHER
MEMBER



Project Name:
MANSFIELD SKI CLUB
628213 SIDE ROAD 15
Mulmur, ON L9V 0T9

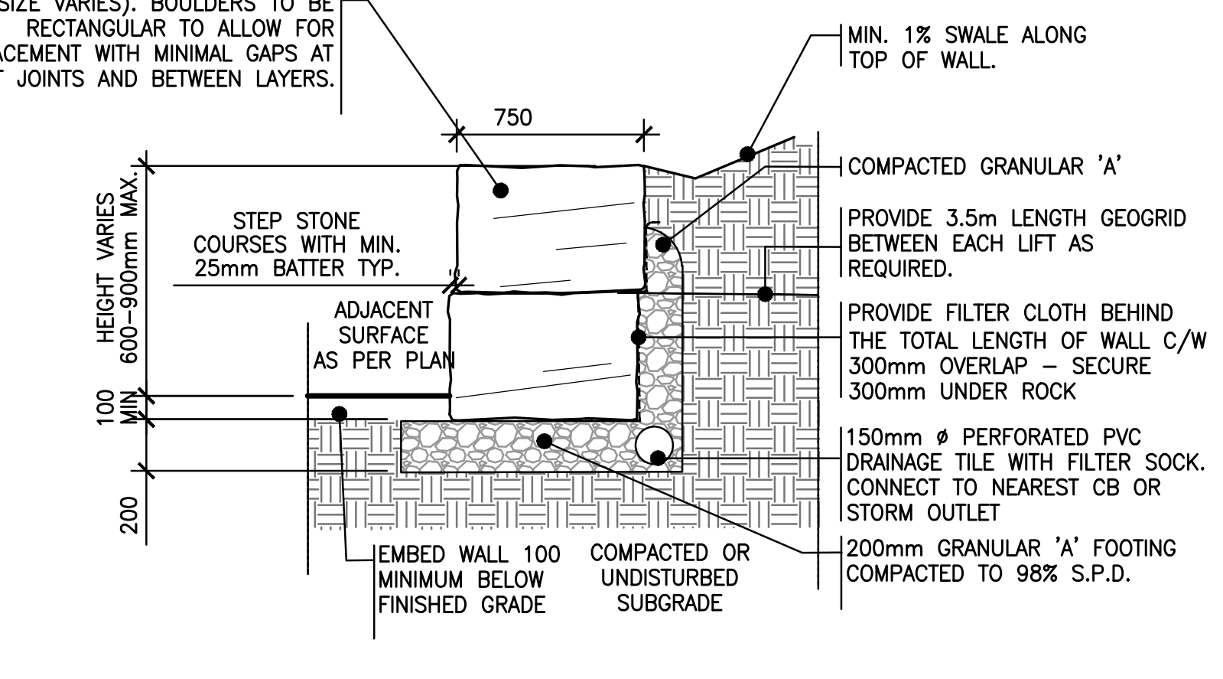
Drawing Title:
OVERALL SITE PLAN

Drawn: JC	Design: BF	Date: JANUARY 2020
Checked: BF	Apprvd: BF	Scale: NTS
CADD File: 151352		Dwg. No.: SP.1



NOTE:
RETAINING WALL DETAIL IS SCHEMATIC TO SHOW DESIGN INTENT FOR TENDER PRICING PURPOSES ONLY. THE AWARDED CONTRACTOR IS TO PROVIDE DETAILED AND COMPLETE SHOP DRAWINGS DESIGNED AND STAMPED BY A PROFESSIONAL ENGINEER REGISTERED IN THE PROVINCE OF ONTARIO FOR CONSULTANT REVIEW AND APPROVAL PRIOR TO INSTALLATION.

ARMOUR STONE WALL TO 2500mm 1:60



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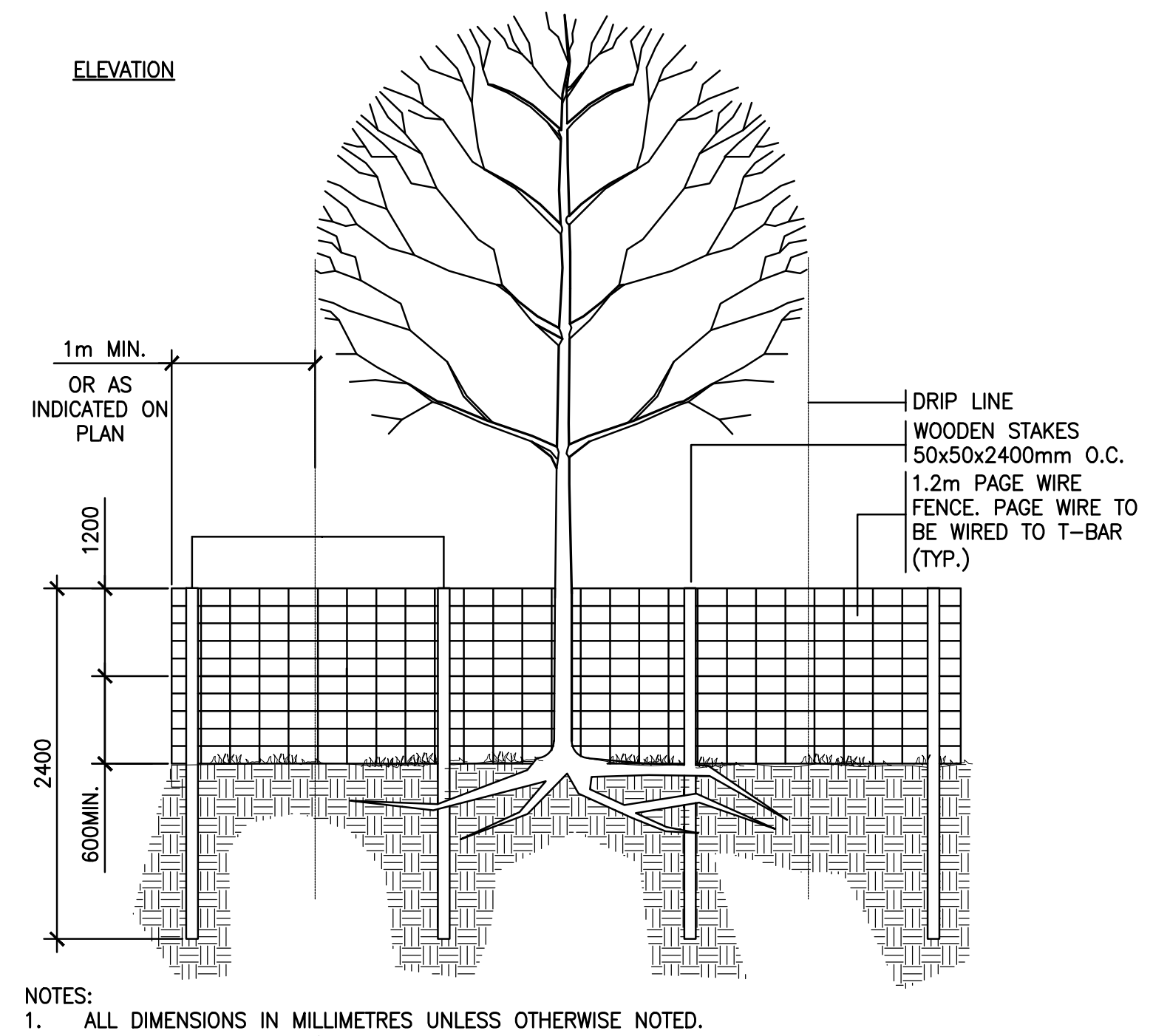
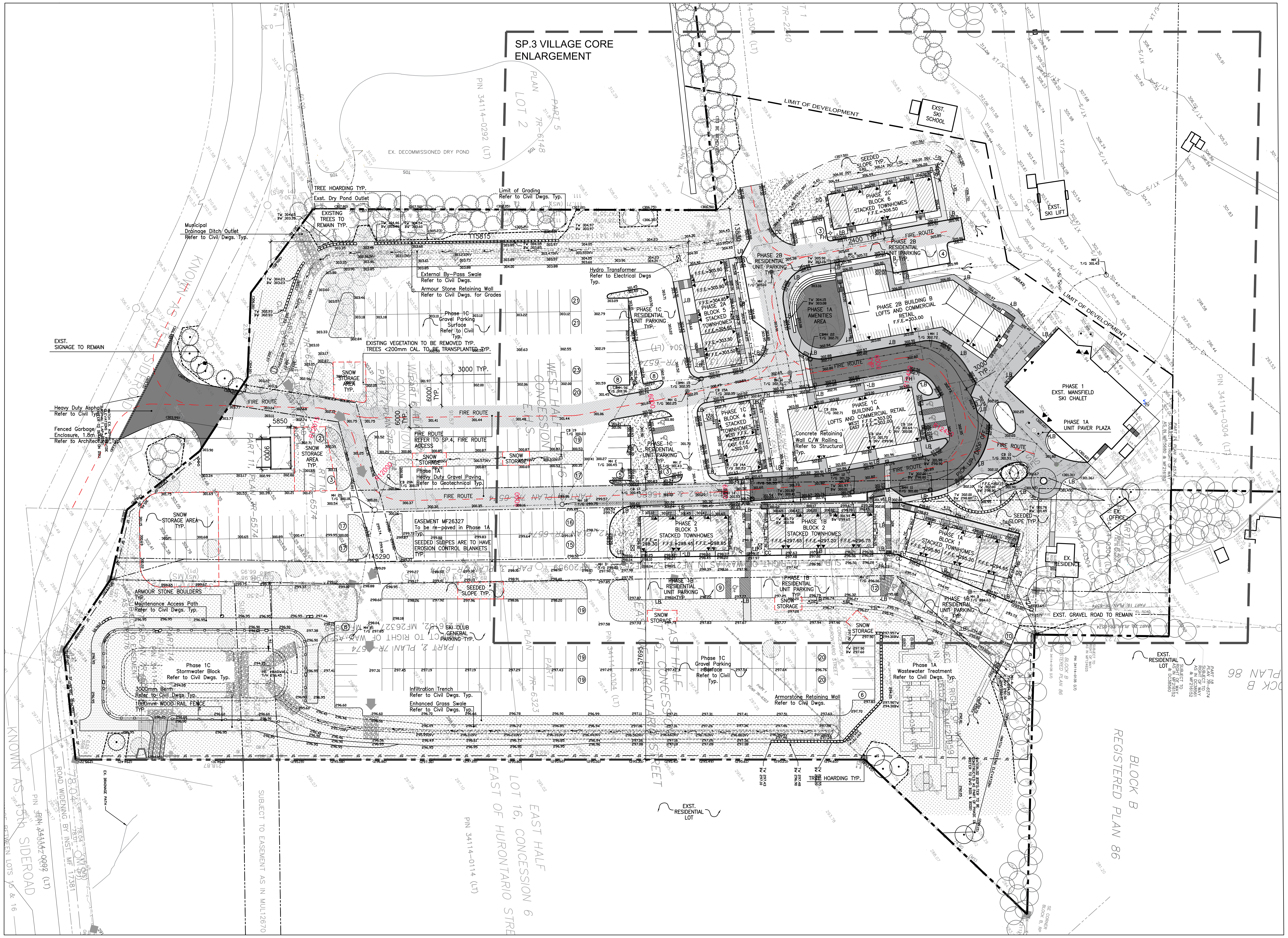
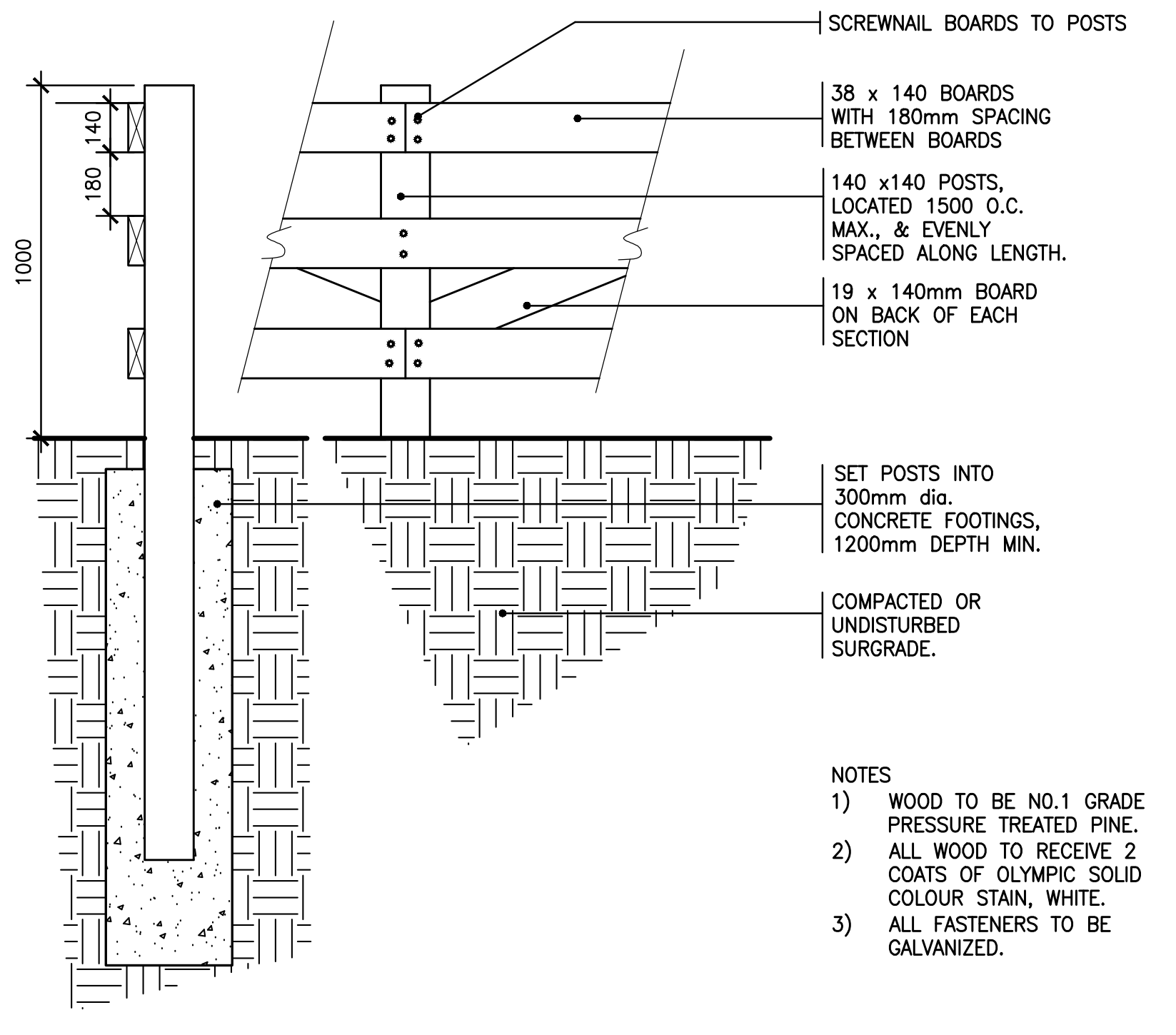
ARMOUR STONE WALL TO 900mm 1:30



NOTES:
1. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
2. IT IS THE CONTRACTOR'S RESPONSIBILITY TO OBTAIN LOCATES OF ALL EXISITNG UTILITIES AND SERVICING PRIOR TO INSTALLING HOARDING.
3. DO NOT DAMAGE VISIBLE TREE ROOTS WHEN INSTALLING T-BARS.
4. HOARDING MUST BE MAINTAINED IN SOUND CONDITION THROUGH ALL PHASES OF CONSTRUCTION UNTIL APPROVAL TO REMOVE HOARDING IS OBTAINED FROM THE LANDSCAPE ARCHITECT.
5. ATTACHMENT OF FENCE TO TREES TO BE PRESERVED IS NOT ALLOWED.
6. ENSURE FENCE IS LOCATED BEYOND THE DRIPLINE OF TREES TO BE PRESERVED.
7. FENCING TO BE INSTALLED PRIOR TO START OF CONSTRUCTION.

TREE PROTECTION HOARDING 1:50





NOTES
1) WOOD TO BE N0.1 GRADE PRESSURE TREATED PINE.
2) ALL WOOD TO RECEIVE 2 COATS OF OLYMPIC SOLID COLOUR STAIN, WHITE.
3) ALL FASTENERS TO BE GALVANIZED.

1000mm WOOD RAIL FENCE 1:20

BUILDING STATISTICS

	BUILDING AREA	# OF RESIDENTIAL UNITS	RESIDENTIAL AREA	OFFICE AND PERSONAL SPACE	DEVELOPMENT PHASE
BUILDING 'A'	630.0m^2	10	1,260.0m^2	882.0m^2	1
BUILDING 'B'	780.0m^2	15	1,402.0m^2	938.0m^2	2
BLOCK-1	345.0m^2	12	1,170.0m^2		1
BLOCK-2	345.0m^2	12	1,170.0m^2		1
BLOCK-3	290.0m^2	10	972.0m^2		2
BLOCK-4	230.0m^2	8	780.0m^2		1
BLOCK-5	345.0m^2	12	1,170.0m^2		2
BLOCK-6	345.0m^2	12	1,170.0m^2		2
TOTAL	**3,310.0m^2**	**91**	**9,252.0m^2**	**1,725.0m^2**	

*NOTE: ALL BUILDING STATISTICS TO GROSS ALL AREAS UP BY 20% TO ACCOUNT FOR SERVICE AREAS

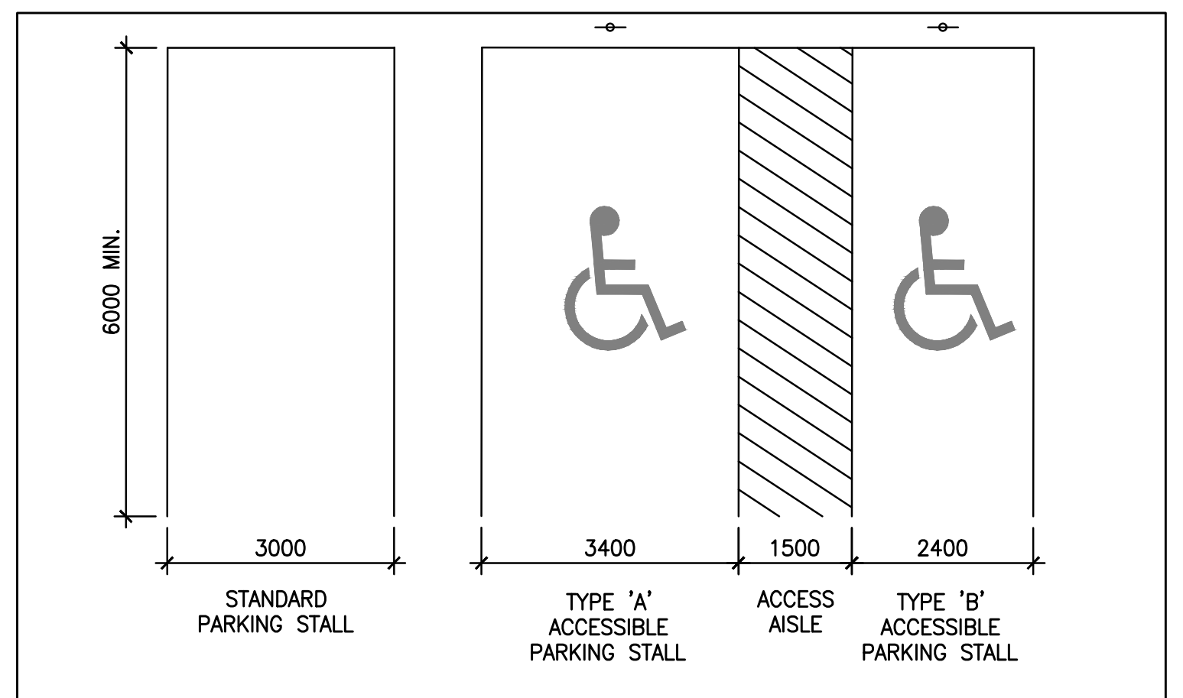
PARKING STATISTICS

TOTAL PROPOSED PARKING STALLS	**371**
TOTAL PROPOSED ACCESSIBLE PARKING STALLS	**9**

*NOTE: AISLES AND LANEWAYS ON–SITE ARE TO BE A MINIMUM OF 3m AND A MAXIMUM OF 9m IN WIDTH.

FIRE ROUTES ARE TO BE A MINIMUM OF 6m IN WIDTH. CENTRELINE RADIUS TO BE 12m MINIMUM.

PARKING STALL STANDARD DIMENSIONS



NOTE: IN PAVED AREAS, ACCESSIBLE STALLS ARE TO BE MARKED WITH HIGH–CONTRAST PAINTED LINES AND SIGNAGE. SIGNAGE IS TO BE PROVIDED IN GRAVEL PARKING AREAS.

SIGNAGE FOR TYPE 'A' STALLS MUST IDENTIFY THE STALL AS 'VAN ACCESSIBLE.'

LEGEND

━ ▪ ▪ ━	PROPERTY LINE
FIRE ROUTE	PROPOSED FIRE TRUCK ACCESS ROUTE
——·— — —	WATER SERVICE LINE
—SAN—SAN—	SANITARY SEWER LINE
➡	OVERLAND FLOW
◀	ENTRANCE
—x——x——x—	1M HT. FENCE
♿	ACCESSIBLE PARKING
▨	PAINTED LINES
▒	UNIT PAVING
░	CONCRETE SIDEWALK
▓	HEAVY DUTY ASPHALT
⁘	SOD
░	SEEDED AREA
⚬	NEW LIGHT STANDARD
⌖	NEW FIRE HYDRANT
◇	BOULDER
B	BOLLARD
CD	CURB DEPRESSION
CC	CURB CUT
⊠	NEW HYDRO TRANSFORMER
○	EXISTING TREE TO REMAIN
◍	EXISTING TREE TO BE TRANSPLANTED ON SITE
○○	EXISTING TREE GROUPING TO REMAIN
◍◍	EXISTING TREE GROUPING TO BE REMOVED
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9. RETAINING WALLS EXCEEDING 1000mm TO HAVE HAND RAIL OR FENCE. RETAINING WALL AND HANDRAIL DETAIL TO BE INCLUDED IN BUILDING PERMIT APPLICATION.

FLEISHER RIDOUT
PARTNERSHIP INC.
l.a.n.d.s.c.a.p.e a.r.c.h.i.t.e.c.t.s
1877 Davenport Road
Toronto, Ontario, M6N 1B9
T: (416) 533–4990

ISSUE	DATE	REMARKS
3	DECEMBER 10, 2020	ISSUED FOR 3RD SITE PLAN APPROVAL
2	AUGUST 14, 2020	ISSUED FOR 2ND SITE PLAN APPROVAL
1	FEBRUARY 4, 2020	ISSUED FOR SITE PLAN APPROVAL

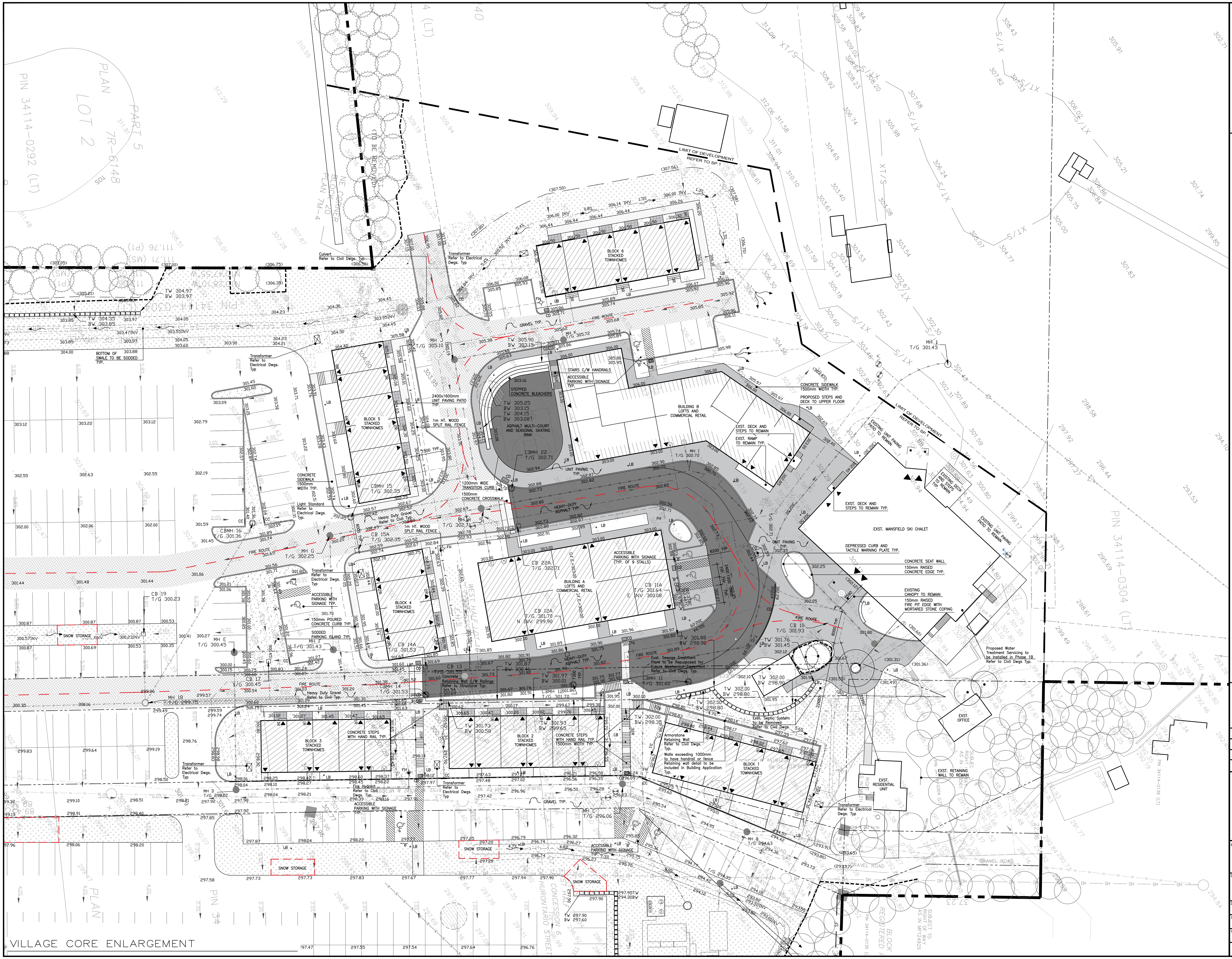
ONTARIO ASSOCIATION OF LANDSCAPE ARCHITECTS
B. J. FLEISHER
MEMBER

N

Project Name:
MANSFIELD SKI CLUB
628213 SIDE ROAD 15
Mulmur, ON L9V 0T9

Drawing Title:
SITE PLAN

Drawn: JC
Design: BF
Date: JANUARY 2020
Checked: BF
Apprvd: BF
Scale: 1:500
CADD File: 151352
Dwg. No.: SP.2



LEGEND

▬ ▪ ▪ ▬	PROPERTY LINE
FIRE ROUTE	PROPOSED FIRE TRUCK ACCESS ROUTE
— W —	WATER SERVICE LINE
— SAN —	SANITARY SEWER LINE
◀	ENTRANCE
— x — x —	1M HT. WOOD SPLIT RAIL FENCE
♿	ACCESSIBLE PARKING
▨	PAINTED LINES
▩	UNIT PAVING
░	CONCRETE SIDEWALK
■	HEAVY DUTY ASPHALT
░	SOD
░	SEEDED AREA
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⌖	PROPOSED FIRE HYDRANT
◇	BOULDER
LB	LIGHT BOLLARD
CD	CURB DEPRESSION
CC	CURB CUT
☒	PROPOSED HYDRO TRANSFORMER Refer to Electrical
○	EXISTING TREE TO REMAIN
○	EXISTING TREE GROUPING TO REMAIN
- - - -	TREE HOARDING

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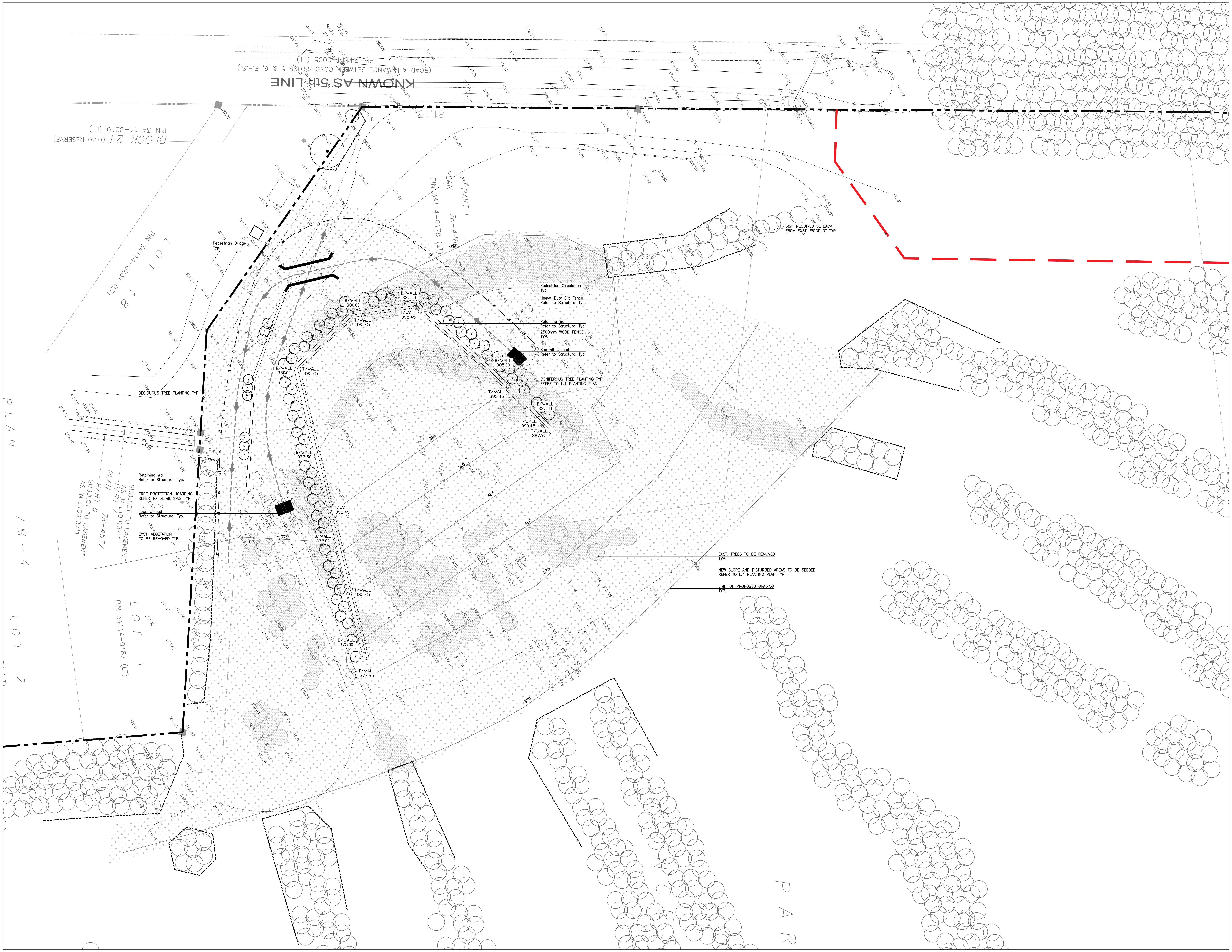
B.J. FLEISHER
MEMBER

Project Name:
MANSFIELD SKI CLUB
628213 SIDE ROAD 15
Mulmur, ON L9V 0T9

Drawing Title:
VILLAGE CORE SITE PLAN

Drawn: JC	Design: BF	Date: JANUARY 2020
Checked: BF	Apprvd: BF	Scale: 1:250
CADD File: 151352		Dwg. No.: SP.3



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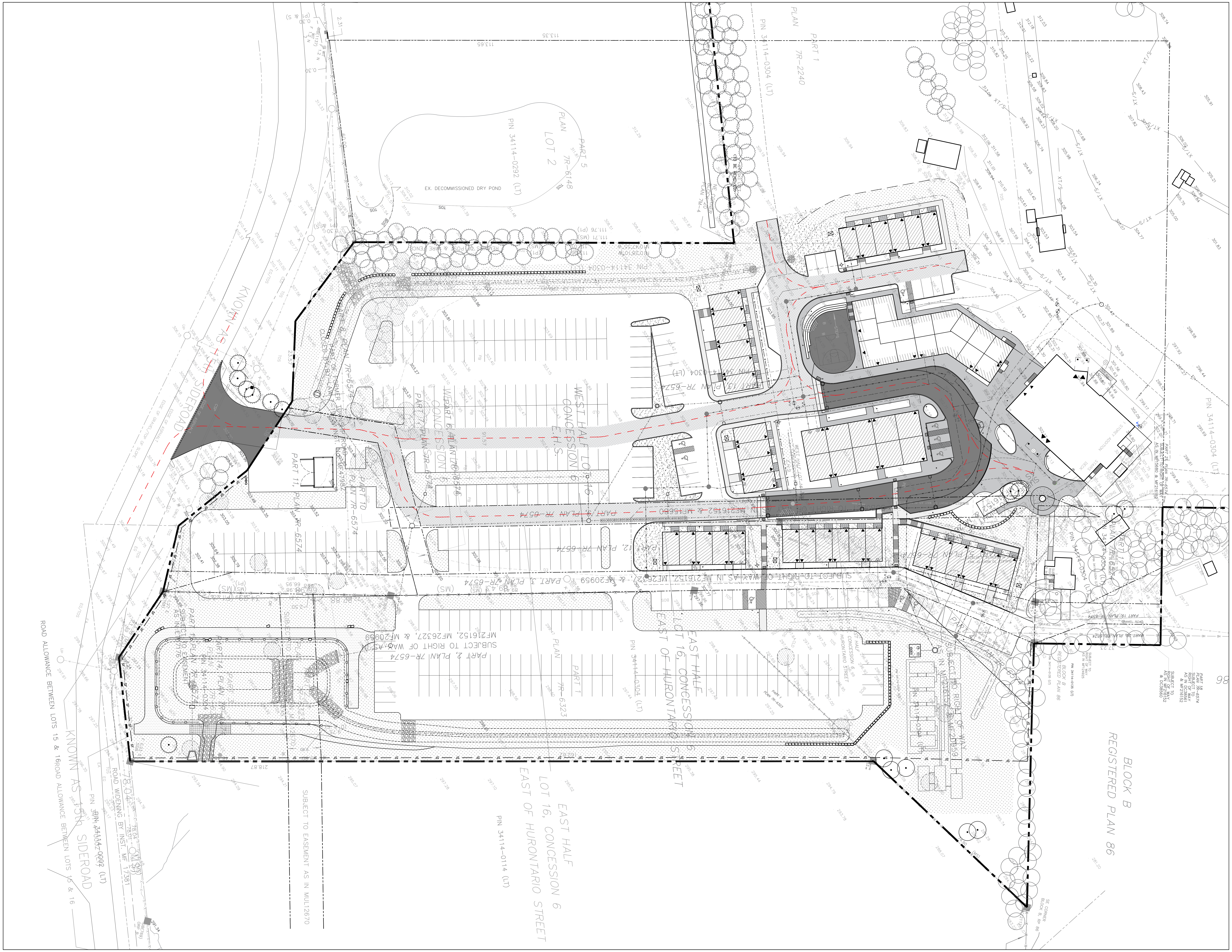
B. J. FLEISHER
MEMBER

Project Name:
MANSFIELD SKI CLUB
628213 SIDE ROAD 15
Mulmur, ON L9V 0T9

Drawing Title:
SKI HILL

Drawn: JC	Design: BF	Date: JANUARY 2020
Checked: BF	Apprvd: BF	Scale: 1:400
CADD File: 151352		Dwg. No.: SP.4



LEGEND

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B. J. FLEISHER
MEMBER

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Project Name:
MANSFIELD SKI CLUB
628213 SIDE ROAD 15
Mulmur, ON L9V 0T9

Drawing Title:
FIRE ROUTE ACCESS

Drawn: JC	Design: BF	Date: JANUARY 2020
Checked: BF	Apprvd: BF	Scale: 1:400
CADD File: 151352		Dwg. No.: SP.5

Site Servicing & Stormwater Management Report

Mansfield Ski Club Township of Mulmur

WMI 15-319
December 2020

Prepared by

WMI & Associates Limited
119 Collier Street, Barrie
Ontario, L4M 1H5

Table of Contents

Appendices

1.0 Introduction

WMI & Associates Limited has been retained by the Mansfield Ski Club (MSC) to prepare a Site Servicing & Stormwater Management Report in support of Site Plan Approval (SPA) associated with the re-development/expansion to the existing Mansfield Ski Club located in the Township of Mulmur, Ontario. The Site Servicing & Stormwater Management Report provided herein has been based on discussions with the Township of Mulmur staff and all proposed works are considered to be in conformance with the current engineering design standards.

The subject area of the Mansfield Ski Club property which is proposed for re-development is comprised of 3.63ha. The property is located north of the 15th Sideroad, south of the 17th Sideroad, east of the 5th Line and approximately 600m west of County Road 18 (Airport Road). The property address is 628213 15th Sideroad, P.O. Box 75 RPO Mansfield, Mulmur, ON. Refer to **FIG 1** in **Appendix A** for the Site Location Plan.

The proposed MSC re-development will include the existing uses such as the Main Chalet, Ski House and GM Office as well as the renovation of the existing Administration Building into Office and Personal Business space at ground level and 15 residential units/lofts on the second level (Building ‘B’, 652m^2 existing ground floor + 128m^2 proposed ground floor = 780m^2 total), a new building consists of Office and Personal Business space at ground level and 10 residential units/lofts on the second level (Building ‘A’, 630m^2 ground floor + 252m^2 mezzanine = 882m^2 total) and 6 separate stacked Townhouse buildings totaling 66 residential units. The existing gravel parking lot is proposed to be expanded but will remain surfaced with gravel with the exception of a section located adjacent to the existing Main Chalet building which is proposed as interlocking paver stone and the main drive aisle around Building ‘A’ which is proposed to be asphalt. This report will summarize all servicing such as stormwater management, sanitary, water and utilities as well as site grading. A separate Traffic Impact Opinion letter is provided herein as **Appendix E**.

2.0 Sanitary Servicing

2.1 Background

Considering the existing condition (private sewage treatment system located on-site) and lack of municipal services within the area of the subject lands, no sanitary servicing is currently allocated to the subject lands. A new private sanitary sewage collection and treatment system is proposed to facilitate the re-development/expansion of the MSC. The proposed sanitary services for the subject site have been designed in accordance with municipal design standards. Estimated sanitary sewage design flows have been calculated using the sewage flow design criteria set-out in the MECP's Design Guidelines for Sewage Works (2008) in conjunction with Tables 8.2.1.3.A. and

8.2.1.3.B. of the 2012 Ontario Building Code (OBC). Using the aforementioned tables, the total daily sewage design flow rate for the proposed condition of the re-development was determined to be 118,950L/day.

Refer to **Appendix B** for the Sanitary Service Design Calculations.

2.2 Proposed Sanitary Sewer System

An internal sanitary sewer system is proposed within the re-development, complete with sanitary service laterals to each building as illustrated on the General Servicing Plan North (**GENN**). The proposed sanitary sewer system will drain via gravity to the northeast corner of the subject lands, to a proposed Waterloo Biofilter sewage treatment system that will ultimately surface discharge treated effluent to the adjacent Pine River.

The proposed sanitary sewer system will be been designed to accommodate the full build-out condition of the re-development.

2.3 Existing Treatment & Subsurface Disposal System

Based on the background information provided to us and our correspondence with staff at the MSC, it is our understanding that the current sanitary sewage collection system consists of a 150mm diameter gravity sewer which collects sewage generated from both the existing 2-storey administration building and the 2-storey main chalet building. The sanitary sewer system discharges to an existing sewage pump chamber and the existing Ski House and GM Office building discharge downstream of the pump chamber directly into the existing sewage treatment system via individual forcemains due to grade constraints.

The existing pump chamber is located approximately 20m southeast of the main chalet at the east limit of the gravel parking area. From the existing pump chamber, the sewage is lifted and pumped into a Northern Purification System (NPS), model GC-2 complete with a 24-hour rated capacity of 22,700L/day. In addition to the systems rated capacity of 22,700L/day, a reserve volume of 9,100L and an additional 18,000L surge tank located immediately east of the NPS system provide additional upstream storage for contingency purposes. From the GC-2 unit, the sewage is pumped southeast approximately 40m to two (2) existing filter beds located immediately east of the existing gravel driveway/easement serving the existing chalets to the northeast of the MSC's main chalet building.

Each of the original water sources (drilled well, bored well and river water) were previously metered and recorded by the MSC. This information was provided to WMI & Associates Limited in early 2016 for the months of December 2014 to March 2015 and was analyzed to determine the total daily sewage flows experienced at the MSC during a full ski season in order to confirm actual sewage flow values experienced by the existing sewage treatment system. It was determined based on the above mentioned water consumption records for December 2014 to March 2015, that the average total daily sewage flow produced at the MSC over this period of operation was 6.6m^3/day (6,600L/day) and the maximum daily sewage flow recorded was 17.8m^3/day (17,800L/day).

Since the 2014-2015 ski season the on-site water source and treatment system have been updated. Based on recent discussions with MSC staff, there are now two water meters located within the Main Chalet. The main meter records the total number of cubic meters (m^3) of water supplied to the Main Chalet from the sole water source which is currently a 150mm diameter drilled well (PW2) as of May of 2016. A separate and smaller water meter is located in series and downstream of the main meter. This submeter only reads the amount of treated water in imperial gallons (IG) that is distributed to the Main Chalet, Administration Building, Ski House and GM Office building. Untreated (non-potable) water that by-passes the submeter is solely used for water closets and urinals within the Main Chalet.

More recently, total water usage (800.9m^3) from Dec. 26, 2019 to March 15, 2020 was provided to WMI & Associates Limited along with the total number of operational days within the subject ski season (58 days). All meter readings provided below are from the main meter referenced above and account for all water used (treated and untreated). From this data, it was determined that the Average Day Demand (total daily sewage design flow produced at the MSC) over last ski season was 13.8m^3/day (13,800L/day). Daily water use records also indicated the following:

Table 1: 2019-2020 Ski Season Water Consumption Log

Description	Date	Meter Reading (m^3)	Usage (m^3)
First Day of Meter Reading	Dec. 26/19	7509.3	
Typical Saturday	Jan. 18/20	7701.5	5.3
Ladies Day	Jan. 24/20	7771.3	21.5
Men’s Day	Feb. 7/20	7913.6	9.7
Family Day Weekend (Sunday)	Feb. 16/20	8035.1	27.7
Typical Thursday	Feb. 27/20	8147.8	9.4
Final Day of Operation	Mar. 15/20	8310.2	9.7

Based on the above, the Maximum Day Demand (maximum sewage flow) recorded was 27.7m^3/day (27,700L/day) resulting in a peaking factor of 2.0 currently experienced at the MSC.

As per the monitoring data provided in **Table 1**, the existing sewage treatment system only experienced 1 day (Sunday Feb. 16/20 during the Family Day long weekend) where it was slightly beyond its rated capacity of 22,700L/day. As a result of the presence of the reserve volume and surge tank, this rare exceedance was handled without any issues as the additional flow was able to be attenuated while maintaining dosage to the filter beds at/below the systems rated capacity. Considering the above and the Average Day Demand of 13,800L/day, the existing sewage treatment system is considered to be working well within its rated capacity.

Additional details with respect to the existing sewage treatment system and its capacity can be found in **Appendix F**, Ski House Development at the Mansfield Ski Club, Sewage Treatment System Analysis prepared by WMI & Associates Limited, dated January 20, 2016.

2.4 Proposed Treatment & Surface Disposal System

Due to the larger footprint required by a typical leaching bed system, the limited space available on-site that is under 4:1 (H:V) slope required to accommodate a conventional leaching bed and the numerous existing residential dwellings located down gradient which are all individually serviced by private wells and subsurface septic systems, a Waterloo Biofilter system complete with surface discharge is proposed to treat and ultimately discharge the effluent via a proposed storm sewer system running north down the Chalet Ski run and then east to the Pine River located approximately 500m northeast of the proposed re-development. Refer to the Site Servicing Outlet Plan provided in **Appendix A** for additional details. The Waterloo Biofilter system will be fully constructed as part of the Phase 1A of the development.

The Total Daily Sanitary Design Flow Calculations and Sanitary Sewer Design Sheet are provided in **Appendix B** for reference. Refer to the General Servicing Plan North (**GENN**) for additional details.

2.4.1 Waterloo Biofilter System (Surface Disposal)

The associated collection, transmission, treatment and disposal of domestic sewage from the MSC re-development has been designed based on a *Rated Capacity* of **1.38L/s** (118,950L/day) total daily design flow. Approximately one (1.0) days' worth of additional storage has been built into the design of the Waterloo Biofilter system which is considered to balance out any peaking of sewage inflows (2 x 60,000L Balancing Tanks for a total of 120,000L) The following outlines the components of the proposed Waterloo Biofilter treatment system:

Grease Interceptor (by others and external to the Main Chalet building)
One (1) exterior oil/grease interceptor, having a capacity of approximately 6,600 L (3353 mm(L) x 2134 mm(W) x 1638 mm(H) + riser), to receive all kitchen sink wastewater from the main chalet, discharging into the sanitary sewer system prior to the trash tank. Any other restaurant type uses proposed on-site will also be required to install individual oil/grease interceptors prior to discharging to the proposed sanitary sewage treatment system;

Trash Tank
One (1) single compartment trash tank, having a capacity of approximately 60,000 L (7315 mm(L) x 3302 mm(W) x 3550 mm(H) +riser), with the inlet and outlet equipped with a baffle, discharging into anaerobic digester tank #1;

Anaerobic Digester Tanks #1 and #2
Two (2) single compartment anaerobic digester tanks, operating in series, each having a capacity of approximately 60,000 L (7315 mm(L) x 3302 mm(W) x 3550 mm(H) +riser), with the inlets equipped with an InnerTube and the outlets equipped with a baffle, discharging into the aeration tank;

Aeration Tank
One (1) double-compartment aeration tank, having a capacity of approximately 60,000 L (7315 mm(L) x 3302 mm(W) x 3550 mm(H) +riser), with the inlet equipped with an InnerTube, equipped with two (2) aerators, and the outlet equipped with a baffle, discharging into anaerobic digester tank #3;

Anaerobic Digester Tank #3
One (1) single compartment anaerobic digester tank, having a capacity of approximately 60,000 L (7315 mm(L) x 3302 mm(W) x 3550 mm(H) +riser), with the inlet equipped with an InnerTube, equipped with a return pump to the trash tank, and the outlet equipped with six (6) effluent filters, discharging into balance tank #1;

Balance Tanks
Two (2) single compartment balance tanks, each having a capacity of approximately 60,000 L (7315 mm(L) x 3302 mm(W) x 3550 mm(H) +riser), connected by bottom drains, balance tank #2 is equipped with two (2) pairs of pumps, with each pair discharging to two (2) Waterloo Biofilter bulk-filled treatment tanks;
WATERLOO BIOFILTER BULK-FILLED TANKS

Four (4) single compartment Waterloo Biofilter bulk-filled tanks, each having a capacity of approximately 55,000 L (7315 mm(L) x 3302 mm(W) x 3050 mm(H) +riser), housing approximately 55 m3 of Biofilter medium; connected by bottom drains, draining into Waterloo Biofilter basket Biofilter tank #1;

Waterloo Biofilter Bulk-Filled Tanks

Two (2) single compartment Waterloo Biofilter basket tanks, each having a capacity of approximately 55,000 L (7315 mm(L) x 3302 mm(W) x 3050 mm(H) +riser), each housing three (3) baskets with approximately 10 m3 of Biofilter medium per basket (60 m3 total); tank #1 with three (3) simplex pumps and two (2) duplex pumps, simplex pump #1 recirculating to the trash tank, simplex pump #2 dosing Waterloo Biofilter basket tanks #1 and #2 on a closed loop, simplex pump #3 dosing sand filters on a closed loop, duplex pumps discharging to the UV disinfection units;

Sand Filters

Two (2) sand filter polishing units located an above ground control building; draining back to basket tank #1;

UV Disinfection Units

Four (4) UV disinfection units located in the above ground control building; discharging to the effluent sampling and disposal chamber;

Effluent Sampling & Outfall

One (1) disposal tank complete with on-demand duplex pumps will be provided downstream of the UV disinfection units which will be used for both effluent sampling and disposal. The pumps will discharge via a 133.6m long forcemain from the sewage treatment system, west to the proposed outlet storm sewer system (MH1) located northwest of the existing Main Chalet building.

One (1) sodium aluminate dosing system located in the above ground control building, metering sodium aluminate chemical into the trash tank and/or anaerobic digester tank #3;

One (1) alkalinity dosing system located in the above ground control building, metering alkalinity into anaerobic digester tank #3;

One (1) bacteria dosing system located in the above ground control building, metering bacteria into balance tank #1;

Waterloo Smart Panel

All new pumps in the system are run by a Waterloo Smart Panel. The Waterloo Smart Panel provides remote monitoring, control, and data logging over a stable wireless cellular network. This functionality allows for real time operational adjustments to optimize system performance. The Waterloo Smart Panel also immediately notifies the operator of a pump failure or high-level alarm, providing them with vital information to limit site visits while keeping the system running properly.

Effluent Objectives

- The *Owner* shall use best efforts to design, construct and operate the *Works* with the objective that the concentrations of the materials named below as effluent parameters are not exceeded in the effluent being discharged from the *Works*.

Table 2 – Effluent Objectives	
Effluent Parameter	**Concentration Objective** (mg/L unless otherwise indicated)
cB0D5	10.0
Total Suspended Solids	10.0
Total Phosphorus	0.5
Total Ammonia Nitrogen	3.0
*E. Coli**	100 organisms/100 mL (*Geometric Mean Density)*
pH of the effluent maintained between 6.5 to 8.5, inclusive, at all times	

* Disinfection of the effluent to be continuous throughout the year, however, for compliance purposes, the *Geometric Mean Density* shall be calculated such that the annual *Geometric Mean Density* of *E. Coli* does not exceed Column 2 of Table 2 above.

Effluent Limits

- The *Owner* shall design and construct the proposed Works and operate and maintain the *Works* such that the concentrations of the materials named below as effluent parameters are not exceeded in the effluent being discharged from the *Works*.

Table 3 – Effluent Limits	
Effluent Parameter	**Concentration Limit** (mg/L unless otherwise indicated)
cB0D5	15.0
Total Suspended Solids	15.0
Total Phosphorus	1.0
Total Ammonia Nitrogen	5.0
*E. Coli**	200 organisms/100 mL (*Geometric Mean Density)*
pH of the effluent maintained between 6.0 to 9.0, inclusive, at all times	

* Disinfection of the effluent to be continuous throughout the year, however, for compliance purposes, the *Geometric Mean Density* shall be calculated such that the annual *Geometric Mean Density* of *E. Coli* does not exceed Column 2 of Table 3 above.

Effluent Loading Limits

- The *Owner* shall design and construct the proposed Works and operate and maintain the *Works* such that the concentrations of the materials named below as effluent parameters are not exceeded in the effluent being discharged from the *Works*.

Table 4 – Effluent Loading Limits

Effluent Parameter	**Concentration Loading Limit** (kg/day unless otherwise indicated)
cB0D5	1.8
Total Suspended Solids	1.8
Total Phosphorus	0.12
Total Ammonia Nitrogen	0.6

Monitoring & Recording

The *Owner* shall, upon commencement of operation of the *Works*, carry out the following monitoring program:

1) All samples and measurements taken for the purposes of this *Approval* are to be taken at a time and in a location characteristic of the quality and quantity of the effluent stream over the time period being monitored.

- For the purposes of this condition, bi-weekly means once every two weeks.

- Samples shall be collected at the locations and frequencies as specified below, by means of the specified sample type and analyzed for each parameter listed and all results recorded:

Raw Sewage Monitoring

Sampling Location:	Trash Tank
Sampling Type:	Grab
Sampling Frequency:	Bi-Weekly
Sampling Parameters:	BOD_5, Total Suspended Solids, Total Kjeldahl Nitrogen (TKN), Total Phosphorus, Temperature, pH, and Alkalinity

Effluent Monitoring

Sampling Location:	Above Ground Control Building/Pump Station
Sampling Type:	Grab
Sampling Frequency:	Bi-Weekly
Sampling Parameters:	$cBOD_5$, Total Suspended Solids, Total Ammonia Nitrogen, Total Phosphorus, *E. Coli*, Temperature, pH, and Alkalinity

Ministry of the Environment, Conservation and Parks (MECP) Pre-Consultation
A pre-consultation meeting with the MECP was conducted on August 9, 2016 at the Guelph District Office to review the proposed sewage treatment and disposal options for the re-development.

In addition to the pre-consultation meeting noted above, a conference call with the MECP was undertaken on April 4, 2017 to further investigate/discuss the proposed Work Plan for the Assimilative Capacity Study which was being completed at the time by Hutchison Environmental Sciences Ltd (dated September 20, 2016) in support of the proposed sewage treatment systems surface disposal to the Pine River.

Refer to **Appendix G** for the aforementioned correspondence with the MECP as well as a copy of their comments related to the ACS works received on July 14, 2017 and their final approval of the ACS received on January 31, 2019.

3.0 Water Servicing

3.1 General

There are no municipal water services within the subject area. As a result, the two (2) existing drilled wells (PW1 and PW2) as well as two (2) additional wells (PW3 and PW4) will ultimately be utilized to supply the necessary domestic water for the proposed re-development of the MSC. Based on the MECP's classification provided under the Drinking-Water Systems (DWS) Regulation (O. Reg. 170/03) mandated under the Safe Drinking Water Act (SDWA), the existing and proposed DWS's are classified as a "Small Non-Municipal Non-Residential" system and a "Non-Municipal Year Round Residential" system respectively. The proposed re-developments drinking water system will ultimately be detailed in an Engineers Evaluation Report (EER) upon the completion of construction of the system as regulated under O. Reg. 170/03 Schedule 21. The supply and distribution system external to the proposed water treatment system are detailed in the following sections of this report.

3.2 Existing Water Supply

The MSC operates seasonally, typically between late December and early April. The MSC monitors and records during times of operation, the water consumption for each of its sources of water that service the existing Main Chalet which also feeds 3 other standalone structures (i.e. Administration Building, GM Office and Ski House). The MSC primary domestic water supply was previously a 150mm diameter drilled well located just west of the southwest corner of Block 2. The drilled well consists of highly mineralized water quality (poor) and a low yield of approximately 27.3L/min. One other source of potable water which was rarely used, was an existing bored well located just northeast of the Main Chalet building on the Chalet Run ski slope. The bored well consisted of good quality water but was low yielding (4.5-9L/min). Lastly, the remaining water source which was previously used to supply all existing water closets and urinals (non-potable) within the Main Chalet, was the Pine River located immediately northeast of the MSC.

As per the recommendations outlined within the Hydrogeology and Test Drilling Report dated June 2016 and its addendum dated May 2, 2019 both prepared by Morrison Environmental Limited (under separate cover), the existing dug well has since been decommissioned in accordance with the Ontario Regulation 903. Based on our understanding and discussions with MSC staff, the existing drilled well adjacent to Block 2 has been disconnected from existing water system and will be decommissioned during Phase 1C.

Since May of 2016 a 150mm diameter drilled well referred to as PW2 has serviced the Administration Building, GM Office and Ski House, as well as the Main Chalet which feeds each of the aforementioned buildings. Well PW2 is located immediately east of the MSC property entrance off of the 17th Sideroad. An additional 150mm diameter well (PW1) was also installed at the same time and in the general vicinity of PW2 but this well has not been connected to the existing water system to date.

From PW2 the water is currently supplied to an existing 2500gal holding tank buried immediately north of the Main Chalet via a Gould's 13GS10 well pump and existing 38mm water line. From the holding tank an existing Gould's 65GS30 submersible pump complete with a constant pressure controller supplies raw water to the existing mechanical room within the Main Chalet. From the Main Chalet the water supply is both treated and distributed internally as well as externally to the other existing buildings on-site.

Refer to the documents noted above for detailed information related to the existing wells/water supply for the subject site.

3.3 Proposed Water Supply

Due to the low yields of the original drilled and dug wells located on-site, two new drilled wells consisting of 150mmø (6 inch nominal) casings, have been extended to a depth of 13.1m and are located at the northeast corner of MSC property immediately east of the property entrance off of the 17th Sideroad. PW1 is located closest to the 17th Sideroad with PW2 53.4m directly south of PW1. The new test wells are located at the base of the escarpment approximately 650m north of the proposed re-development area. Refer to the Proposed Snow Making Pond & Well Location Plan (**SMPLP**) for the well locations.

Based on discussions with Morrison Environmental Limited, a total of four (4) individual drilled wells each capable of yielding 20igpm (91L/min), as per the existing two (2) drilled wells (PW1 and PW2) pump test results, are proposed to adequately service the re-development at the MSC. As per MECP requirements, the four (4) wells will be capable of supplying the re-developments full build-out condition Maximum Day Demand (MDD) of 369,509L/day (256.6L/min).

Two (2) of the drilled wells (PW1 and PW3) will alternate duty once PW3 is constructed. Assuming PW3 will have a similar yield as PW1, a Gould's 13GS10 well pump will supply water from each well individually via an existing 38mm water line to the existing 2500gal holding tank buried immediately north of the Main Chalet. Based on the pump test for PW1 and the existing well pump and system-head curve, 16USGPM will be supplied from PW1 to the existing holding tank. Similarly, the other two (2) drilled wells (PW2 and PW4) will alternate duty and supply water via a proposed 50mm water line to the existing 2500gal holding tank. Based on the pump test for PW2 and the proposed well pump and system-head curve, 29USGPM will be supplied from PW2 to the existing holding tank using a Gould's 25GS20 well pump. A total of 45USGPM can be supplied to the holding tank when both water lines are running. This is consistent with the 24/7 combined pump test for PW1 and PW2 which was completed by Morrison Environmental Limited (37.4IGPM or 45USGPM). This well pump setup will provide contingency by limiting the loading on each of the wells and their respective pumping/supply infrastructure.

From the existing 2500gal holding tank raw water will be supplied via an existing Gould's 65GS30 submersible pump complete with a constant pressure controller to the proposed water treatment system located within the basement of the Main Chalets proposed addition. An additional and identical pump will be installed within the existing holding tank for contingency purposes.

The proposed mechanical room located within the basement of the Main Chalet's addition will house all of the necessary equipment to provide both primary and secondary disinfection of the raw water prior to pumping it through the proposed potable water distribution system. The water treatment system will consist of a treatment skid complete with filtration and UV treatment, an Ozone skid, water softening equipment, Day Tanks connected in series and a booster skid.

Considering that the proposed water treatment system has a rated capacity of 40USGPM (151.2L/min), treated water will be stored in Day Tanks in order to accommodate the MDD and PHD conditions. In the full build-out condition of the re-development, the PHD is 397.8L/min which requires 14,797L of Day Tank storage ((397.8L/min – 151.2L/min) x 60min) and the MDD is 256.6L/min which requires 151,781L of Day Tank storage ((256.6L/min – 151.2L/min) x 1440min). To accommodate the governing volume of 151,781L, five (5) 7300IG (33,142L) Day Tanks connected in series have been accounted for within the mechanical room space requirements. Considering that the re-development is proposed to be constructed in phases, initially two (2) 7300IG (33,142L) Day Tanks connected in series are proposed. Water usage will be monitored and as demand increase, additional Day Tank storage will be incorporated into the mechanical room accordingly. This approach will allow actual demand to drive any necessary additional storage costs rather than theoretical demand.

The proposed booster skid will consist of 3 pumps designed in a lead/lag/standby configuration. Each pump is designed for 70USGPM (264.6L/min) at 95psi. Therefore, the system is capable of providing a maximum flow of 140 USGPM (529.2L/min) when the two pumps are running in parallel (lead/lag configuration). The booster skid will be set and controlled to maintain the necessary maximum and minimum flows/pressures within the 100mm diameter domestic water distribution system.

As previously noted, upon completion of construction of the water treatment system an Engineers Evaluation Report will be prepared and submitted to the MECP to confirm the DWS's compliance with O. Reg. 170/03.

3.4 Design

Based on the Ministry of the Environment, Conservation and Parks (MECP) Design Guidelines dated 2008 and Tables 8.2.1.3.A. and 8.2.1.3.B. of the 2012 Ontario Building Code (OBC), the total daily domestic water supply flow rates were calculated for each of the buildings proposed within the re-development. The Average Daily Demand (ADD) for the re-development was determined to be 118,950L/day (82.6L/min), the Maximum Daily Demand (MDD) was determined to be 369,509L/day (256.6L/min) and the Peak Hourly Demand (PHD) was determined to be 572,852L/day (397.8L/min).

The Water Supply Design Calculations are provided in **Appendix B** for reference. Refer to the General Servicing Plan North (**GENN**), Water Treatment Facility Plan (**WF**), Site Servicing Outlet Plan (**SSOP**) and the Proposed Snow Making Pond & Well Location Plan (**SMPLP**) for additional details.

3.5 Fire Protection

As a result of the sites absence of an accessible municipal water supply for fire protection and based on Subsections 3.2.5.7. and A-3.2.5.7. of the 2012 Ontario Building Code (OBC), Division B, Part 3, the proposed re-development is required to provide on-site Fire Protection Water Storage. Each of the existing and proposed buildings were analysed individually to determine an associated fire protection water storage volume and flow rate based on the guidelines listed above.

The largest of the proposed buildings (Building ‘B’) governed the fire storage volume requirement with a total volume of 162,162L. Based on Table 2 provided in the OBC A.3.2.5.7., the required minimum water supply flow rate is 5400L/min and is to be provided within an unobstructed distance of 90m from the nearest hydrant to the buildings main entrance. Considering the total storage volume of 162,162L and the minimum water supply flow rate of 5400L/min, the minimum 30-minute duration can be provided as required by the OBC.

In order to provide the necessary fire protection water storage on-site, four (4) 50,000L concrete water storage tanks (or approved equivalent) are proposed. In an effort to reduce the potential for stagnation and the associated water quality impacts associated with an oversized domestic water distribution system, as well as to eliminate the need for standby power, the fire supply system is proposed to be a standalone system pressurized via static head/elevation. The fire storage tanks are proposed west of the re-development area, up the ski hill at a minimum ground grade of 342.50m. Based on the elevated 200,000L of fire storage water and the proposed 250mmø and 150mmø fire supply mains complete with four (4) proposed fire hydrants, the required flow rates will be provided within the required distance of each building at the minimum allowable pressure of 20psi. A proposed connection to the snow making supply line in the vicinity of the storage tanks will be used to fill the tanks with water from the proposed snow making pond when necessary. A low level alarm will be installed to ensure that the tanks stay full at all times.

The Water Supply Design Calculations and Fire Protection Water Storage Design Calculations are provided in **Appendix B**. Refer to the General Servicing Plan North (**GENN**) and Fire Water Storage Plan (**FWS**) for additional details.

3.6 Temporary Water Servicing for Phase 1A (Block 1)

As noted above, the proposed re-development has been broken up into construction phases. Phase 1A consists of the construction of Block 1 which is a 12 unit Townhouse complete with 2 bedrooms per unit resulting in an average day demand (ADD) of 13,200L/day based on 275L/cap/day. The average day demand (ADD) for the existing condition at the MSC which was confirmed to be 13,800L/day based on 2019-2020 ski season water meter reading records resulting in an interim condition total ADD of 27,000L/day.

Based on the existing well pump (PW2) and supply line configuration, 16USGPM (60.5L/min) is able to be supplied to the existing 2500gal (9450L) holding tank providing sufficient flow to accommodate the MDD for Phase 1A (49.5L/min). The existing holding tank and Gould’s 65GS30 pump located within it will sufficiently accommodate a PHD condition.

To service Block 1 with water in Phase 1A, a 50mmø water service will be extended from the Main Chalet’s water system to the northeast corner of Block 1. To avoid further servicing conflicts in this area during future phases of construction, the existing water service to the Ski House will be connected into the proposed Phase 1A 50mmø water service immediately north of Block 1. When the complete water distribution system in constructed during future phases, the section of the proposed 50mmø water service closest to the Main Chalet will be removed both ends of the Phase 1A 50mmø watermain will be extended and connected into the proposed 100mmø watermain for looping purposes.

Primary disinfection of the water supply for Block 1 will be provided within the Main Chalet via the existing water treatment system. The water service for Block 1 will need to be internally distributed within the building to each of the 12 units from the single 50mmø water service connection. A mechanical room/space within Block 1 at the water services entrance into the building will be required to facilitate the installation of a UV unit (NSF 55 standard) for secondary treatment purposes. Ultimately when the complete water treatment and distribution system is in place, the UV system within Block 1 can be removed if necessary.

Refer to the General Servicing Plan North (**GENN**) for additional details.

4.0 Stormwater Management

4.1 Design Criteria Guidelines

The stormwater management features that have been designed for this site include grass filter strips, enhanced grass swales (Low Impact Development (LID) controls), storm sewer, and a dry detention basin which will form an integrated treatment train approach for providing both stormwater quality and quantity control.

The stormwater management design for the site will incorporate the policies and criteria of a number of agencies, including the Ministry of the Environment, Conservation and Parks (MECP), Nottawasaga Valley Conservation Authority (NVCA) and the Township of Mulmur (Township). Considering the size and type of re-development proposed and the desire to provide both water balance and stormwater quality control for the site runoff, additional design guidance has been provided based on the Low Impact Development Stormwater Management Planning & Design Guide (LID Manual) prepared by the Credit Valley Conservation (CVC) and the Toronto and Region Conservation Authority (TRCA), Version 1.0, dated 2010. The above noted agencies stormwater design criteria for the proposed re-development are summarized below:

- Stormwater quality controls will be provided based on the guidelines described in the Ministry of the Environment, Stormwater Management Planning and Design Manual dated March 2003 and the LID Manual. Following the MOE and LID Guidelines noted above, the stormwater management design utilized for the site will provide water quality control at an Enhanced Level of Protection (minimum of 80% Total Suspended Solids removal efficiency). NVCA Guidelines will be used as a reference for the design of the stormwater management system.
- The Ontario Ministry of Transportation (MTO) rainfall intensity-duration-frequency (IDF) curve lookup tool was used to confirm the rainfall IDF data for the site which was ultimately utilized to determine the peak flow rates and runoff volumes generated both on and off-site (external drainage area).
- Stormwater quality control will be provided via the use of enhanced grass swales complete with grass filter strips upstream for pre-treatment as well as a dry detention basin located downstream. Additionally, the storm sewer’s inlet structures will have deep sumps that will allow sedimentation of particulates upstream of the dry detention basin. The proposed treatment train approach is premised on the stormwater being both filtrated as well as infiltrated into the in-situ soils where possible.
- Stormwater quantity control will be provided via the use of a dry detention basin to attenuate the post-development peak flows for each of the analyzed design storm events to their respective pre-development target rates, including extended detention of the 25mm runoff volume.

- Erosion and sediment control shall be provided during the construction phase and until the site is fully stabilized.

4.2 Pre-Development Condition

4.2.1. General

The subject lands (site/re-development area) for all intents and purposes of this stormwater management report has been considered as the 3.86ha area comprised of the MSC's existing infrastructure (Main Chalet, Administration Building, Ski House and GM Office building) and the gravel parking lot.

The majority of the site is considered to be gravel and unimproved lands consisting of small trees and shrubs along with heavy grass cover. Runoff from the majority of the site (south portion, PRE1 drainage area) is considered to concentrate via overland flow at the predominant drainage feature located at the southeast corner of the site. The aforementioned drainage feature is an existing swale traversing the adjacent lands to the east of the site which outlets at an existing 800mmø CSP cross culvert located under the 15th Sideroad. The runoff from the residual site area (north portion, PRE2 drainage area) is considered to also concrete via overland flow at the northeast corner of the subject lands. The topography of the subject lands can be described as having a moderate slope, with an average grade in the range of approximately 5.6% and 9.3% in a west to east direction for the PRE1 and PRE2 areas respectively.

Refer to the Pre-Development Drainage Plan, **FIG 2** provided in **Appendix A** for additional details.

4.2.2. External Drainage

The subject lands are considered to be self-contained with no external drainage contributing runoff as a result of the existing ditch and culvert by-pass system presently in-place along the west and southern limits of the site. All external drainage is captured and conveyed via an existing network of swales located along the west property boundary. Immediately west of the southwest corner of the existing Administration Building, an inlet structure and pipe system are used to capture the runoff generated by a localized section of the existing Kids Ski Run. The drainage pipe then discharges into an existing ditch which runs north to south along the west limit of the gravel parking lot. The existing ditch intercepts all external runoff directed to the west limit of the subject lands. At the southwest corner of the site, both the runoff from the north side of the 15th Sideroad municipal right-of-way as well as the discharge from the adjacent detention basin located immediately west of the subject lands, is conveyed via existing swales to the aforementioned perimeter ditch located on-site. At the southwest limit of the site the converged swale network discharges into an existing CSP culvert which traverses the gravel parking lot in a west to east direction. Lastly, from the east limit of the site at the outlet of the existing CSP culvert, the external runoff is discharged into an existing swale and is conveyed along with the site runoff, across the neighbouring property, east to an 800mmø CSP cross culvert located under the 15th Sideroad. From the 15th Sideroad cross culvert the runoff is conveyed downstream through a series of grass covered road side ditches, swales as well as two existing dry ponds/basins prior to reaching the ultimate receiver, the Pine River which is located approximately 1050m downstream of the site.

Refer to the Downstream Drainage Outlet Plan, **FIG 5** provided in **Appendix A** for additional details.

The external drainage area is bound to the south by the 15th Sideroad, to the west by top of the escarpment and to the north by a natural split in the existing topography. The topographic relief over the 11.71ha external drainage area is approximately 80m which falls in a west-east direction towards the site. The external drainage area consists of a portion of the estate lot subdivision (Lloyd's Traverse Crescent) located at the top of the escarpment, a portion of the 15th Sideroad and 5th Line right-of-way's, as well as some pasture, treed and unimproved lands. The majority of the external runoff is captured by the existing dry pond/basin located immediately west of the southwest corner of the subject lands where the runoff is attenuated prior to being released to the site. The hydrologic modelling and stormwater management design provided herein has conservatively not accounted for the peak flow attenuation/storage provided upstream of the site within the existing dry pond/basin.

Refer to the External Drainage Plan, **FIG 4** provided in **Appendix A** for additional details.

4.2.3. Soil Conditions

According to the Soils Map of Dufferin County, Ontario, Soil Survey Report No. 38 prepared for the Department of Agriculture, the site and external drainage areas consist of Dunedin clay which is described as having good drainage characteristics. Dunedin clay belongs to Hydrologic Soil Group 'D'.

The Runoff Coefficients and Curve Numbers associated with the site and external drainage area were computed by calculating weighted values based on corresponding land uses and soil type. The Hydrologic Soil Group was determined in accordance with the Ontario Ministry of Transportation (MTO) Soil Classification System. It should be noted that, in an effort to be conservative the peak flows and runoff volumes calculated for the site are based on the native soils (Dunedin Clay) although it is assumed that the majority of the site area is comprised of fill material having improved drainage characteristics over the native clay soils.

A Geotechnical Investigation conducted in May 2018 by Shad & Associates Inc. (Preliminary Geotechnical Investigation June 21, 2018) consisting of the drilling and sampling of eight (8) boreholes as well as their further sample analyses completed to further define the existing site soil conditions. A supplementary letter provided by Shad & Associates dated March 20, 2020 was provided to support the construction of the fire route. Lastly, an Addendum to the Geotechnical Investigation (Shad & Associates, April 22, 2020) was also provided to support the construction of the asphalt areas, dry detention basin, site services, snow making pond, etc.

Refer to **Appendix H** for each of the documents referenced above.

4.3 Post-Development Conditions

4.3.1. General

The proposed site works include the renovation of the existing Administration Building into Office and Personal Business space at ground level and 15 residential units/lofts on the second level (Building 'B', 652m^2 existing ground floor + 128m^2 proposed ground floor = 780m^2 total), a new building consists of Office and Personal Business space at ground level and 10 residential units/lofts on the second level (Building 'A', 630m^2 ground floor + 252m^2 mezzanine = 882m^2 total) and 6 separate stacked Townhouse buildings totaling 66 residential units. The existing gravel parking lot is proposed to be expanded but will remain surfaced with gravel with the exception of a section located adjacent to the existing Main Chalet building which is proposed as interlocking paver stone and the main drive aisle around Building 'A' which is proposed to be asphalt. The runoff generated from the site area will be directed west to east across the subject lands as in the existing condition.

Refer to **FIG 3** in **Appendix A** for the Post-Development Drainage Plan and the stormwater management design calculations provided in **Appendix C** for additional details.

4.3.2. Post-Development Drainage

Post-development drainage patterns on-site will be generally consistent with that of the existing condition.

The proposed re-development will consist of overland sheet flow drainage as in the existing condition and will concentrate at the northeast and southeast corners of the subject lands similar to the existing condition. Although the proposed parking lot surface will remain as gravel, as per the NVCA design standards this area has been conservatively considered as asphalt (impervious surface) in the post-development condition hydrologic modelling and associated design calculations.

Due to the lack of a sufficient drainage outlet at the northeast corner of the site and in an effort to mitigate any adverse impacts the proposed re-development may have on the adjacent lands to the northeast of the site (down gradient along the escarpment), the site has been graded such that the drainage area directed to the northeast corner has been reduced in magnitude relative to that of the pre-development condition thereby resulting in reduced peak flows and runoff volumes released off-site in the post-development condition. The post-development drainage area directed to the northeast corner of the site will be reduced from 1.40ha (PRE2) to 0.89ha (POST2) and will be graded such that flows are in the form of overland sheet flow leaving the site rather than concentrated flow in order to resemble that of the existing condition.

The residual site area (2.74ha, POST1) will be directed to the southeast corner of the site via a combination of both storm sewer and overland sheet flow over a series of grassed filter strips, and an enhanced grass swale prior to discharging into a proposed dry detention basin. The proposed dry detention basin will be used to attenuate the post-development peak flows to the corresponding pre-development target rates (or less) for each of the 2-100 year design storm events. Each of the aforementioned stormwater management features will be used as part of a treatment train approach for the purposes of providing stormwater quality control for the contributing drainage area at an Enhanced Level of Protection (80% Total Suspended Solids Removal Efficiency), phosphorus reduction benefits and at source groundwater recharge (water balance) benefits.

External drainage patterns on-site will be generally consistent with that of the existing condition. A proposed ‘cut-off’ (grass) swale will be constructed along the west and southwest limits of the site to capture and convey the external runoff to a proposed ditch inlet catchbasin (DICB) which will ultimately convey the runoff through the proposed storm sewer system into the dry detention basin. In the event of a storm that generates a peak flow greater than the storm sewer capacity (25-year or less frequent storm event), the excess runoff will spill onto the parking lot to the north and will be conveyed overland to the proposed (south) enhanced grass swale along the eastern property line and ultimately into the proposed dry detention basin.

The attenuated peak flows from the dry detention basin will discharge to the existing drainage feature located immediately east of the basin which will ultimately convey all site and external runoff downstream to the existing 800mmø CSP cross culvert located under the 15th Sideroad. The proposed drainage patterns described above are consistent with the existing condition.

4.3.3. Rainfall Data

The 6, 12 and 24-hour SCS Type-II and the 4-hour Chicago Storm rainfall distributions were used for the 1:2, 1:5, 1:25 and 1:100 year design storm event hydrologic modelling. The SCS and Chicago storms were developed from the recorded rainfall data obtained from the MTO IDF Curve Lookup website.

4.4 Pre-Development Condition Modelling Results

Using the site and external drainage areas as illustrated on **FIG 2** and **FIG 4** and the program SWMHYMO, the total flows were determined for the 2-year, 5-year, 25-year and 100-year design storm events. These flows are summarized in **Tables 1a** and **1b** below. The hydrologic model runs for the pre-development 6-hour, 12-hour and 24-hour SCS Type-II and 4-hour Chicago storm distributions can be found in **Appendix D**.

Table 1a: Pre-Development Peak Flows – Site

Catchment	Area (ha)	Pre-Development Peak Flows (m^3/s) (24-hour SCS Type-II Storm Distribution)			
		2-yr	**5-yr**	**25-yr**	**100-yr**
PRE1	2.46	0.154	0.261	0.446	0.598
PRE2	1.40	0.100	0.165	0.280	0.373
EXT	11.71	0.592	0.948	1.529	2.025

Due to the more conservative values calculated for the peak flows, the design of all conveyance features (i.e. by-pass swale and storm sewer from it to the basin) were based on the 24-hour SCS Type-II storm distribution.

Table 1b: Pre-Development Peak Flow Target Rates – PRE1 & EXT Combined

Catchment PRE1 + EXT	Area (ha)	Pre-Development Peak Flows (m^3/s) (24-hour SCS Type-II Storm Distribution) (Post-Development Dry Detention Basin Target Rates)			
		2-yr	**5-yr**	**25-yr**	**100-yr**
TOTAL	14.17	0.743	1.192	1.914	2.537

In the post-development condition, catchments POST1 & EXT will both be routed through the stormwater management facility. To determine the pre-development target rates for these catchments, the combined peak flows for catchments PRE1 & EXT were modelled.

4.5 Post-Development Condition Modelling Results

The post-development peak flows are summarized in **Tables 2a** and **b** below.

Table 2a: Post-Development Uncontrolled Peak Flows - Site

Catchment	Area (ha)	Post-Development Peak Flows (m^3/s) (24-hour SCS Type-II Storm Distribution)			
		2-yr	**5-yr**	**25-yr**	**100-yr**
POST1	2.74	0.378	0.526	0.760	0.949
POST2	0.89	0.073	0.116	0.192	0.251
EXT	11.94	0.604	0.966	1.559	2.065

Table 2b: Post-Development Uncontrolled Peak Flows – POST1 & EXT Combined

Catchment POST1 + EXT	Area (ha)	Post-Development Peak Flows (m^3/s) (24-hour SCS Type-II Storm Distribution)			
		2-yr	**5-yr**	**25-yr**	**100-yr**
TOTAL	14.68	0.861	1.315	2.015	2.628

By comparing **Tables 1a and Table 1b** with **Table 2a and Table 2b respectively**, it is evident that the total uncontrolled post-development peak flows for the POST1 drainage area exceeds the pre-development targets (PRE1) and thus peak flow attenuation is required before releasing the site's runoff to the existing swale located east of the site. The proposed dry detention basin will be designed to incorporate the necessary quantity control for the runoff generated on-site.

Due to the reduced drainage area of the POST2 catchment relative to the PRE2 catchment, the corresponding post-development peak flows as well as runoff volumes, do <u>not</u> exceed the pre-development target values and as a result <u>no</u> stormwater attenuation is proposed within the POST2 catchment. Refer to **Table 3b** below for additional information. The absence of any stormwater management feature/facility aids in maintaining the overall drainage in the form of overland sheet flow similar to that of the existing condition. Considering the absence of a sufficient drainage outlet at the northeast corner of the site and the presence of the existing development downstream, it is was determined that reducing the overall peak flows and volumes as well as maintaining overland sheet flow drainage from this area of the site would be the preferred design approach.

4.6 Stormwater Quantity Control

A comparison between the 6-hour, 12-hour and 24-hour SCS Type-II and 4-hour Chicago storm distributions was completed to determine which storm distribution would be used for sizing the proposed stormwater management facility (dry detention basin). The design storms based on the 24-hour SCS Type-II storm distribution required greater storage volumes than the same design storms based on the other three (3) storm distributions when modelled using SWMHYMO. Therefore, the 24-hour SCS Type-II storm distribution was used to size the proposed stormwater management facility (dry detention basin).

Table 3a below summarizes the storage-storage-discharge characteristics for the dry detention basin and the corresponding uncontrolled and controlled post-development peak flows and pre-development target rates.

Table 3a: SWM Facility Characteristics

Storm Event (Year)	**Area (ha)**	**Basin Inflow Post-Development Uncontrolled Peak Flow (m^3/s)** (per Table 2b)	**Basin Outflow Post-Development Controlled Peak Flow (m^3/s)**	**Storage Provided (m^3)**	**Estimated Water Levels (m)**
2	14.68	0.861	0.709	741.9	296.12
5		1.315	1.120	921.8	296.32
25		2.015	1.784	1158.0	296.56
100		2.628	2.275	1364.0	296.61

Table 3b below summarizes the pre- and post-development peak flows and runoff volumes generated by the uncontrolled northeast portion of the re-development (Catchments PRE2 and POST2).

Table 3b: Uncontrolled Catchments (PRE2 & POST2)

Storm Event (Year)	**Area (ha)**	**Pre-Development Uncontrolled Peak Flow (m^3/s)** (per Table 1a)	**Pre-Development Runoff Volume (m^3)**	**Post-Development Uncontrolled Peak Flow (m^3/s)** (per Table 2a)	**Post-Development Runoff Volume (m^3)**
2	1.40 (PRE2) 0.89 (POST2)	0.100	354	0.073	266
5		0.165	550	0.116	396
25		0.280	868	0.192	605
100		0.373	1142	0.251	783

The erosion control volume (25mm runoff volume of 442.9m^3) can easily be accommodated within the basin. The 24-hour draw down of the 25mm runoff volume was targeted, but could not be achieved even using the MOE's minimum orifice size (75mmø). The drawdown time using a 75mmø orifice is 13.6 hours. As recommended in the MOE SWM Manual (2003), since the minimum orifice size will be used, a draw down time >12hrs is considered acceptable.

Refer to **Section 4.8** for the Dry Detention Basin Details.

4.7 Stormwater Quality Control

The stormwater management requirements for this site were determined based on the NVCA Design Guidelines. The appropriate level of quality control was determined to be an 'Enhanced' Level of Protection as defined by the MOE's Stormwater Management Planning & Design Manual (2003), which equates to the provision of 80% total suspended solids (TSS) removal efficiency.

In determining the stormwater management practices to implement for the proposed re-development, various methods were considered. During the review, the main factors considered were as follows:

- Existing land characteristics and uses (soils, topography, location, etc.);
- Local requirements and maintenance considerations with regard to quality control;
- Facility feasibility & proximity to a suitable stormwater outlet and the receiving watercourse (Pine River).
- Utilizing an 'integrated treatment train' approach to treat stormwater runoff;
- Ability to utilize landscaped areas and providing water balance and nutrient uptake benefits;

Based on the above noted factors, the application of a low impact enhanced grass swales complete with upstream grass filter strips (buffers) and a downstream dry detention basin, has been chosen as the preferred means of providing a complete treatment train approach for the treatment of contaminated stormwater runoff generated on-site.

Long shallow sloped enhanced grass swales are proposed to capture and convey all stormwater runoff prior to reaching the dry detention basin. Enhanced grass swales are considered advantageous as they can be integrated into the various landscape features proposed throughout the site. From a performance perspective they are beneficial in that they can function adequately when graded into areas of varying slope and will provide exceptional capture due to the longitudinal dimension and location of the swales with respect to the overland runoff's perpendicular direction of flow. The design of the enhanced grass swales is highly conducive to providing optimal capture of the site's stormwater runoff while facilitating a reduction in flow velocity as the runoff is conveyed downstream towards the proposed dry detention basin, and ultimately the site outlet. The enhanced grass swales will provide additional pre-treatment of the stormwater by means of vegetative filtration, infiltration, nutrient uptake and evapotranspiration.

The enhanced grass swales are proposed to be integrated into the site's landscaped area located at the eastern limit of the site's parking area. The enhanced grass swales will run parallel to the parking area boundary, capturing all contaminated runoff from the re-development. Based upon guidance from the LID Manual, the enhanced grass swales will consist of a 0.75 bottom width (minimum), 3:1 (H:V) side slopes, longitudinal slopes 1.0% or less, and flow velocities less than 0.5m/s during a 25mm design storm event. The site grading is such that runoff from all impervious area not captured by the storm sewer is directed to the enhanced grass swales before entering the dry detention basin.

Based on the information provided in the LID Guide, the median TSS removal rate for an enhanced grass swale is considered to be 76%. Considering the dry detention basins design is functionally similar to an enhanced grass swale, it has also been considered to have a median TSS removal rate of 76%. Based on the proposed treatment train which consists of a storm sewer with deep sumps/grass filter strips for pre-treatment in conjunction with the enhanced grass swales and dry detention basin, a minimum of 80% Total Suspended Solids (TSS) removal efficiency is considered to be achievable on-site.

With respect to overall water balance for the subject lands, the proposed SWM design is considered to have made every feasible effort to maintain the pre-development infiltration and evapo-transpiration rates. All proposed pervious surfaces have been kept to a maximum with respect to overall magnitude and are proposed to be landscaped as per the Landscape Plans (provided by others). The presence of the proposed grass filter strips, enhanced grass swales and the dry detention basin will inherently provide extended opportunity for nutrient uptake and evapotranspiration through the vegetative cover and extended detention (ponding) storage, prior to the site's stormwater runoff being released off-site.

Refer to the Site Grading Plan North (**SGRN**), Site Grading Plan South (**SGRS**), Site Servicing Plan North (**GENN**), Site Servicing Plan South (**GENS**) and the Stormwater Management Facility Plan (**SWM**) for additional details.

4.8 Total Phosphorus Removal Initiatives

Phosphorus removal initiatives are also proposed for the subject site, in accordance with the requirements of the NVCA.

Each of the on-site stormwater management features noted above will retain pollutants and nutrients (such as phosphorus). The proposed Best Management Practices (BMPs) have been designed as a treatment train to provide filtration, evapotranspiration, infiltration, and nutrient uptake.

Each proposed BMP (i.e. grass filter strips, enhanced grass swales and the dry detention basin) have been designed based on the runoff volume generated by a 25mm rainfall event. Considering this, the “first flush” of any rainfall event, which consists of the vast majority of pollutants and contaminants including phosphorus, will be captured, conveyed and retained on-site prior to be discharged downstream.

Using the NVCA PLDv2 Tool, the proposed re-development and associated stormwater management BMPs were modelled to determine the total post-development phosphorus export from the site. Based on the calculations, the total pre-development phosphorus export from the site is **0.81kg/yr**, and the total post-development phosphorus export from the site is **0.85kg/yr** with the proposed BMPs. Based on the above, the increase in phosphorus loading in the post-development condition through the implementation of the proposed BMPs is considered negligible relative to the pre-development condition.

For supporting calculations, refer to the NVCA PLDv2 Tool output summary located in **Appendix B**.

4.9 Dry Detention Basin Details

Details of the proposed Dry Detention Basin are summarized below:

- The proposed dry detention basin is designed to attenuate the stormwater runoff generated by the majority of the re-development (POST1 catchment) prior to releasing it off-site. Quantity control will be provided to attenuate each of the 2-100 year design storm post-development peak flows to the corresponding pre-development target rates. The first flush (25mm design storm runoff volume (erosion control volume)) of 442.9m^3 will be drawn down through a 75mmø orifice over a period of 13.6 hours which is consistent with the allowable 12 hour minimum for the minimum orifice size as specified in the MOE guidelines. This form of stormwater attenuation will provide inherent water balance benefits through both infiltration and evapotranspiration, suspended solids removal capabilities, and nutrient uptake through the vegetation provided within the basin.
- The proposed dry detention basin will include both an overland inlet swale located at the northeast limit of the basin and a piped inlet at the northwest limit of the basin. The proposed piped inlet will convey all design storm peak flows up to and including the 5-year design storm from the POST1 catchment area, as well as peak flows up to and including the 25-year design storm from the external lands located west of the site (EXT catchment area). The proposed overland inlet will convey all remaining design storm peak flows up to and including the 100-year design storm

from both the POST1 & EXT catchment area into the dry detention basin. Both the basin's inlets will be lined with filter cloth and rip-rap for erosion protection and are located as far away as possible from the basin's outlet structure to prevent short circuiting of the runoff through the dry detention basin.

- The dry detention basin will be constructed with a sediment forebay that will aid in the pre-treatment of stormwater as it enters the basin as well as concentrate the majority of basin maintenance to this area. Peak flow velocities will be reduced within the forebay promoting sedimentation prior to entering the main cell. The forebay will also inherently provide infiltration benefits.
- The dry detention basin has been designed to have 4:1 (H:V) side slopes, a maximum depth of 2.55m, a large flat base area of 121m^2, and a total storage capacity of 1772.5m^3.
- A 3.0m wide Maintenance Access will be constructed around the majority of the basin providing opportunity for vehicular access to the basin and its outlet structures. The Maintenance Access will begin at the proposed parking area north of the basin and extend around the western & southern perimeter of the basin terminating at the Overflow Spillway Weir.
- The basin's outlet structure will consist of a combination of an orifice plate and rectangular/triangular weir configured into a 600mm x 1200mm ditch inlet catchbasin (DICB) located at the basin's southeast limit. The 25mm design storm runoff volume will enter the outlet structure through and be attenuated by a 75mmø orifice plate (Invert Elevation = 294.35m) located within the DICB via a 150mmø a hickenbottom perforated pipe connection from the base of the basin. This extended detention volume (442.9m^3) will draw down over a period of 13.6hrs. In conjunction with the proposed orifice plate, a sharp-crested rectangular weir (0.9m wide, weir crest elevation = 295.55) cut into the face of DICB outlet structure, in combination with the sloped portion of the DICB (which will function as a triangular-shaped weir with 2:1 side slopes) is proposed to attenuate the peak flows of the remaining storm events within the dry detention basin. This outlet structure configuration will provide sufficient stormwater attenuation within the dry detention basin to control the post-development peak flows to the corresponding pre-development target rates for each of the 2-100 year design storm events. A proposed 900mmø outlet pipe from the control structure (DICB) will convey all of the 2-100 year design storm events to the existing site outlet.
- In the event of a partial blockage in the outlet structure or during a storm event less frequent than the 100-year design storm, the proposed Overflow Spillway Weir (broad-crested weir) will safely convey the flows to the existing site outlet. The Overflow Spillway Weir will be trapezoidal in shape, have a 4.0m bottom width and 10:1 side slopes. The Overflow Spillway weir will be lined with Turfstone Pavers to armour the weir against erosion and allow vehicular access over the weir if necessary. An Overflow Spillway will be constructed from the Overflow Spillway Weir to the site outlet at the eastern property line. The Overflow Spillway is sized to convey flows from the Overflow Spillway Weir (peak flows less frequent than the 100-year design storm). The Overflow Spillway will have a 2.0m bottom width, 4:1

side slopes, and be lined with filter cloth and rip-rap for erosion protection. Both the Overflow Spillway Weir and Overflow Spillway will be capable of safely conveying post-development peak flows generated by storm events less frequent than the 100-year design storm without any restriction in order to prevent any potential flood hazards associated with larger peak flows/runoff volumes.

Refer to **Appendix C** for supporting calculations.

4.10 Erosion & Sediment Controls

In accordance with NVCA policies, effective erosion and sediment control must be established prior to construction commencement and maintained until the site has been stabilized. Exposure of the soil during construction should be minimized to avoid erosion and sedimentation. The sites erosion potential may be mitigated through the use of sound erosion and sedimentation control measures. The following measures shall be carried out prior to construction and maintained until disturbed areas have been sufficiently stabilized/established:

Topsoil Stripping: Topsoil stripping will be reduced as much as possible on-site. Where grading is necessary, the exposed soil will be stabilized by seeding immediately upon being set to grade. Should topsoil stockpiling be required, the stockpiles will be kept at manageable levels for grass/weed cutting purposes.

Silt Fence: Silt fence will be placed along the down slope of all excavated material and along the perimeter of the site where grading is directed towards the property line to prevent sediment transport onto adjacent lands. Periodic inspections and repairs to the silt fence should be performed regularly, as well as after every rainfall event.

Vegetated Buffers: Existing grassland vegetation, wooded and/or lawn areas along the development limits are to be maintained wherever possible. These areas will provide a natural barrier to filter potentially sediment-laden overland flow before it is released from the site.

Conveyance Protection: Straw bale check dams will be placed within all swales immediately after being constructed, and should be removed only after the area has been fully stabilized.

Finally, the Site Engineer will be responsible for completing routine inspections of the sediment and erosion control structures throughout the construction phase of the re-development, particularly after rainfall events. All damaged or clogged control devices or fencing must be repaired immediately.

Refer to the Erosion and Sediment Control Plan (**ESC**) for additional details.

5.0 Grading

The proposed grading will meet the requirements of the site layout and stormwater management strategy. In order to achieve these goals the following design criteria were used;

- Grading of internal driveways, parking and landscaped areas to be completed according to current engineering design standards.
- Minimize earthworks operations on-site (i.e. minimize cut/fill) where possible.
- Provide overland conveyance of as much stormwater runoff as possible to the site outlet at the southeast limit of the property. Where existing topography does not allow for positive grading to the southeast corner, any uncontrolled runoff peak flows and volumes are to be less than or equal to that of the pre-development condition and in the form of overland sheet flow (not concentrated flow).
- Minimize the need for steep slopes and retaining walls where practical.

6.0 Traffic Impact Opinion

A separate Traffic Impact Opinion letter has been completed to ensure that no negative traffic impacts will result from the proposed re-development of the subject lands. Refer to **Appendix E** for the Traffic Impact Opinion letter.

7.0 Summary and Conclusions

In conclusion, this Site Servicing and Stormwater Management Report demonstrates how the proposed re-development can be serviced and integrated into the existing Mansfield Ski Club (MSC), without imposing any adverse impacts to the surrounding lands/environment. Specifically, we note the following:

- The re-development can be accommodated with private potable drinking water system consisting of four (4) drilled wells (2 existing and 2 proposed) located at the north limit of the property adjacent to the 17th Sideroad site entrance. From the four (4) drilled wells, two (2) separate raw water supply lines (1 existing and 1 proposed) will supply water from the wells to the existing holding tank buried at the northeast corner of the Main Chalet. From the existing holding tank raw water will be supplied to a proposed water treatment system located within the proposed basement addition of the Main Chalet. The proposed water treatment system will consist of the equipment necessary to treat the raw water in order to meet the requirements of O. Reg. 170/03 and will provide sufficient storage of treated water (Day Tanks) to accommodate the required domestic water supply during maximum day and peak hour demands. Secondary disinfection will be provided by means of chlorination for the proposed domestic water distribution system.

- Fire supply will be provided for the re-development by means of a gravity fed standalone fire supply distribution system complete with four (4) fire hydrants. Sufficient fire storage volume and flow will be provide by means of 4-50,000L concrete tanks connected in parallel and located west of the re-development up the existing ski hill at an elevation (static head) capable of providing the fire flows at 20psi pressure for each of the respective fire hydrants. A proposed connection to the snow making supply line in the vicinity of the storage tanks will be used to fill the tanks with water from the proposed snow making pond when necessary. A low level alarm will be installed to ensure that the tanks stay full at all times.
- Sanitary drainage will be provided via a proposed sanitary sewer system which will discharge the re-developments influent into an on-site sewage treatment system (Waterloo Biofilter system complete with surface disposal). The proposed on-site sewage treatment system will discharge the treated effluent safely back into the environment as determined by the previously completed and MECP approved Assimilative Capacity Study completed for the Pine River. The treated effluent will discharge into a proposed storm sewer system running down the Chalet Ski run immediately north of the Main Chalet, to base of the ski run where it will drain further east and ultimately into the Pine River.
- Stormwater quantity control will be provided to attenuate the post-development 2-100 year design storm peak flows to their corresponding pre-development target rates for the site via the use a dry detention basin complete with an outlet structure consisting of a combination of weirs and an orifice plate located within a ditch inlet catchbasin. An Overflow Spillway Weir and Overflow Spillway built into the southeast corner of the basin will convey peak flows to the site outlet in the event of a blockage of the outlet structure. The area at the northeast limit of the re-development area that is not able to be directed into the proposed dry detention basin has been reduced as much as possible through proposed re-grading, to ensure that all peak flows and runoff volumes in the post-development condition are equal to or less than those of the pre-development condition.
- Stormwater quality control, phosphorus reduction and overall water balance as per NVCA standards will be provided via the use of an integrated treatment train approach which will help minimize any negative impacts the proposed re-development may have on the existing quality of stormwater runoff. An 'Enhanced' Level of Protection, as defined in the MOE's Stormwater Management Planning & Design Manual, will be provided through the use of grass buffers (grass filter strips) for pre-treatment of the runoff, and enhanced grass swales in conjunction with a dry detention basin for their inherent water balance, phosphorus loading reduction and TSS removal efficiency benefits. Inlet structures within the proposed storm sewer on-site will consist of deep sumps to aid in TSS removal upstream of the dry detention basin. In addition to the treatment train approach noted above, all pervious surfaces have been maximized (gravel parking and landscaped areas) as

per the Landscaping Plans (by others), to match as closely as possible the post- to pre-development water balance (evapo-transpiration and infiltration) volumes on-site.

- The proposed grading scheme for the site can be achieved while maintaining existing overall drainage patterns. The site will consist of sufficient topographic relief to provide adequate overland sheet flow conveyance for the majority of the site’s runoff in a northwest-southeast direction towards the proposed dry detention basin which will discharge to the sites existing outlet at the southeast corner of the property. Considering this, it is anticipated that the proposed re-development will not adversely affect existing major and/or minor system stormwater flow routes.
- A separate Traffic Impact Opinion letter has been completed to ensure that no negative traffic impacts will result from the proposed re-development of the subject lands.
- The use of silt fence, straw bale check dams, and existing vegetated buffers will ensure downstream stormwater quality is maintained during construction.

The site servicing design as described above is considered to be capable of adequately servicing the proposed re-development and the stormwater management system can be constructed and maintained as a feasible method of treating, controlling and discharging all stormwater run-off generated on-site safely to existing outlets. This Site Servicing and Stormwater Management Report and the associated engineering design drawings are based on information provided at the time of their preparation and are considered only applicable to the proposed works as described in this report. Any changes subsequent to the report and drawings date of issuance should be reviewed by WMI & Associates Ltd. to ensure applicability of the design contained within the documents.

Based on the above, we request that this report be received by the Township of Mulmur and the NVCA in support of the construction of the proposed re-development submitted on behalf of the MSC.

Respectfully submitted,

WMI & Associates Limited

Ben Daniels

REGISTERED PROFESSIONAL ENGINEER
J.W.LIGHTHEART
100140403
Dec 15/20
PROVINCE OF ONTARIO

Benjamin Daniels, B. Eng.

Jeremy W. Lightheart, P. Eng.

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T:416–588–6370
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CERTIFICATE OF PRACTICE NUMBER:
3356
Name of Project:
MANSFIELD SKI CLUB
Location: MULMUR TOWNSHIP – DUFFERIN COUNTY

PROJECT DESCRIPTION: NEW 3–STOREY, TWELVE–PLEX, DWELLING UNITS		O.B.C. REFERENCE:
BLOCK 1		PART 9 / PART 3
MAJOR OCCUPANCY(s):	RESIDENTIAL – GROUP C	9.10.2.1 & 3.2.2.47
BUILDING AREA (M^2) (FOOTPRINT):	GROUND FLOOR: TOTAL 345.0M²	1.4.1.2
GROSS AREA (M^2):	BASEMENT FLOOR: 345.0M² GROUND FLOOR: 345.0M² SECOND FLOOR: 240.0M² THIRD FLOOR: 240.5M² TOTAL: 1,170.0M²	1.4.1.2
NUMBER OF STOREYS	ABOVE GRADE: 3 BELOW GRADE: 1	1.4.1.2
HEIGHT OF BUILDING (M^2)	14M	1.4.1.2
NUMBER OF STREETS / ACCESS ROUTES:	ONE STREET	3.2.2.47
BUILDING CLASSIFICATION:	RESIDENTIAL, GROUP C, UP TO 3 STOREYS	3.2.2.47
SPRINKLER SYSTEM:	NOT REQUIRED	3.2.2.47
STANDPIPE:	NOT REQUIRED	3.2.9
FIRE ALARM:	NOT REQUIRED	9.10.18.2(2) & 3.2.4.1
WATER SERVICE / SUPPLY IS ADEQUATE:	YES	9.31.3 & 3.7.4
HIGH BUILDING	NO	3.2.6
CONSTRUCTION:	COMBUSTIBLE	3.2.2.47
MEZZANINE(S):	N/A	9.10.4.1 & 3.2.8
TOTAL OCCUPANCY LOAD:	GROUND FLOOR: 12 PERSONS FIRST FLOOR: 12 PERSONS SECOND FLOOR: 12 PERSONS THIRD FLOOR: 12 PERSONS TOTAL: 48 PERSONS	9.9.1.3 & 3.1.17
PLUMBING FACILITIES:	YES	9.31.4 & 3.7.4
BARRIER–FREE DESIGN:	YES	9.5.2.1(2) & 3.8.1.1
HAZARDOUS MATERIALS:	NO	9.10.1.3(4) & 3.3.1.2
TRAVEL DISTANCE:	EGRESS FROM DWELLING UNITS	9.9.9.1, 9.9.8.6 & 3.3.4.4
FIRE EXTINGUISHERS:	NOT REQUIRED	9.10.20.4 & 3.2.5.17
SMOKE ALARMS:	REQUIRED	9.10.19 & 3.2.4.22
CARBON MONOXIDE ALARMS:	REQUIRED	9.33.4
SPATIAL SEPARATION – CONSTRUCTION OF EXTERIOR WALLS		9.10.14 & 3.2.3.1

WALL	E.B.F. (LARGEST FIRE COMP.)	L.D (m)	L/H OR H/L	PERMITTED MAX % OF OPENINGS	PROPOSED % OF OPENINGS	F.R.R. (HOURS)	TYPE OF CONST.	TYPE OF CLADDING
NORTH	58.8 sq.m	4.2	LESS THAN 3:1	22	20	1HR	COMBUST. OR NONCOMBUST.	NONCOMBUST.
SOUTH	58.8 sq.m	4.5	LESS THAN 3:1	29	25	45MIN.	COMBUST. OR NONCOMBUST.	NONCOMBUST.
EAST	29.4 sq.m	4.3	LESS THAN 3:1	35	30	45MIN.	COMBUST. OR NONCOMBUST.	NONCOMBUST.
WEST	29.4 sq.m	12.8	LESS THAN 3:1	100	80	45MIN.	COMBUST. OR NONCOMBUST.	COMBUST. OR NONCOMBUST.

REQUIRED FIRE RESISTANCE RATING FOR STRUCTURAL MEMBERS AND ASSEMBLIES (FRR):		9.10.8, 9.10.9 & 3.2.2.47
HORIZONTAL ASSEMBLIES FRR (HOURS): FLOORS: ROOF: MEZZANINE:	45 MIN NOT REQUIRED N/A	(1Hr) ASSEMBLY No.F6h, O.B.C. SB–3
VERTICAL ASSEMBLIES FRR (HOURS): TYPICAL DEMISING WALLS: DEMISING WALLS AT STAIRS:	45 MIN 45 MIN	(1Hr) ASSEMBLY No.W9b, O.B.C. SB–3 (1Hr) ASSEMBLY No.W9b, O.B.C. SB–3
CORRIDOR FRR (HOURS):	N/A	3.3.1.4
SUITE SEPARATION FRR (HOURS):	1 HR	3.3.4.2

BLOCK 1

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CERTIFICATE OF PRACTICE NUMBER:
3356
Name of Project:
MANSFIELD SKI CLUB
Location: MULMUR TOWNSHIP – DUFFERIN COUNTY

PROJECT DESCRIPTION: NEW 3–STOREY, TWELVE–PLEX, DWELLING UNITS		O.B.C. REFERENCE:
BLOCK 2		PART 9 / PART 3
MAJOR OCCUPANCY(s):	RESIDENTIAL – GROUP C	9.10.2.1 & 3.2.2.47
BUILDING AREA (M^2) (FOOTPRINT):	GROUND FLOOR: TOTAL 345.0M²	1.4.1.2
GROSS AREA (M^2):	BASEMENT FLOOR: 345.0M² GROUND FLOOR: 345.0M² SECOND FLOOR: 240.0M² THIRD FLOOR: 240.0M² TOTAL: 1,170.0M²	1.4.1.2
NUMBER OF STOREYS	ABOVE GRADE: 3 BELOW GRADE: 1	1.4.1.2
HEIGHT OF BUILDING (M^2)	14M	1.4.1.2
NUMBER OF STREETS / ACCESS ROUTES:	ONE STREET	3.2.2.47
BUILDING CLASSIFICATION:	RESIDENTIAL, GROUP C, UP TO 3 STOREYS	3.2.2.47
SPRINKLER SYSTEM:	NOT REQUIRED	3.2.2.47
STANDPIPE:	NOT REQUIRED	3.2.9
FIRE ALARM:	NOT REQUIRED	9.10.18.2(2) & 3.2.4.1
WATER SERVICE / SUPPLY IS ADEQUATE:	YES	9.31.3 & 3.7.4
HIGH BUILDING	NO	3.2.6
CONSTRUCTION:	COMBUSTIBLE	3.2.2.47
MEZZANINE(S):	N/A	9.10.4.1 & 3.2.8
TOTAL OCCUPANCY LOAD:	BASEMENT FLOOR: 12 PERSONS GROUND FLOOR: 12 PERSONS SECOND FLOOR: 12 PERSONS THIRD FLOOR: 12 PERSONS TOTAL: 48 PERSONS	9.9.1.3 & 3.1.17
PLUMBING FACILITIES:	YES	9.31.4 & 3.7.4
BARRIER–FREE DESIGN:	YES	9.5.2.1(2) & 3.8.1.1
HAZARDOUS MATERIALS:	NO	9.10.1.3(4) & 3.3.1.2
TRAVEL DISTANCE:	EGRESS FROM DWELLING UNITS	9.9.9.1, 9.9.8.6 & 3.3.4.4
FIRE EXTINGUISHERS:	NOT REQUIRED	9.10.20.4 & 3.2.5.17
SMOKE ALARMS:	REQUIRED	9.10.19 & 3.2.4.22
CARBON MONOXIDE ALARMS:	REQUIRED	9.33.4
SPATIAL SEPARATION – CONSTRUCTION OF EXTERIOR WALLS		9.10.14 & 3.2.3.1

WALL	E.B.F. (LARGEST FIRE COMP.)	L.D (m)	L/H OR H/L	PERMITTED MAX % OF OPENINGS	PROPOSED % OF OPENINGS	F.R.R. (HOURS)	TYPE OF CONST.	TYPE OF CLADDING
NORTH	58.8 sq.m	4.5	LESS THAN 3:1	29	25	45MIN	COMBUST. OR NONCOMBUST.	NONCOMBUST.
SOUTH	58.8 sq.m	5.5	LESS THAN 3:1	41	40	45MIN.	COMBUST. OR NONCOMBUST.	NONCOMBUST.
EAST	29.4 sq.m	4.8	LESS THAN 3:1	58	55	45MIN.	COMBUST. OR NONCOMBUST.	NONCOMBUST.
WEST	29.4 sq.m	6	LESS THAN 3:1	83	80	45MIN.	COMBUST. OR NONCOMBUST.	COMBUST. OR NONCOMBUST.

REQUIRED FIRE RESISTANCE RATING FOR STRUCTURAL MEMBERS AND ASSEMBLIES (FRR):		9.10.8, 9.10.9 & 3.2.2.47
HORIZONTAL ASSEMBLIES FRR (HOURS): FLOORS: ROOF: MEZZANINE:	45 MIN NOT REQUIRED N/A	(1Hr) ASSEMBLY No.F6h, O.B.C. SB–3
VERTICAL ASSEMBLIES FRR (HOURS): TYPICAL DEMISING WALLS: DEMISING WALLS AT STAIRS:	45 MIN 45 MIN	(1Hr) ASSEMBLY No.W9b, O.B.C. SB–3 (1Hr) ASSEMBLY No.W9b, O.B.C. SB–3
CORRIDOR FRR (HOURS):	N/A	3.3.1.4
SUITE SEPARATION FRR (HOURS):	1 HR	3.3.4.2

BLOCK 2

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3356
Name of Project:
MANSFIELD SKI CLUB
Location: MULMUR TOWNSHIP – DUFFERIN COUNTY

PROJECT DESCRIPTION: NEW 3–STOREY, TEN–PLEX, DWELLING UNITS		O.B.C. REFERENCE:
BLOCK 3		PART 9 / PART 3
MAJOR OCCUPANCY(s):	RESIDENTIAL – GROUP C	9.10.2.1 & 3.2.2.47
BUILDING AREA (M^2) (FOOTPRINT):	GROUND FLOOR: TOTAL 290.0M²	1.4.1.2
GROSS AREA (M^2):	BASEMENT FLOOR: 290.0M² GROUND FLOOR: 290.0M² SECOND FLOOR: 196.0M² THIRD FLOOR: 196.0M² TOTAL: 972.0M²	1.4.1.2
NUMBER OF STOREYS	ABOVE GRADE: 3 BELOW GRADE: 1	1.4.1.2
HEIGHT OF BUILDING (M^2)	14M	1.4.1.2
NUMBER OF STREETS / ACCESS ROUTES:	TWO STREET	3.2.2.47
BUILDING CLASSIFICATION:	RESIDENTIAL, GROUP C, UP TO 3 STOREYS	3.2.2.47
SPRINKLER SYSTEM:	NOT REQUIRED	3.2.2.47
STANDPIPE:	NOT REQUIRED	3.2.9
FIRE ALARM:	NOT REQUIRED	9.10.18.2(2) & 3.2.4.1
WATER SERVICE / SUPPLY IS ADEQUATE:	YES	9.31.3 & 3.7.4
HIGH BUILDING	NO	3.2.6
CONSTRUCTION:	COMBUSTIBLE	3.2.2.47
MEZZANINE(S):	N/A	9.10.4.1 & 3.2.8
TOTAL OCCUPANCY LOAD:	BASEMENT FLOOR: 10 PERSONS GROUND FLOOR: 10 PERSONS SECOND FLOOR: 10 PERSONS THIRD FLOOR: 10 PERSONS TOTAL: 40 PERSONS	9.9.1.3 & 3.1.17
PLUMBING FACILITIES:	YES	9.31.4 & 3.7.4
BARRIER–FREE DESIGN:	YES	9.5.2.1(2) & 3.8.1.1
HAZARDOUS MATERIALS:	NO	9.10.1.3(4) & 3.3.1.2
TRAVEL DISTANCE:	EGRESS FROM DWELLING UNITS	9.9.9.1, 9.9.8.6 & 3.3.4.4
FIRE EXTINGUISHERS:	NOT REQUIRED	9.10.20.4 & 3.2.5.17
SMOKE ALARMS:	REQUIRED	9.10.19 & 3.2.4.22
CARBON MONOXIDE ALARMS:	REQUIRED	9.33.4
SPATIAL SEPARATION – CONSTRUCTION OF EXTERIOR WALLS		9.10.14 & 3.2.3.1

WALL	E.B.F. (LARGEST FIRE COMP.)	L.D (m)	L/H OR H/L	PERMITTED MAX % OF OPENINGS	PROPOSED % OF OPENINGS	F.R.R. (HOURS)	TYPE OF CONST.	TYPE OF CLADDING
NORTH	58.8 sq.m	5	LESS THAN 3:1	32	30	45MIN	COMBUST. OR NONCOMBUST.	NONCOMBUST.
SOUTH	58.8 sq.m	6.5	LESS THAN 3:1	57.6	50	45MIN.	COMBUST. OR NONCOMBUST.	NONCOMBUST.
EAST	29.4 sq.m	4.6	LESS THAN 3:1	51.5	45	45MIN.	COMBUST. OR NONCOMBUST.	NONCOMBUST.
WEST	29.4 sq.m	5.5	LESS THAN 3:1	76	70	45MIN.	COMBUST. OR NONCOMBUST.	COMBUST. OR NONCOMBUST.

REQUIRED FIRE RESISTANCE RATING FOR STRUCTURAL MEMBERS AND ASSEMBLIES (FRR):		9.10.8, 9.10.9 & 3.2.2.47
HORIZONTAL ASSEMBLIES FRR (HOURS): FLOORS: ROOF: MEZZANINE:	45 MIN NOT REQUIRED N/A	(1Hr) ASSEMBLY No.F6h, O.B.C. SB–3
VERTICAL ASSEMBLIES FRR (HOURS): TYPICAL DEMISING WALLS: DEMISING WALLS AT STAIRS:	45 MIN 45 MIN	(1Hr) ASSEMBLY No.W9b, O.B.C. SB–3 (1Hr) ASSEMBLY No.W9b, O.B.C. SB–3
CORRIDOR FRR (HOURS):	N/A	3.3.1.4
SUITE SEPARATION FRR (HOURS):	1 HR	3.3.4.2

BLOCK 3

FIRM NAME:
+VG ARCHITECTS
72 STAFFORD STREET, SUITE 200, TORONTO, ONTARIO, M6J 3L1
T:416–588–6370
F: 416–588–6327
CERTIFICATE OF PRACTICE NUMBER:
3356
Name of Project:
MANSFIELD SKI CLUB
Location: MULMUR TOWNSHIP – DUFFERIN COUNTY

PROJECT DESCRIPTION: NEW 3–STOREY, EIGHT–PLEX, DWELLING UNITS		O.B.C. REFERENCE:
BLOCK 4		PART 9 / PART 3
MAJOR OCCUPANCY(s):	RESIDENTIAL – GROUP C	9.10.2.1 & 3.2.2.47
BUILDING AREA (M^2) (FOOTPRINT):	GROUND FLOOR: TOTAL 230.0M²	1.4.1.2
GROSS AREA (M^2):	BASEMENT FLOOR: 230.0M² GROUND FLOOR: 230.0M² SECOND FLOOR: 160.0M² THIRD FLOOR: 160.0M² TOTAL: 780.0M²	1.4.1.2
NUMBER OF STOREYS	ABOVE GRADE: 3 BELOW GRADE: 1	1.4.1.2
HEIGHT OF BUILDING (M^2)	14M	1.4.1.2
NUMBER OF STREETS / ACCESS ROUTES:	THREE STREETS	3.2.2.47
BUILDING CLASSIFICATION:	RESIDENTIAL, GROUP C, UP TO 3 STOREYS	3.2.2.47
SPRINKLER SYSTEM:	NOT REQUIRED	3.2.2.47
STANDPIPE:	NOT REQUIRED	3.2.9
FIRE ALARM:	NOT REQUIRED	9.10.18.2(2) & 3.2.4.1
WATER SERVICE / SUPPLY IS ADEQUATE:	YES	9.31.3 & 3.7.4
HIGH BUILDING	NO	3.2.6
CONSTRUCTION:	COMBUSTIBLE	3.2.2.47
MEZZANINE(S):	N/A	9.10.4.1 & 3.2.8
TOTAL OCCUPANCY LOAD:	BASEMENT FLOOR: 8 PERSONS GROUND FLOOR: 8 PERSONS SECOND FLOOR: 8 PERSONS THIRD FLOOR: 8 PERSONS TOTAL: 32 PERSONS	9.9.1.3 & 3.1.17
PLUMBING FACILITIES:	YES	9.31.4 & 3.7.4
BARRIER–FREE DESIGN:	YES	9.5.2.1(2) & 3.8.1.1
HAZARDOUS MATERIALS:	NO	9.10.1.3(4) & 3.3.1.2
TRAVEL DISTANCE:	EGRESS FROM DWELLING UNITS	9.9.9.1, 9.9.8.6 & 3.3.4.4
FIRE EXTINGUISHERS:	NOT REQUIRED	9.10.20.4 & 3.2.5.17
SMOKE ALARMS:	REQUIRED	9.10.19 & 3.2.4.22
CARBON MONOXIDE ALARMS:	REQUIRED	9.33.4
SPATIAL SEPARATION – CONSTRUCTION OF EXTERIOR WALLS		9.10.14 & 3.2.3.1

WALL	E.B.F. (LARGEST FIRE COMP.)	L.D (m)	L/H OR H/L	PERMITTED MAX % OF OPENINGS	PROPOSED % OF OPENINGS	F.R.R. (HOURS)	TYPE OF CONST.	TYPE OF CLADDING
NORTH	58.8 sq.m	5	LESS THAN 3:1	32	30	45MIN	COMBUST. OR NONCOMBUST.	NONCOMBUST.
SOUTH	58.8 sq.m	8.6	LESS THAN 3:1	100	80	45MIN.	COMBUST. OR NONCOMBUST.	NONCOMBUST.
EAST	29.4 sq.m	4.8	LESS THAN 3:1	53.8	50	45MIN.	COMBUST. OR NONCOMBUST.	NONCOMBUST.
WEST	29.4 sq.m	5	LESS THAN 3:1	56	50	45MIN.	COMBUST. OR NONCOMBUST.	COMBUST. OR NONCOMBUST.

REQUIRED FIRE RESISTANCE RATING FOR STRUCTURAL MEMBERS AND ASSEMBLIES (FRR):		9.10.8, 9.10.9 & 3.2.2.47
HORIZONTAL ASSEMBLIES FRR (HOURS): FLOORS: ROOF: MEZZANINE:	45 MIN NOT REQUIRED N/A	(1Hr) ASSEMBLY No.F6h, O.B.C. SB–3
VERTICAL ASSEMBLIES FRR (HOURS): TYPICAL DEMISING WALLS: DEMISING WALLS AT STAIRS:	45 MIN 45 MIN	(1Hr) ASSEMBLY No.W9b, O.B.C. SB–3 (1Hr) ASSEMBLY No.W9b, O.B.C. SB–3
CORRIDOR FRR (HOURS):	N/A	3.3.1.4
SUITE SEPARATION FRR (HOURS):	1 HR	3.3.4.2

BLOCK 4

FIRM NAME:
+VG ARCHITECTS
72 STAFFORD STREET, SUITE 200, TORONTO, ONTARIO, M6J 3L1
T:416–588–6370
F: 416–588–6327
CERTIFICATE OF PRACTICE NUMBER:
3356
Name of Project:
MANSFIELD SKI CLUB
Location: MULMUR TOWNSHIP – DUFFERIN COUNTY

PROJECT DESCRIPTION: NEW 3–STOREY, TWELVE–PLEX, DWELLING UNITS		O.B.C. REFERENCE:
BLOCK 5		PART 9 / PART 3
MAJOR OCCUPANCY(s):	RESIDENTIAL – GROUP C	9.10.2.1 & 3.2.2.47
BUILDING AREA (M^2) (FOOTPRINT):	GROUND FLOOR: TOTAL 345.0M²	1.4.1.2
GROSS AREA (M^2):	BASEMENT FLOOR: 345.0M² GROUND FLOOR: 345.0M² SECOND FLOOR: 240.0M² THIRD FLOOR: 240.0M² TOTAL: 1,170.0M²	1.4.1.2
NUMBER OF STOREYS	ABOVE GRADE: 3 BELOW GRADE: 1	1.4.1.2
HEIGHT OF BUILDING (M^2)	14M	1.4.1.2
NUMBER OF STREETS / ACCESS ROUTES:	THREE STREETS	3.2.2.47
BUILDING CLASSIFICATION:	RESIDENTIAL, GROUP C, UP TO 3 STOREYS	3.2.2.47
SPRINKLER SYSTEM:	NOT REQUIRED	3.2.2.47
STANDPIPE:	NOT REQUIRED	3.2.9
FIRE ALARM:	NOT REQUIRED	9.10.18.2(2) & 3.2.4.1
WATER SERVICE / SUPPLY IS ADEQUATE:	YES	9.31.3 & 3.7.4
HIGH BUILDING	NO	3.2.6
CONSTRUCTION:	COMBUSTIBLE	3.2.2.47
MEZZANINE(S):	N/A	9.10.4.1 & 3.2.8
TOTAL OCCUPANCY LOAD:	BASEMENT FLOOR: 12 PERSONS GROUND FLOOR: 12 PERSONS SECOND FLOOR: 12 PERSONS THIRD FLOOR: 12 PERSONS TOTAL: 48 PERSONS	9.9.1.3 & 3.1.17
PLUMBING FACILITIES:	YES	9.31.4 & 3.7.4
BARRIER–FREE DESIGN:	YES	9.5.2.1(2) & 3.8.1.1
HAZARDOUS MATERIALS:	NO	9.10.1.3(4) & 3.3.1.2
TRAVEL DISTANCE:	EGRESS FROM DWELLING UNITS	9.9.9.1, 9.9.8.6 & 3.3.4.4
FIRE EXTINGUISHERS:	NOT REQUIRED	9.10.20.4 & 3.2.5.17
SMOKE ALARMS:	REQUIRED	9.10.19 & 3.2.4.22
CARBON MONOXIDE ALARMS:	REQUIRED	9.33.4
SPATIAL SEPARATION – CONSTRUCTION OF EXTERIOR WALLS		9.10.14 & 3.2.3.1

WALL	E.B.F. (LARGEST FIRE COMP.)	L.D (m)	L/H OR H/L	PERMITTED MAX % OF OPENINGS	PROPOSED % OF OPENINGS	F.R.R. (HOURS)	TYPE OF CONST.	TYPE OF CLADDING
NORTH	58.8 sq.m	11	LESS THAN 3:1	100	80	45MIN	COMBUST. OR NONCOMBUST.	NONCOMBUST.
SOUTH	58.8 sq.m	8.4	LESS THAN 3:1	85	80	45MIN.	COMBUST. OR NONCOMBUST.	NONCOMBUST.
EAST	29.4 sq.m	5	LESS THAN 3:1	56	50	45MIN.	COMBUST. OR NONCOMBUST.	NONCOMBUST.
WEST	29.4 sq.m	13.8	LESS THAN 3:1	100	80	45MIN.	COMBUST. OR NONCOMBUST.	COMBUST. OR NONCOMBUST.

REQUIRED FIRE RESISTANCE RATING FOR STRUCTURAL MEMBERS AND ASSEMBLIES (FRR):		9.10.8, 9.10.9 & 3.2.2.47
HORIZONTAL ASSEMBLIES FRR (HOURS): FLOORS: ROOF: MEZZANINE:	45 MIN NOT REQUIRED N/A	(1Hr) ASSEMBLY No.F6h, O.B.C. SB–3
VERTICAL ASSEMBLIES FRR (HOURS): TYPICAL DEMISING WALLS: DEMISING WALLS AT STAIRS:	45 MIN 45 MIN	(1Hr) ASSEMBLY No.W9b, O.B.C. SB–3 (1Hr) ASSEMBLY No.W9b, O.B.C. SB–3
CORRIDOR FRR (HOURS):	N/A	3.3.1.4
SUITE SEPARATION FRR (HOURS):	1 HR	3.3.4.2

BLOCK 5

FIRM NAME:
+VG ARCHITECTS
72 STAFFORD STREET, SUITE 200, TORONTO, ONTARIO, M6J 3L1
T:416–588–6370
F: 416–588–6327
CERTIFICATE OF PRACTICE NUMBER:
3356
Name of Project:
MANSFIELD SKI CLUB
Location: MULMUR TOWNSHIP – DUFFERIN COUNTY

PROJECT DESCRIPTION: NEW 3–STOREY, TWELVE–PLEX, DWELLING UNITS		O.B.C. REFERENCE:
BLOCK 6		PART 9 / PART 3
MAJOR OCCUPANCY(s):	RESIDENTIAL – GROUP C	9.10.2.1 & 3.2.2.47
BUILDING AREA (M^2) (FOOTPRINT):	GROUND FLOOR: TOTAL 345.0M²	1.4.1.2
GROSS AREA (M^2):	BASEMENT FLOOR: 345.0M² GROUND FLOOR: 345.0M² SECOND FLOOR: 240.0M² THIRD FLOOR: 240.0M² TOTAL: 1,170.0M²	1.4.1.2
NUMBER OF STOREYS	ABOVE GRADE: 3 BELOW GRADE: 1	1.4.1.2
HEIGHT OF BUILDING (M^2)	14M	1.4.1.2
NUMBER OF STREETS / ACCESS ROUTES:	THREE STREETS	3.2.2.47
BUILDING CLASSIFICATION:	RESIDENTIAL, GROUP C, UP TO 3 STOREYS	3.2.2.47
SPRINKLER SYSTEM:	NOT REQUIRED	3.2.2.47
STANDPIPE:	NOT REQUIRED	3.2.9
FIRE ALARM:	NOT REQUIRED	9.10.18.2(2) & 3.2.4.1
WATER SERVICE / SUPPLY IS ADEQUATE:	YES	9.31.3 & 3.7.4
HIGH BUILDING	NO	3.2.6
CONSTRUCTION:	COMBUSTIBLE	3.2.2.47
MEZZANINE(S):	N/A	9.10.4.1 & 3.2.8
TOTAL OCCUPANCY LOAD:	BASEMENT FLOOR: 12 PERSONS GROUND FLOOR: 12 PERSONS SECOND FLOOR: 12 PERSONS THIRD FLOOR: 12 PERSONS TOTAL: 48 PERSONS	9.9.1.3 & 3.1.17
PLUMBING FACILITIES:	YES	9.31.4 & 3.7.4
BARRIER–FREE DESIGN:	YES	9.5.2.1(2) & 3.8.1.1
HAZARDOUS MATERIALS:	NO	9.10.1.3(4) & 3.3.1.2
TRAVEL DISTANCE:	EGRESS FROM DWELLING UNITS	9.9.9.1, 9.9.8.6 & 3.3.4.4
FIRE EXTINGUISHERS:	NOT REQUIRED	9.10.20.4 & 3.2.5.17
SMOKE ALARMS:	REQUIRED	9.10.19 & 3.2.4.22
CARBON MONOXIDE ALARMS:	REQUIRED	9.33.4
SPATIAL SEPARATION – CONSTRUCTION OF EXTERIOR WALLS		9.10.14 & 3.2.3.1

WALL	E.B.F. (LARGEST FIRE COMP.)	L.D (m)	L/H OR H/L	PERMITTED MAX % OF OPENINGS	PROPOSED % OF OPENINGS	F.R.R. (HOURS)	TYPE OF CONST.	TYPE OF CLADDING
NORTH	58.8 sq.m	6.7	LESS THAN 3:1	60	65	45MIN	COMBUST. OR NONCOMBUST.	NONCOMBUST.
SOUTH	58.8 sq.m	20	LESS THAN 3:1	100	80	45MIN.	COMBUST. OR NONCOMBUST.	NONCOMBUST.
EAST	29.4 sq.m	6	LESS THAN 3:1	83	80	45MIN.	COMBUST. OR NONCOMBUST.	NONCOMBUST.
WEST	29.4 sq.m	13.5	LESS THAN 3:1	100	80	45MIN.	COMBUST. OR NONCOMBUST.	COMBUST. OR NONCOMBUST.

REQUIRED FIRE RESISTANCE RATING FOR STRUCTURAL MEMBERS AND ASSEMBLIES (FRR):		9.10.8, 9.10.9 & 3.2.2.47
HORIZONTAL ASSEMBLIES FRR (HOURS): FLOORS: ROOF: MEZZANINE:	45 MIN NOT REQUIRED N/A	(1Hr) ASSEMBLY No.F6h, O.B.C. SB–3
VERTICAL ASSEMBLIES FRR (HOURS): TYPICAL DEMISING WALLS: DEMISING WALLS AT STAIRS:	45 MIN 45 MIN	(1Hr) ASSEMBLY No.W9b, O.B.C. SB–3 (1Hr) ASSEMBLY No.W9b, O.B.C. SB–3
CORRIDOR FRR (HOURS):	N/A	3.3.1.4
SUITE SEPARATION FRR (HOURS):	1 HR	3.3.4.2

BLOCK 6

FIRM NAME:
+VG ARCHITECTS
72 STAFFORD STREET, SUITE 200, TORONTO, ONTARIO, M6J 3L1
T:416–588–6370
F: 416–588–6327
CERTIFICATE OF PRACTICE NUMBER:
3356
Name of Project:
MANSFIELD SKI CLUB
Location: MULMUR TOWNSHIP – DUFFERIN COUNTY

PROJECT DESCRIPTION: NEW 3–STOREY, TEN–PLEX, DWELLING UNITS & RETAIL UNITS		O.B.C. REFERENCE:
BUILDING A		PART 9 / PART 3
MAJOR OCCUPANCY(s):	RESIDENTIAL – GROUP C OFFICE OR PERSONAL BUSINESS – GROUP D	9.10.2.1 / 3.2.2.47 & 3.2.2.53
BUILDING AREA (M^2) (FOOTPRINT):	GROUND FLOOR: TOTAL 630.0M²	1.4.1.2
GROSS AREA (M^2):	GROUND FLOOR (SEE NOTE 1): 630.0M² MEZZANINE FLOOR (SEE NOTE 1): 252.0M² SECOND FLOOR (RESIDENTIAL): 630.0M² THIRD FLOOR (RESIDENTIAL): 630.0M² TOTAL: 2,142.0M²	1.4.1.2 NOTE 1: ANCILLARY USES TO EXISTING SKI LODGE I.E. ADMINISTRATIVE OFFICES, SKI LOCKERS & TUNING ROOMS, ETC.
NUMBER OF STOREYS	ABOVE GRADE: 3 BELOW GRADE: N/A	1.4.1.2
HEIGHT OF BUILDING (M^2)	14M	1.4.1.2
NUMBER OF STREETS / ACCESS ROUTES:	THREE STREETS	3.2.2.47 & 3.2.2.53
BUILDING CLASSIFICATION:	OFFICE OR PERS. BUSINESS, GROUP D, UP TO 3 STOREYS RESIDENTIAL, GROUP C, UP TO 3 STOREYS	3.2.2.53 9.10.2.1 & 3.2.2.47
SPRINKLER SYSTEM:	NOT REQUIRED	3.2.2.47 & 3.2.2.53
STANDPIPE:	NOT REQUIRED	3.2.9
FIRE ALARM:	NOT REQUIRED	9.10.18.2(2) & 3.2.4.1
WATER SERVICE / SUPPLY IS ADEQUATE:	YES	9.31.3 & 3.7.4
HIGH BUILDING	NO	3.2.6
CONSTRUCTION:	COMBUSTIBLE OR NON COMBUSTIBLE	3.2.2.47 & 3.2.2.53
MEZZANINE(S):	YES	9.10.4.1 & 3.2.8
TOTAL OCCUPANCY LOAD:	GROUND FLOOR (GROUP D): 137 PERSONS MEZZANINE FLOOR (GROUP D): 55 PERSONS SECOND FLOOR (RESIDENTIAL): 20 PERSONS THIRD FLOOR (RESIDENTIAL): 20 PERSONS TOTAL: 232 PERSONS	9.9.1.3 & 3.1.17
PLUMBING FACILITIES:	YES	9.31.4 & 3.7.4
BARRIER–FREE DESIGN:	YES	9.5.2.1(2) & 3.8.1.1
HAZARDOUS MATERIALS:	NO	9.10.1.3(4) & 3.3.1.2
TRAVEL DISTANCE:	EGRESS FROM DWELLING UNITS	9.9.9.1, 9.9.8.6 & 3.3.4.4
FIRE EXTINGUISHERS:	NOT REQUIRED	9.10.20.4 & 3.2.5.17
SMOKE ALARMS:	REQUIRED	9.10.19 & 3.2.4.22
CARBON MONOXIDE ALARMS:	REQUIRED	9.33.4
SPATIAL SEPARATION – CONSTRUCTION OF EXTERIOR WALLS		9.10.14 & 3.2.3.1

WALL	E.B.F. (LARGEST FIRE COMP.)	L.D (m)	L/H OR H/L	PERMITTED MAX % OF OPENINGS	PROPOSED % OF OPENINGS	F.R.R. (HOURS)	TYPE OF CONST.	TYPE OF CLADDING
NORTH	45 sq.m	10	LESS THAN 3:1	76	70	45MIN	COMBUST. OR NONCOMBUST.	NONCOMBUST.
SOUTH	45 sq.m	5	LESS THAN 3:1	18	15	45MIN.	COMBUST. OR NONCOMBUST.	NONCOMBUST.
EAST	42 sq.m	8	LESS THAN 3:1	59	55	45MIN.	COMBUST. OR NONCOMBUST.	NONCOMBUST.
WEST	42 sq.m	9.3	LESS THAN 3:1	76	70	45MIN.	COMBUST. OR NONCOMBUST.	COMBUST. OR NONCOMBUST.

REQUIRED FIRE RESISTANCE RATING FOR STRUCTURAL MEMBERS AND ASSEMBLIES (FRR):		9.10.8, 9.10.9 & 3.2.2.47
HORIZONTAL ASSEMBLIES FRR (HOURS): FLOORS: ROOF: MEZZANINE: SEPARATION OF MAJOR OCCUPANCIES:	45 MIN 45 MIN 45 MIN 1 HRS	(1Hr) ASSEMBLY No.F6h, O.B.C. SB–3
VERTICAL ASSEMBLIES FRR (HOURS): TYPICAL DEMISING WALLS: DEMISING WALLS AT STAIRS:	45 MIN 45 MIN	(1Hr) ASSEMBLY No.W9b, O.B.C. SB–3 (1Hr) ASSEMBLY No.W9b, O.B.C. SB–3
CORRIDOR FRR (HOURS):	45 MIN	3.3.1.4
SUITE SEPARATION FRR (HOURS):	1 HR	3.3.4.2

BUILDING A

FIRM NAME:
+VG ARCHITECTS
72 STAFFORD STREET, SUITE 200, TORONTO, ONTARIO, M6J 3L1
T:416–588–6370
F: 416–588–6327
CERTIFICATE OF PRACTICE NUMBER:
3356
Name of Project:
MANSFIELD SKI CLUB
Location: MULMUR TOWNSHIP – DUFFERIN COUNTY

PROJECT DESCRIPTION: NEW 3–STOREY, FIFTEEN–PLEX, DWELLING UNITS & RETAIL UNITS		O.B.C. REFERENCE:
BUILDING B		PART 9 / PART 3
MAJOR OCCUPANCY(s):	RESIDENTIAL – GROUP C OFFICE OR PERSONAL BUSINESS – GROUP D	9.10.2.1 / 3.2.2.47 & 3.2.2.53
BUILDING AREA (M^2) (FOOTPRINT):	GROUND FLOOR: TOTAL 780.0M²	1.4.1.2
GROSS AREA (M^2):	GROUND FLOOR (SEE NOTES 1 & 3): 780.0M² SECOND FLOOR (SEE NOTES 2 & 3): 158.0M² SECOND FLOOR (RESIDENTIAL): 622.0M² THIRD FLOOR (RESIDENTIAL): 780.0M² TOTAL: 2,340.0M²	NOTE 1: EXISTING GROUP "D", NO CHANGE IN USE. EXISTING USES ARE ADMINISTRATIVE OFFICES, SKI LOCKERS, SKI TUNING ROOMS. NOTE 2: EXISTING GROUP "D", NO CHANGE IN USE. EXISTING USE IS ADMINISTRATIVE OFFICES. NOTE 3: BUILDING B GROUND AND PART. 2ND FLOOR AREAS ARE INCLUDED IN THE EXISTING MAIN CHALET, ADMIN BUILDING, GM OFFICE, AND SKI HOUSE.
NUMBER OF STOREYS	ABOVE GRADE: 3 BELOW GRADE: N/A	1.4.1.2
HEIGHT OF BUILDING (M^2)	14M	1.4.1.2
NUMBER OF STREETS / ACCESS ROUTES:	TWO STREETS	3.2.2.47 & 3.2.2.53
BUILDING CLASSIFICATION:	OFFICE OR PERS. BUSINESS GROUP D, UP TO 3 STOREYS RESIDENTIAL, GROUP C, UP TO 3 STOREYS	3.2.2.53 9.10.2.1 & 3.2.2.47
SPRINKLER SYSTEM:	NOT REQUIRED	3.2.2.47 & 3.2.2.53
STANDPIPE:	NOT REQUIRED	3.2.9
FIRE ALARM:	NOT REQUIRED	9.10.18.2(2) & 3.2.4.1
WATER SERVICE / SUPPLY IS ADEQUATE:	YES	9.31.3 & 3.7.4
HIGH BUILDING	NO	3.2.6
CONSTRUCTION:	COMBUSTIBLE OR NON COMBUSTIBLE	3.2.2.47 & 3.2.2.53
MEZZANINE(S):	NO	9.10.4.1 & 3.2.8
TOTAL OCCUPANCY LOAD:	GROUND FLOOR (GROUP D): 168 PERSONS MEZZANINE FLOOR (GROUP D): 34 PERSONS SECOND FLOOR (RESIDENTIAL): 30 PERSONS THIRD FLOOR (RESIDENTIAL): 30 PERSONS TOTAL: 262 PERSONS	9.9.1.3 & 3.1.17
PLUMBING FACILITIES:	YES	9.31.4 & 3.7.4
BARRIER–FREE DESIGN:	YES	9.5.2.1(2) & 3.8.1.1
HAZARDOUS MATERIALS:	NO	9.10.1.3(4) & 3.3.1.2
TRAVEL DISTANCE:	EGRESS FROM DWELLING UNITS	9.9.9.1, 9.9.8.6 & 3.3.4.4
FIRE EXTINGUISHERS:	NOT REQUIRED	9.10.20.4 & 3.2.5.17
SMOKE ALARMS:	REQUIRED	9.10.19 & 3.2.4.22
CARBON MONOXIDE ALARMS:	REQUIRED	9.33.4
SPATIAL SEPARATION – CONSTRUCTION OF EXTERIOR WALLS		9.10.14 & 3.2.3.1

WALL	E.B.F. (LARGEST FIRE COMP.)	L.D (m)	L/H OR H/L	PERMITTED MAX % OF OPENINGS	PROPOSED % OF OPENINGS	F.R.R. (HOURS)	TYPE OF CONST.	TYPE OF CLADDING
NORTH	36 sq.m	8.8	LESS THAN 3:1	74.3	70	45MIN	COMBUST. OR NONCOMBUST.	NONCOMBUST.
SOUTH	48 sq.m	20	LESS THAN 3:1	100	90	45MIN.	COMBUST. OR NONCOMBUST.	NONCOMBUST.
EAST	62.4 sq.m	6.45	LESS THAN 3:1	28.6	25	45MIN.	COMBUST. OR NONCOMBUST.	NONCOMBUST.
WEST	36 sq.m	6	LESS THAN 3:1	32	30	45MIN.	COMBUST. OR NONCOMBUST.	COMBUST. OR NONCOMBUST.

REQUIRED FIRE RESISTANCE RATING FOR STRUCTURAL MEMBERS AND ASSEMBLIES (FRR):		9.10.8, 9.10.9 & 3.2.2.47
HORIZONTAL ASSEMBLIES FRR (HOURS): FLOORS: ROOF: MEZZANINE: SEPARATION OF MAJOR OCCUPANCIES:	45 MIN 45 MIN 45 MIN 1 HRS	(1Hr) ASSEMBLY No.F6h, O.B.C. SB–3
VERTICAL ASSEMBLIES FRR (HOURS): TYPICAL DEMISING WALLS: DEMISING WALLS AT STAIRS:	45 MIN 45 MIN	(1Hr) ASSEMBLY No.W9b, O.B.C. SB–3 (1Hr) ASSEMBLY No.W9b, O.B.C. SB–3
CORRIDOR FRR (HOURS):	45 MIN	3.3.1.4
SUITE SEPARATION FRR (HOURS):	1 HR	3.3.4.2

BUILDING B

LEGEND

GENERAL NOTES:

1. MATRICES PREPARED BY +VG ARCHITECTS LTD. AND CORRESPOND WITH ARCHITECTURAL PLANS PREPARED BY +VG ARCHITECTS LTD.

FLEISHER RIDOUT
PARTNERSHIP INC.
l.a.n.d.s.c.a.p.e a.r.c.h.i.t.e.c.t.s
1877 Davenport Road
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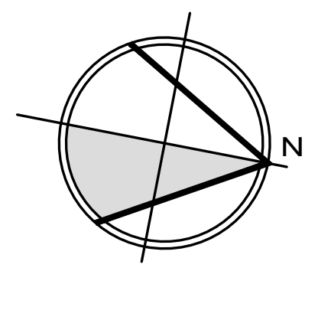
T: (416) 533–4990

ISSUE	DATE	REMARKS
3	DECEMBER 10, 2020	ISSUED FOR 3RD SITE PLAN APPROVAL
2	AUGUST 14, 2020	ISSUED FOR 2ND SITE PLAN APPROVAL
1	FEBRUARY 4, 2020	ISSUED FOR SITE PLAN APPROVAL

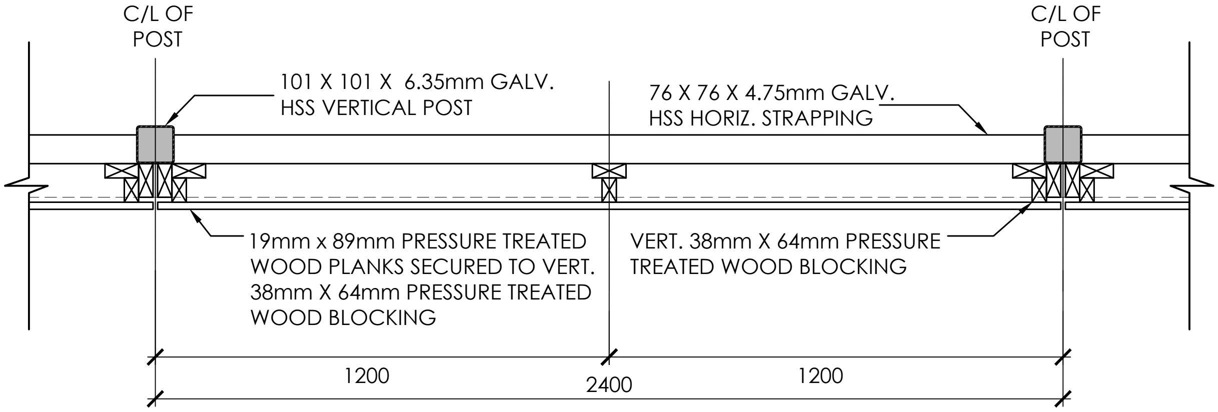
ONTARIO ASSOCIATION OF LANDSCAPE ARCHITECTS
B. J. FLEISHER
MEMBER



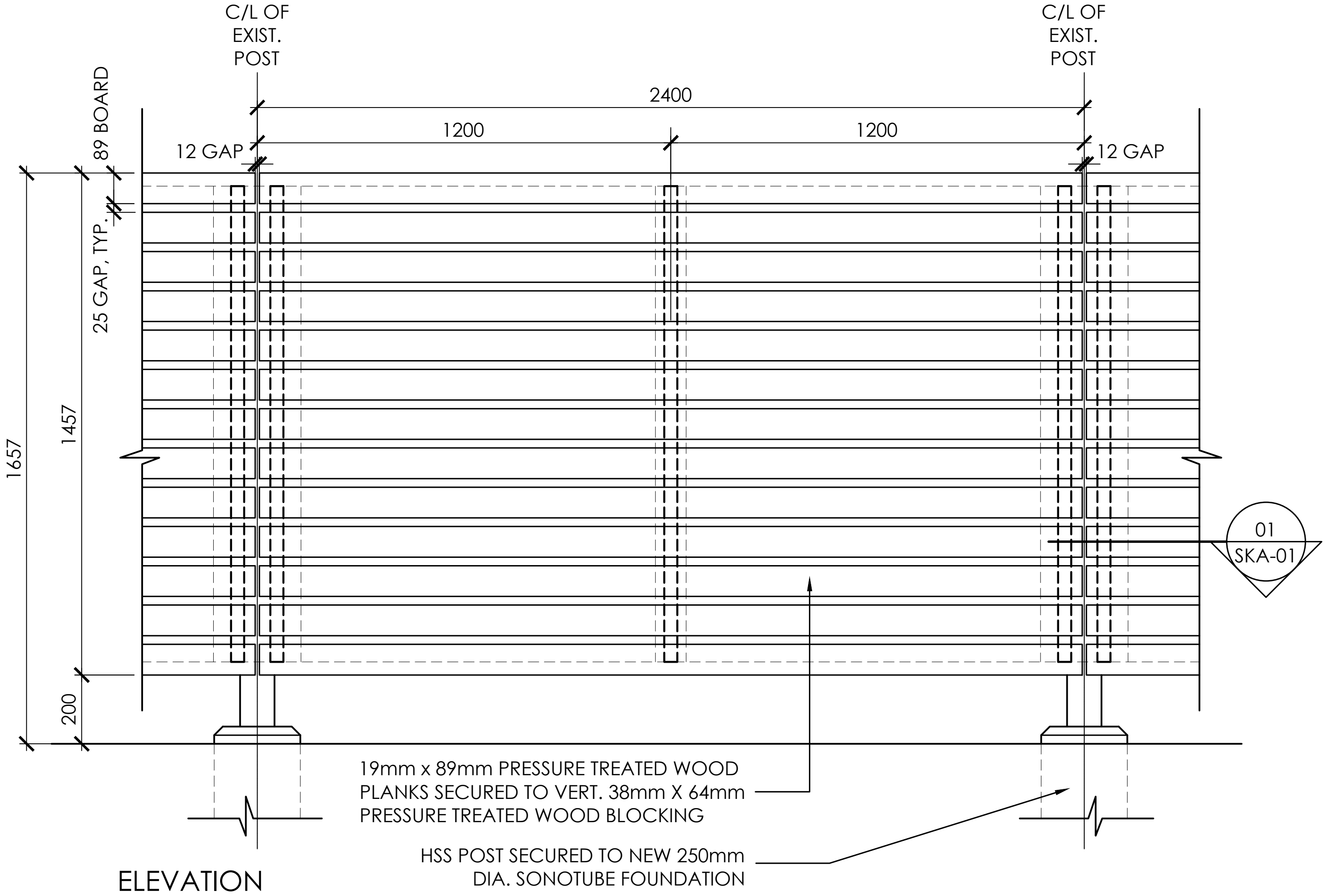
Project Name:
MANSFIELD SKI CLUB
628213 SIDE ROAD 15
Mulmur, ON L9V 0T9

Drawing Title:
ONTARIO BUILDING CODE MATRICES

Drawn: JC	Design: BF	Date: JANUARY 2020
Checked: BF	Apprvd: BF	Scale: NTS
CADD File: 151352		Dwg. No.: SP.6



PLAN VIEW
1/SKA-01



ELEVATION
2/SKA-01

Plot Date: Apr 08, 2020 - 3:23pm By: pfren Filename: C:\Users\pfren\Desktop\MANSFIELD\Fence Detail\21945 - SKA_01.dwg

+VG ARCHITECTS
THE VENTIN GROUP LTD

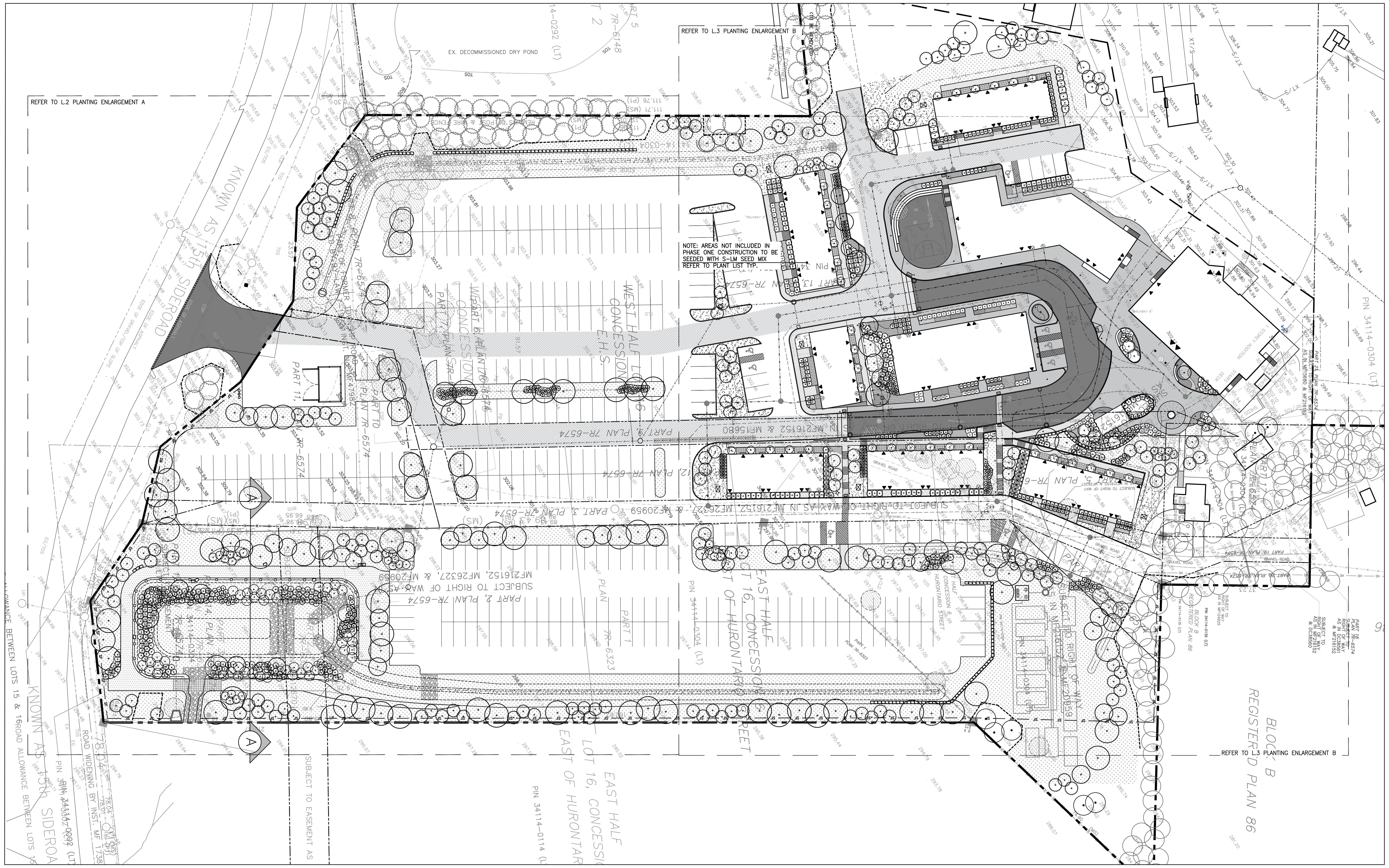
DESCRIPTION:
ENCLOSURE FOR OUTDOOR GARBAGE AREA
PART ELEVATION, PLAN & DETAIL

DATE: 2020.04.06 **SCALE:** NTS
DWG. REF. NO.: N/A **ISSUED FOR:** SITE PLAN
PROJECT NO: 21945

MANSFIELD SKI CLUB - VILLAGE CENTRE

DRAWN BY: PF CHECKED BY: PB

SKA-01



NOTE: AREAS NOT INCLUDED IN PHASE ONE CONSTRUCTION TO BE SEEDED WITH S-LM SEED MIX REFER TO PLANT LIST TYP.

PLANTING NOTES:

1. ALL PLANT MATERIAL IS TO MEET THE STANDARDS AS OUTLINED IN THE CANADIAN STANDARDS FOR NURSERY STOCK, CURRENT EDITION.
2. FOR ALL CONTRACTOR PURCHASED MATERIALS PLANT SIZES WILL BE AS MEASURED ON SITE. NURSERY WAYBILLS WILL NOT BE ACCEPTABLE FOR DETERMINATION OF PLANT SIZES.
3. PROTECT PLANT MATERIAL FROM FROST, EXCESSIVE HEAT, WIND AND SUN DURING TRANSPORTATION. ALL WILTED OR WIND DAMAGED PLANT MATERIAL WILL BE REJECTED.
4. CONTRACTOR TO LAYOUT ALL PLANT MATERIAL AS PER PLANTING PLANS PRIOR TO INSTALLATION FOR LANDSCAPE ARCHITECT REVIEW AND APPROVAL.
5. WARRANTY PERIOD FOR ALL PLANTING IS ONE YEAR FROM SUBSTANTIAL COMPLETION. WARRANTY REPLACEMENTS OF ALL PLANT MATERIAL WILL BE UNDERTAKEN BY THE CONTRACTOR AS REQUESTED BY THE LANDSCAPE ARCHITECT AT ANY TIME DURING THE WARRANTY PERIOD.
6. FOR BURLAPPED ROOT BALLS, CUT AWAY TOP ONE THIRD OF WRAPPING AND WIRE BASKET WITHOUT DAMAGING ROOT BALL. DO NOT PULL BURLAP OR ROPE FROM UNDER ROOT BALL. FOR POTTED PLANTS REMOVE ENTIRE CONTAINER.
7. BACKFILL SOIL IN 150mm LIFTS. TAMP EACH LIFT TO ELIMINATE AIR POCKETS. WHEN TWO THIRDS OF DEPTH OF PLANTING PIT HAS BEEN BACKFILLED, FILL REMAINING SPACE WITH WATER. AFTER WATER HAS PENETRATED INTO SOIL, BACKFILL TO FINISH GRADE.
8. PLANTS SHOWN IN GROUPS ARE TO BE PLANTED IN CONTINUOUS PLANT BEDS AS SHOWN ON PLANTING DETAIL.
9. PLANT MATERIAL INSTALLED FOLLOWING LEAF DROP IN THE FALL WILL BE ACCEPTED AFTER THE START OF THE NEXT GROWING SEASON PROVIDED THAT ACCEPTANCE CONDITIONS ARE FULFILLED.
10. ANY PLANTING OR LANDSCAPING WORK THAT IS REJECTED AT THE FINAL INSPECTION WILL BE CORRECTED IN A TIMELY MANNER AT CONTRACTOR'S EXPENSE.
10. REJECTED PLANT MATERIAL MUST BE REMOVED FROM THE SITE WITHIN ONE WORKING DAY.
11. WATER TREES ONCE A WEEK FOR FIRST 4 WEEKS AND THEN SUFFICIENTLY THERE AFTER TO MAINTAIN OPTIMUM GROWING WITHIN THE FIRST 2 YEARS AFTER PLANTING. APPLY SUFFICIENT WATER PER APPLICATION TO OBTAIN MOISTURE PENETRATION OF 75–100MM. ENSURE ADEQUATE MOISTURE IN ROOT ZONE AT FREEZE–UP.
12. ALL TOPSOIL TO BE NEW. TOPSOIL TO BE FRIABLE, SOIL TEXTURE TO CONSIST OF 45% SAND, 35% SILT, AND 20% CLAY AND CONTAIN A MAXIMUM OF 5% ORGANIC MATTER. TOPSOIL MUST BE FREE FROM SUBSOIL, ROOTS, GRASS, WEEDS, TOXIC MATERIALS, STONES, FOREIGN OBJECTS AND WITH AN ACIDITY RANGE (PH) OF 5.5 TO 7.5.
13. SOIL MIXTURE FOR PLANTING TO BE 50% SANDY TOPSOIL, 25% PEATMOSS, 25% WELL ROTTED MANURE, AND 500G BONEMEAL PER CUBIC METRE OF PLANTING SOIL.
14. ALL SEEDED SLOPES 4:1 AND OVER TO UTILIZE EROSION MATS.
15. CONTRACTOR TO CHECK QUANTITIES AND REPORT ANY DISCREPANCIES TO THE THE LANDSCAPE ARCHITECT IMMEDIATELY. PLANT QUANTITIES INDICATED ON THE PLAN SUPERCEDE THE TOTALS IN THE PLANT LIST.
16. ALL AREAS LIMITED TO PHASE TWO CONSTRUCTION TO BE SEEDED. REFER TO PLANTING PLAN AND SEED MIX SCHEDULE.

LEGEND

PROPERTY LINE
PROPOSED FIRE TRUCK ACCESS ROUTE
WATER SERVICE LINE
SANITARY SEWER LINE
◀ ENTRANCE
1M HT. WOOD SPLIT RAIL FENCE
▨ UNIT PAVING
▨ CONCRETE SIDEWALK
■ HEAVY DUTY ASPHALT
▨ SOD
▨ SEEDED AREA
PROPOSED FIRE HYDRANT
BOULDER
⊠ PROPOSED HYDRO TRANSFORMER Refer to Electrical
EXISTING TREE TO REMAIN
EXISTING TREE GROUPING TO REMAIN
TREE HOARDING
PROPOSED DECIDUOUS TREE
PROPOSED CONIFEROUS TREE
SHRUB BED

GENERAL NOTES:

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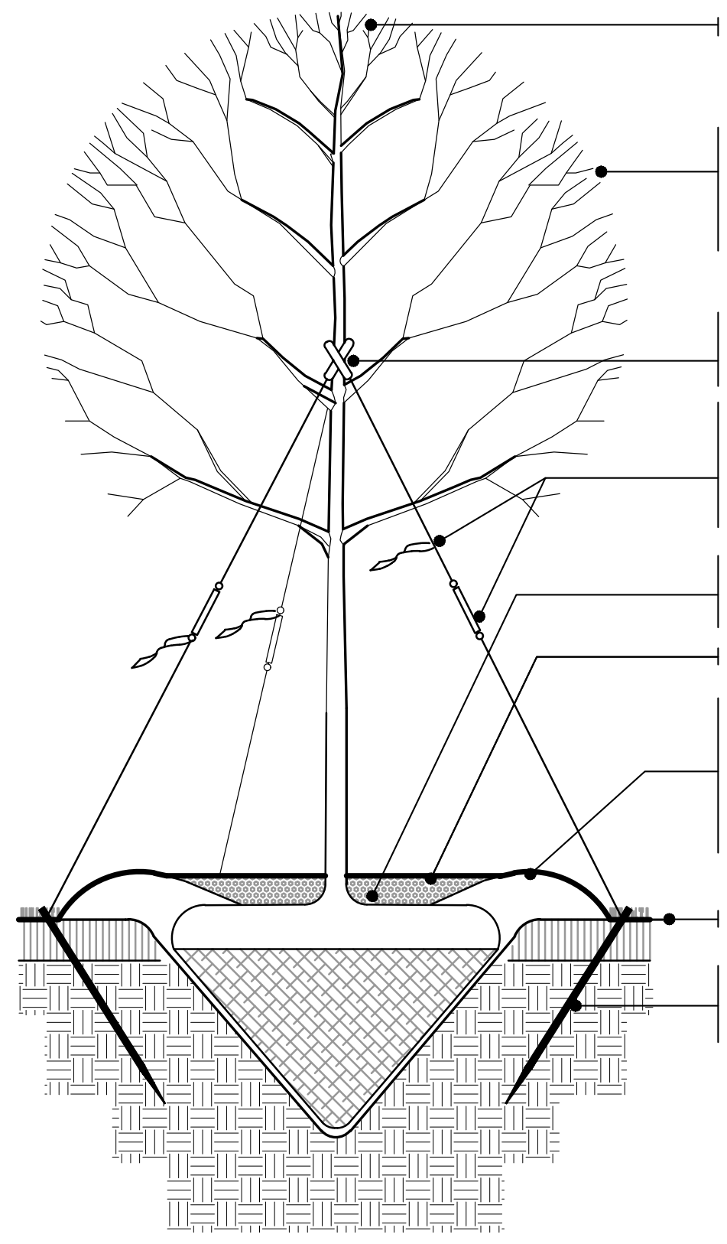
3. CONTRACTOR TO VERIFY ALL SITE CONDITIONS AND REPORT ANY DISCREPANCIES TO THE CONSULTANT IMMEDIATELY.
4. LAYOUT ALL WORK FOR INSPECTION AND APPROVAL BY CONSULTANT PRIOR TO COMMENCEMENT OF CONSTRUCTION.
5. CONTRACTOR RESPONSIBLE FOR ANY AND ALL UNDERGROUND UTILITIES.
6. CONTRACTOR TO LAY OUT ALL SITE FURNISHINGS FOR CONSULTANT / OWNER REVIEW AND FINAL FIELD ADJUSTMENT PRIOR TO CONTRACTOR AFFIXING SITE FURNISHINGS TO HARD SURFACES.
7. CONTRACTOR TO ENSURE POSITIVE DRAINAGE FROM ALL STRUCTURES.
8. CONTRACTOR TO MAKE GOOD ALL DAMAGE TO ANY EXISTING OR ADJACENT CONDITIONS/ STRUCTURES DURING CONSTRUCTION TO THE SATISFACTION AND ACCEPTANCE OF THE CONSULTANT.



DO NOT PRUNE LEADER BRANCH

ORIENT TREE TO GIVE THE BEST APPEARANCE IN RELATION TO STRUCTURES, ROADS AND WALKS. PRUNE TREE ONLY AS DIRECTED BY LANDSCAPE ARCHITECT

3mm GALVANIZED GUY WIRES, 3 PER TREE IN 2 PLY REINFORCED RUBBER HOSE, 12mm DIA.

GALVANIZED TURNBUCKLES WITH 150mm LONG EYEBOLTS OR APPROVED WIRE TIGHTENER. ALL GUY WIRES TO BE FLAGGED WITH ORANGE OE YELLOW PLASTIC FLAGGING TAPE

SET TREE 50mm HIGHER THAN ADJACENT FINSHED GRADE TO ALLOW FOR SETTLEMENT

50mm DEPTH SHREDDED BARK MULCH

FORM EARTH WATERING SAUCER AROUND TREE, 100mm HIGH PLANTING SOIL MIXTURE TO BE: 9 PARTS TOPSOIL / 1 PART PEATMOSS / 1.5 kg OF BONEMEAL (0–20–0) PER CUBIC METRE OF PLANTING SOIL

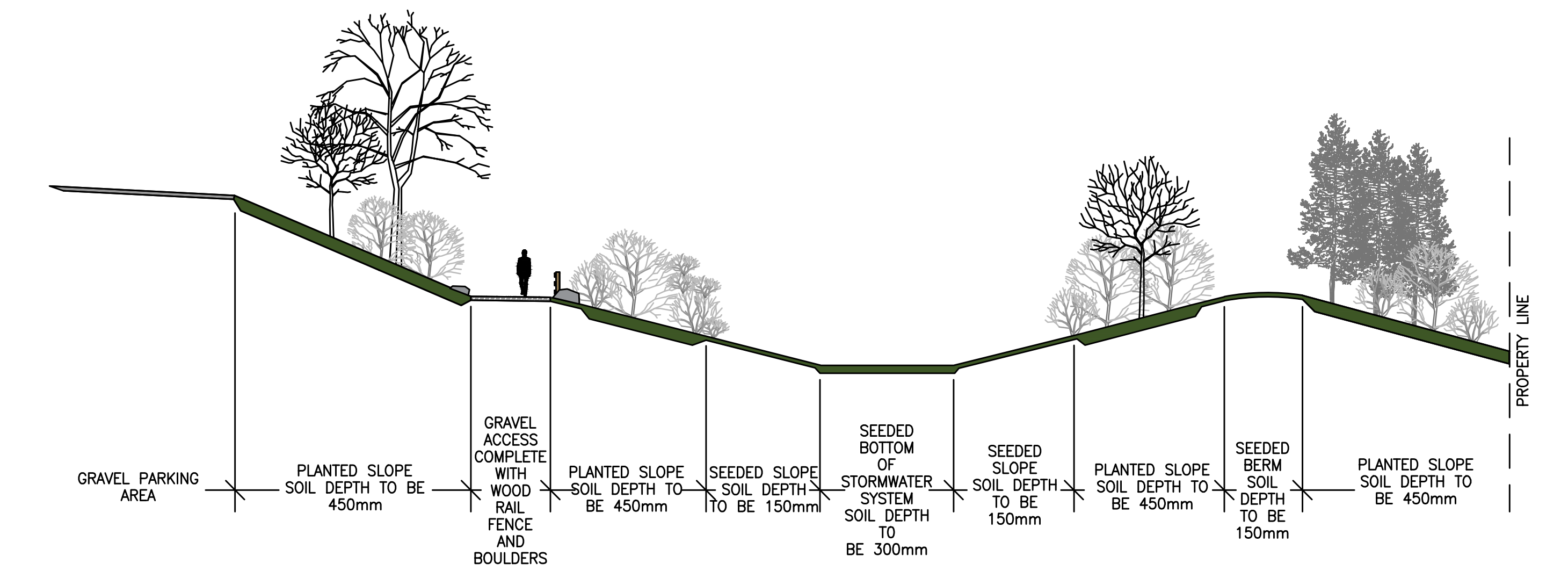
FINISHED GRADE

STEEL 'T' BAR STAKES, 750mm LENGTH DRIVE TOP OF STAKE FLUSH WITH FINISHED GRADE

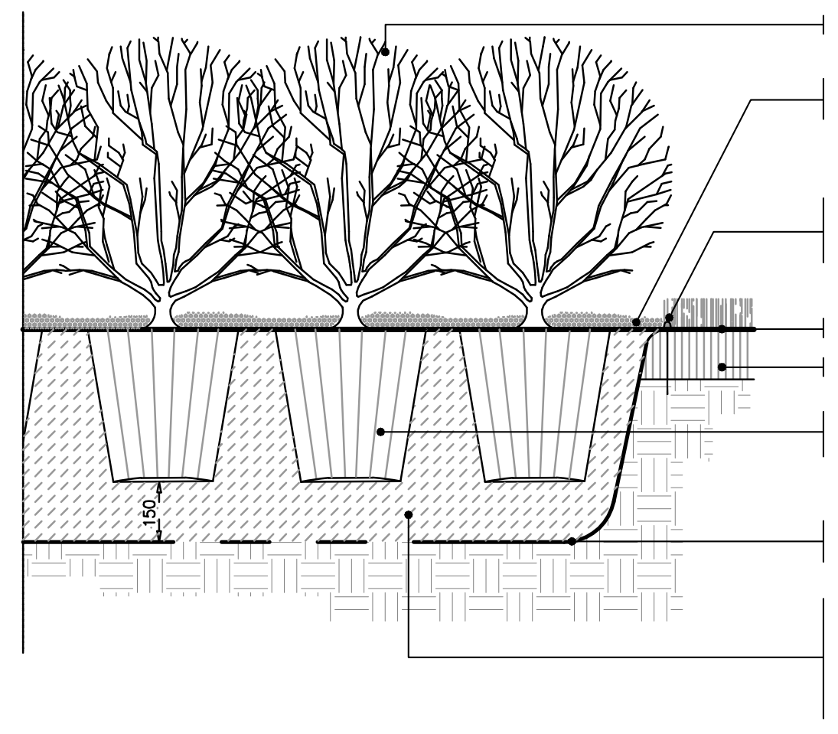
NOTES:

1. USE MECHANICAL TREE SPADE FOR ALL TRANSPLANTING. SIZE TO BE APPROVED BY LANDSCAPE ARCHITECT.
2. WHERE SUBGRADE IS IMPERMEABLE INSTALL DRAINAGE TILE CONNECTED TO STORM DRAIN

TREE TRANSPLANTING NTS



SECTION A – STORMWATER SYSTEM PLANTING SCHEMATIC 1:200



PRUNE DEAD BRANCHES

75mm MIN. DEPTH SHREDDED BARK MULCH

EDGE OF SHRUB BEDS ADJACENT TO BUILDINGS TO BE DEFINED WITH CONTINUOUS METAL EDGE

FINISHED GRADE

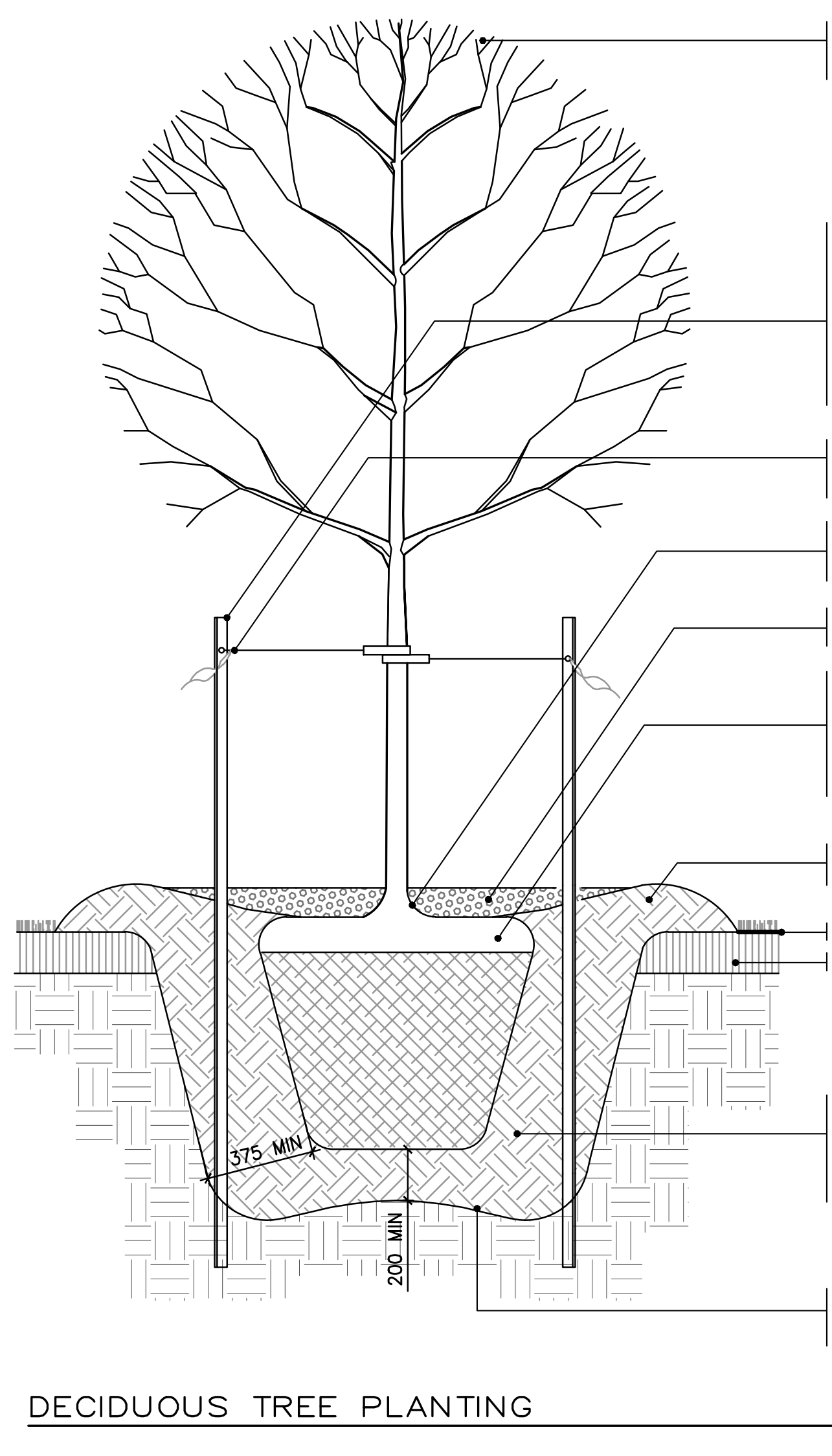
TOPSOIL

REMOVE SHRUB FROM CONTAINERS WITHOUT BREAKING ROOT BALL

GEOTEXTILE FABRIC

PLANTING SOIL MIXTURE TO BE: 9 PARTS TOPSOIL / 1 PART LEAF MULCH / 1.5 kg OF BONEMEAL PER CUBIC METRE OF PLANTING SOIL

SHRUB AND PERENNIAL PLANTING NTS



REMOVE ONLY DEAD OR BROKEN BRANCHES. NEVER PRUNE LEADER.

2440mm LENGTH STEEL 'T' BAR STAKES DRIVEN TO A MINIMUM DEPTH OF 900mm CONNECT TO TREE RINGS FABRICATED FROM 2.5mm GALVANIZED WIRE ENCASED IN 12mm DIAMETER RUBBER. STAKES TO BE CLEAR OF ROOT BALL

ALL STAKES TO BE FLAGGED WITH ORANGE PLASTIC FLAGGING TAPE

SET TREE 50mm HIGHER THAN ADJACENT FINISHED GRADE TO ALLOW FOR SETTLEMENT

75mm DEPTH SHREDDED PINE BARK MULCH

REMOVE ALL ROPE AND BURLAP FROM 1/3 OF ROOT BALL, WIRE BASKETS TO BE CUT AND BENT BACK FROM ROOT BALL AS MUCH AS POSSIBLE WITH TREE IN HOLE

FORM EARTH WATERING SAUCER AROUND TREE, 100mm HIGH

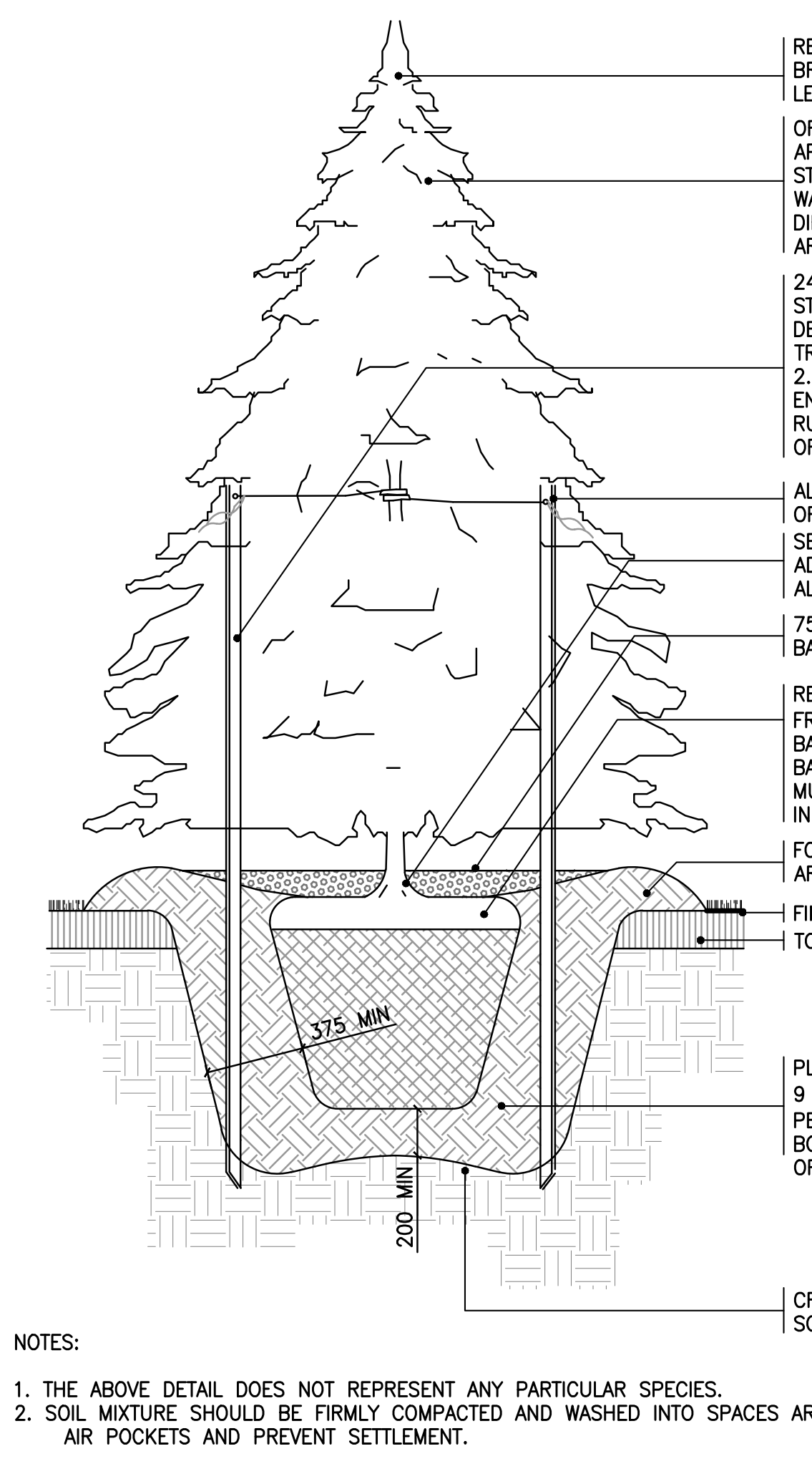
FINISHED GRADE

TOPSOIL

PLANTING SOIL MIXTURE TO BE: 9 PARTS TOPSOIL / 1 PART PEATMOSS / 1.5 kg OF BONEMEAL PER CUBIC METRE OF PLANTING SOIL

CROWN BOTTOM OF TREE PIT AND SCARIFY TO A DEPTH OF 150mm

DECIDUOUS TREE PLANTING NTS



REMOVE ONLY DEAD OR BROKEN BRANCHES. DO NOT PRUNE LEADER.

ORIENT TREE FOR THE BEST APPEARANCE IN RELATION TO STRUCTURES, ROADS AND WALKS. PRUNE ONLY AS DIRECTED BY LANDSCAPE ARCHITECT

2440mm LENGTH STEEL 'T' BAR STAKES DRIVEN TO A MINIMUM DEPTH OF 900mm CONNECT TO TREE RINGS FABRICATED FROM 2.5mm GALVANIZED WIRE ENCASED IN 12mm DIAMETER RUBBER. STAKES TO BE CLEAR OF ROOT BALL

ALL STAKES TO BE FLAGGED WITH ORANGE PLASTIC FLAGGING TAPE

SET TREE 50mm HIGHER THAN ADJACENT FINISHED GRADE TO ALLOW FOR SETTLEMENT

75mm DEPTH SHREDDED PINE BARK MULCH

REMOVE ALL ROPE AND BURLAP FROM 1/3 OF ROOT BALL, WIRE BASKETS TO BE CUT AND BENT BACK FROM ROOT BALL AS MUCH AS POSSIBLE WITH TREE IN HOLE

FORM EARTH WATERING SAUCER AROUND TREE, 125mm HIGH

FINISHED GRADE

TOPSOIL

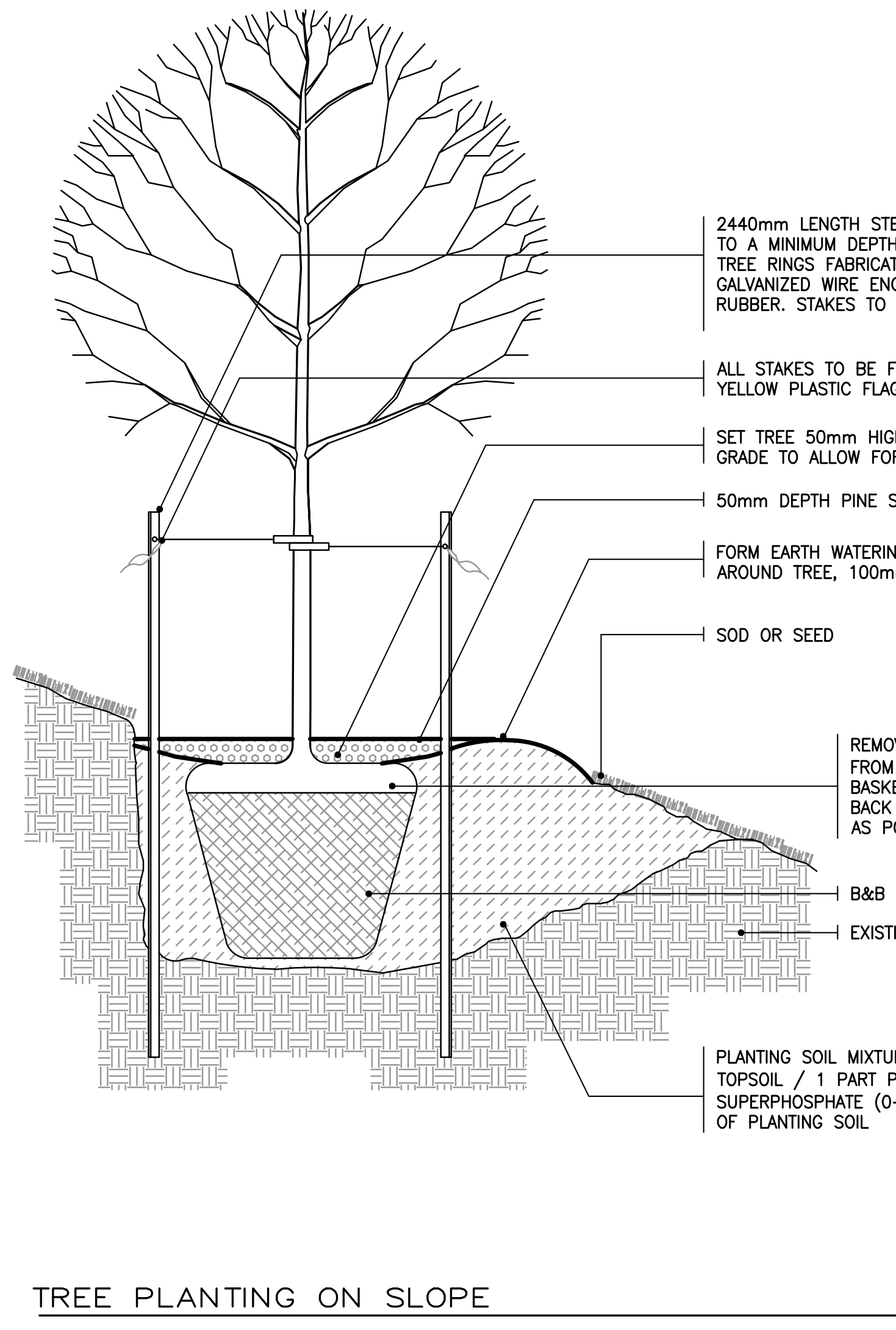
PLANTING SOIL MIXTURE TO BE: 9 PARTS TOPSOIL / 1 PART PEATMOSS / 1.5 kg OF BONEMEAL PER CUBIC METRE OF PLANTING SOIL

CROWN BOTTOM OF TREE PIT AND SCARIFY TO A DEPTH OF 150mm

NOTES:

1. THE ABOVE DETAIL DOES NOT REPRESENT ANY PARTICULAR SPECIES.
2. SOIL MIXTURE SHOULD BE FIRMLY COMPACTED AND WASHED INTO SPACES AROUND ROOTBALL TO ELIMINATE AIR POCKETS AND PREVENT SETTLEMENT.

CONIFEROUS TREE PLANTING NTS



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ALL STAKES TO BE FLAGGED WITH ORANGE OR YELLOW PLASTIC FLAGGING TAPE

SET TREE 50mm HIGHER THAN ADJACENT FINSHED GRADE TO ALLOW FOR SETTLEMENT

50mm DEPTH PINE SHREDDED BARK MULCH

FORM EARTH WATERING SAUCER AROUND TREE, 100mm HIGH

SOD OR SEED

REMOVE ALL ROPE AND BURLAP FROM 1/3 OF ROOT BALL. WIRE BASKETS TO BE CUT AND BENT BACK FROM ROOT BALL AS MUCH AS POSSIBLE WITH TREE IN HOLE

B&B ROOT BALL

EXISTING SUB GRADE

PLANTING SOIL MIXTURE TO BE: 9 PARTS TOPSOIL / 1 PART PEATMOSS / 1.5 kg OF SUPERPHOSPHATE (0–20–0) PER CUBIC METRE OF PLANTING SOIL

TREE PLANTING ON SLOPE NTS

FLEISHER RIDOUT PARTNERSHIP INC.
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1	FEBRUARY 4, 2020	ISSUED FOR SITE PLAN APPROVAL

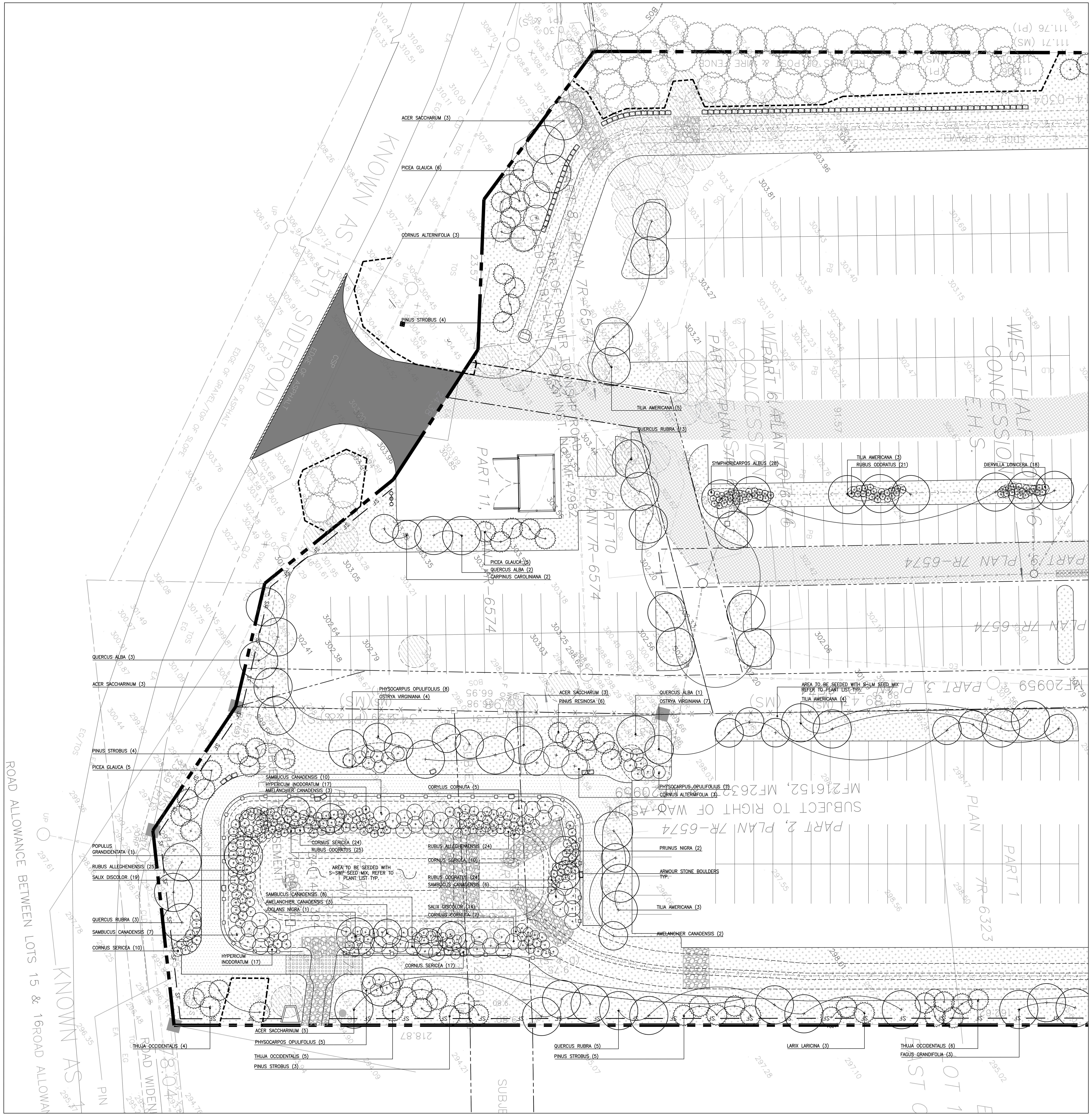
B. J. FLEISHER
MEMBER

N

Project Name:
MANSFIELD SKI CLUB
628213 SIDE ROAD 15
Mulmur, ON L9V 0T9

Drawing Title:
OVERALL PLANTING PLAN

Drawn:	Design:	Date:
JC	BF	JANUARY 2020
Checked: BF	Apprvd: BF	Scale: 1:500
CADD File: 151352		Dwg. No.: L.1



PLANT LIST

BOTANICAL NAME	COMMON NAME	QUANTITY	SIZE	CONDITION	COMMENTS
TREES					
Acer saccharinum	Silver Maple	16	70 mm	B.B.	
Acer saccharum	Sugar Maple	7	70 mm	B.B.	
Amelanchier canadensis	Canadian Serviceberry	24	70 mm	B.B.	Multistem
Carpinus caroliniana	Blue Beech	10	45 mm	B.B.	
Fagus grandifolia	American Beech	6	70 mm	B.B.	
Larix laricena	Tamarack	20	1.8 m	W.B.	
Juglans nigra	Black Walnut	4	70 mm	B.B.	
Ostrya virginiana	Ironwood	15	70 mm	B.B.	
Picea glauca	White Spruce	83	1.8 m	W.B.	
Pinus resinosa	Red Pine	42	1.8 m	W.B.	
Pinus strobus	White Pine	63	1.8 m	W.B.	
Populus grandidentata	Large-tooth Aspen	1	70 mm	B.B.	
Prunus nigra	Black Cherry	2	45 mm	B.B.	
Quercus alba	White Oak	12	70 mm	B.B.	
Quercus rubra	Red Oak	23	70 mm	B.B.	
Thuja occidentalis	White Cedar	37	70 mm	B.B.	
Tilia americana	Basswood	21	70 mm	B.B.	
Tsuga canadensis	Hemlock	13	1.8 m	W.B.	
SHRUBS					
Amelanchier canadensis	Saskatoon Berry	42	7 gal.	potted	Multistem
Aronia melanocarpa	Black Chokeberry	94	3 gal.	potted	
Ceanothus americanus	New Jersey Tea	35	3 gal.	potted	
Cornus alternifolia	Pagoda Dogwood	12	15 gal.	B.B.	
Cornus sericea	Red Osier Dogwood	290	3 gal.	potted	
Corylus comuta	Beaked Hazel	20	3 gal.	potted	
Diervilla lonicera	Bush Honeysuckle	105	3 gal.	potted	
Hypericum inodorum	St. John's Wort	50	3 gal.	potted	
Juniperus horizontalis	Spreading Juniper	213	3 gal.	potted	
Physocarpus opulifolius	Common Ninebark	95	3 gal.	potted	
Salix discolor	Pussy Willow	70	3 gal.	potted	
Sambucus canadensis	Elderberry	63	3 gal.	potted	
Symphoricarpos albus	Snowberry	59	3 gal.	potted	
Rubus allegheniensis	Alleghany Blackberry	81	3 gal.	potted	
Rubus odoratus	Flowering Raspberry	128	3 gal.	potted	
PERENNIALS					
Achillia millefolium	Common Yarrow	165	1 gal.	potted	
Agastache foeniculum	Anise Hyssop	200	1 gal.	potted	
Asclepias tuberosa	Butterflyweed	250	1 gal.	potted	
Echinacea purpurea	Purple Coneflower	945	1 gal.	potted	
Rudbeckia hirta	Black-eyed Susan	280	1 gal.	potted	
GRASSES					
Andropogen gerardii	Big Blue Stem	50	1 gal.	potted	
Panicum virgatum	Switch Grass	245	1 gal.	potted	
Schizachyrium scoparium	Little Bluestem	360	1 gal.	potted	

SEED MIX

S-SWP	Stormwater Pond Mix Contains: Fox Sedge, Virginia Wild Rye, Canada Bluegrass, Indian Grass, Black Eyed Susan, New England Aster, Grass Leafed Golden Rod
S-FACW	Wetland Mixture Contains: Bebb's Sedge, Blue Lobelia, Blue Vervain, Blunt Broom Sedge, Boneset, Fox Sedge, Green Bulrush, Heath Aster, Lurid Sedge, New
S-LM	No Maintenance Eco-Lawn Mix Contains: Creeping Red Fescue, Ecostar Hard Fescue, Chewings Fescue and Perennial Rye.

LEGEND

- PROPERTY LINE
- FIRE ROUTE — PROPOSED FIRE TRUCK ACCESS ROUTE
- W — WATER SERVICE LINE
- SAN — SANITARY SEWER LINE
- ◀ ENTRANCE
- x — 1M HT. WOOD SPLIT RAIL FENCE
- UNIT PAVING
- CONCRETE SIDEWALK
- HEAVY DUTY ASPHALT
- SOD
- SEEDED AREA
- ⌖ PROPOSED FIRE HYDRANT
- ◇ BOULDER
- ☒ PROPOSED HYDRO TRANSFORMER Refer to Electrical
- ◉ EXISTING TREE TO REMAIN
- EXISTING TREE GROUPING TO REMAIN
- TREE HOARDING

GENERAL NOTES:

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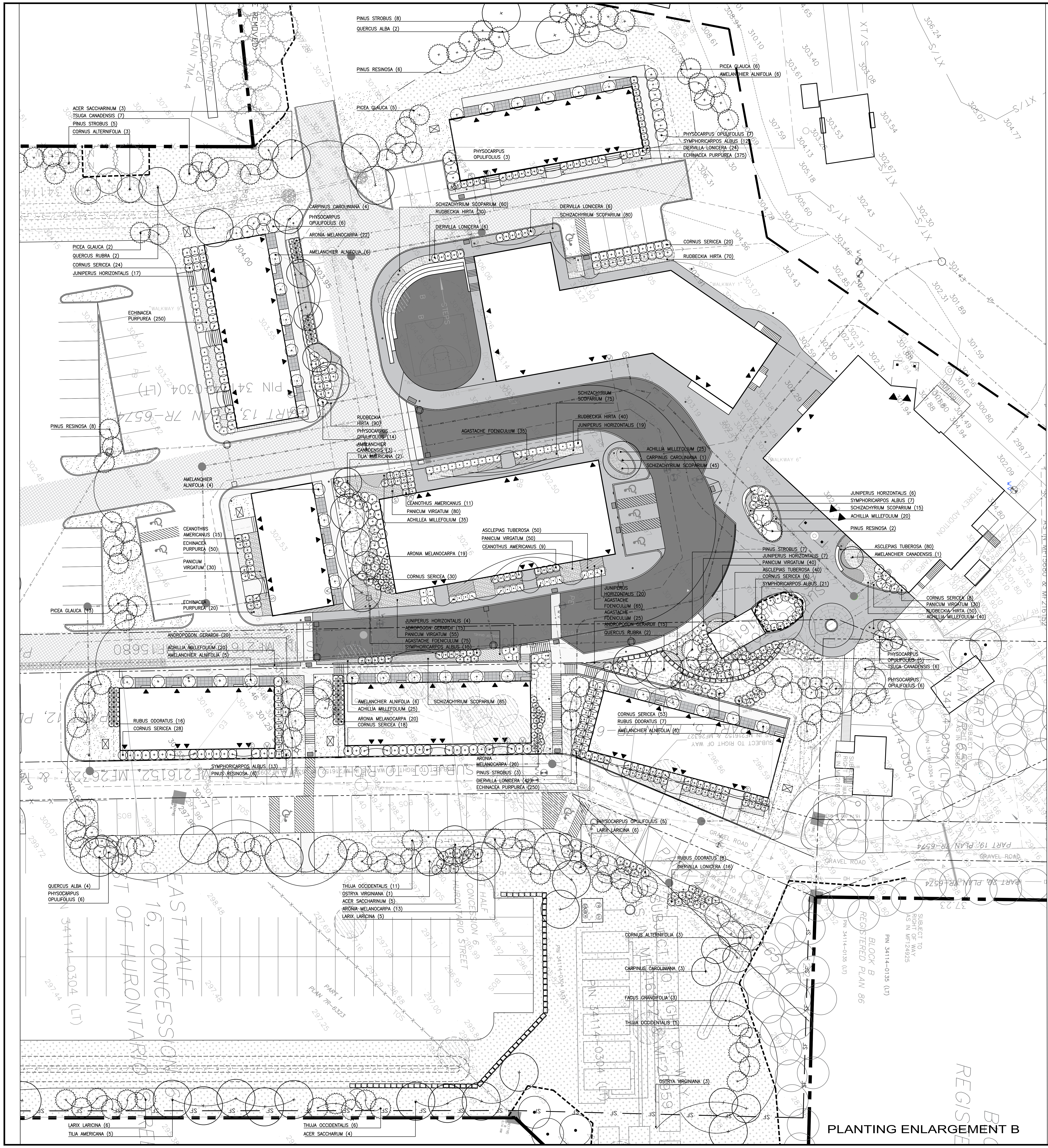
B. J. FLEISHER

N

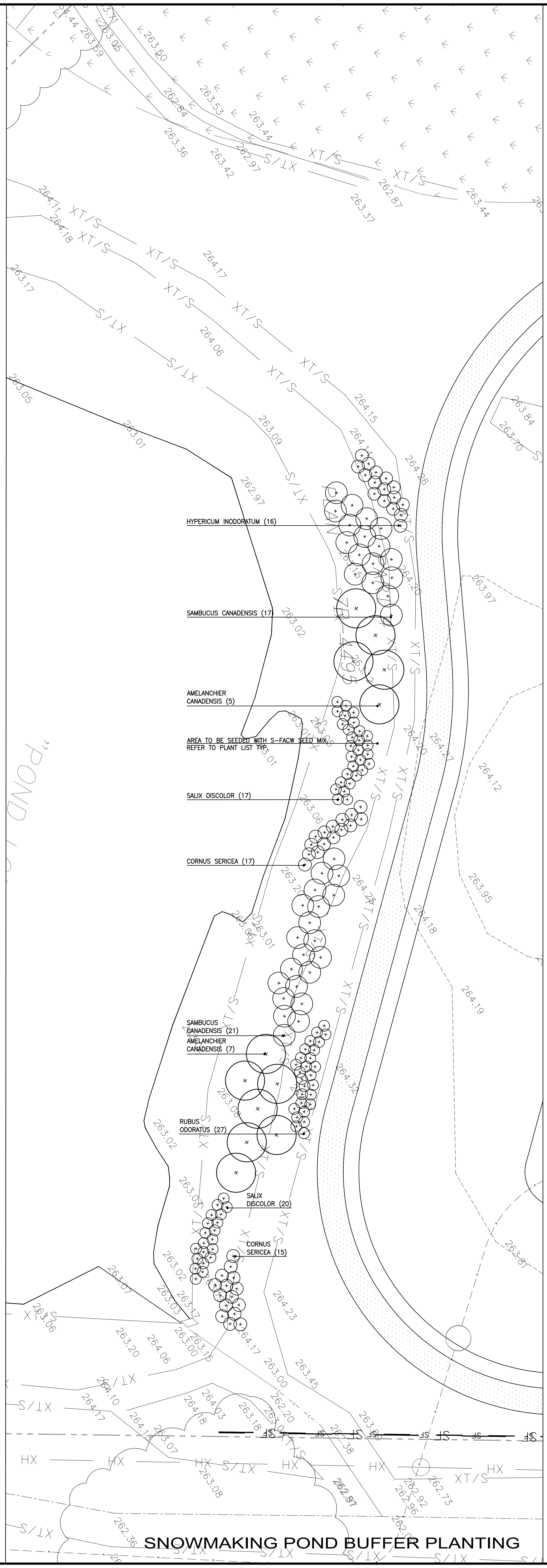
Project Name:
MANSFIELD SKI CLUB
628213 SIDE ROAD 15
Mulmur, ON L9V 0T9

Drawing Title:
PLANTING ENLARGEMENT A

Drawn: JC	Design: BF	Date: JANUARY 2020
Checked: BF	Apprvd: BF	Scale: 1:250
CADD File: 151352		Dwg. No.: L.2



PLANTING ENLARGEMENT B



SNOWMAKING POND BUFFER PLANTING

LEGEND

- PROPERTY LINE
- FIRE ROUTE — PROPOSED FIRE TRUCK ACCESS ROUTE
- WATER SERVICE LINE
- SANITARY SEWER LINE
- ◀ ENTRANCE
- —x—x— 1M HT. WOOD SPLIT RAIL FENCE
- ▨ UNIT PAVING
- ▨ CONCRETE SIDEWALK
- ■ HEAVY DUTY ASPHALT
- ▨ SOD
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4. LAYOUT ALL WORK FOR INSPECTION AND APPROVAL BY CONSULTANT PRIOR TO COMMENCEMENT OF CONSTRUCTION.
5. CONTRACTOR RESPONSIBLE FOR ANY AND ALL UNDERGROUND UTILITIES.
6. CONTRACTOR TO LAY OUT ALL SITE FURNISHINGS FOR CONSULTANT / OWNER REVIEW AND FINAL FIELD ADJUSTMENT PRIOR TO CONTRACTOR AFFIXING SITE FURNISHINGS TO HARD SURFACES.
7. CONTRACTOR TO ENSURE POSITIVE DRAINAGE FROM ALL STRUCTURES.
8. CONTRACTOR TO MAKE GOOD ALL DAMAGE TO ANY EXISTING OR ADJACENT CONDITIONS/ STRUCTURES DURING CONSTRUCTION TO THE SATISFACTION AND ACCEPTANCE OF THE CONSULTANT.

FLEISHER RIDOUT
PARTNERSHIP INC.
l.a.n.d.s.c.a.p.e a.r.c.h.i.t.e.c.t.s
1877 Davenport Road
Toronto, Ontario, M6N 1B9
T: (416) 533-4990

ISSUE	DATE	REMARKS
3	DECEMBER 10, 2020	ISSUED FOR 3RD SITE PLAN APPROVAL
2	AUGUST 14, 2020	ISSUED FOR 2ND SITE PLAN APPROVAL
1	FEBRUARY 4, 2020	ISSUED FOR SITE PLAN APPROVAL

ONTARIO ASSOCIATION OF LANDSCAPE ARCHITECTS
B. J. FLEISHER
MEMBER

N

Project Name:
MANSFIELD SKI CLUB
628213 SIDE ROAD 15
Mulmur, ON L9V 0T9

Drawing Title:
PLANTING ENLARGEMENT B

Drawn: JC	Design: BF	Date: JANUARY 2020
Checked: BF	Apprvd: BF	Scale: 1:250
CADD File: 151352		Dwg. No.: L.3

LEGEND

- PROPERTY LINE
- FIRE ROUTE — PROPOSED FIRE TRUCK ACCESS ROUTE
- WATER SERVICE LINE
- SAN — SANITARY SEWER LINE
- ◀ ENTRANCE
- x — 1M HT. WOOD SPLIT RAIL FENCE
- UNIT PAVING
- CONCRETE SIDEWALK
- HEAVY DUTY ASPHALT
- SOD
- SEEDED AREA
- PROPOSED FIRE HYDRANT
- BOULDER
- ⊠ PROPOSED HYDRO TRANSFORMER Refer to Electrical
- EXISTING TREE TO REMAIN
- EXISTING TREE GROUPING TO REMAIN
- TREE HOARDING
- PROPOSED DECIDUOUS TREE
- PROPOSED CONIFEROUS TREE
- SHRUB BED

GENERAL NOTES:

1. ALL CONSTRUCTION HOARDING AND TREE PROTECTION TO BE INSTALLED PRIOR TO START OF OPERATIONS.
2. EXISTING CONDITIONS PLAN OF SURVEY BY RODNEY GEYER, O.L.S. INC. DATED FEBRUARY 16, 2016.
3. CONTRACTOR TO VERIFY ALL SITE CONDITIONS AND REPORT ANY DISCREPANCIES TO THE CONSULTANT IMMEDIATELY.
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1	FEBRUARY 4, 2020	ISSUED FOR SITE PLAN APPROVAL
ISSUE	DATE	REMARKS

ONTARIO ASSOCIATION OF LANDSCAPE ARCHITECTS
B. J. FLEISHER
MEMBER

N

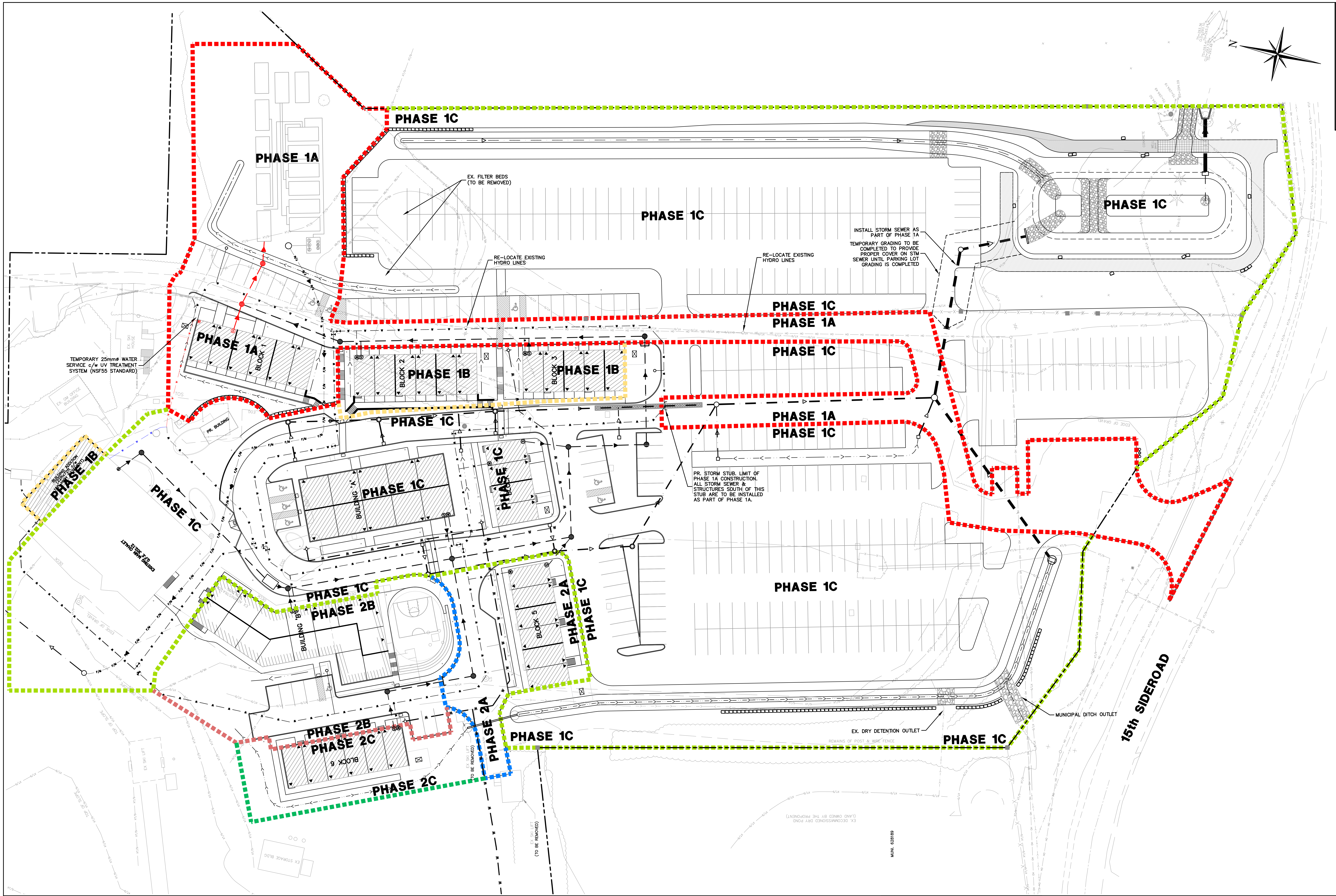
Project Name:

MANSFIELD SKI CLUB
628213 SIDE ROAD 15
Mulmur, ON L9V 0T9

Drawing Title:

SKI HILL PLANTING PLAN

Drawn: JC	Design: BF	Date: JANUARY 2020
Checked: BF	Apprvd: BF	Scale: 1:250
CADD File: 151352		Dwg. No.: L.4



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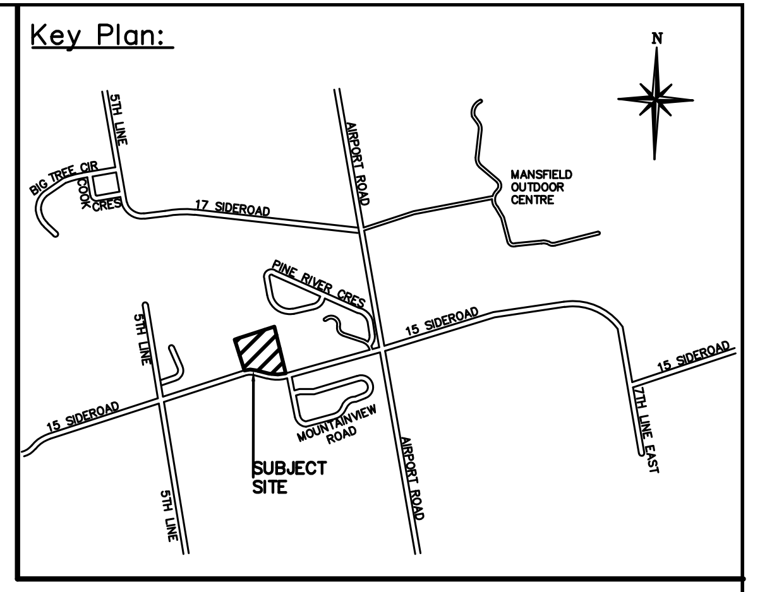

Legend:

EXISTING FEATURES (EX)

EX SIB	EX STD IRON BAR
EX IB	EX IRON BAR
EX UP	EX UTILITY POLE
☒	EX BELL PED
EX WS	EX WATER SERVICE
EX HYD	EX FIRE HYD.
NS	EX ST NAME SIGN
SS	EX STOP SIGN
X 123.45	EX ELEVATION
	EX FENCE
GAS	EX U/G GASMAIN
XB	EX U/G BELL
XH	EX HYDRO
XB/S	EX BOTTOM OF SLOPE
XT/S	EX TOP OF SLOPE
EX WV	EX WATERMAIN & VALVE
EX SAN @ 0.0%	EX SAN SEWER & MH
EX STM @ 0.0%	EX STM SEWER & MH

PROPOSED FEATURES (PR)

NS	PR STREET NAME SIGN
SS	PR STOP SIGN
SF	PR SILT FENCE
	PR LEGAL PART LOTS
	PR LEGAL BOUNDARY
Ⓛ	PR STREET LIGHT
Ⓦ	PR WATER SERVICE
Ⓢ	PR SAN SERVICE
	PR HYDRO TRANSFORMER
00mmø W/M	PR WATERMAIN
00mmø W/M	PR TEMPORARY WATERMAIN FOR PHASE 1A
00mmø W/M	PR PERMANENT WATERMAIN FOR PHASE 1A
	PR FIRE HYDRANT
	PR WATER VALVE
0m–00mmø SAN @ 0.0%	PR SAN SEWER
	PR PERMANENT SAN SEWER FOR PHASE 1A
MH K	PR SANITARY MANHOLE
0m–00mmø STM @ 0.0%	PR STM SEWER
MH 4	PR CATCHBASIN MANHOLE
MH 4	PR MANHOLE
□	PR CATCHBASIN
x 000.00	PROPOSED ELEVATION
x (000.00)	PR. MATCH EXISTING ELEVATION (INTERPOLATED)
	PR SWALE
▨	PR HEAVY DUTY ASPHALT
▨	PR UNIT PAVING
▨	PR BERM
☒	PR FIRE ACCESS
U.F.E	UPPER FLOOR ELEVATION
G.F.E	GROUND FLOOR ELEVATION

Phasing Legend:

🟥	PHASE 1A
🟨	PHASE 1B
🟩	PHASE 1C
🟦	PHASE 2A
🟥	PHASE 2B
🟩	PHASE 2C

CAUTION

CONTRACTOR TO DETERMINE LOCATION OF EXISTING UTILITIES PRIOR TO CONSTRUCTION.

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Benchmark: 463.937m

ELEVATIONS SHOWN HEREON ARE GEODETIC AND ARE DERIVED FROM CANNET NETWORK BASE STATION ORVL HAVING A PUBLISHED ELEVATION OF 463.937m

No.	Issue / Revision	Date
1	SPA FIRST SUBMISSION	AUG. 17, 2020
2	SPA SECOND SUBMISSION	DEC. 15, 2020

Mansfield Ski Club

PHASING PLAN

Client:

Mansfield Ski Club

628213 15th Sideroad
PO Box 75 RPO Mansfield,
Mulmur, Ontario
L9V 3M6

WMI & Associates Limited
119 Collier Street
Barrie, Ontario
L4M 1H5
Ph 705-797-2027
www.wmiengineering.ca

Drawn By AW	Checked By JWL	Drawing No. PHA
Scale 1:400	Project No. 15–319	

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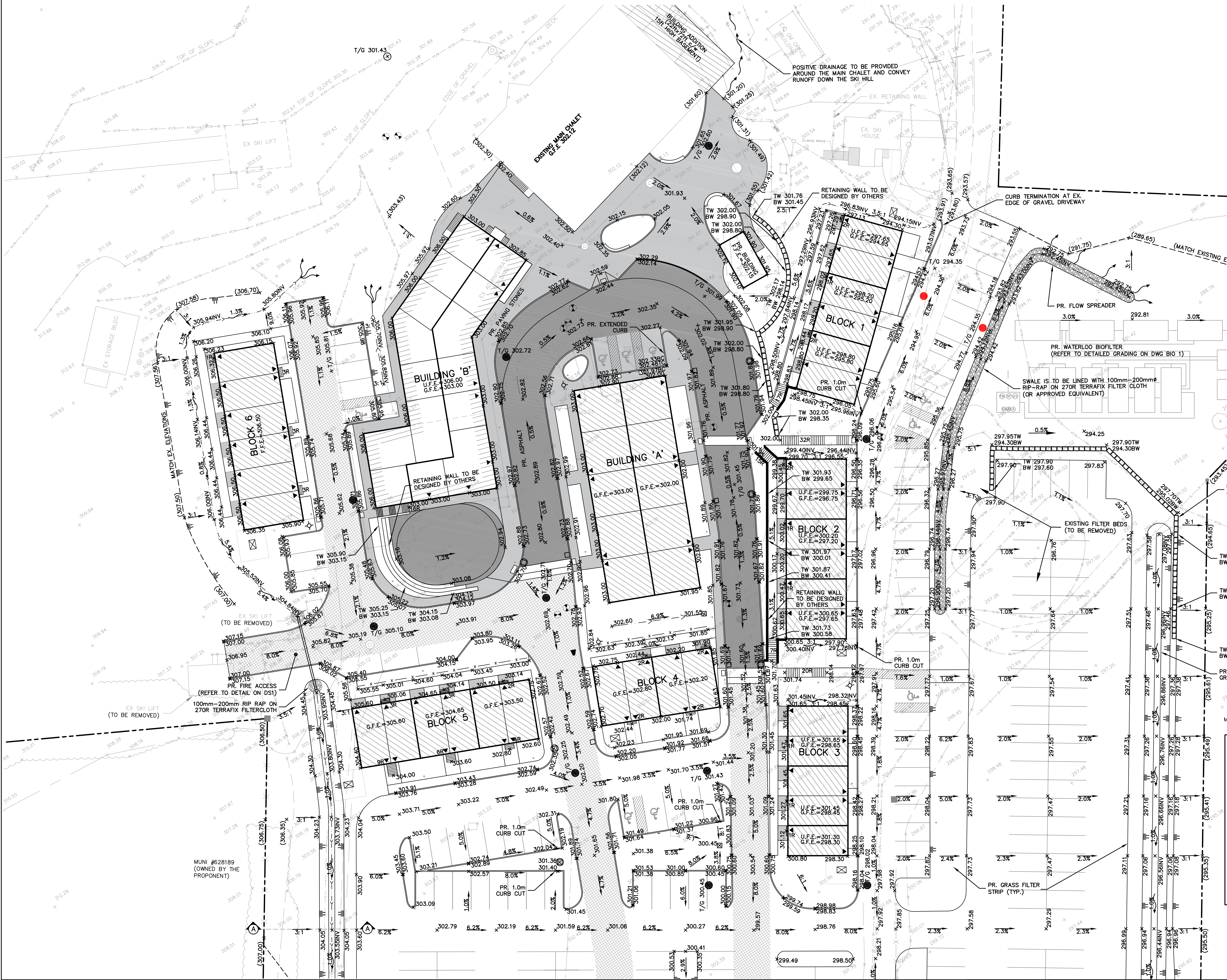

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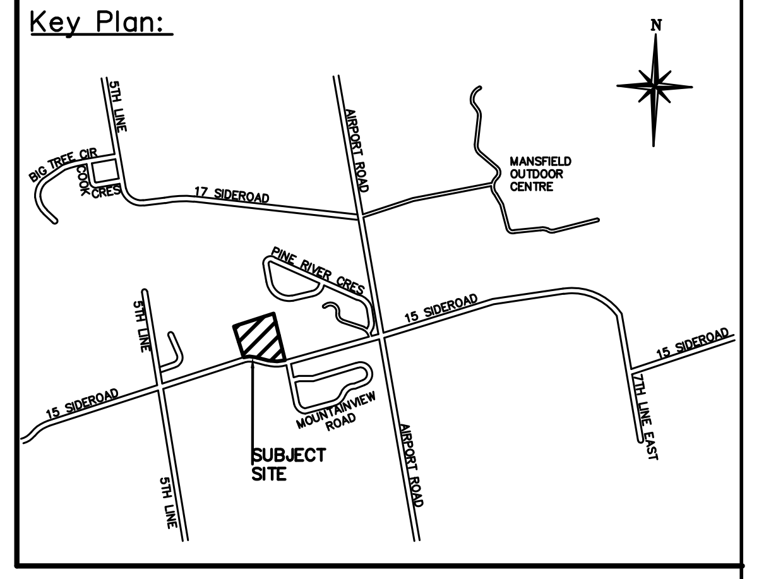


Legend:

EXISTING FEATURES (EX)

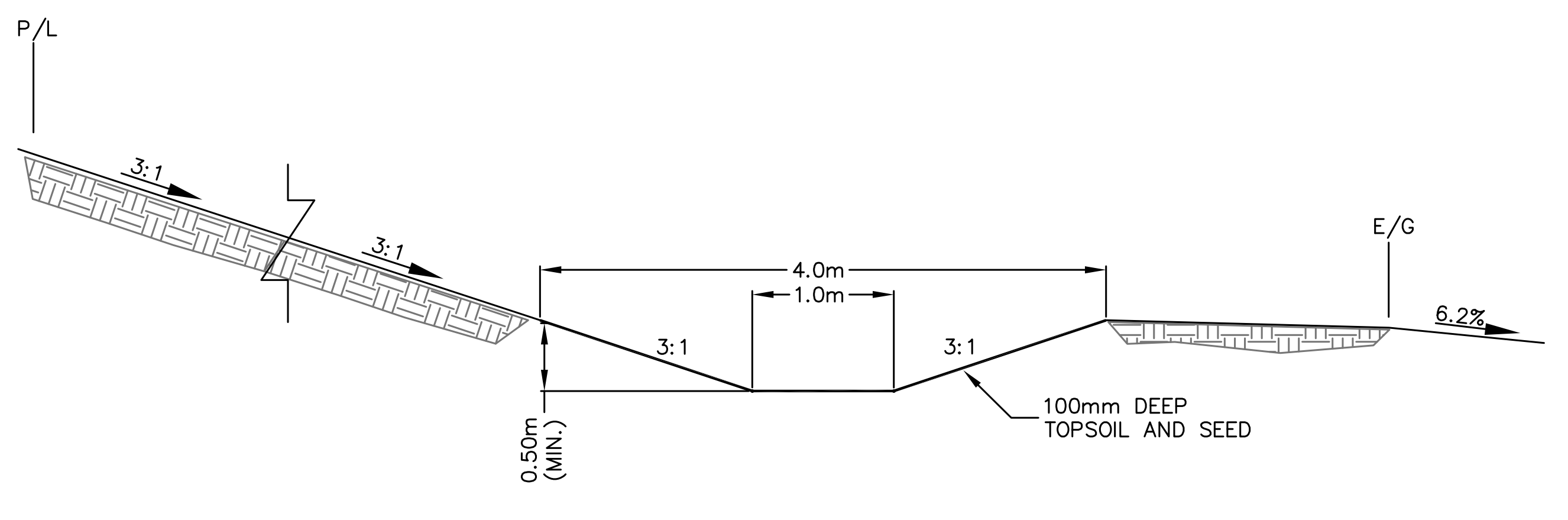
EX SIB	EX STD IRON BAR
EX IB	EX IRON BAR
EX UP	EX UTILITY POLE
☒	EX BELL PED
EX WS	EX WATER SERVICE
EX HYD	EX FIRE HYD.
NS	EX ST NAME SIGN
SS	EX STOP SIGN
x 123.45	EX ELEVATION
—o—o—o—	EX FENCE
— GAS — GAS — GAS —	EX U/G GASMAIN
— XB —	EX U/G BELL
— XH — XH — XH — XH —	EX HYDRO
— XB/S — XB/S — XB/S — XB/S —	EX BOTTOM OF SLOPE
— XT/S — XT/S — XT/S — XT/S —	EX TOP OF SLOPE
EX WV	EX WATERMAIN & VALVE
EX SAN @ 0.0%	EX SAN SEWER & MH
EX STM @ 0.0%	EX STM SEWER & MH

PROPOSED FEATURES (PR)

NS	PR STREET NAME SIGN
SS	PR STOP SIGN
— SF — SF — SF —	PR SILT FENCE
— — — —	PR LEGAL PART LOTS
▬ - ▬ - ▬	PR LEGAL BOUNDARY
Ⓛ	PR STREET LIGHT
Ⓦ	PR WATER SERVICE
Ⓢ	PR SAN SERVICE
▼	PR HYDRO TRANSFORMER
00mmø W/M	PR WATERMAIN
00mmø W/M	PR TEMPORARY WATERMAIN FOR PHASE 1A
00mmø W/M	PR PERMANENT WATERMAIN FOR PHASE 1A
⌖	PR FIRE HYDRANT
	PR WATER VALVE
0m-00mmø SAN @ 0.0%	PR SAN SEWER
	PR PERMANENT SAN SEWER FOR PHASE 1A
● MH K	PR SANITARY MANHOLE
0m-00mmø STM @ 0.0%	PR STM SEWER
MH 4	PR CATCHBASIN MANHOLE
○ MH 4	PR MANHOLE
□	PR CATCHBASIN
x 000.00	PROPOSED ELEVATION
x (000.00)	PR. MATCH EXISTING ELEVATION (INTERPOLATED)
→	PR SWALE
▓	PR HEAVY DUTY ASPHALT
▒	PR UNIT PAVING
░	PR BERM
▨	PR FIRE ACCESS
U.F.E	UPPER FLOOR ELEVATION
G.F.E	GROUND FLOOR ELEVATION

RETAINING WALL NOTE:

ALL RETAINING WALL DESIGNS ARE TO BE COMPLETED BY OTHERS AS PART OF THE BUILDING PERMIT APPROVAL STAGE. ALL WALLS OVER 1.0m HIGH WILL REQUIRE RAILINGS/FENCING AS PER OBC.



EXTERNAL BY-PASS SWALE (TYP.)
CROSS SECTION A-A
N.T.S.

CAUTION
CONTRACTOR TO DETERMINE LOCATION OF EXISTING UTILITIES PRIOR TO CONSTRUCTION.

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Benchmark: 463.937m

ELEVATIONS SHOWN HEREON ARE GEODETIC AND ARE DERIVED FROM CANNET NETWORK BASE STATION ORVL HAVING A PUBLISHED ELEVATION OF 463.937m

J.W.LIGHTHEART
100140403
DEC. 15, 2020

No.	Issue / Revision	Date
1	SPA FIRST SUBMISSION	AUG. 17, 2020
2	SPA SECOND SUBMISSION	DEC. 15, 2020

Mansfield Ski Club

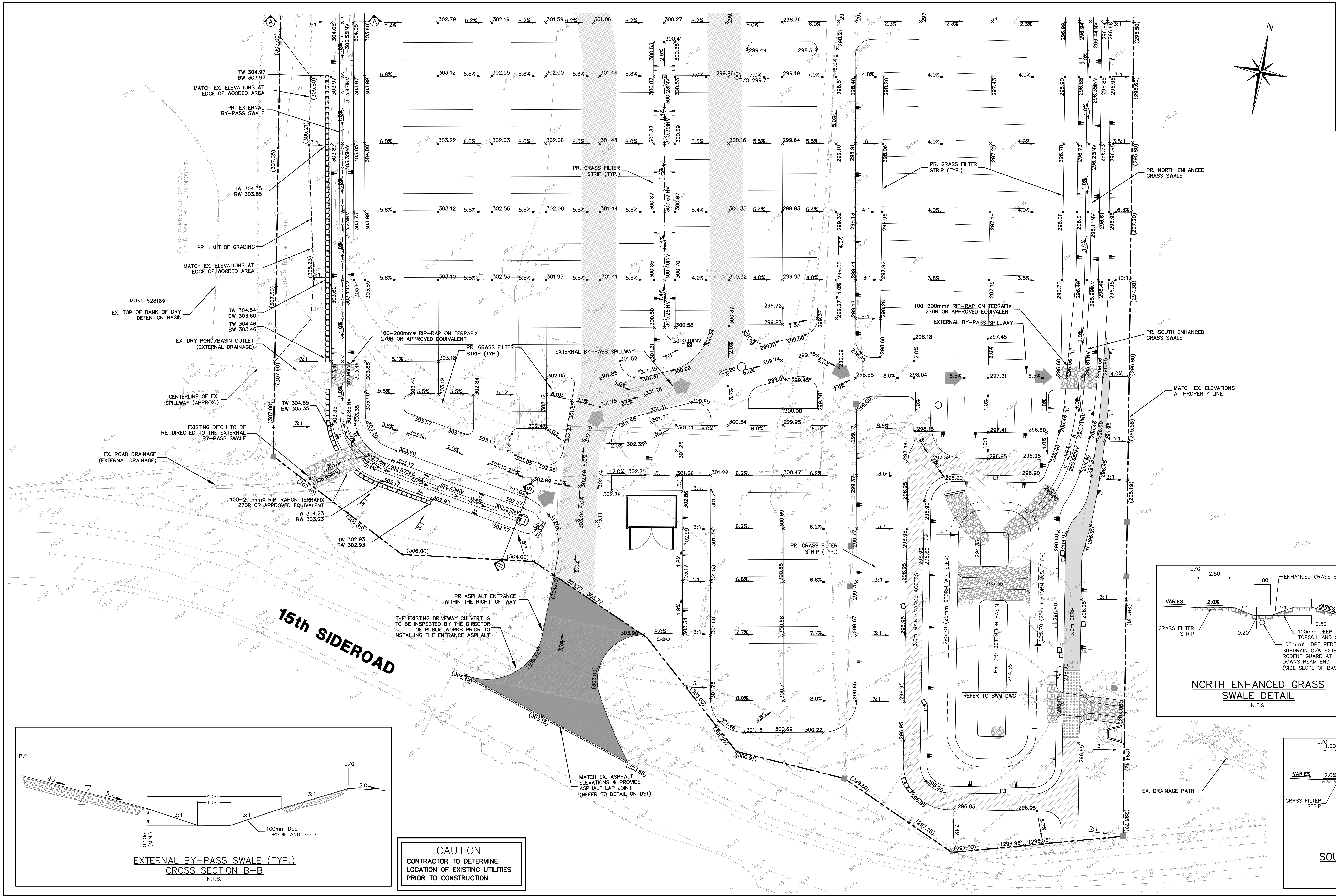
SITE GRADING PLAN NORTH

Client:
Mansfield Ski Club
628213 15th Sideroad
PO Box 75 RPO Mansfield,
Mulmur, Ontario
L9V 3M6

WMI & Associates Limited
119 Collier Street
Barrie, Ontario
L4M 1H5
Ph 705-797-2027
www.wmiengineering.ca

Drawn By AW
Checked By JWL
Drawing No. SGRN
Scale 1:300
Project No. 15-319

\\WMI-SERVER\wmi-server\Data\Projects\2015\15-319\CAD\WMI\Issue_No2\201210_Baseplan_15-319.dwg, SGRN, 1:1



EXTERNAL BY-PASS SWALE (TYP.)
CROSS SECTION B–B
N.T.S.

NORTH ENHANCED GRASS SWALE DETAIL
N.T.S.

SOUTH ENHANCED GRASS SWALE DETAIL
N.T.S.

CAUTION
CONTRACTOR TO DETERMINE LOCATION OF EXISTING UTILITIES PRIOR TO CONSTRUCTION.

RETAINING WALL NOTE:

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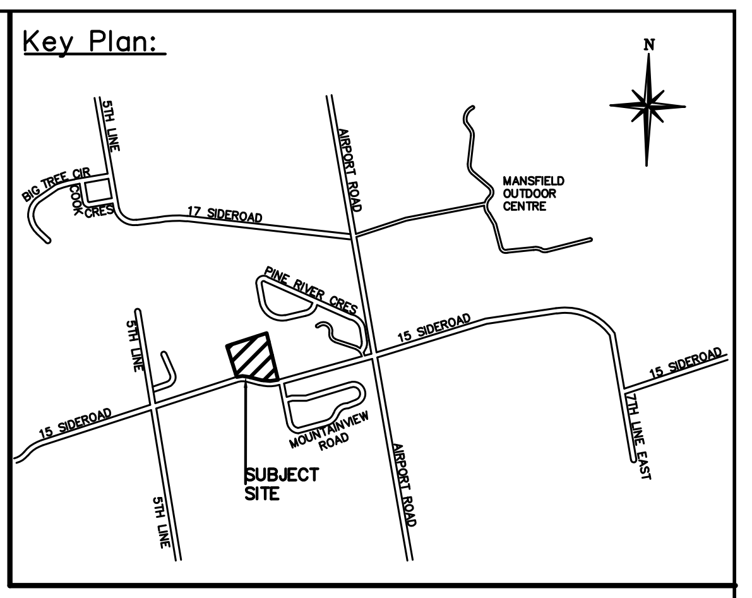
Key Plan:



Legend:

EXISTING FEATURES (EX)

EX SIB	EX STD IRON BAR
EX IB	EX IRON BAR
EX UP	EX UTILITY POLE
☒	EX BELL PED
EX WS	EX WATER SERVICE
EX HYD	EX FIRE HYD.
NS	EX ST NAME SIGN
SS	EX STOP SIGN
x123.45	EX ELEVATION
	EX FENCE
GAS	EX U/G GASMAIN
XB	EX U/G BELL
XH	EX HYDRO
XB/S	EX BOTTOM OF SLOPE
XT/S	EX TOP OF SLOPE
EX WV	EX WATERMAIN & VALVE
EX SAN @ 0.0%	EX SAN SEWER & MH
EX STM @ 0.0%	EX STM SEWER & MH

PROPOSED FEATURES (PR)

NS	PR STREET NAME SIGN
SS	PR STOP SIGN
SF SF SF	PR SILT FENCE
	PR LEGAL PART LOTS
	PR LEGAL BOUNDARY
Ⓛ	PR STREET LIGHT
Ⓦ	PR WATER SERVICE
Ⓢ	PR SAN SERVICE
	PR HYDRO TRANSFORMER
00mmø W/M	PR WATERMAIN
00mmø W/M	PR TEMPORARY WATERMAIN FOR PHASE 1A
00mmø W/M	PR PERMANENT WATERMAIN FOR PHASE 1A
	PR FIRE HYDRANT
	PR WATER VALVE
0m–00mmø SAN @ 0.0%	PR SAN SEWER
	PR PERMANENT SAN SEWER FOR PHASE 1A
MH K	PR SANITARY MANHOLE
0m–00mmø STM @ 0.0%	PR STM SEWER
MH 4	PR CATCHBASIN MANHOLE
MH 4	PR MANHOLE
☐	PR CATCHBASIN
x000.00	PROPOSED ELEVATION
x(000.00)	PR. MATCH EXISTING ELEVATION (INTERPOLATED)
	PR SWALE
▨	PR HEAVY DUTY ASPHALT
▨	PR UNIT PAVING
▨	PR BERM
▨	PR FIRE ACCESS
U.F.E	UPPER FLOOR ELEVATION
G.F.E	GROUND FLOOR ELEVATION
➡	EXTERNAL BY-PASS SPILLWAY

Notes:

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Benchmark: 463.937m

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J.W.LIGHTHEART
100140403
DEC. 15, 2020

No.	Issue / Revision	Date
1	SPA SUBMISSION	AUG. 17, 2020
2	SPA SECOND SUBMISSION	DEC. 15, 2020

Mansfield Ski Club

SITE GRADING PLAN SOUTH

Client:

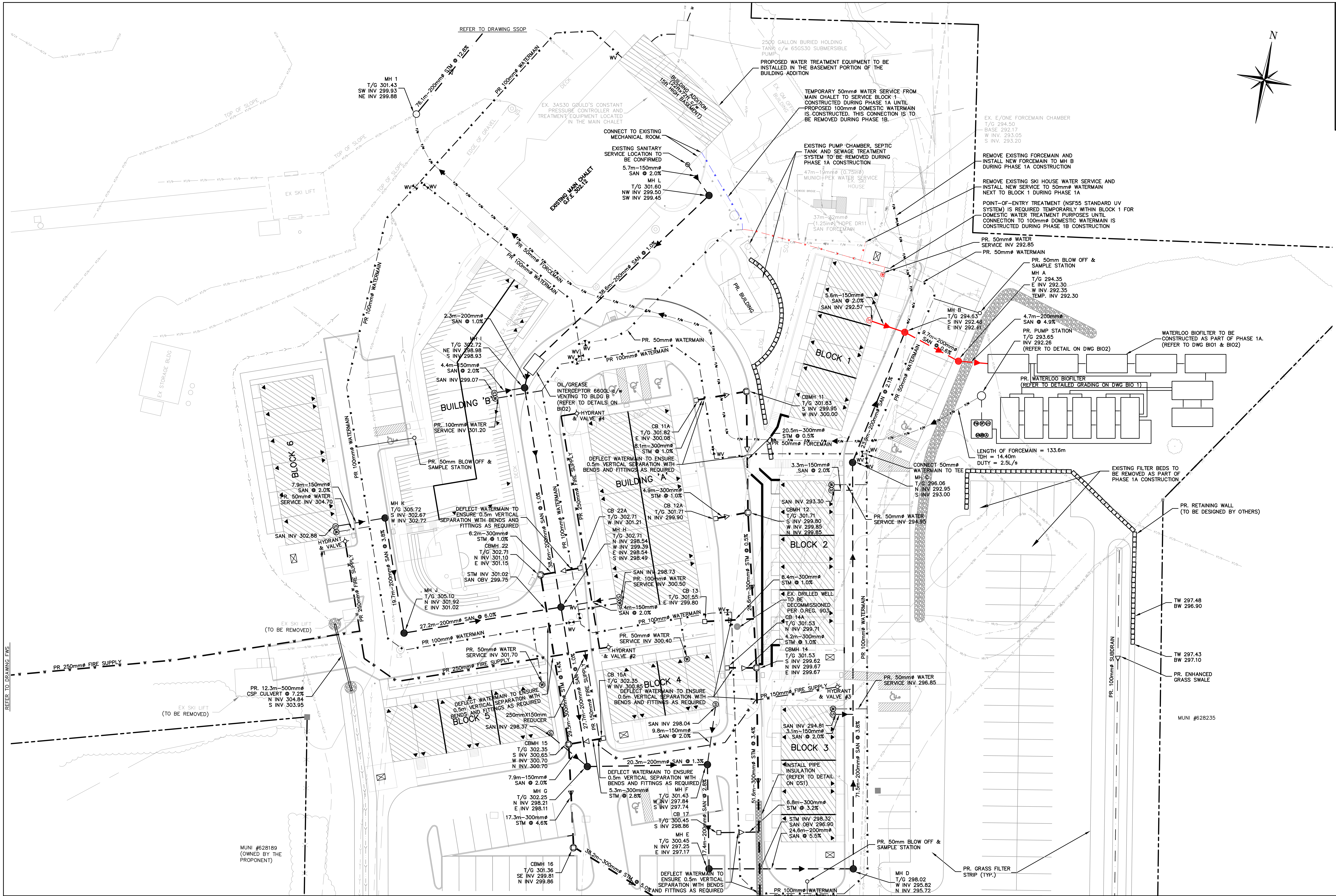
Mansfield Ski Club

628213 15th Sideroad
PO Box 75 RPO Mansfield,
Mulmur, Ontario
L9V 3M6

WMI & Associates Limited
119 Collier Street
Barrie, Ontario
L4M 1H5
Ph 705-797-2027
www.wmiengineering.ca

Drawn By AW	Checked By JWL	Drawing No.
Scale 1:300	Project No. 15–319	SGRS

\\WMI-SERVER\wmi-server\Data\Projects\2015\15-319\CAD\WMI\Issue_No2\201210_Baseplan_15-319.dwg, SGRS, 1:1



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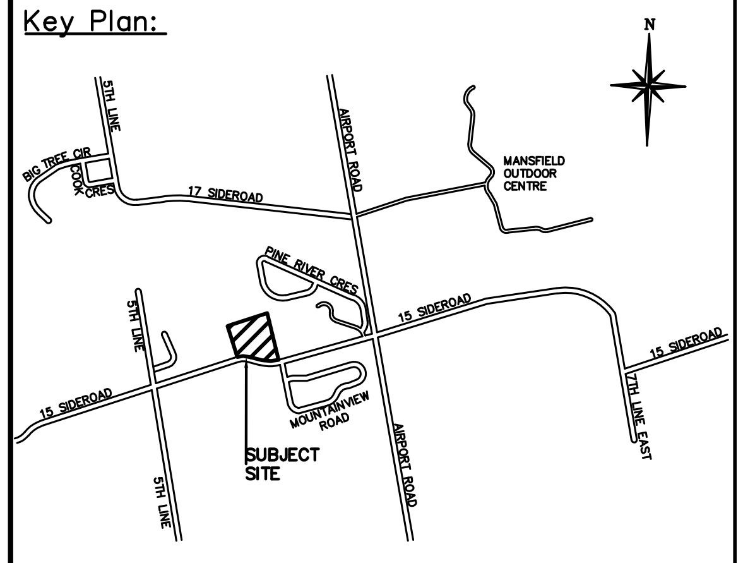

Legend:

EXISTING FEATURES (EX)

EX SIB	EX STD IRON BAR
EX IB	EX IRON BAR
EX UP	EX UTILITY POLE
☒	EX BELL PED
EX WS	EX WATER SERVICE
EX HYD	EX FIRE HYD.
NS	EX ST NAME SIGN
SS	EX STOP SIGN
x 123.45	EX ELEVATION
—o—o—o—	EX FENCE
— GAS — GAS — GAS —	EX U/G GASMAIN
— XB —	EX U/G BELL
— XH — XH — XH — XH —	EX HYDRO
— XB/S — XB/S — XB/S — XB/S —	EX BOTTOM OF SLOPE
— XT/S — XT/S — XT/S — XT/S —	EX TOP OF SLOPE
EX WV	EX WATERMAIN & VALVE
EX SAN @ 0.0%	EX SAN SEWER & MH
EX STM @ 0.0%	EX STM SEWER & MH

PROPOSED FEATURES (PR)

NS	PR STREET NAME SIGN
— SF — SF — SF —	PR SILT FENCE
SS	PR STOP SIGN
— — — —	PR LEGAL PART LOTS
— - - — - - —	PR LEGAL BOUNDARY
Ⓛ	PR STREET LIGHT
—Ⓦ	PR WATER SERVICE
—Ⓢ	PR SAN SERVICE
▼	PR HYDRO TRANSFORMER
00mmø W/M	PR WATERMAIN
00mmø W/M	PR TEMPORARY WATERMAIN FOR PHASE 1A
00mmø W/M	PR PERMANENT WATERMAIN FOR PHASE 1A
⌖	PR FIRE HYDRANT
⊗	PR WATER VALVE
0m–00mmø SAN @ 0.0%	PR SAN SEWER
— — —	PR PERMANENT SAN SEWER FOR PHASE 1A
● MH K	PR SANITARY MANHOLE
0m–00mmø STM @ 0.0%	PR STM SEWER
⊡ MH 4	PR CATCHBASIN MANHOLE
○ MH 4	PR MANHOLE
□	PR CATCHBASIN
x 000.00	PROPOSED ELEVATION
x (000.00)	PR. MATCH EXISTING ELEVATION (INTERPOLATED)
~→	PR SWALE
▩	PR HEAVY DUTY ASPHALT
▨	PR UNIT PAVING
▢	PR BERM
▦	PR FIRE ACCESS
U.F.E	UPPER FLOOR ELEVATION
G.F.E	GROUND FLOOR ELEVATION

WATERMAIN NOTE:
1. THE PROPOSED BUILDINGS ARE NOT SPRINKLERED. NO SIAMESE CONNECTIONS ARE REQUIRED.

SANITARY NOTE:
1. ALL BUILDINGS THAT HAVE RESTAURANT USES WILL REQUIRE AN OIL/GREASE INTERCEPTOR PRIOR TO DISCHARGING INTO THE SANITARY SEWER SYSTEM.

CAUTION

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J.W.LIGHTHEART
100140403
DEC. 15, 2020

No.	Issue / Revision	Date
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2	SPA SECOND SUBMISSION	DEC. 15, 2020

Mansfield Ski Club

GENERAL SERVICING PLAN NORTH

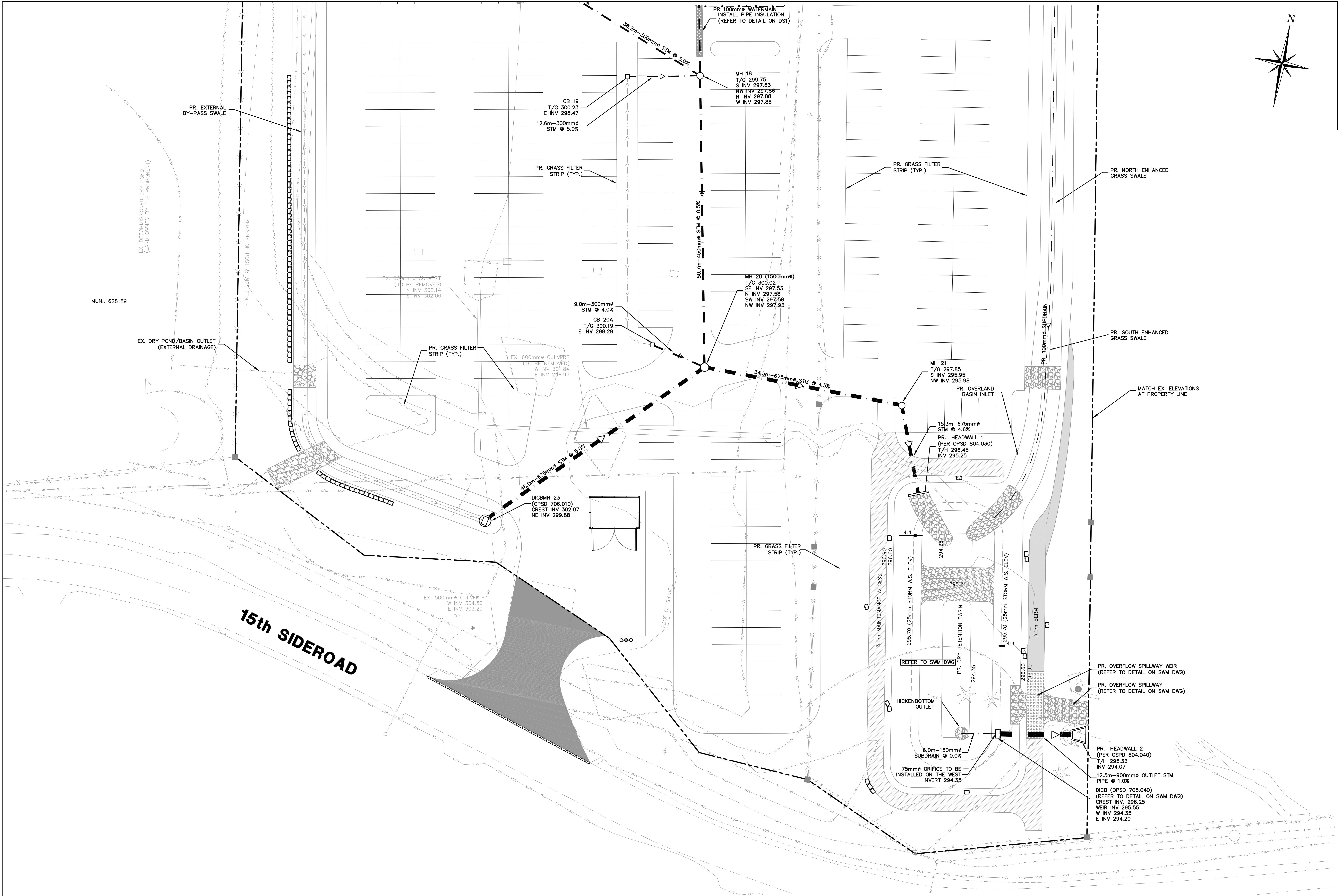
Client:

Mansfield Ski Club
628213 15th Sideroad
PO Box 75 RPO Mansfield,
Mulmur, Ontario
L9V 3M6

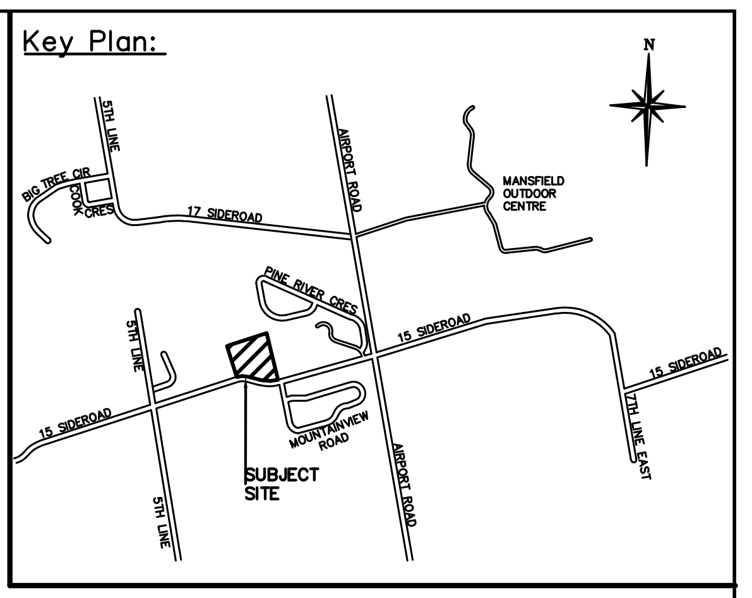
WMI & Associates Limited
119 Collier Street
Barrie, Ontario
L4M 1H5
Ph 705-797-2027
www.wmiengineering.ca

Drawn By	Checked By	Drawing No.
AW	JWL	GENN
Scale 1:300	Project No. 15–319	

\\WMI-SERVER\wmi-server\Data\Projects\2015\15-319\CAD\WMI\Issue_No2\201210_Baseplan_15-319.dwg, GENN, 1:1



Key Plan:



Legend:

EXISTING FEATURES (EX)

- ■ EX SIB — EX STD IRON BAR
- ■ EX IB — EX IRON BAR
- ○ EX UP — EX UTILITY POLE
- ☒ — EX BELL PED
- Ⓦ EX WS — EX WATER SERVICE
- EX HYD — EX FIRE HYD.
- NS — EX ST NAME SIGN
- SS — EX STOP SIGN
- x 123.45 — EX ELEVATION
- EX FENCE
- GAS — EX U/G GASMAIN
- XB — EX U/G BELL
- XH — EX HYDRO
- XB/S — EX BOTTOM OF SLOPE
- XT/S — EX TOP OF SLOPE
- EX WV — EX WATERMAIN & VALVE
- EX SAN @ 0.0% — EX SAN SEWER & MH
- EX STM @ 0.0% — EX STM SEWER & MH

PROPOSED FEATURES (PR)

- NS — PR STREET NAME SIGN
- SS — PR STOP SIGN
- SF — PR SILT FENCE
- PR LEGAL PART LOTS
- PR LEGAL BOUNDARY
- Ⓛ — PR STREET LIGHT
- Ⓦ — PR WATER SERVICE
- Ⓢ — PR SAN SERVICE
- PR HYDRO TRANSFORMER
- 00mmø W/M — PR WATERMAIN
- 00mmø W/M — PR TEMPORARY WATERMAIN FOR PHASE 1A
- 00mmø W/M — PR PERMANENT WATERMAIN FOR PHASE 1A
- PR FIRE HYDRANT
- PR WATER VALVE
- 0m–00mmø SAN @ 0.0% — PR SAN SEWER
- PR PERMANENT SAN SEWER FOR PHASE 1A
- ● MH K — PR SANITARY MANHOLE
- 0m–00mmø STM @ 0.0% — PR STM SEWER
- MH 4 — PR CATCHBASIN MANHOLE
- ○ MH 4 — PR MANHOLE
- ☐ — PR CATCHBASIN
- x 000.00 — PROPOSED ELEVATION
- x (000.00) — PR. MATCH EXISTING ELEVATION (INTERPOLATED)
- PR SWALE
- ▨ — PR HEAVY DUTY ASPHALT
- ▨ — PR UNIT PAVING
- ▨ — PR BERM
- ▨ — PR FIRE ACCESS
- U.F.E — UPPER FLOOR ELEVATION
- G.F.E — GROUND FLOOR ELEVATION

CAUTION

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Benchmark: 463.937m

ELEVATIONS SHOWN HEREON ARE GEODETIC AND ARE DERIVED FROM CANNET NETWORK BASE STATION ORVL HAVING A PUBLISHED ELEVATION OF 463.937m

REGISTERED PROFESSIONAL ENGINEER
J.W.LIGHTHEART
100140403
DEC. 15, 2020
PROVINCE OF ONTARIO

No.	Issue / Revision	Date
1	SPA FIRST SUBMISSION	AUG. 17, 2020
2	SPA SECOND SUBMISSION	DEC. 15, 2020

Mansfield Ski Club

GENERAL SERVICING PLAN SOUTH

Client:

Mansfield Ski Club
628213 15th Sideroad
PO Box 75 RPO Mansfield,
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L9V 3M6

WMI & Associates Limited
119 Collier Street
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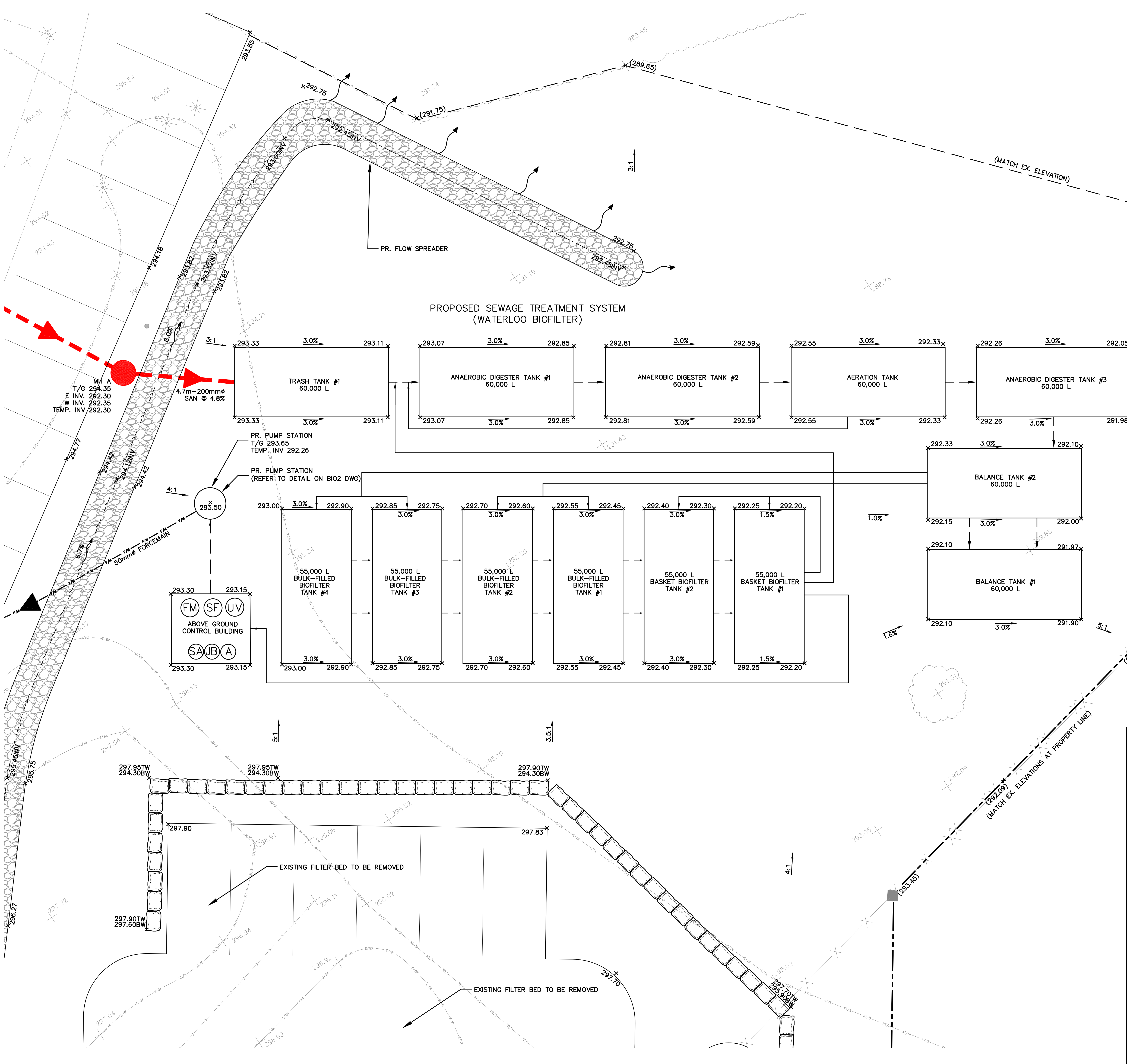
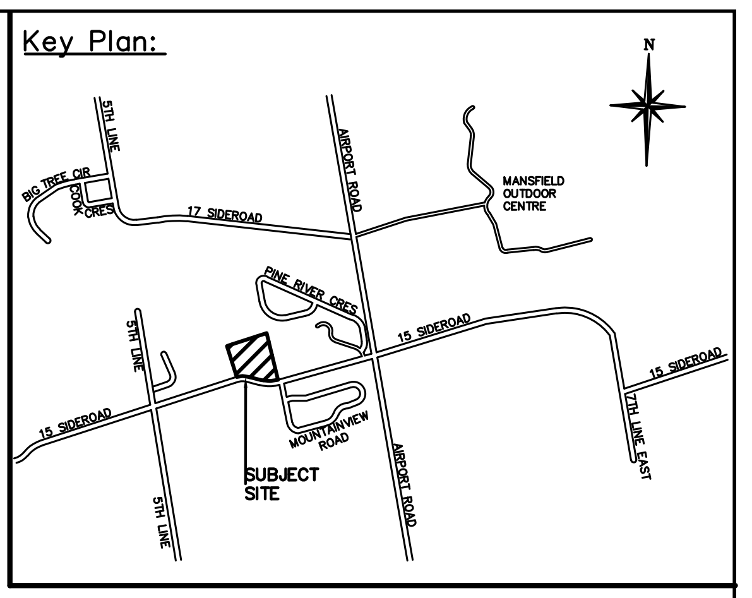
Drawn By AW
Checked By JWL
Drawing No. GENS
Scale 1:300
Project No. 15–319

\\WMI-SERVER\wmi-server\Data\Projects\2015\15-319\CAD\WMI\Issue_No2\201210_Baseplan_15-319.dwg, GENS, 1:1





Legend:

⟶	PR. FORCEMAIN
– – ⟶	PR. GRAVITY SEWER
104.90	PR. ELEVATION
(104.90)	MATCH EXISTING ELEVATIONS

BIOFILTER TANK	GROUND ELEV.	TOP OF STRUCTURE ELEV.	INLET ELEV.	OUTLET ELEV.
TRASH TANK	293.33	292.42	292.07	292.02
ANAEROBIC DIGESTER TANK #1	293.07	292.19	291.84	291.79
ANAEROBIC DIGESTER TANK #2	292.81	291.96	291.61	291.56
AERATION TANK	292.55	291.73	291.38	291.33
ANAEROBIC DIGESTER TANK #3	292.26	291.48	291.13	291.08
BALANCE TANK #2	292.00	291.38	291.03 (G)	287.82 (G) 290.68 (F)
BALANCE TANK #1	291.90	291.32	287.82 (G)	287.82 (G)
BULK–FILLED BIOFILTER TANK #4	293.00	292.08	292.70 (M)	290.10 (G)
BULK–FILLED BIOFILTER TANK #3	292.85	292.08	292.55 (M) 290.10 (G)	290.10 (G)
BULK–FILLED BIOFILTER TANK #2	292.70	291.93	292.40 (M) 289.95 (G)	289.95 (G)
BULK–FILLED BIOFILTER TANK #1	292.55	291.93	292.25 (M) 289.95 (G)	289.95 (G)
BASKET BIOFILTER TANK #2	292.40	291.78	292.10 (M) 289.80 (G)	289.80 (G)
BASKET BIOFILTER TANK #1	292.25	291.78	291.95 (M) 289.80 (G)	289.80 (F)
ABOVE GROUND CONTROL BUILDING	292.15	N/A	N/A	N/A
PUMP STATION	293.50	293.65	292.30	292.30

NOTES:

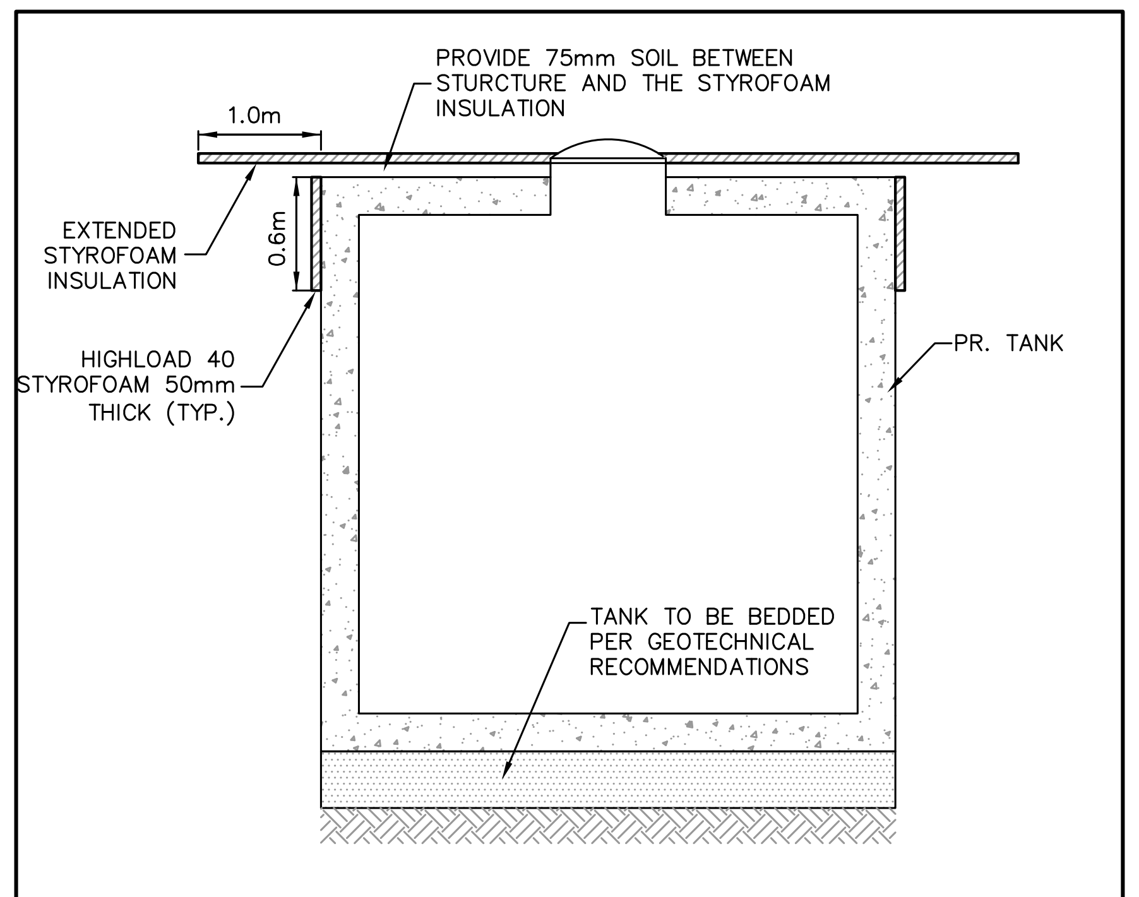
IF TANK HAS MULTIPLE INLETS AND/OR OUTLETS, ASSUME ALL INLETS ARE AT THE SAME ELEVATION AND ALL OUTLETS ARE AT THE SAME ELEVATION UNLESS OTHERWISE INDICATED.

(G) = GRAVITY SEWER
(F) = FORCEMAIN
(M) = 50mm FORCEMAIN SPRAY MANIFOLD THROUGH POLYLOK RISER

NOTES:

1. BIOFILTER DESIGN PROVIDED BY WATERLOO BIOFILTER SYSTEMS INC.
2. REFER TO SHOP DRAWINGS PROVIDED BY WATERLOO BIOFILTER SYSTEMS INC. FOR ALL TANK INTERIOR COMPONENTS AND DETAILS.
3. REFER TO BIO 2 DRAWINGS FOR TYPICAL BIOFILTER TANK CROSS SECTIONS.
4. WATERLOO BIOFILTER SYSTEMS INC. TO PROVIDE INSPECTION DURING CONSTRUCTION OF ALL BIOFILTER SYSTEM STRUCTURES/COMPONENTS.
5. ALL CONCRETE TANKS ARE TO BE INSULATED WITH STYROFOAM HIGHLOAD 40 INSULATION (BY OTHERS). STYROFOAM TO BE EXTENDED 1.0m BEYOND THE PERIMETER OF THE TANK AND EXTENDED 0.6m BELOW BOTTOM ON THE TANK. (REFER TO DETAIL ON THIS DRAWING)
6. PROVIDE A MINIMUM OF 0.3m OF COVER OVER ALL BIOFILTER STRUCTURES.
7. ALL STRUCTURES THAT CONTAIN FILTERS, SCREENS, PUMPS, ETC. REQUIRE 0.75x0.75m ALUMINUM ACCESS HATCHES. ALL OTHER STRUCTURE REQUIRE A 0.6m MAINTENANCE HOLE ACCESS LIDS.
8. ALL GRAVITY SEWERS TO BE 100mmø and 150mmø PVC SDR 28 SEWER PIPE AND ALL FORCEMAIN TO BE 50mmø (2.0inø) HDPE DR11 SANITARY PIPE (OR APPROVED EQUIVALENT) C/W CAUTION TAPE PLACED 300mm ABOVE THE PIPE FOR ALL BIOFILTER SERVICING. REFER TO SHOP DRAWINGS FOR PIPE SIZING.
9. ALL BIOFILTER STRUCTURES (TANKS) TO BE PORTER'S QUALITY PRECAST CONCRETE & ACCESSORIES OR APPROVED EQUIVALENT. REFER TO BIO 2 FOR ADDITIONAL DETAILS.
10. FORCEMAIN TO BE PLACED AT A CONSTANT GRADE IN ONE DIRECTION (I.E. MINIMIZE UP/DOWN BENDS WHERE POSSIBLE) TO REDUCE THE POSSIBILITY OF AIR–LOCKING THE SYSTEM.
11. ALL SANITARY SEWER SHALL HAVE 1.2m OF COVER MINIMUM. WHERE 1.2m OF COVER CAN'T BE OBTAINED, SANITARY SEWER SHALL BE INSULATED AS PER DETAIL ON DS1.
12. ALL TANK PLUMBING (I.E. PUMPS, VALVES, FILTERS, AND SCREENS) TO BE ACCESSIBLE AT GRADE.
13. THE CONTRACTOR SHALL BE A LICENSED INSTALLER AND BE APPROVED BY WATERLOO BIOFILTER SYSTEMS INC.
14. ESTABLISH ONTARIO BUILDING CODE SETBACKS FOR CLASS 4 TREATMENT UNITS (TABLES 8.2.1.6.A.)

SETBACK DESCPRITION	DISTANCE (m)
ALL TANKS TO STRUCTURES	1.5
ALL TANKS TO LAKE, POND, SPRING	15
ALL TANKS TO ANY WELL	15
ALL TANKS TO PROPERTY LINE	3



STYROFOAM INSULATION DETAIL

N.T.S.

CAUTION
CONTRACTOR TO DETERMINE LOCATION OF EXISTING UTILITIES PRIOR TO CONSTRUCTION.

NOTE: CONTRACTOR TO ARRANGE WITH HYDRO RE: METERING REQUIREMENTS, METERING CABINET, MOUNTING & FINAL CONNECTION AT CONTROL PANEL. CONTRACTOR TO COORDINATE BELL CONNECTION FOR ALARM FOR PROPOSED SEWAGE PUMPING STATION

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DEC. 15, 2020
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Mansfield Ski Club

BIOFILTER PLAN 1

Client:

Mansfield Ski Club

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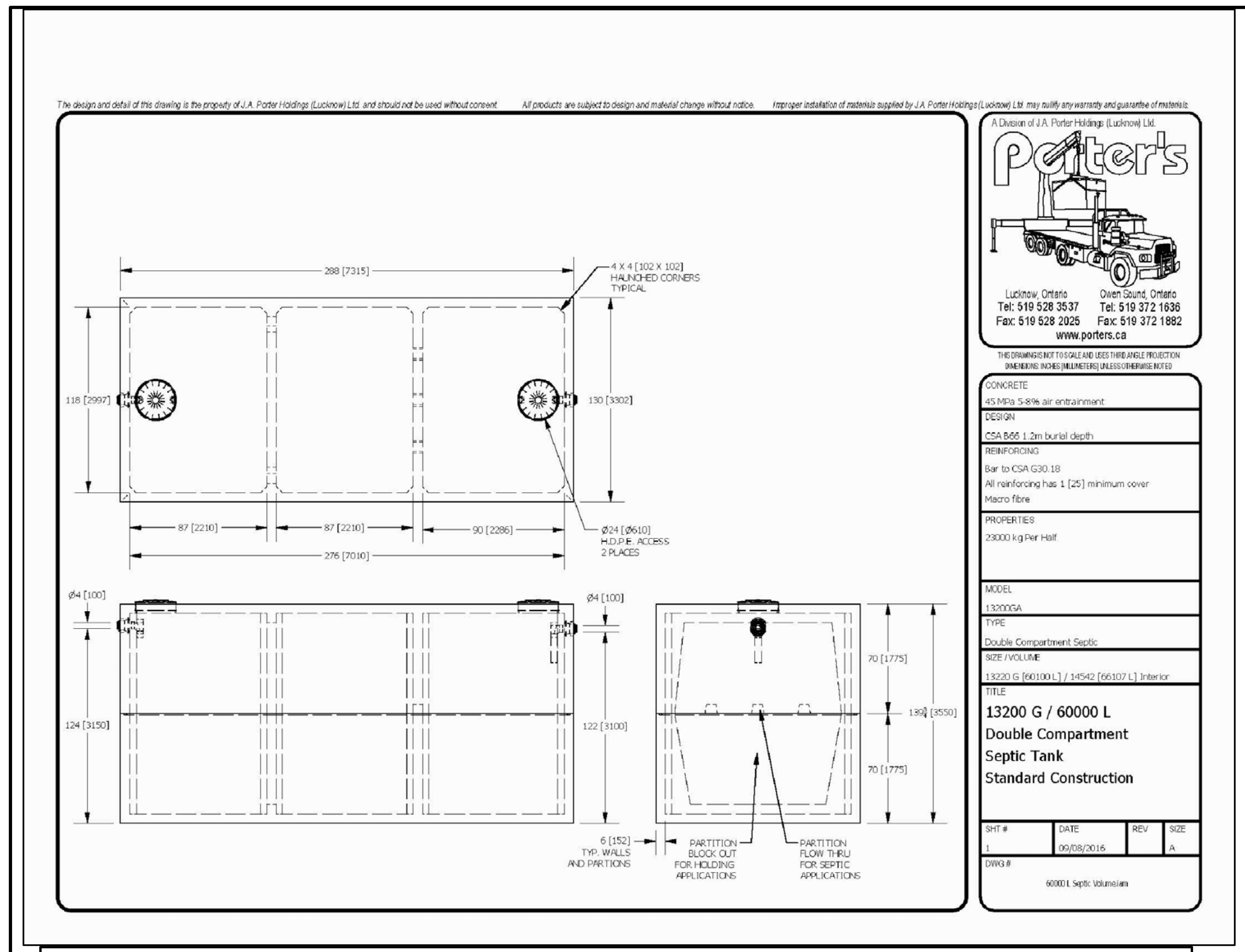
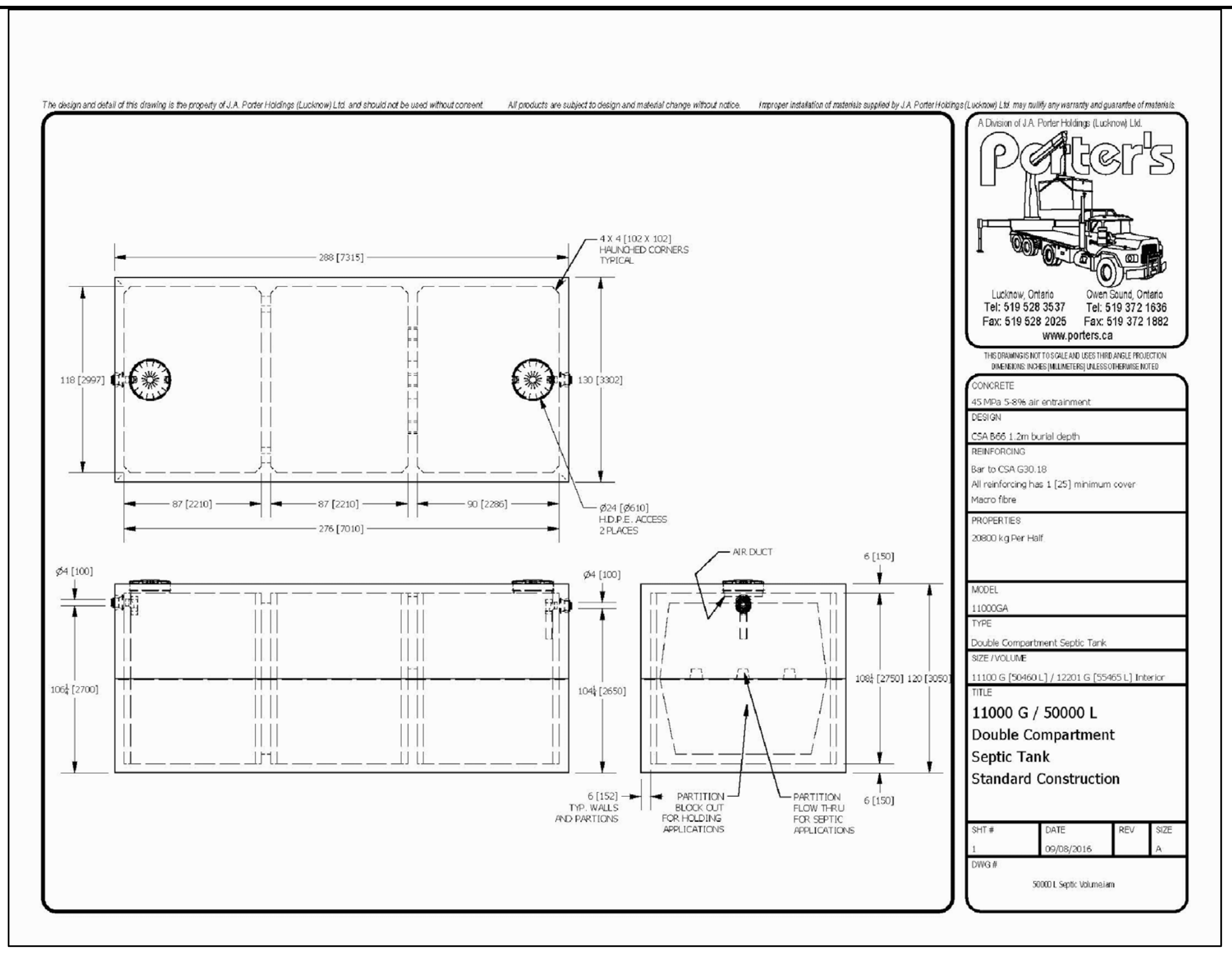
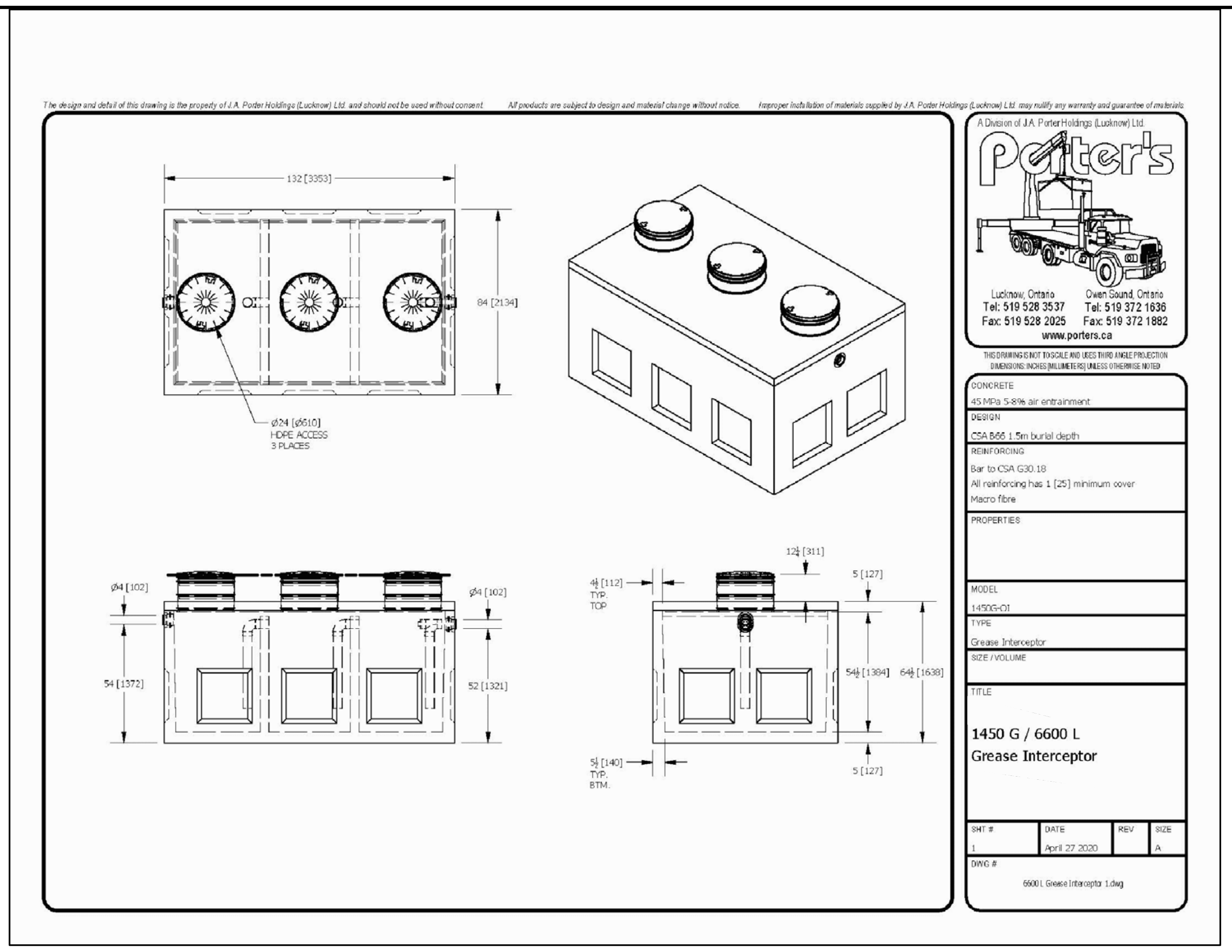
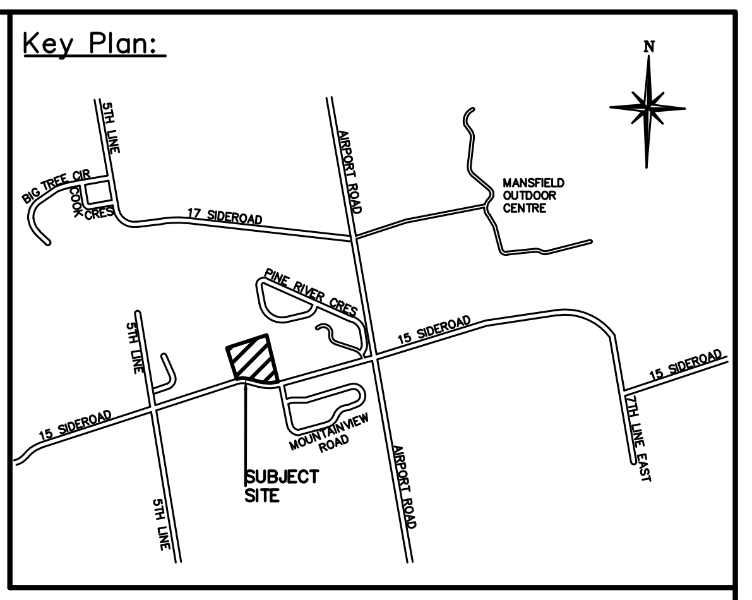
Drawn By AW	Checked By JWL	Drawing No. BIO1
Scale 1:100	Project No. 15–319	









CAUTION

CONTRACTOR TO DETERMINE LOCATION OF EXISTING UTILITIES PRIOR TO CONSTRUCTION.

BIOFILTER SYSTEM NOTES PROVIDED BY WATERLOO BIOFILTER SYSTEMS INC.:

1. THIS IS A PRELIMINARY PROCESS DESCRIPTION FOR A WATERLOO BIOFILTER SEWAGE TREATMENT SYSTEM.
2. THE TOTAL DAILY SANITARY SEWAGE DESIGN FLOW FOR THIS FACILITY IS 118,950 L/day.
3. THE RAW SEWAGE IS EXPECTED TO HAVE THE FOLLOWING TYPICAL CONCENTRATIONS:

BOD = 250 mg/L
TSS = 210 mg/L
TP = 7 mg/L
TKN = 60 mg/L

4. WASTEWATER FROM THE RESTAURANT KITCHEN SINKS FLOWS BY GRAVITY INTO A 6,600 L OIL/GREASE INTERCEPTOR. THE INTERCEPTOR IS VENTED AS PER MANUFACTURER'S RECOMMENDATIONS.
5. THE INTERCEPTOR EFFLUENT AND ALL SANITARY SEWAGE FROM THE FACILITY FLOWS BY GRAVITY INTO A 60,000 L SINGLE COMPARTMENT TRASH TANK. THE INLET AND OUTLET OF THE TANK ARE EQUIPPED WITH BAFFLES.
6. THE TRASH TANK EFFLUENT FLOWS BY GRAVITY THROUGH TWO (2) 60,000 L SINGLE COMPARTMENT ANAEROBIC DIGESTER TANKS (#1 & #2) ARRANGED IN SERIES. THE INLET OF EACH TANK IS EQUIPPED WITH AN INNERTUBE AND THE OUTLET IS EQUIPPED WITH A BAFFLE.
7. ANAEROBIC DIGESTER TANK #2 EFFLUENT FLOWS BY GRAVITY INTO A 60,000 L DOUBLE COMPARTMENT AERATION TANK. THE INLET OF THE TANK IS EQUIPPED WITH A BAFFLE. THE AERATION TANK HOUSES TWO (2) AERATORS. THE OUTLET OF THE TANK IS EQUIPPED WITH A BAFFLE.
8. THE AERATION TANK EFFLUENT FLOWS BY GRAVITY INTO A 60,000 L SINGLE COMPARTMENT ANAEROBIC DIGESTER TANK (#3). THE INLET OF THE TANK IS EQUIPPED WITH AN INNERTUBE. A SUBMERSIBLE PUMP RECIRCULATES A PORTION OF THE EFFLUENT TO THE INLET OF THE TRASH TANK. THE OUTLET OF THE TANK IS EQUIPPED WITH SIX (6) EFFLUENT FILTERS.
9. THE ANAEROBIC DIGESTER TANK #3 EFFLUENT FLOWS BY GRAVITY INTO A 60,000 L SINGLE COMPARTMENT BALANCING TANK #2 WHICH IS CONNECTED BY BOTTOM DRAINS WITH A 60,000 L SINGLE COMPARTMENT BALANCING TANK #1. BALANCING TANK #2 IS EQUIPPED WITH TWO (2) PAIRS OF SUBMERSIBLE PUMPS, WITH EACH PAIR OPERATING ON AN ALTERNATING TIMER.
10. EACH PAIR OF PUMPS IN BALANCING TANK #2 DOSES TWO (2) 55,000 L SINGLE COMPARTMENT BULK–FILLED BIOFILTER TANKS EACH FILLED WITH 55 m^3 OF BIOFILTER MEDIUM (220 m^3 TOTAL). THE SEWAGE IS EVENLY DISTRIBUTED OVER THE SURFACE OF THE MEDIUM AND TREATED AS IT TRICKLES THROUGH THE INTERIOR OF THE MEDIUM. SMALL, LOW VOLTAGE AIR FANS AND PASSIVE VENTING PROMOTE AEROBIC CONDITIONS. THE BULK–FILLED BIOFILTER TANKS ARE CONNECTED BY BOTTOM DRAINS.
11. BULK–FILLED BIOFILTER TANK #1 IS CONNECTED BY BOTTOM DRAINS TO A 55,000 L SINGLE COMPARTMENT BASKET BIOFILTER TANK #2 WHICH IN TURN IS CONNECTED BY BOTTOM DRAINS TO A 55,000 L BASKET BIOFILTER TANK #1. BASKET BIOFILTER TANK #1 IS EQUIPPED WITH THREE (3) SUBMERSIBLE PUMPS OPERATING ON SEPARATE TIMERS AND TWO (2) SUBMERSIBLE PUMPS OPERATING ON ALTERNATING DEMAND.
12. THE FIRST SIMPLEX PUMP IN BASKET BIOFILTER TANK #1 PUMPS A MAXIMUM OF 43,000 L/day TO THREE (3) BASKETS LOCATED IN EACH OF BASKET BIOFILTER TANK #1 & #2. EACH BASKET IS FILLED WITH 10 m^3 OF BIOFILTER MEDIUM (60 m^3 TOTAL). THE SEWAGE IS EVENLY DISTRIBUTED OVER THE SURFACE OF THE MEDIUM AND TREATED AS IT TRICKLES THROUGH THE INTERIOR OF THE MEDIUM. SMALL, LOW VOLTAGE AIR FANS AND PASSIVE VENTING PROMOTE AEROBIC CONDITIONS. THE EFFLUENT FROM THE BASKETS MIXES WITH THE EFFLUENT FROM THE BULK–FILLED BIOFILTER TANKS.
13. THE SECOND SIMPLEX PUMP IN BASKET BIOFILTER TANK #1 RECIRCULATES A PORTION OF THE EFFLUENT (PERCENTAGE IS ADJUSTABLE) TO THE INLET OF THE TRASH TANK.
14. THE THIRD SIMPLEX PUMP IN BASKET BIOFILTER TANK #1 PUMPS A PORTION OF THE EFFLUENT (PERCENTAGE IS ADJUSTABEL) TO TWO (2) SAND FILTERS LOCATED IN AN ABOVE GROUND CONTROL BUILDING. THE EFFLUENT FROM THE SAND FILTERS DRAINS BY GRAVITY BACK TO BASKET BIOFILTER TANK #1.
15. THE PAIR OF PUMPS IN BASKET BIOFILTER TANK #1 PUMP THE EFFLUENT THROUGH A FLOW METER AND FOUR (4) UV DISINFECTION UNITS LOCATED IN THE ABOVE GROUND CONTROL BUILDING.
16. THE CONTROL BUILDING ALSO HOUSES THREE (3) METERING PUMPS. THE FIRST TO DOSE SODIUM ALUMINATE INTO THE TRASH TANK AND/OR ANAEROBIC DIGESTER TANK #3, THE SECOND TO DOSE AN ALKALINITY CHEMICAL INTO ANAEROBIC DIGESTER TANK #3, AND THE THIRD TO DOSE BENEFICIAL BACTERIA TO THE INLET OF BALANCING TANK #1.
17. THE UV EFFLUENT CONTINUES TO A PUMP STATION SUPPLIED BY JOHN BROOKS COMPANY LIMITED.
18. ALL PUMPS ARE RUN BY A WATERLOO SMART PANEL(S). THE WATERLOO SMART PANEL PROVIDES REMOTE MONITORING, CONTROL, AND DATA LOGGING OVER A STABLE WIRELESS CELLULAR NETWORK. THIS FUNCTIONALITY ALLOWS FOR REAL TIME OPERATIONAL ADJUSTMENTS TO OPTIMIZE SYSTEM PERFORMANCE. THE WATERLOO SMART PANEL ALSO IMMEDIATELY NOTIFIES THE SERVICE PROVIDER OF A PUMP FAILURE OR HIGH LEVEL ALARM, PROVIDING THEM WITH VITAL INFORMATION TO LIMIT SITE VISITS WHILE KEEPING THE SYSTEM OPERATING PROPERLY.
19. ADHERENCE TO BEST MANAGEMENT PRACTICES (PROVIDING THE APPROPRIATE STRENGTH SEWAGE, PERFORMING ROUTINE MAINTENANCE, LIMITING TOXINS ENTERING THE SYSTEM, ETC.) IS NECESSARY FOR OPTIMAL PERFORMANCE OF THE WATERLOO BIOFILTER TREATMENT SYSTEM OUTLINED IN THIS SCHEMATIC, WHICH IS DESIGNED FOR THE FOLLOWING EFFLUENT OBJECTIVES (LIMITS) (LOADING LIMITS):

cBOD = 10.0 mg/L (15.0 mg/L) (1.8 kg/day)
TSS = 10.0 mg/L (15.0 mg/L) (1.8 kg/day)
TP = 0.5 mg/L (1.0 mg/L) (0.12 kg/day)
TAN = 3.0 mg/L (5.0 mg/L) (0.6 kg/day)
E.Coli = 100 cfu/100 mL (200 cfu/100 mL)
pH = 6.5 to 8.5 (6.0 to 9.0)

PUMP STATION NOTES:

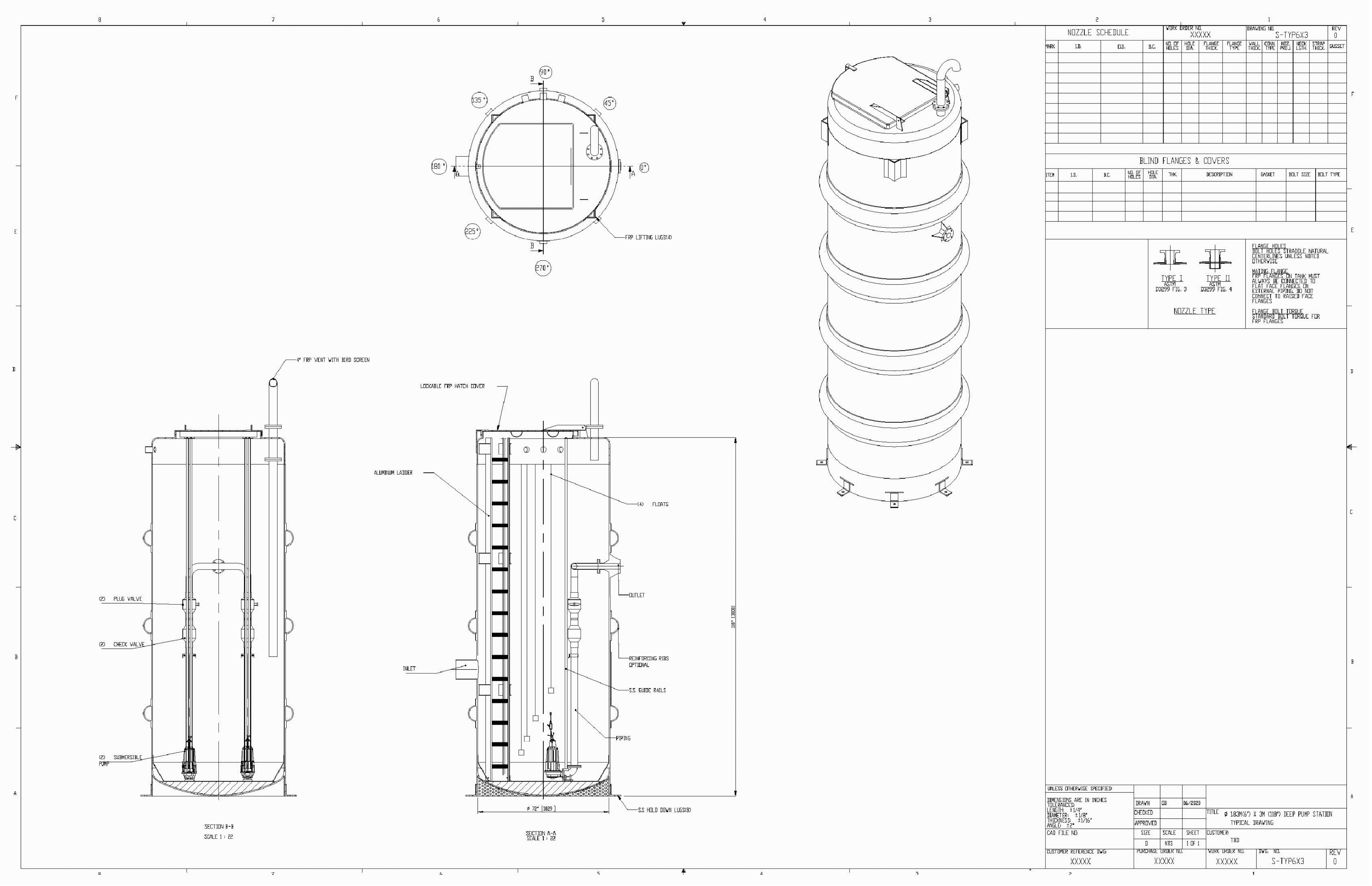
1. THE CONTRACTOR SHALL TAKE PRECAUTIONS TO PREVENT UPLIFT DURING CONSTRUCTION.
2. ELECTRICAL CONDUITS SHALL BE BURIED 0.9m MIN. BELOW FINISHED GRADE C/W TRACING WIRE.
3. DUTY POINT: 2.5 L/S @ 14.40m TDH

ONE (1) JOHN BROOKS DUPLEX SUBMERSIBLE PUMP STATION WITH THE FOLLOWING COMPONENTS:

- (2) TWO SUBMERSIBLE SEWAGE GRINDER PUMP
- (2) TWO 10FT GALV LIFTING CHAIN PACKAGES
- (1) ONE STAINLESS STEEL LEVEL CONTROL BRACKET #10–0253
- (1) ONE NEMA 4X DUPLEX CONTROL PANEL WITH HWA & AUX CONTACT (#10–1044).
- (4) FOUR #10–0744 LEVEL CONTROLS ONE
- (4) FOUR FLOATATION WEIGHTS
- (2) JUNCTION BOX (WIRING BY OTHERS)
- (1) ONE FIBERGLASS BASIN (1800mmø X 3.0m DEEP) WITH QUICK DISCONNECTS, PVC DISCHARGE PIPING, GUIDE RAILS, FIBERGLASS COVER AND HATCHES
- (2) TWO 2x2 EZ–OUT ASSEMBLY WITH UPPER GUIDE BRACKET #39–0083
- (2) TWO #30–0152 2" CAST IRON FULL FLOW CHECK VALVE
- (2) TWO SHUT OFF VALVES
- (2) TWO VENTS
- UNLOADING AND INSTALLATION TO BE COMPLETED BY THE CONTRACTOR
- ****ANTI–FLOAT CONCRETE BLOCK REQUIRED**

  (PUMP STATION BALLAST TO BE DONE BY OTHERS)
- SUITABLE CONDUIT SEALS ARE TO BE SUPPLIED AND INSTALLED BETWEEN THE JUNCTION BOX AND THE PANEL AS REQUIRED BY THE CANADIAN ELECTRICAL CODE, THE ENGINEER OR THE AUTHORITY HAVING JURISDICTION

4. VENT PIPE ASSEMBLY AS PER DETAIL ON BROOKS DRAWING
5. ELECTRICAL WORK AND EQUIPMENT IN WET WELL TO COMPLY WITH THE CURRENT ONTARIO ELECTRICAL CODE



NOTE: THIS DRAWING IS FOR SCHEMATIC PURPOSES ONLY AND FINAL SHOP DRAWINGS ARE TO BE PROVIDED BY JOHN BROOKS COMPANY PRIOR TO CONSTRUCTION.

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REGISTERED PROFESSIONAL ENGINEER
J.W.LIGHTHEART
100140403
DEC. 15, 2020
PROVINCE OF ONTARIO

No.	Issue / Revision	Date
1	SPA FIRST SUBMISSION	AUG. 17, 2020
2	SPA SECOND SUBMISSION	DEC. 15, 2020

Mansfield Ski Club

BIOFILTER PLAN 2

Client:

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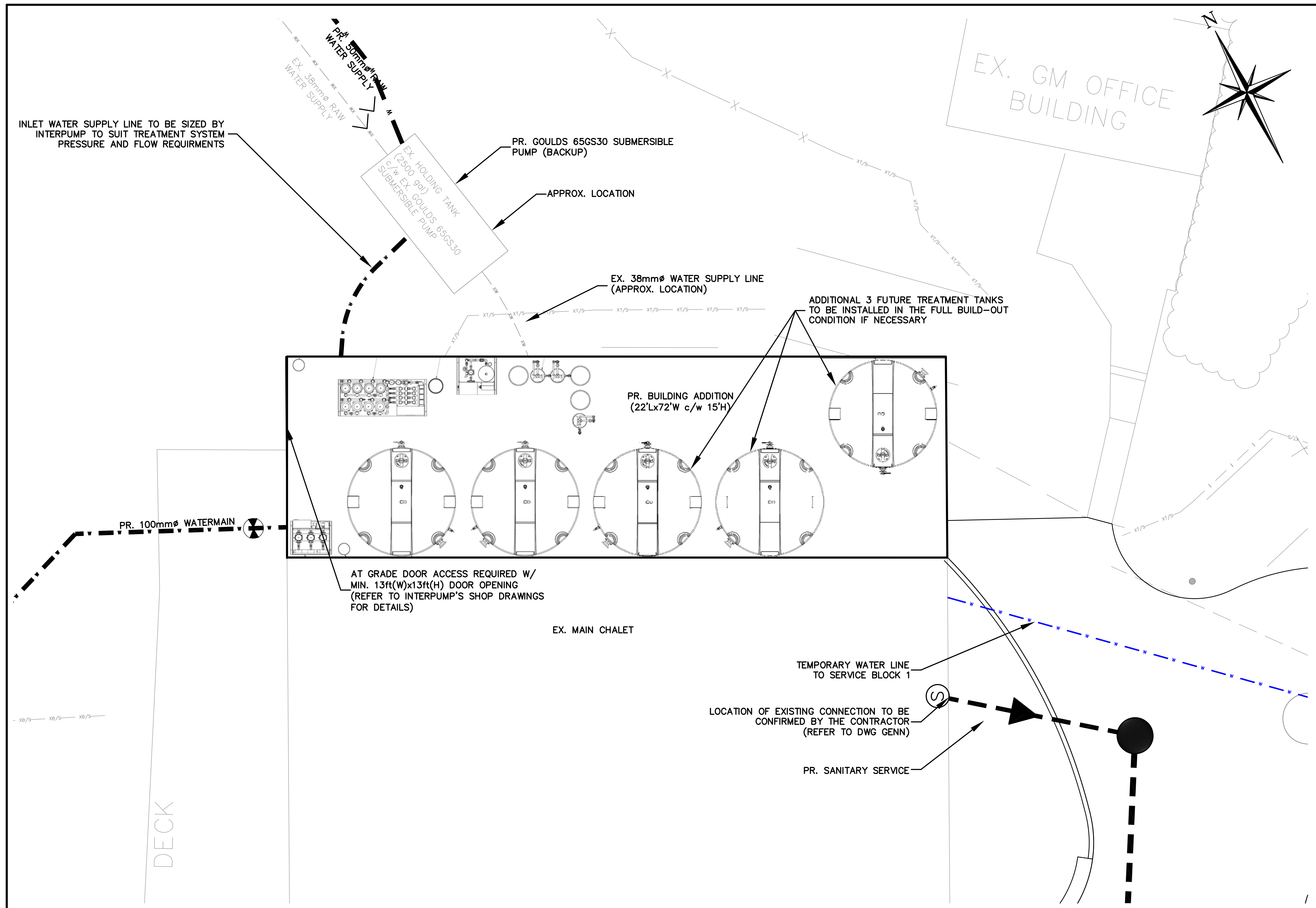
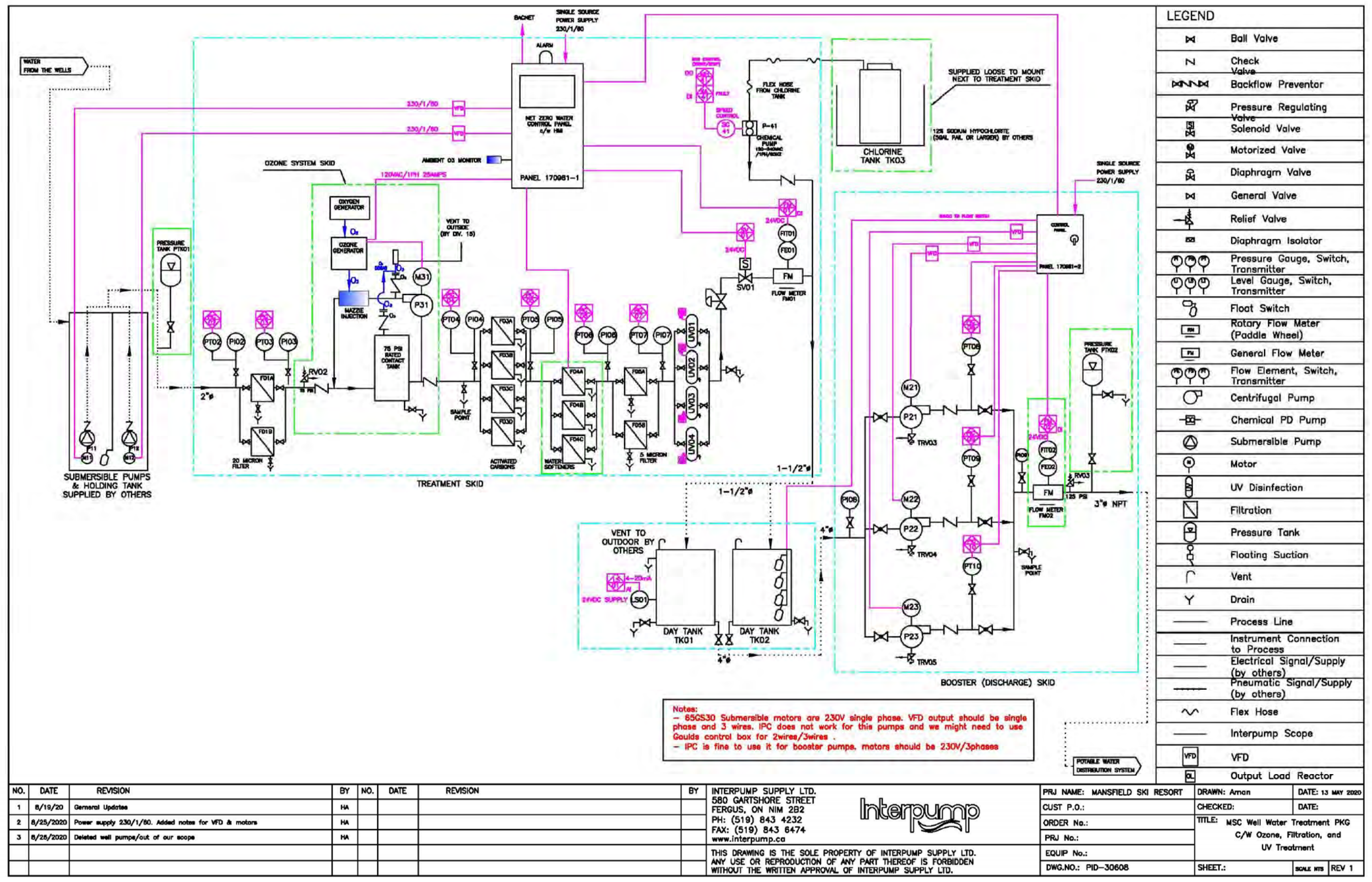
L9V 3M6

WMI & Associates Limited
119 Collier Street
Barrie, Ontario
L4M 1H5
Ph 705-797-2027
www.wmiengineering.ca

Drawn By	AW	Checked By	JWL	Drawing No.
Scale	1:100	Project No.	15–319	BIO2





Notes:
- 65GS30 Submersible motors are 230V single phase. VFD output should be single phase and 3 wires. IPC does not work for this pumps and we might need to use Goulds control box for 2wires/3wires .
- IPC is fine to use it for booster pumps. motors should be 230V/3phases

NO.	DATE	REVISION	BY	NO.	DATE	REVISION	BY
1	8/19/20	General Updates	HA				
2	8/25/2020	Power supply 230/1/60. Added notes for VFD & motors	HA				
3	8/28/2020	Deleted well pumps/out of our scope	HA				

INTERPUMP SUPPLY LTD.
580 GARTSHORE STREET
FERGUS, ON NIM 2B2
PH: (519) 843 4232
FAX: (519) 843 6474
www.interpump.ca

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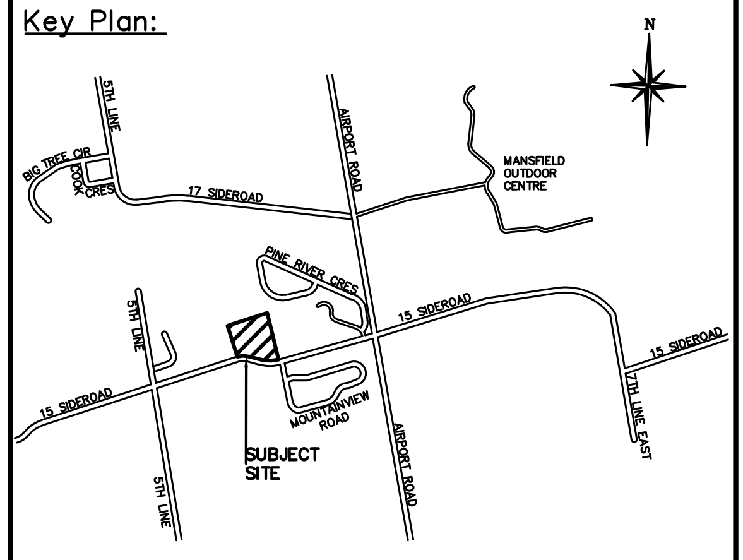
PRJ NAME: MANSFIELD SKI RESORT
CUST P.O.:
ORDER No.:
PRJ No.:
EQUIP No.:
DWG.NO.: PID-30608
DRAWN: Aman
DATE: 13 MAY 2020
CHECKED:
DATE:
TITLE: MSC Well Water Treatment PKG C/W Ozone, Filtration, and UV Treatment
SHEET.:
SCALE NTS
REV 1

Key Plan:



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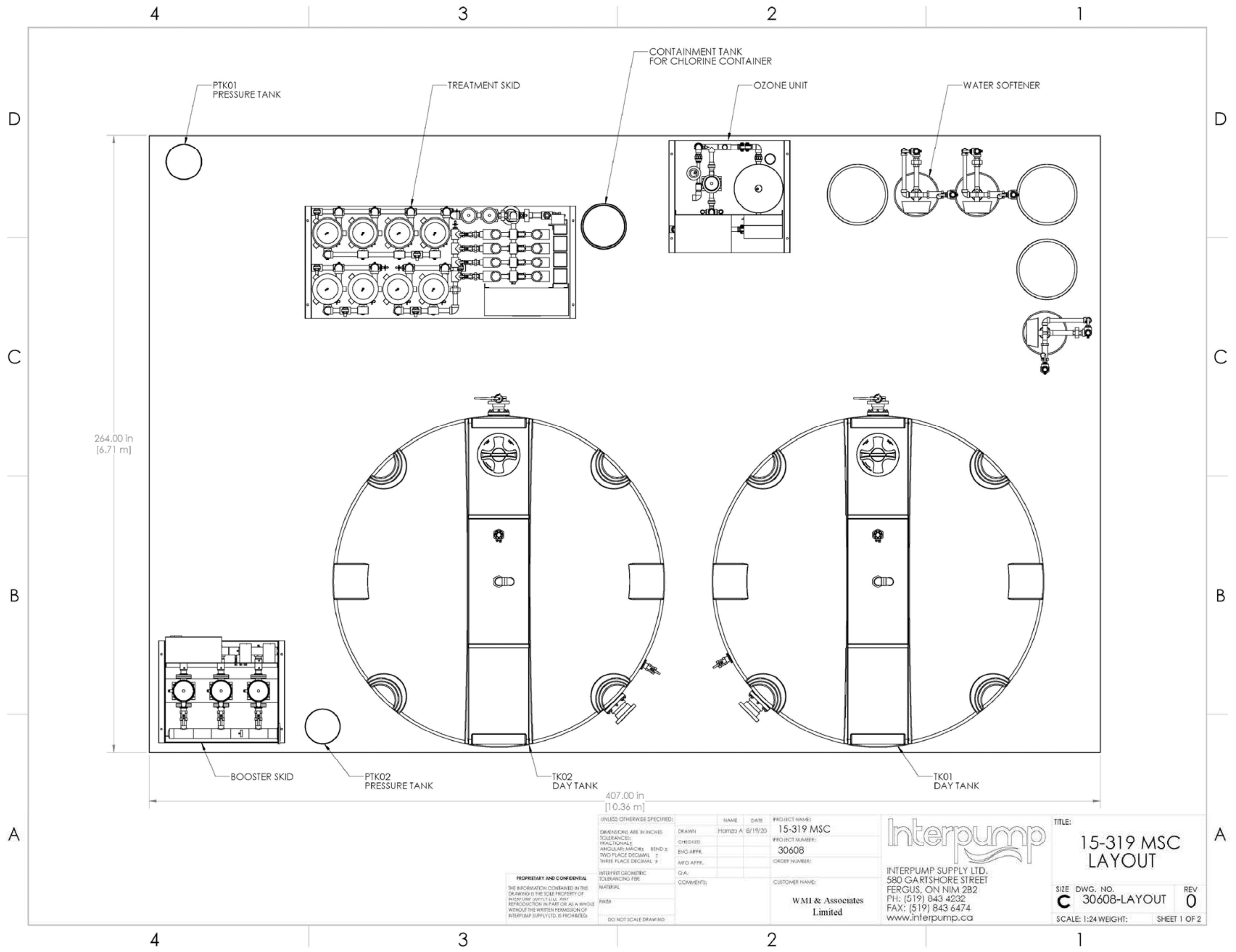

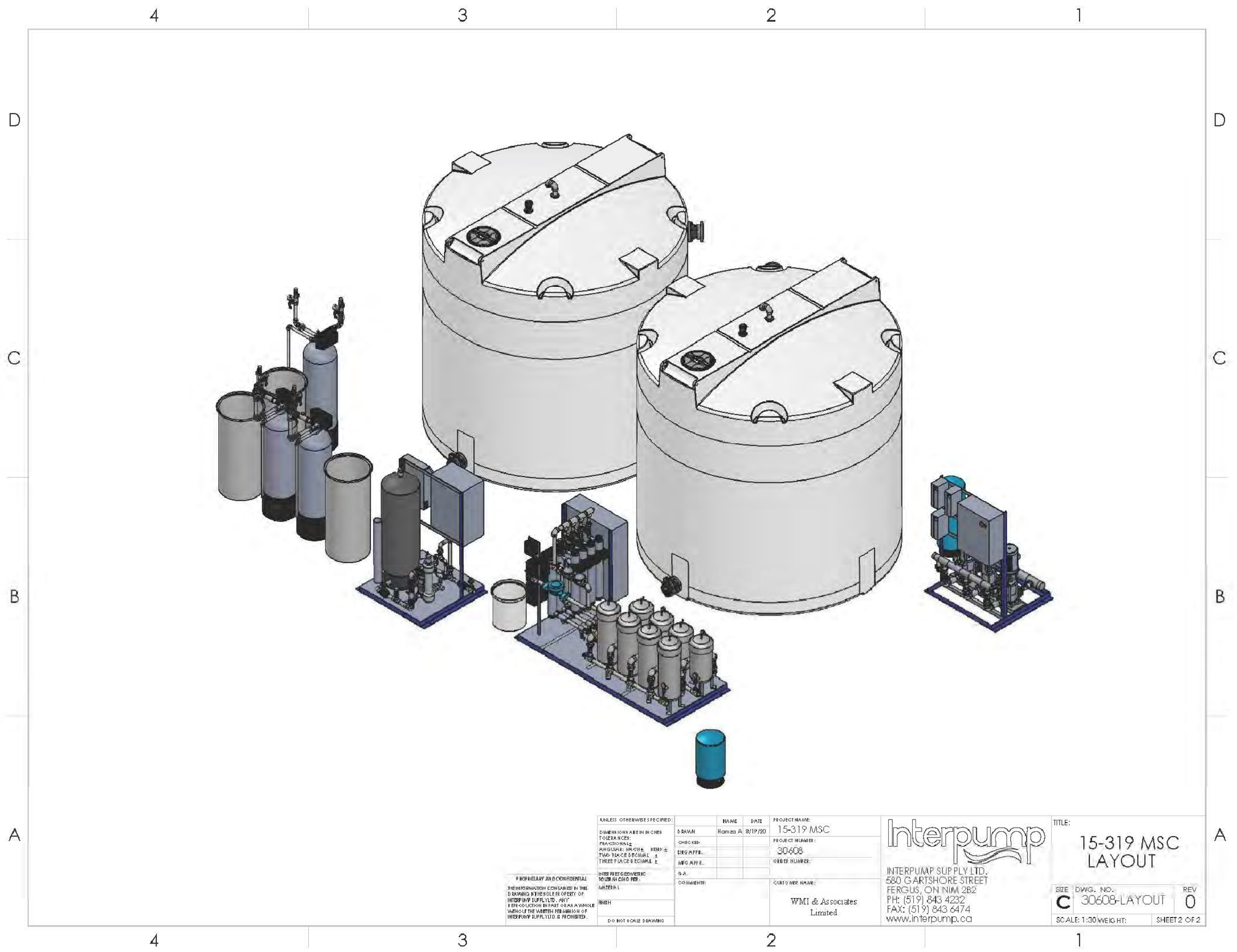

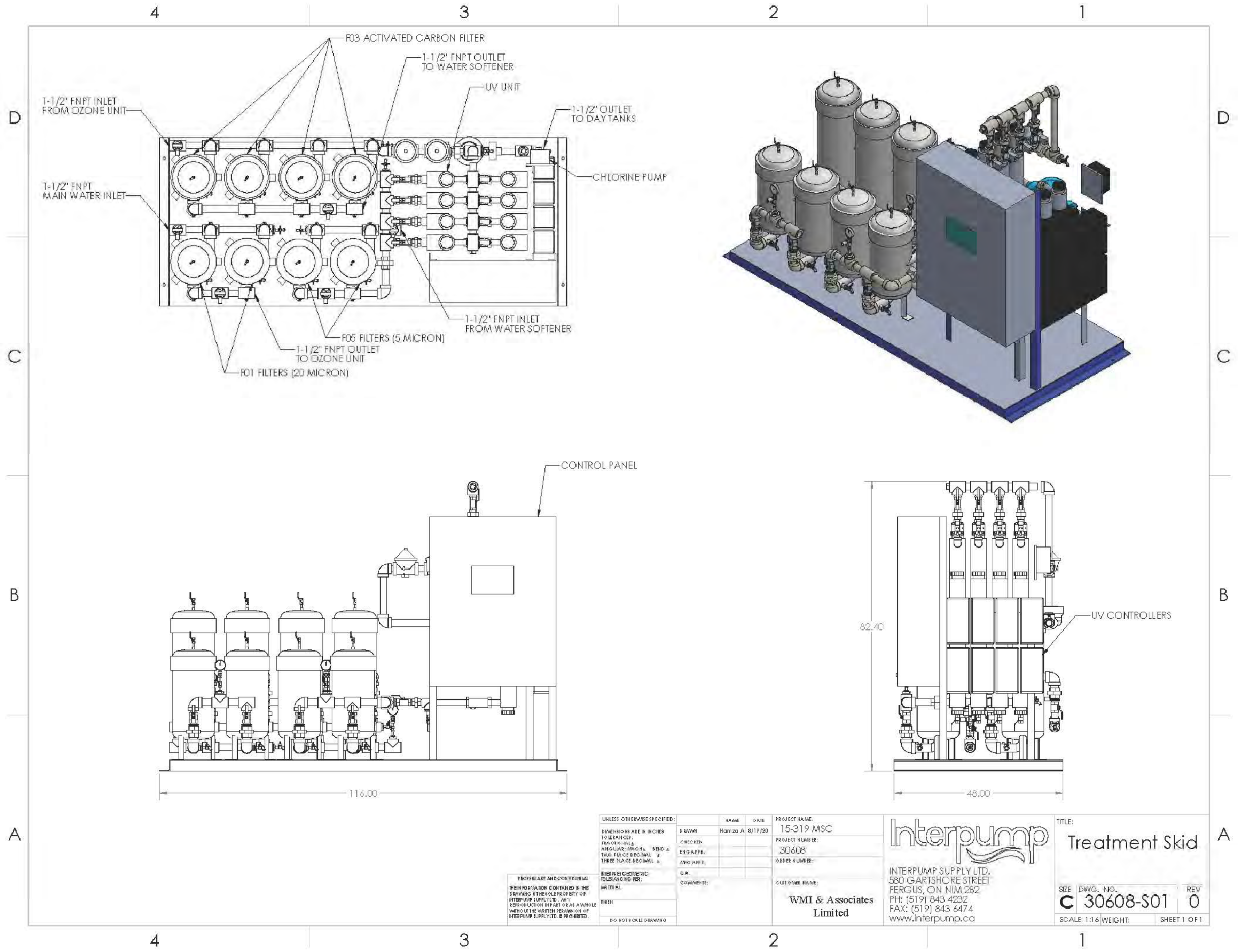

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100140403
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Mansfield Ski Club

WATER TREATMENT FACILITY

Client:

Mansfield Ski Club

628213 15th Sideroad
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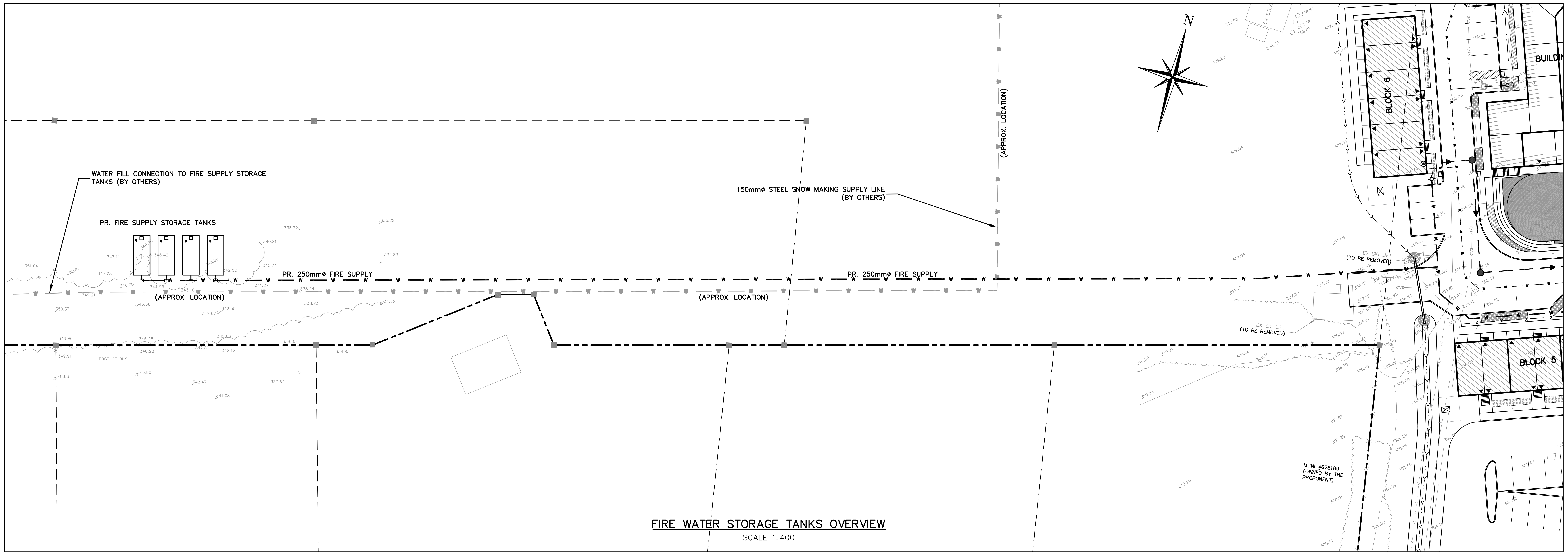
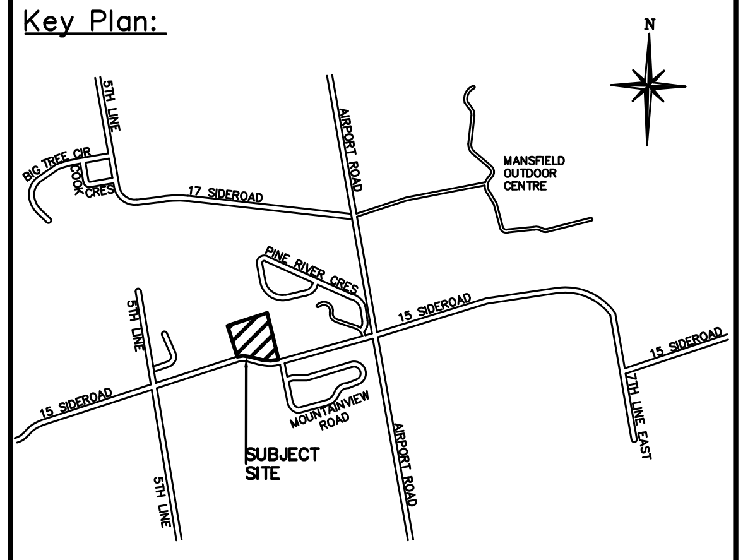
Drawn By	Checked By	Drawing No.
AW	JWL	WF
Scale 1:100	Project No. 15-319	

\\WMI-SERVER\wmi-server\Data\Projects\2015\15-319\CAD\WMI\Issue_No2\201210_Baseplan_15-319.dwg, WF, 1:1



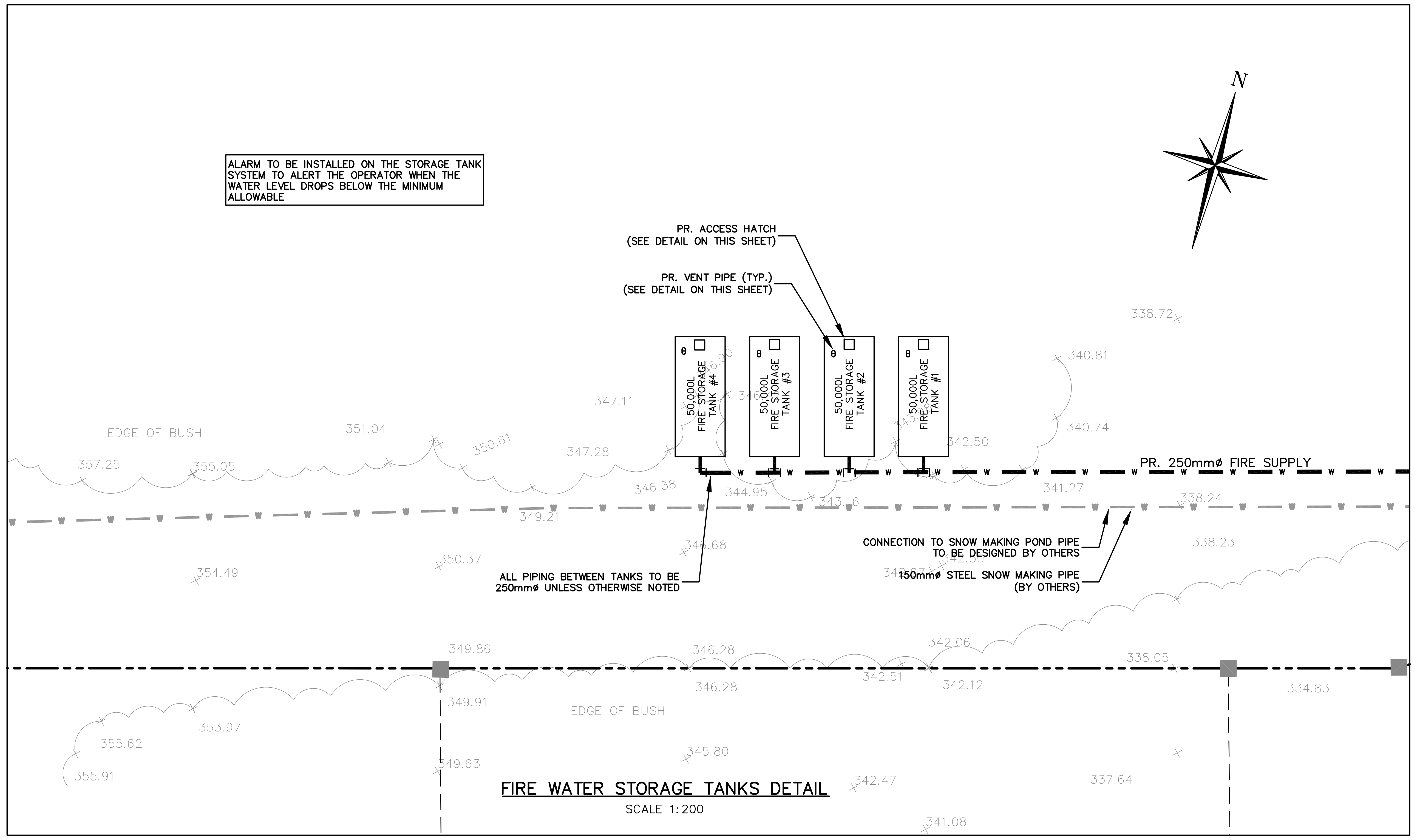
FIRE WATER STORAGE TANKS OVERVIEW

SCALE 1:400



CAUTION

CONTRACTOR TO DETERMINE LOCATION OF EXISTING UTILITIES PRIOR TO CONSTRUCTION.



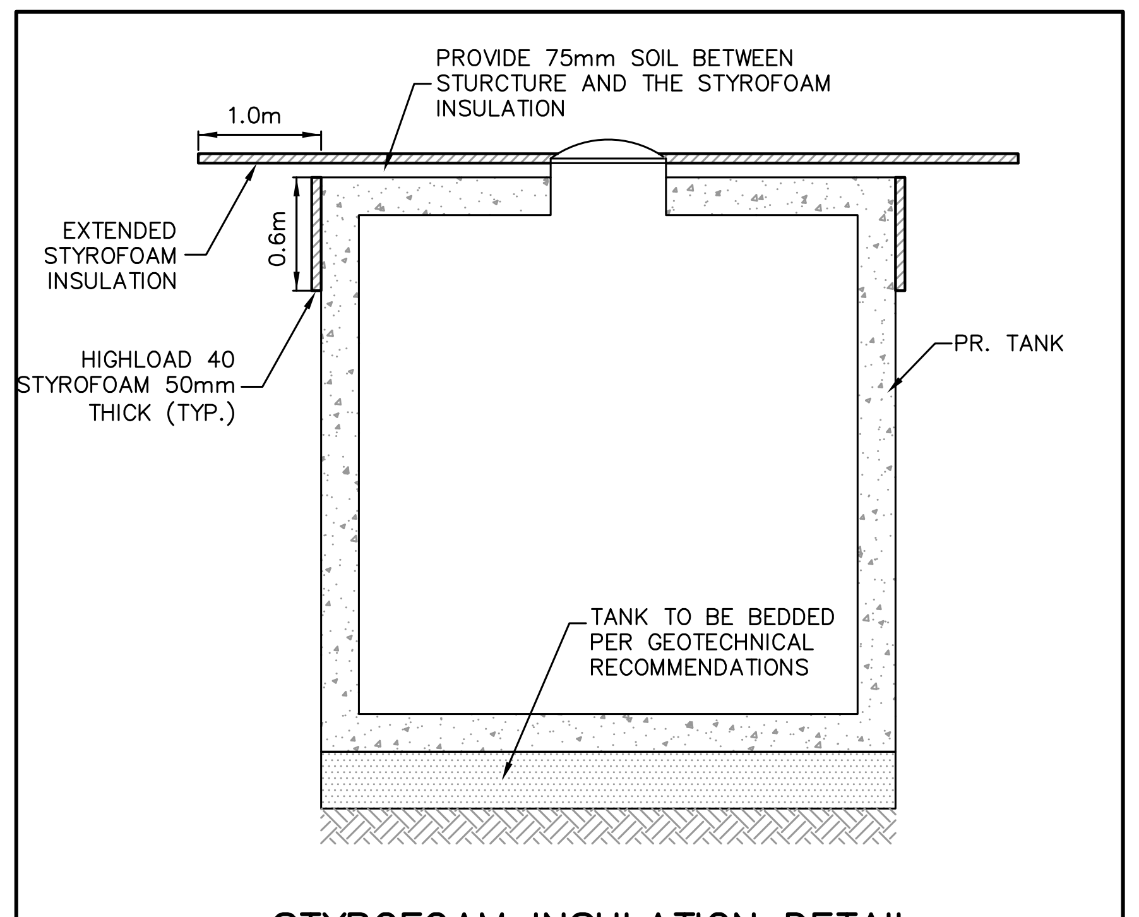
FIRE WATER STORAGE TANKS DETAIL

SCALE 1:200

WATER TANK	GROUND ELEV.	TOP OF STRUCTURE ELEV.	OUTLET ELEV.
FIRE STORAGE TANK #1	343.50	342.15	339.45
FIRE STORAGE TANK #2	344.00	342.65	339.95
FIRE STORAGE TANK #3	345.50	344.15	341.45
FIRE STORAGE TANK #4	346.90	345.55	342.85

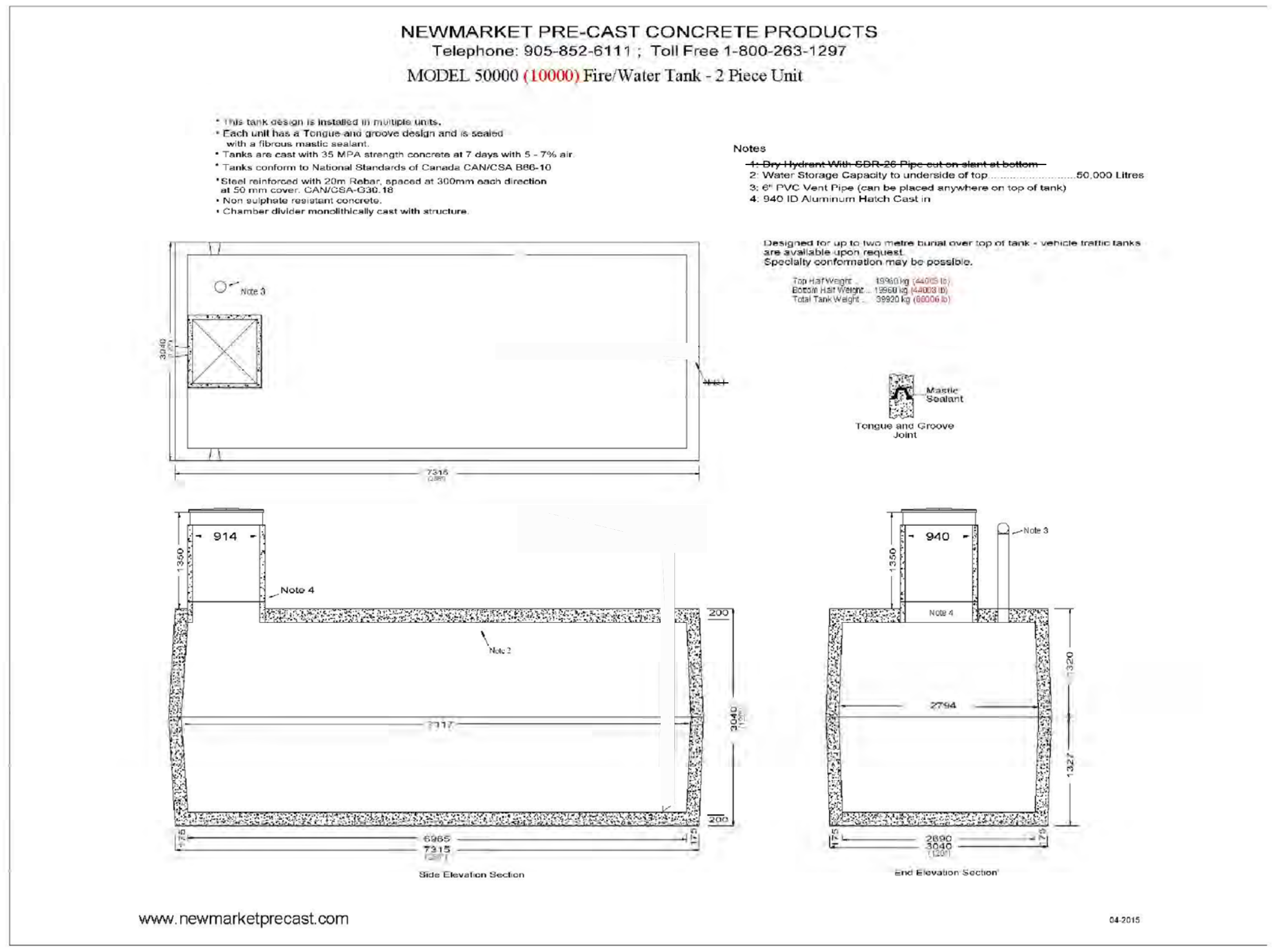
NOTES:

1. TANK ACCESS MUST BE PROVIDED VIA LOCKED WATER CHUTE ACCESS HATCH COMPLETE WITH LADDER RUNGS.
2. ALL CONNECTIONS TO THE STORAGE TANKS ARE TO BE WATER TIGHT.
3. TANK IS TO BE BEDDED AS PER GEOTECHNICAL RECOMMENDATIONS.
4. REFER TO DRAWING ON THIS SHEET FOR 50,000L TANK CROSS SECTION DETAILS.
5. ALL CONCRETE TANKS ARE TO HAVE 1.2m COVER (MIN.) OR TO BE INSULATED (REFER TO DETAIL ON THIS SHEET)
6. ALL STRUCTURES (TANKS) TO BE NEWMARKET PRE-CAST CONCRETE PRODUCTS OR APPROVED EQUIVALENT. REFER TO THIS DRAWING FOR TANK DETAILS.



STYROFOAM INSULATION DETAIL

N.T.S.



NEWMARKET PRE-CAST CONCRETE PRODUCTS
Telephone: 905-852-6111 ; Toll Free 1-800-263-1297
MODEL 50000 (10000) Fire/Water Tank - 2 Piece Unit

- This tank design is installed in multiple units.
- Each unit has a Tongue and groove design and is sealed with a fibrous mastic sealant.
- Tanks are cast with 35 MPA strength concrete at 7 days with 5 - 7% air.
- Tanks conform to National Standards of Canada CAN/CSA B66-10
- Steel reinforced with 20m Rebar, spaced at 300mm each direction at 50 mm cover. CAN/CSA-G30.18
- Non sulphate resistant concrete.
- Chamber divider monolithically cast with structure.

Notes
~~1: Dry Hydrant With SDR-26 Pipe cut on slant at bottom~~
2: Water Storage Capacity to underside of top..........................50,000 Litres
3: 6" PVC Vent Pipe (can be placed anywhere on top of tank)
4: 940 ID Aluminum Hatch Cast in

Designed for up to two metre burial over top of tank - vehicle traffic tanks are available upon request.
Specialty conformation may be possible.

Top Half Weight	19960 kg	(44003 lb)
Bottom Half Weight	19960 kg	(44003 lb)
Total Tank Weight	39920 kg	(88006 lb)

Side Elevation Section
End Elevation Section
www.newmarketprecast.com
04-2015

Notes:

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Benchmark: 463.937m

ELEVATIONS SHOWN HEREON ARE GEODETIC AND ARE DERIVED FROM CANNET NETWORK BASE STATION ORVL HAVING A PUBLISHED ELEVATION OF 463.937m

REGISTERED PROFESSIONAL ENGINEER
J.W.LIGHTHEART
100140403
DEC. 15, 2020
PROVINCE OF ONTARIO

No.	Issue / Revision	Date
1	SPA FIRST SUBMISSION	AUG. 17, 2020
2	SPA SECOND SUBMISSION	DEC. 15, 2020

Mansfield Ski Club

FIRE WATER STORAGE

Client:

Mansfield Ski Club

628213 15th Sideroad
PO Box 75 RPO Mansfield,
Mulmur, Ontario
L9V 3M6

WMI & Associates Limited
119 Collier Street
Barrie, Ontario
L4M 1H5
Ph 705-797-2027
www.wmiengineering.ca

Drawn By AW	Checked By JWL	Drawing No. FWS
Scale AS SHOWN	Project No. 15-319	

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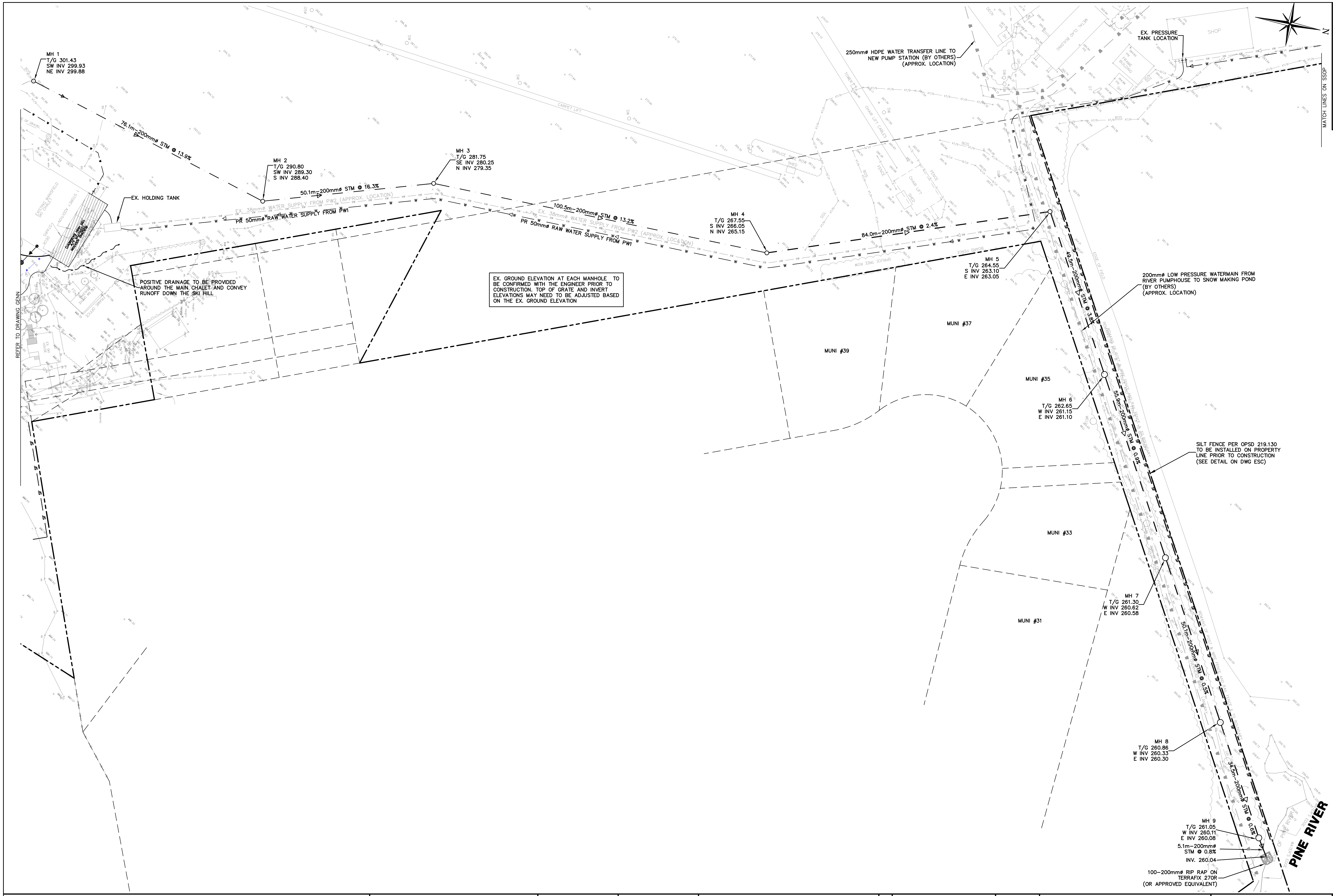
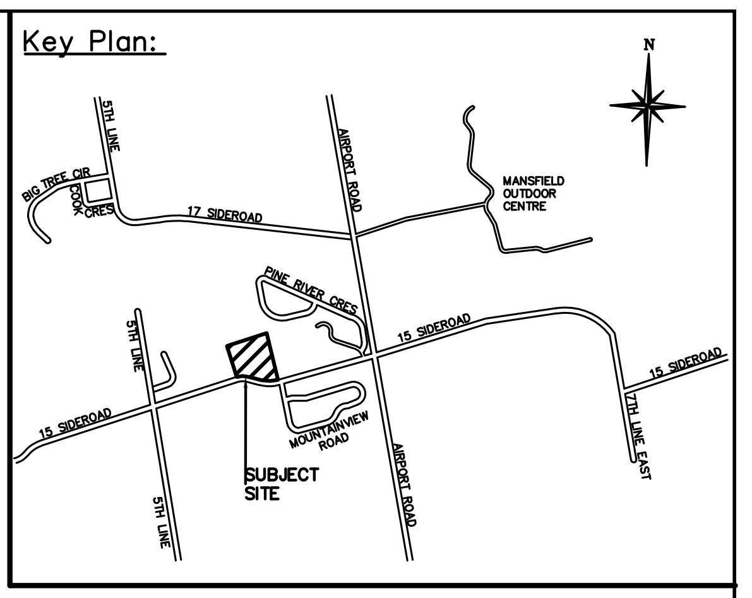


Key Plan:



Legend:

EXISTING FEATURES (EX)

■ EX SIB	EX STD IRON BAR	Ⓦ EX WS	EX WATER SERVICE
■ EX IB	EX IRON BAR	EX HYD	EX FIRE HYD.
○ EX UP	EX UTILITY POLE	NS	EX ST NAME SIGN
☒	EX BELL PED	SS	EX STOP SIGN
		x 123.45	EX ELEVATION

	EX FENCE
GAS	EX U/G GASMAIN
XB	EX U/G BELL
XH	EX HYDRO
XB/S	EX BOTTOM OF SLOPE
XT/S	EX TOP OF SLOPE
EX WV	EX WATERMAIN & VALVE
EX SAN @ 0.0%	EX SAN SEWER & MH
EX STM @ 0.0%	EX STM SEWER & MH

PROPOSED FEATURES (PR)

NS	PR STREET NAME SIGN
SS	PR STOP SIGN
SF SF SF	PR SILT FENCE
	PR LEGAL PART LOTS
	PR LEGAL BOUNDARY
Ⓛ	PR STREET LIGHT
Ⓦ	PR WATER SERVICE
Ⓢ	PR SAN SERVICE
	PR HYDRO TRANSFORMER
00mmø W/M	PR WATERMAIN
00mmø W/M	PR TEMPORARY WATERMAIN FOR PHASE 1A
00mmø W/M	PR PERMANENT WATERMAIN FOR PHASE 1A
	PR FIRE HYDRANT
	PR WATER VALVE
0m–00mmø SAN @ 0.0%	PR SAN SEWER
	PR PERMANENT SAN SEWER FOR PHASE 1A
● MH K	PR SANITARY MANHOLE
0m–00mmø STM @ 0.0%	PR STM SEWER
MH 4	PR CATCHBASIN MANHOLE
○ MH 4	PR MANHOLE
□	PR CATCHBASIN
x 000.00	PROPOSED ELEVATION
x (000.00)	PR. MATCH EXISTING ELEVATION (INTERPOLATED)
	PR SWALE
	PR HEAVY DUTY ASPHALT
	PR UNIT PAVING
	PR BERM
	PR FIRE ACCESS
U.F.E	UPPER FLOOR ELEVATION
G.F.E	GROUND FLOOR ELEVATION
W	WATERMAIN BY OTHERS

CAUTION
CONTRACTOR TO DETERMINE LOCATION OF EXISTING UTILITIES PRIOR TO CONSTRUCTION.

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Benchmark: 463.937m

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J.W.LIGHTHEART
100140403
DEC. 15, 2020

No.	Issue / Revision	Date
1	SPA FIRST SUBMISSION	AUG. 17, 2020
2	SPA SECOND SUBMISSION	DEC. 15, 2020

Mansfield Ski Club

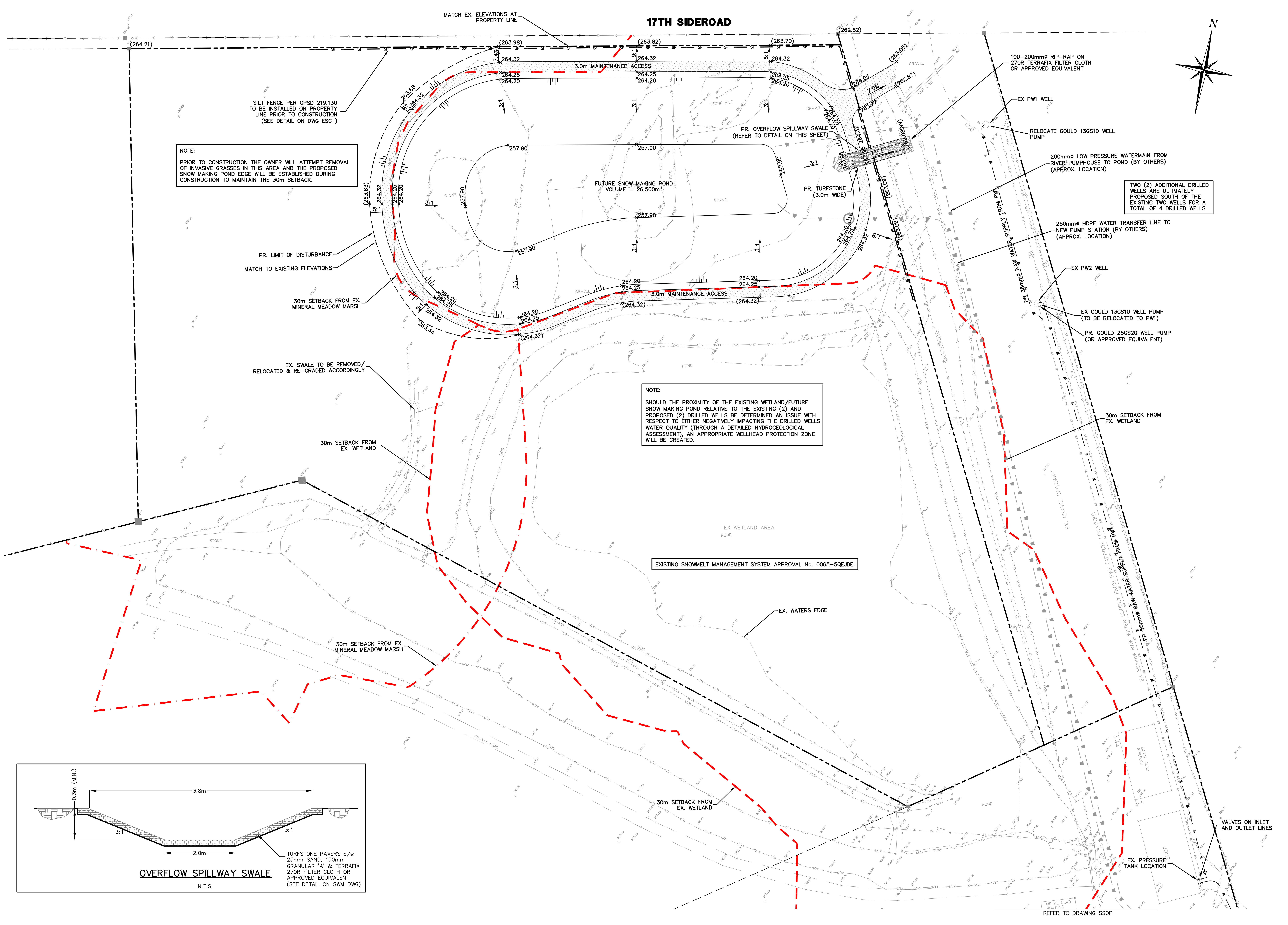
SITE SERVICING OUTLET PLAN

Client:

Mansfield Ski Club
628213 15th Sideroad
PO Box 75 RPO Mansfield,
Mulmur, Ontario
L9V 3M6

WMI & Associates Limited
119 Collier Street
Barrie, Ontario
L4M 1H5
Ph 705-797-2027
www.wmiengineering.ca

Drawn By	Checked By	Drawing No.
AW	JWL	SSOP
Scale 1:500	Project No. 15–319	



NOTE:

PRIOR TO CONSTRUCTION THE OWNER WILL ATTEMPT REMOVAL OF INVASIVE GRASSES IN THIS AREA AND THE PROPOSED SNOW MAKING POND EDGE WILL BE ESTABLISHED DURING CONSTRUCTION TO MAINTAIN THE 30m SETBACK.

NOTE:

SHOULD THE PROXIMITY OF THE EXISTING WETLAND/FUTURE SNOW MAKING POND RELATIVE TO THE EXISTING (2) AND PROPOSED (2) DRILLED WELLS BE DETERMINED WITH RESPECT TO EITHER NEGATIVELY IMPACTING THE DRILLED WELLS WATER QUALITY (THROUGH A DETAILED HYDROGEOLOGICAL ASSESSMENT), AN APPROPRIATE WELLHEAD PROTECTION ZONE WILL BE CREATED.

TWO (2) ADDITIONAL DRILLED WELLS ARE ULTIMATELY PROPOSED SOUTH OF THE EXISTING TWO WELLS FOR A TOTAL OF 4 DRILLED WELLS

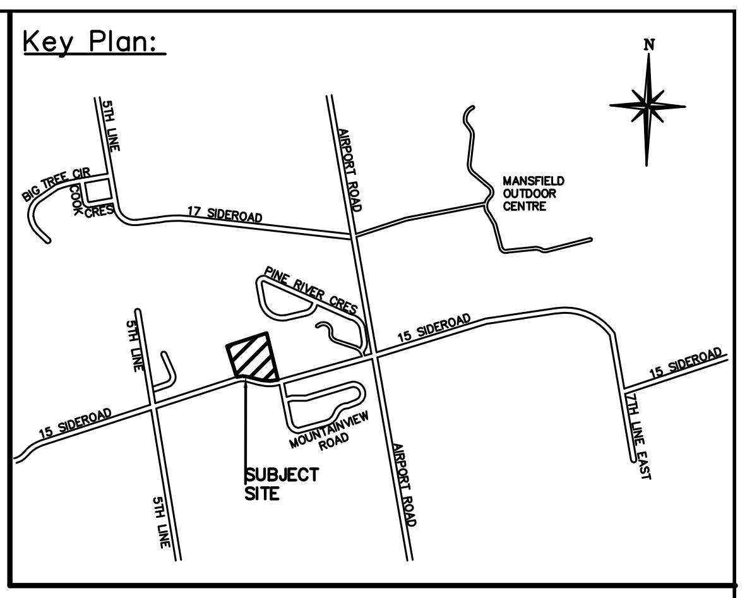
EXISTING SNOWMELT MANAGEMENT SYSTEM APPROVAL No. 0065-5QEJDE.

TURFSTONE PAVERS c/w 25mm SAND, 150mm GRANULAR 'A' & TERRAFIX 270R FILTER CLOTH OR APPROVED EQUIVALENT (SEE DETAIL ON SWM DWG)

OVERFLOW SPILLWAY SWALE

N.T.S.

Key Plan:



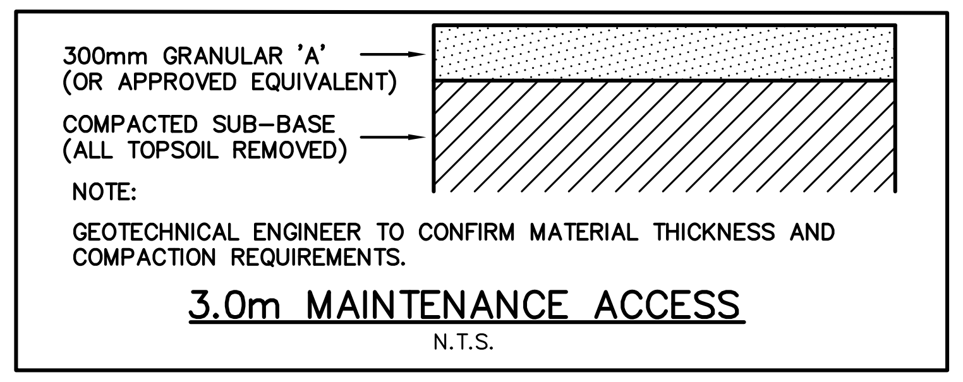
Legend:

EXISTING FEATURES (EX)

EX SIB	EX STD IRON BAR
EX IB	EX IRON BAR
EX UP	EX UTILITY POLE
☒	EX BELL PED
EX WS	EX WATER SERVICE
EX HYD	EX FIRE HYD.
NS	EX ST NAME SIGN
SS	EX STOP SIGN
X 123.45	EX ELEVATION
	EX FENCE
GAS GAS GAS	EX U/G GASMAIN
XB	EX U/G BELL
XH XH XH XH	EX HYDRO
XB/S XB/S XB/S XB/S	EX BOTTOM OF SLOPE
XT/S XT/S XT/S XT/S	EX TOP OF SLOPE
EX WV	EX WATERMAIN & VALVE
EX SAN @ 0.0%	EX SAN SEWER & MH
EX STM @ 0.0%	EX STM SEWER & MH

PROPOSED FEATURES (PR)

NS	PR STREET NAME SIGN
SS	PR STOP SIGN
SF SF SF	PR SILT FENCE
	PR LEGAL PART LOTS
	PR LEGAL BOUNDARY
Ⓛ	PR STREET LIGHT
Ⓦ	PR WATER SERVICE
Ⓢ	PR SAN SERVICE
	PR HYDRO TRANSFORMER
00mmø W/M	PR WATERMAIN
00mmø W/M	PR TEMPORARY WATERMAIN FOR PHASE 1A
00mmø W/M	PR PERMANENT WATERMAIN FOR PHASE 1A
	PR FIRE HYDRANT
	PR WATER VALVE
0m-00mmø SAN @ 0.0%	PR SAN SEWER
	PR PERMANENT SAN SEWER FOR PHASE 1A
● MH K	PR SANITARY MANHOLE
0m-00mmø STM @ 0.0%	PR STM SEWER
MH 4	PR CATCHBASIN MANHOLE
○ MH 4	PR MANHOLE
□	PR CATCHBASIN
x 000.00	PROPOSED ELEVATION
x (000.00)	PR. MATCH EXISTING ELEVATION (INTERPOLATED)
	PR SWALE
▨	PR HEAVY DUTY ASPHALT
▨	PR UNIT PAVING
▨	PR BERM
▨	PR FIRE ACCESS
U.F.E	UPPER FLOOR ELEVATION
G.F.E	GROUND FLOOR ELEVATION
	WATERMAIN BY OTHERS



NOTE:

GEOTECHNICAL ENGINEER TO CONFIRM MATERIAL THICKNESS AND COMPACTION REQUIREMENTS.

3.0m MAINTENANCE ACCESS

N.T.S.

CAUTION

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Benchmark: 463.937m

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J.W.LIGHTHEART
100140403
DEC. 15, 2020

No.	Issue / Revision	Date
1	SPA FIRST SUBMISSION	AUG. 17, 2020
2	SPA SECOND SUBMISSION	DEC. 15, 2020

Mansfield Ski Club

PROPOSED SNOW MAKING POND & WELL LOCATION PLAN

Client:

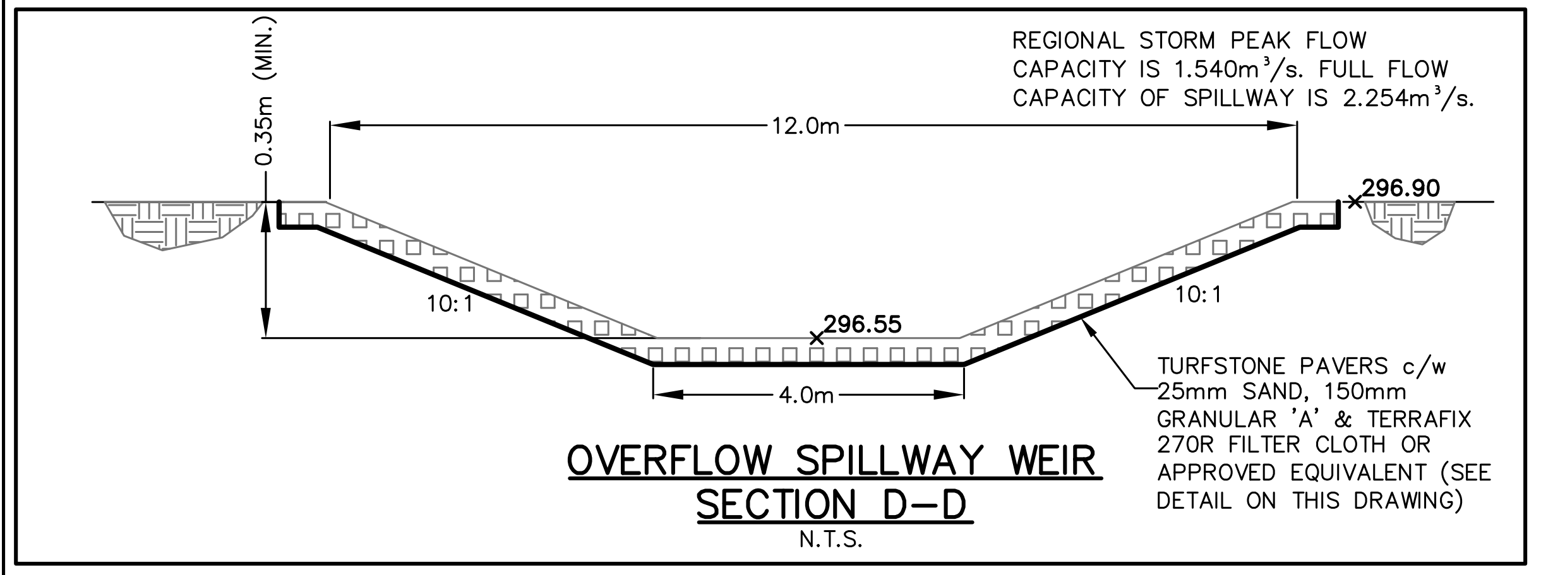
Mansfield Ski Club

628213 15th Sideroad
PO Box 75 RPO Mansfield,
Mulmur, Ontario
L9V 3M6

WMI & Associates Limited
119 Collier Street
Barrie, Ontario
L4M 1H5
Ph 705-797-2027
www.wmiengineering.ca

Drawn By: AW
Checked By: JWL
Drawing No.: SMPLP
Scale: 1:500
Project No.: 15-319

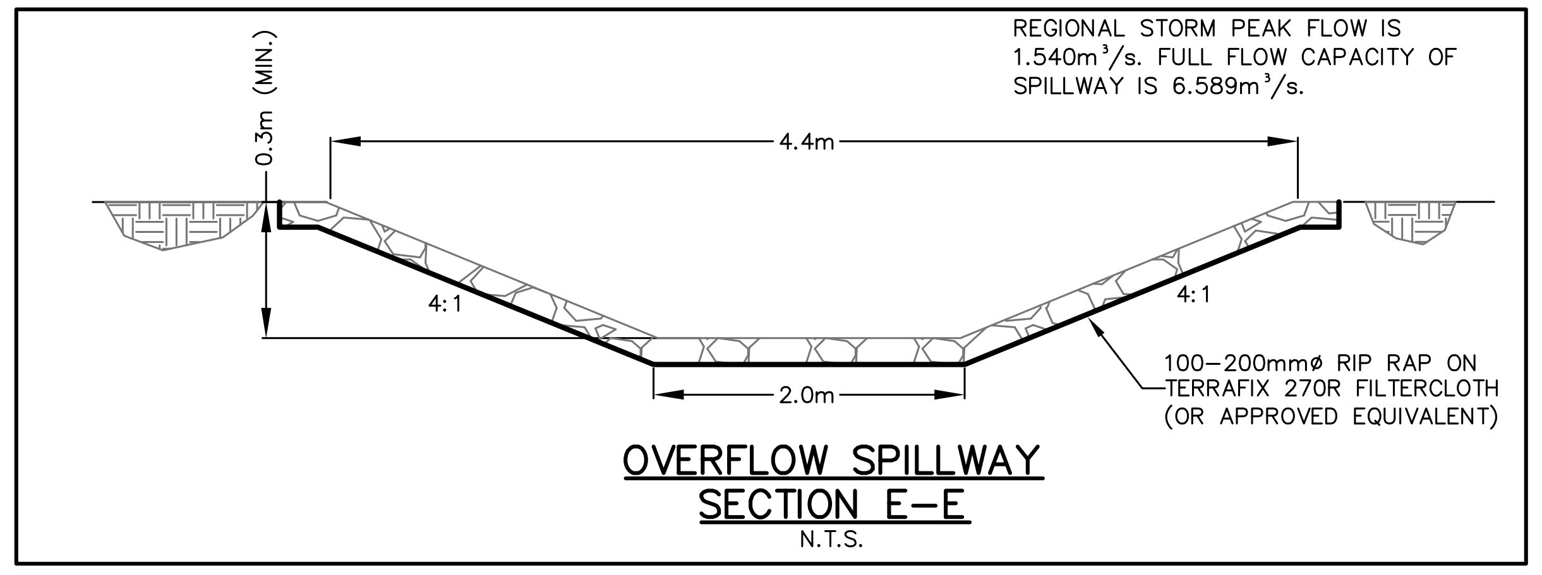
\\WMI-SERVER\wmi-server\Data\Projects\2015\15-319\CAD\WMI\Issue_No2\201210_Baseplan_15-319.dwg, SMPLP, 1:1



REGIONAL STORM PEAK FLOW CAPACITY IS 1.540m³/s. FULL FLOW CAPACITY OF SPILLWAY IS 2.254m³/s.

OVERFLOW SPILLWAY WEIR SECTION D–D

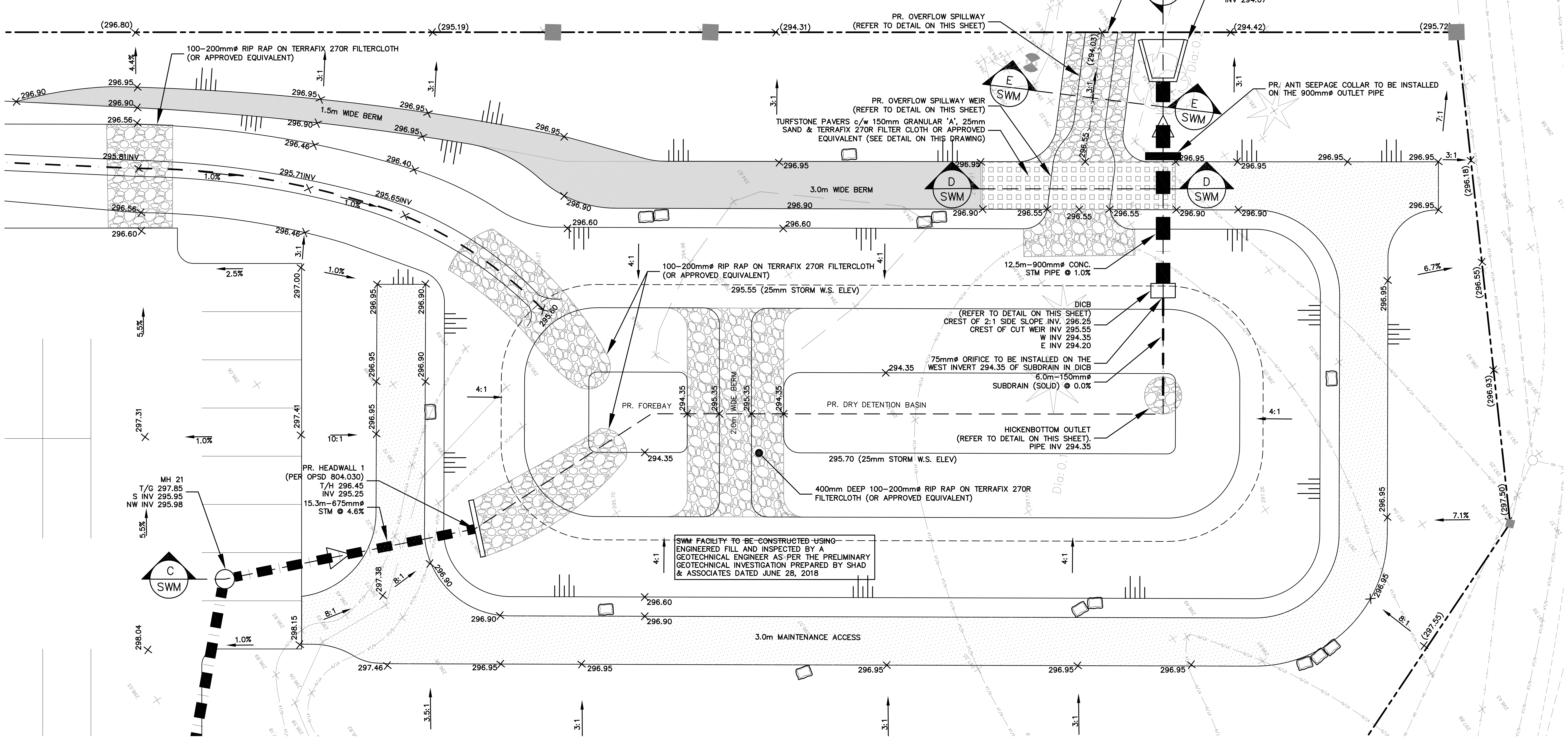
N.T.S.



REGIONAL STORM PEAK FLOW IS 1.540m³/s. FULL FLOW CAPACITY OF SPILLWAY IS 6.589m³/s.

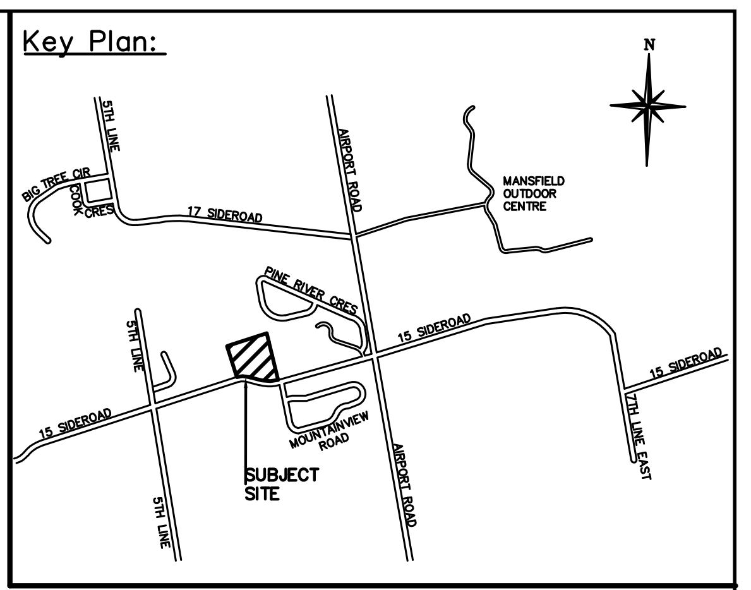
OVERFLOW SPILLWAY SECTION E–E

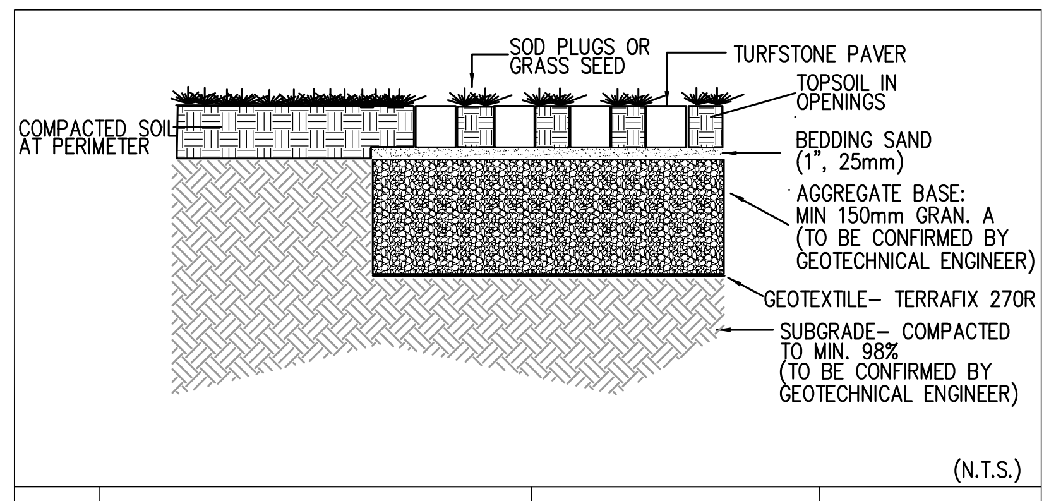
N.T.S.



FEATURE	ELEVATION	VOLUME
BASE OF BASIN	294.35m	0.0m³
(ACTIVE STORAGE VOLUMES)		
25mm HWL	295.70	443m³
2 YR HWL	296.12	742m³
5 YR HWL	296.32	922m³
REGIONAL STORM HWL	296.48	1080m³
25 YR HWL	296.56	1158m³
100 YR HWL	296.61	1364m³
TOP OF BASIN	296.90	1772m³

Key Plan:





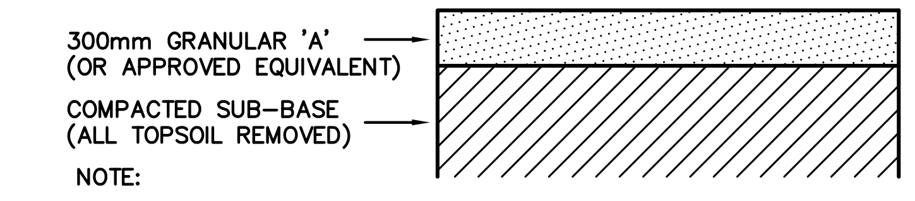
(N.T.S.)

OVERFLOW SPILLWAY WEIR
Turfstone Paver

UNILOCK®
Designed to be a step ahead
1•800•UNILOCK
www.unilock.com

PAVER DETAIL
Cross Section

SWM.DWG

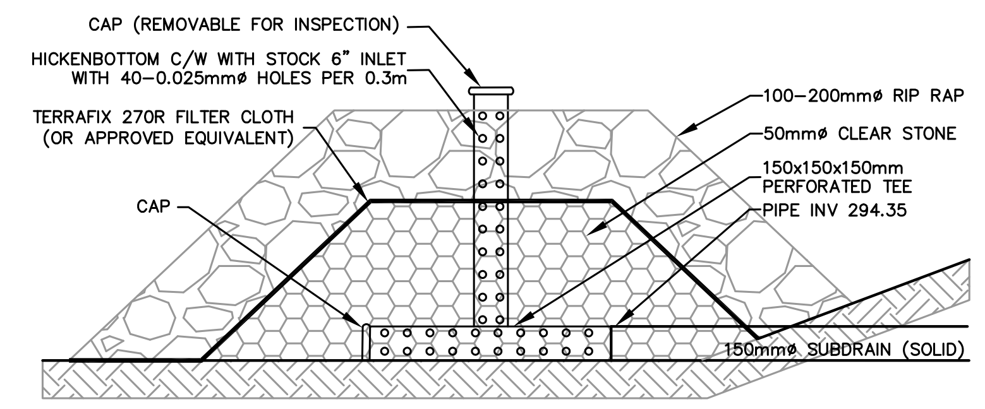


NOTE:

GEOTECHNICAL ENGINEER TO CONFIRM MATERIAL THICKNESS AND COMPACTION REQUIREMENTS.

3.0m MAINTENANCE ACCESS

N.T.S.



HICKENBOTTOM OUTLET DETAIL

N.T.S.

Legend:

EXISTING FEATURES (EX)

■ EX SIB	EX STD IRON BAR
■ EX IB	EX IRON BAR
○ EX UP	EX UTILITY POLE
☒	EX BELL PED
Ⓦ EX WS	EX WATER SERVICE
EX HYD	EX FIRE HYD.
NS	EX ST NAME SIGN
SS	EX STOP SIGN
x 123.45	EX ELEVATION
	EX FENCE
GAS	EX U/G GASMAIN
XB	EX U/G BELL
XH	EX HYDRO
XB/S	EX BOTTOM OF SLOPE
XT/S	EX TOP OF SLOPE
EX WV	EX WATERMAIN & VALVE
EX SAN @ 0.0%	EX SAN SEWER & MH
EX STM @ 0.0%	EX STM SEWER & MH

PROPOSED FEATURES (PR)

NS	PR STREET NAME SIGN
SS	PR STOP SIGN
SF SF SF	PR SILT FENCE
	PR LEGAL PART LOTS
	PR LEGAL BOUNDARY
Ⓛ	PR STREET LIGHT
Ⓦ	PR WATER SERVICE
Ⓢ	PR SAN SERVICE
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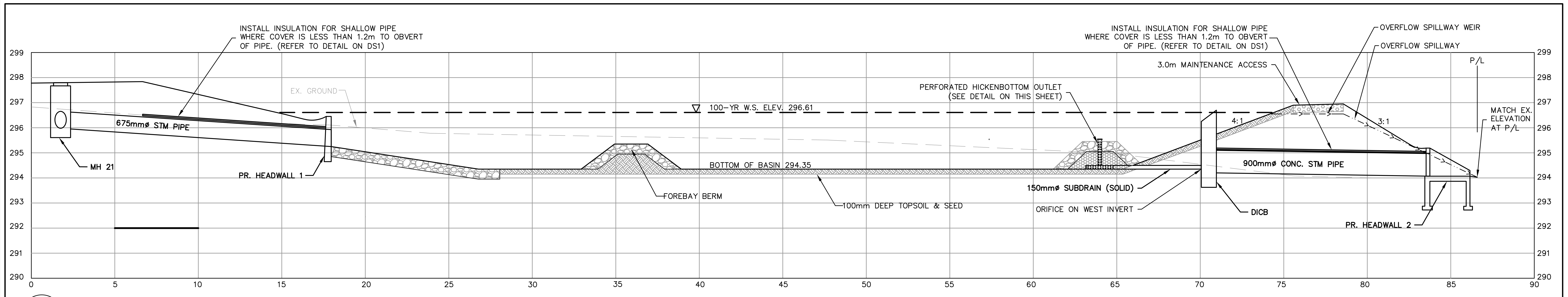
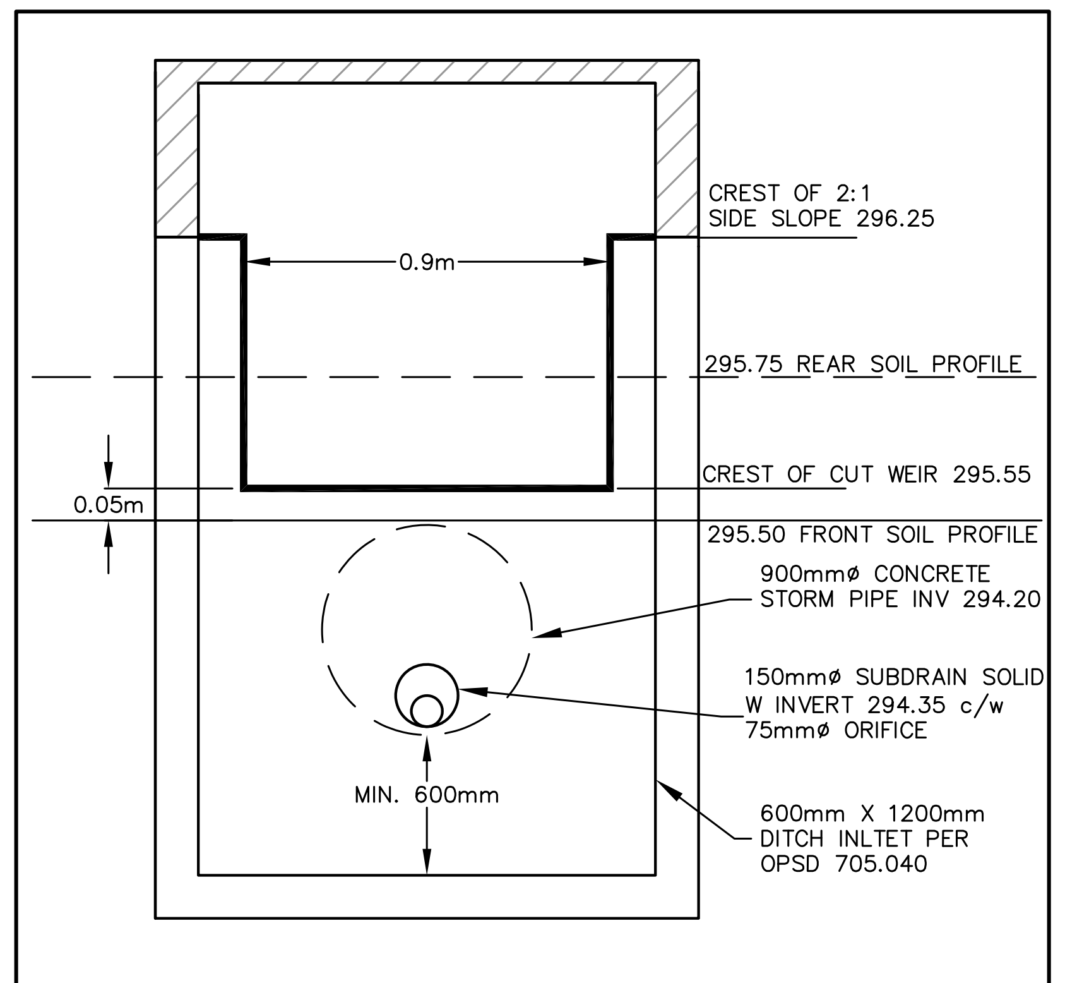
	PR FIRE HYDRANT
	PR WATER VALVE
0m–00mmø SAN @ 0.0%	PR SAN SEWER
	PR PERMANENT SAN SEWER FOR PHASE 1A
● MH K	PR SANITARY MANHOLE
0m–00mmø STM @ 0.0%	PR STM SEWER
MH 4	PR CATCHBASIN MANHOLE
○ MH 4	PR MANHOLE
□	PR CATCHBASIN
x 000.00	PROPOSED ELEVATION
x (000.00)	PR. MATCH EXISTING ELEVATION (INTERPOLATED)
	PR SWALE
▨	PR HEAVY DUTY ASPHALT
▨	PR UNIT PAVING
▨	PR BERM
▨	PR FIRE ACCESS
U.F.E	UPPER FLOOR ELEVATION
G.F.E	GROUND FLOOR ELEVATION

CAUTION

CONTRACTOR TO DETERMINE LOCATION OF EXISTING UTILITIES PRIOR TO CONSTRUCTION.

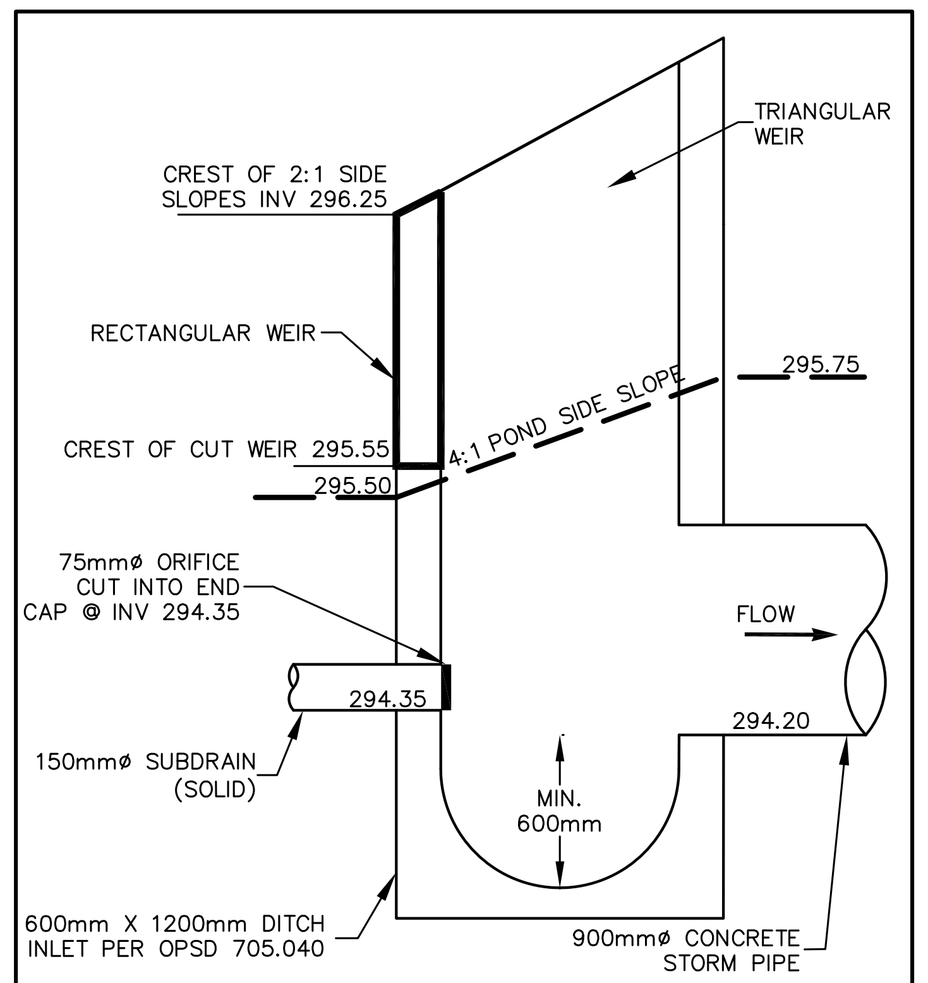


C
SWM
SECTION C–C
H 1:150 V 1:100



DICB WEIR DETAIL A

N.T.S.



DICB WEIR DETAIL B

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J.W.LIGHTHEART
100140403
DEC. 15, 2020

No.	Issue / Revision	Date
1	SPA FIRST SUBMISSION	AUG. 17, 2020
2	SPA SECOND SUBMISSION	DEC. 15, 2020

Mansfield Ski Club

STORMWATER MANAGEMENT FACILITY PLAN

Client:

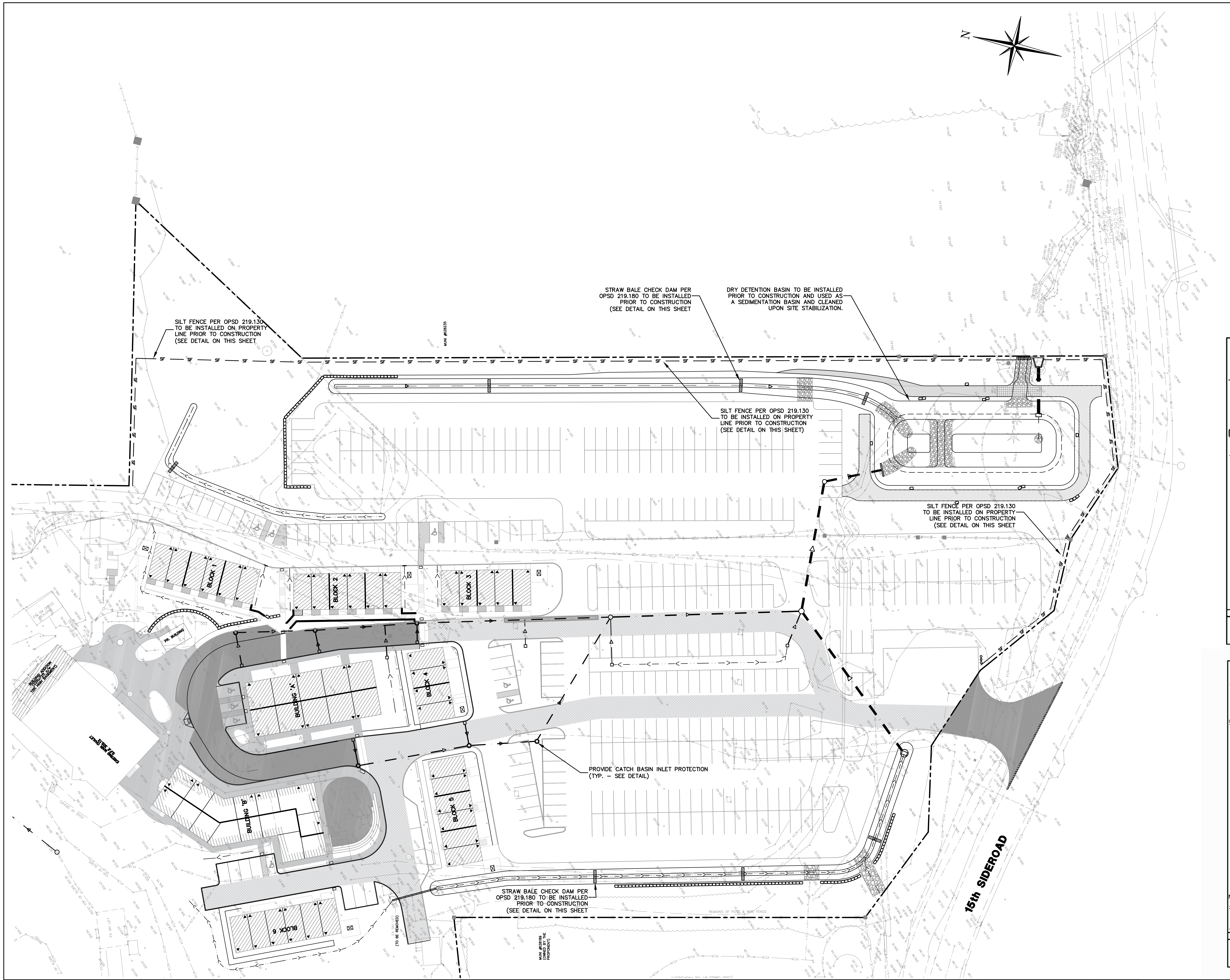
Mansfield Ski Club

628213 15th Sideroad
PO Box 75 RPO Mansfield,
Mulmur, Ontario
L9V 3M6

WMI & Associates Limited
119 Collier Street
Barrie, Ontario
L4M 1H5
Ph 705-797-2027
www.wmiengineering.ca

Drawn By AW
Checked By JWL
Drawing No. SWM
Scale 1:150
Project No. 15–319

\\WMI-SERVER\wmi-server\Data\Projects\2015\15-319\CAD\WMI\Issue_No2\201210_Baseplan_15-319.dwg, SWM, 1:1



NOTES

EROSION CONTROL WORKS TO BE INSPECTED REGULARLY AFTER EVERY RAINFALL AND REPAIRED/REPLACED AS REQUIRED BY THE MUNICIPALITY OR DEVELOPER'S ENGINEER.

ALL DISTURBED AREAS TO BE RESTORED USING TOPSOIL AND SEED IMMEDIATELY UPON ESTABLISHING FINAL GRADES.

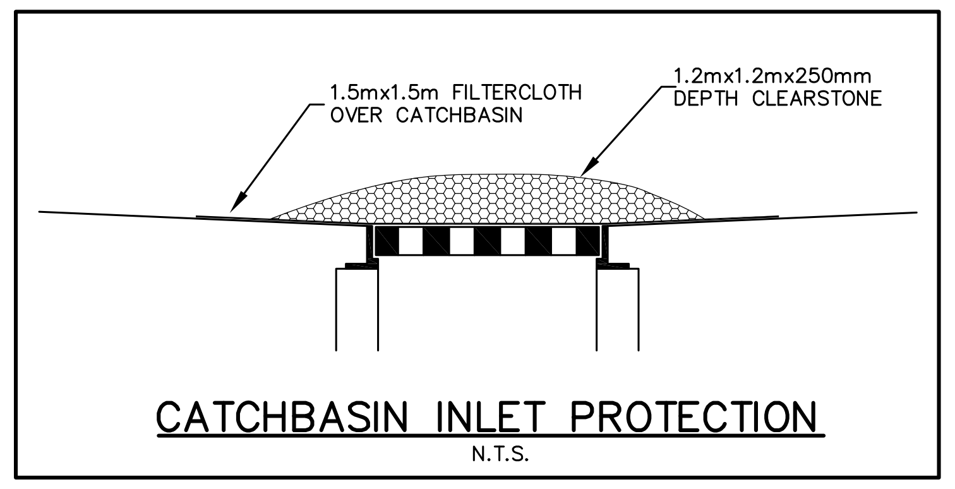
EROSION CONTROL WORKS TO BE MAINTAINED UNTIL THE SITE HAS STABILIZED AND REMOVAL IS DIRECTED BY THE MUNICIPALITY OR DEVELOPER'S ENGINEER.

SILT FENCE TO BE MAINTAINED ON THE DOWNSTREAM SIDE OF ALL STOCK PILES.

SILT FENCE IS TO BE CONSTRUCTED/INSTALLED AS INDICATED PRIOR TO CONSTRUCTION COMMENCEMENT.

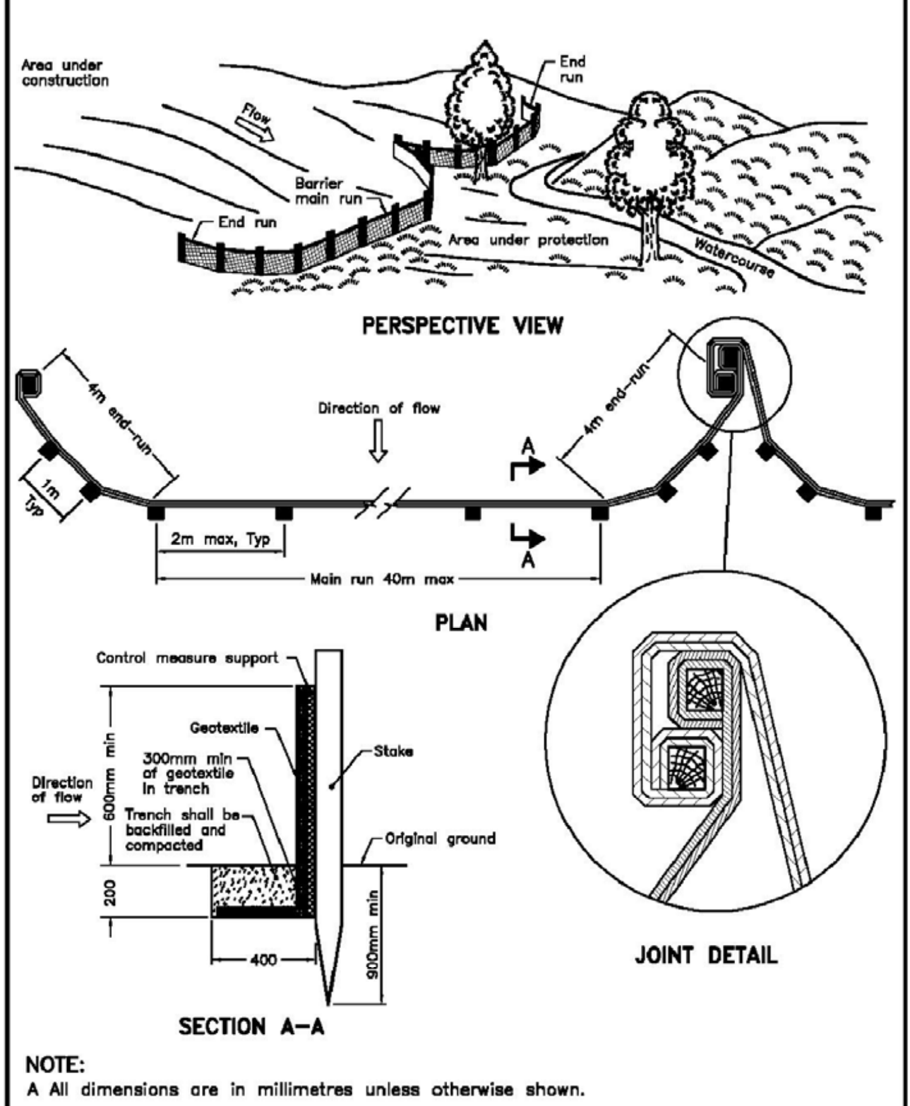
ALL SWALES c/w STRAW BALE CHECK DAMS (REFER TO DETAIL ON ON THIS SHHET) TO BE POSITIONED AND INSTALLED BY THE CONTRACTOR PRIOR TO ANY SITE DISTURBANCE.

STORM OUTLET STRUCTURES, DITCHES/SWALES, CULVERTS AND THE DRY DETENTION BASIN ARE TO BE CLEANED UPON COMPLETION OF THE SITE GRADING AND SITE STABILIZATION WORKS.



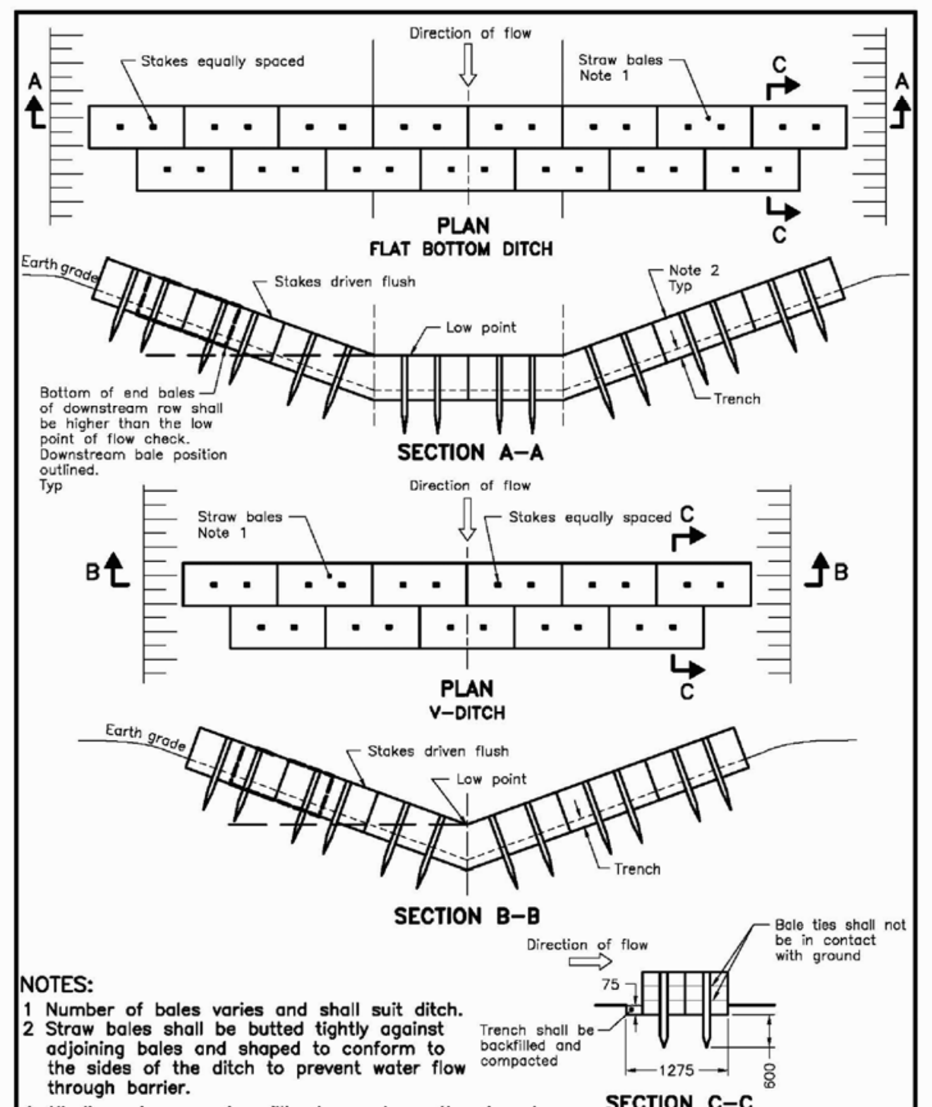
CATCHBASIN INLET PROTECTION

N.T.S.



NOTE:
A All dimensions are in millimetres unless otherwise shown.

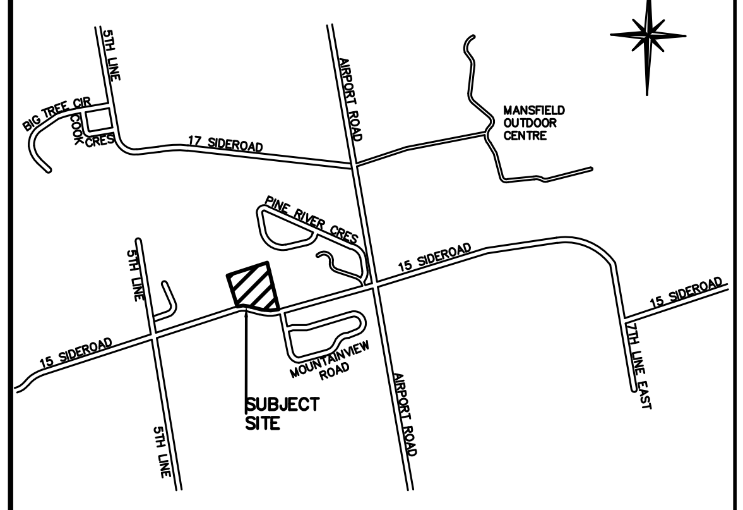
ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2015	Rev 2
HEAVY–DUTY SILT FENCE BARRIER	OPSD 219.130	



NOTES:
1 Number of bales varies and shall suit ditch.
2 Straw bales shall be butted tightly against adjoining bales and shaped to conform to the sides of the ditch to prevent water flow through barrier.
A All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2015	Rev 2
STRAW BALE FLOW CHECK DAM	OPSD 219.180	

Key Plan:



Legend:

EXISTING FEATURES (EX)

▨ EX SIB	EX STD IRON BAR
▨ EX IB	EX IRON BAR
○ EX UP	EX UTILITY POLE
☒	EX BELL PED
Ⓦ EX WS	EX WATER SERVICE
EX HYD	EX FIRE HYD.
NS	EX ST NAME SIGN
SS	EX STOP SIGN
X 123.45	EX ELEVATION
—○—○—○—	EX FENCE
— GAS — GAS — GAS —	EX U/G GASMAIN
— XB —	EX U/G BELL
— XH — XH — XH — XH —	EX HYDRO
— XB/S — XB/S — XB/S — XB/S —	EX BOTTOM OF SLOPE
— XT/S — XT/S — XT/S — XT/S —	EX TOP OF SLOPE
EX WV	EX WATERMAIN & VALVE
EX SAN @ 0.0%	EX SAN SEWER & MH
EX STM @ 0.0%	EX STM SEWER & MH

PROPOSED FEATURES (PR)

NS	PR STREET NAME SIGN
SS	PR STOP SIGN
— SF — SF — SF —	PR SILT FENCE
— — — — — —	PR LEGAL PART LOTS
—— - - —— - - ——	PR LEGAL BOUNDARY
Ⓛ	PR STREET LIGHT
——Ⓦ	PR WATER SERVICE
——Ⓢ	PR SAN SERVICE
▼	PR HYDRO TRANSFORMER
00mmø W/M	PR WATERMAIN
00mmø W/M	PR TEMPORARY WATERMAIN FOR PHASE 1A
00mmø W/M	PR PERMANENT WATERMAIN FOR PHASE 1A
	PR FIRE HYDRANT
	PR WATER VALVE
0m–00mmø SAN @ 0.0%	PR SAN SEWER
	PR PERMANENT SAN SEWER FOR PHASE 1A
● MH K	PR SANITARY MANHOLE
0m–00mmø STM @ 0.0%	PR STM SEWER
MH 4	PR CATCHBASIN MANHOLE
○ MH 4	PR MANHOLE
□	PR CATCHBASIN
x 000.00	PROPOSED ELEVATION
x (000.00)	PR. MATCH EXISTING ELEVATION (INTERPOLATED)
⟶	PR SWALE
▨	PR HEAVY DUTY ASPHALT
▨	PR UNIT PAVING
▨	PR BERM
▨	PR FIRE ACCESS
U.F.E	UPPER FLOOR ELEVATION
G.F.E	GROUND FLOOR ELEVATION
▨	PR STRAW BALE CHECK DAM

CAUTION
CONTRACTOR TO DETERMINE LOCATION OF EXISTING UTILITIES PRIOR TO CONSTRUCTION.

Notes:

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Benchmark: 463.937m

ELEVATIONS SHOWN HEREON ARE GEODETIC AND ARE DERIVED FROM CANNET NETWORK BASE STATION ORVL HAVING A PUBLISHED ELEVATION OF 463.937m

J.W.LIGHTHEART
100140403
DEC. 15, 2020

No.	Issue / Revision	Date
1	SPA FIRST SUBMISSION	AUG. 17, 2020
2	SPA SECOND SUBMISSION	DEC. 15, 2020

Mansfield Ski Club

EROSION & SEDIMENT CONTROL PLAN

Client:
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Drawn By	Checked By	Drawing No.
AW	JWL	ESC
Scale 1:500	Project No. 15–319	

\\WMI-SERVER\wmi-server\Data\Projects\2015\15-319\CAD\WMI\Issue_No2\201210_Baseplan_15-319.dwg, ESC, 1:1

GENERAL – CONSTRUCTION

1. ALL MEASUREMENTS ARE IN METRES, PIPE SIZES IN MILLIMETRES, UNLESS OTHERWISE NOTED.
2. ALL CONSTRUCTION SHALL BE IN ACCORDANCE WITH CURRENT MUNICIPAL STANDARDS AND THE MOST CURRENT ONTARIO PROVINCIAL STANDARD DRAWINGS AND SPECIFICATIONS (IN THAT ORDER UNLESS NOTED OTHERWISE). IF A DISCREPANCY ARISES THE MUNICIPAL STANDARDS ARE TO GOVERN.
3. LOCATIONS OF EXISTING SERVICES ARE NOT GUARANTEED. CONTRACTOR TO CONFIRM EXISTING UTILITY LOCATIONS AND ELEVATIONS PRIOR TO CONSTRUCTION. THE CONTRACTOR IS REQUIRED TO NOTIFY THE VARIOUS UTILITY COMPANIES 48 HOURS PRIOR TO THE COMMENCEMENT OF ANY WORK.
4. THE CONTRACTOR SHALL INFORM THE MUNICIPALITY AND ENGINEER A MINIMUM OF 48 HOURS IN ADVANCE OF COMMENCING ANY WORK. THE CONTRACTOR IS RESPONSIBLE FOR COORDINATING INSPECTION FOR ALL CIVIL WORKS WITH THE ENGINEER IN ORDER TO PROVIDE SUFFICIENT CERTIFICATION AS REQUIRED BY THE MUNICIPALITY.
5. ALL DIMENSIONS AND ELEVATIONS ARE TO BE CHECKED AND VERIFIED BY THE CONTRACTOR. ANY DISCREPANCIES ARE TO BE REPORTED TO THE ENGINEER.
6. TRAFFIC CONTROLS TO CONFORM TO THE LATEST REVISION OF THE MANUAL OF UNIFORM TRAFFIC CONTROL DEVICES AND ONTARIO TRAFFIC MANUAL TEMPORARY CONDITIONS (BOOK 7).
7. STREET AND TRAFFIC SIGNS – M.T.O. STANDARDS
8. FILTER FABRIC – TERRAFIX 270R OR APPROVED EQUAL.
9. DEWATERING TO BE CARRIED OUT IN ACCORDANCE WITH OPSS–517 AND 518 TO MAINTAIN ALL TRENCHES IN A DRY CONDITION, CONTRACTOR IS RESPONSIBLE FOR OBTAINING NECESSARY PERMITS FOR DEWATERING.
10. ALL DISTURBED AREAS WITHIN EXISTING RIGHT–OF–WAYS ARE TO BE REINSTATED TO THEIR ORIGINAL CONDITION OR BETTER AS DETERMINED BY THE MUNICIPALITY (MIN 300mm TOPSOIL AND NURSERY SOD).
11. ALL SEWER SYSTEMS INCLUDING SERVICE CONNECTIONS TO THE SEWER MAINS AS WELL AS CATCHBASINS AND MANHOLES SHALL BE THOROUGHLY FLUSHED AND/OR CLEANED OF DEBRIS AND ALL PIPES SHALL BE TESTED IN ACCORDANCE WITH OPS AND SHALL BE INSPECTED BY AN APPROVED VIDEO CAMERA TESTING COMPANY AND THE ENGINEER SHALL BE PROVIDED A COPY OF APPROPRIATE DATA UPON COMPLETION OF CONSTRUCTION AND PRIOR TO FINAL APPROVAL. ANY SECTIONS OF SEWER OR SERVICE CONNECTIONS THAT FAIL TO MEET THE REQUIREMENTS SHALL BE REPAIRED OR REPLACED AT THE DIRECTION OF THE ENGINEER. ONLY CHEMICAL PRESSURE GROUTING REPAIR TECHNIQUES WILL BE CONSIDERED ACCEPTABLE.
12. THESE ENGINEERING DRAWINGS ARE TO BE READ IN CONJUNCTION WITH THE LATEST VERSION OF THE GEOTECHNICAL INVESTIGATION. GEOTECHNICAL INSPECTION & MATERIALS TESTING TO BE PROVIDED DURING ALL SERVICING, PARKING LOT SUB–GRADE, PARKING LOT BASE, PAVEMENT, SWM POND, BERMING AND CONCRETE WORKS.
13. FOR SPECIFIC DIMENSIONS AND BUILDING INFORMATION REFER TO SITE PLAN/ARCHITECTURAL DRAWINGS.
14. PIPE DEFLECTION SHOULD BE USED WHEREVER POSSIBLE TO MINIMIZE THE USE OF BENDS, WHEREVER IT IS NECESSARY TO DEFLECT FROM A STRAIGHT LINE, EITHER IN THE VERTICAL OR HORIZONTAL PLANE. THE AMOUNT OF DEFLECTION SHALL NOT EXCEED THE MANUFACTURER'S SPECIFICATIONS.

ABOVE GROUND WORKS:

1. SUB–GRADE PREPARATION TO BE COMPLETED IN ACCORDANCE WITH THE GEOTECHNICAL INVESTIGATIONS RECOMMENDATIONS.
2. ASPHALT SURFACES TO BE CONSTRUCTED AS SHOWN ON THE PAVEMENT CROSS–SECTIONS DETAIL.
3. ENTRANCE CONNECTIONS TO CONSIST OF GRINDING EXISTING ASPHALT AND PROVIDE 0.3m WIDE OVERLAP JOINT AS SHOWN ON THE PAVEMENT LAP JOINT DETAIL.
4. CONCRETE CURB ON THE PROPERTY TO BE AS PER OPSD–600.110 BARRIER CURB. .
5. SIDEWALKS TO BE CONSTRUCTED AS PER OPSD 310.010, 310.020, & 310.030.
6. CONCRETE STRENGTH FOR CURB AND SIDEWALK IS TO BE 30MPa AT 28 DAYS.
7. A ROAD OCCUPANCY PERMIT IS REQUIRED PRIOR TO COMMENCEMENT OF WORK IN ANY MUNICIPAL RIGHT–OF–WAY.
8. A SITE ALTERATION PERMIT MAY BE REQUIRED FROM THE MUNICIPALITY PRIOR TO THE COMMENCEMENT OF EARTHWORKS.

SANITARY SEWER:

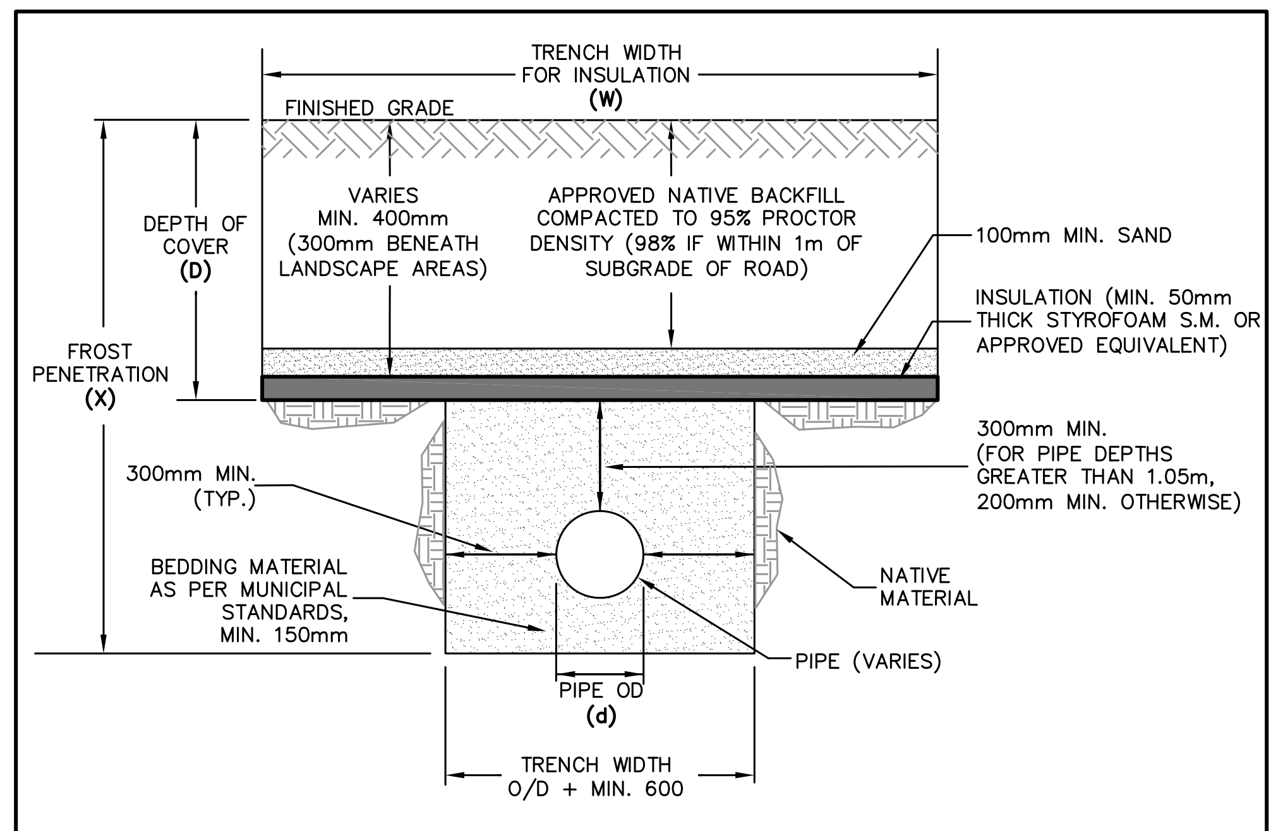
1. SANITARY MANHOLES TO BE 1200mmø AS PER OPSD 701.010 WITH BENCHING ACCORDING TO OPSD–701.021.
2. ALL SANITARY SEWERS TO BE PVC SDR–35 (OR APPROVED EQUIVALENT). ALL SANITARY SERVICES TO BE PVC SDR–28. BEDDING TO BE IN ACCORDANCE WITH OPSD 1006.020 AND 802.010.
3. PROVIDE SANITARY SEWER CLEANOUTS AS REQUIRED BY THE ONTARIO BUILDING CODE.
4. ALL SANITARY MANHOLES SHALL BE COMPLETED WITH FROST STRAPS PER OPSD 701.100.
5. MODULAR ADJUSTMENT UNITS FOR MANHOLES TO BE PROVIDED IN ACCORDANCE WITH OPSD 704.010. MAXIMUM THICKNESS OF ADJUSTMENTS UNITS IS 300mm.
6. WATER TIGHT COVERS TO BE PROVIDED FOR SANITARY MANHOLES LOCATED IN PONDING AREAS.
7. TESTING INCLUDING BUT NOT LIMITED TO DEFLECTION AND CCTV ARE TO BE COMPLETED AS PER MUNICIPAL STANDARDS AND OPSS.

STORM SEWER:

1. ALL SITE DRAINAGE POSSIBLE, INCLUDING ALL ROOF AND ASPHALT DRAINAGE, IS TO BE DIRECTED TO THE STORMWATER MANAGEMENT SYSTEM.
2. STORM SEWER 450mmø OR LESS: PVC CERTIFIED TO C.S.A. STANDARDS 182.2 AND 182.4.
   STORM SEWER GREATER THAN 450mmø: REINFORCED CONCRETE WITH A MINIMUM STRENGTH OF 50 N/m/mm CERTIFIED TO C.S.A. STANDARD A257.2, CLASS 50–D
3. STORM SEWER TO BE MINIMUM 300mm DIAMETER WITH JOINTS CONFORMING TO C.S.A. STANDARD A257.3.
4. MODULAR ADJUSTMENT UNITS FOR MANHOLES TO BE PROVIDED IN ACCORDANCE WITH OPSD 704.010. MAXIMUM THICKNESS OF ADJUSTMENTS UNITS IS 300mm.
5. STORM SEWER BEDDING AS PER OPSD 802.010 (FLEXIBLE PIPE) OR 802.030 (RIGID PIPE).
6. MANHOLES AND CATCHBASINS ARE TO BE IN ACCORDANCE WITH OPSD STANDARDS. CATCHBASIN MANHOLES ARE TO HAVE SUMPS.
7. CATCHBASIN LEADS – 300mmø. DOUBLE CATCHBASIN LEADS – 300mmø UNLESS OTHERWISE NOTED.
8. STORM SEWER COVER LESS THAN 1.2m TO PIPE OBVERT WILL REQUIRE FROST PROTECTION INSULATION, SEE INSULATION FOR SHALLOW PIPE DETAIL.
9. ALL STORM MANHOLES SHALL BE COMPLETED WITH FROST STRAPS AS PER OPSD 701.100.
10. TESTING INCLUDING BUT NOT LIMITED TO DEFLECTION AND CCTV ARE TO BE COMPLETED AS PER MUNICIPAL STANDARDS AND OPSS.

WATERMAINS:

1. WATERMAIN PIPES, FITTINGS, HYDRANTS, SERVICE PIPE TYPES & MANUFACTURERS ARE TO BE IN ACCORDANCE WITH MUNICIPAL STANDARDS.
2. WATERMAINS SHALL BE MINIMUM 100mmø, DR18. FIRE SUPPLY (250mmø) SHALL BE POLYVINYL CHLORIDE (PVC) CLASS 235 (DR18) OR APPROVED EQUIVALENT. TRACER WIRE (#12 STRANDED COPPER WIRE WITH OUTER PLASTIC COATING) SHALL BE INSTALLED ALONG THE ENTIRE LENGTH OF PVC WATERMAIN, SECURED TO FITTINGS AT INTERVALS NOT EXCEEDING 3m, AND BROUGHT UP AND LOOPED AT EACH VALVE BOX, CHAMBER AND HYDRANT SUCH THAT CONTINUITY IS MAINTAINED. TAPE IS TO BE USED TO AFFIX THE WIRE TO THE PIPE.
3. 50mmø WATER SUPPLY LINE FROM WELL PW1 IS TO BE 50mmø MUNICIPLEX (OR APPROVED EQUIVALENT).
4. WATERMAIN BEDDING AS PER OPSD 802.010 (FLEXIBLE PIPE) OR 802.030 (RIGID PIPE) AND AS PER TOWN STANDARDS.
5. HYDRANT INSTALLATION AS PER MUNICIPAL STANDARD.
6. THE MINIMUM HORIZONTAL SEPARATION BETWEEN THE WATERMAIN / WATER SERVICES AND THE SANITARY / STORM SEWER IS TO BE 2.5m.
7. A MINIMUM OF 0.5m VERTICAL CLEARANCE BETWEEN THE WATERMAIN / WATER SERVICES AND ALL UTILITIES SHALL BE MAINTAINED, WHILE MAINTAINING A MINIMUM DEPTH OF COVER AT ALL TIMES. WATERMAIN & WATER SERVICE TO BE INSULATED WITH HI–40 INSULATION AND/OR CONCRETE ENCASED AT THE ENGINEER'S DISCRETION WHERE 0.5m SEPARATION CANNOT BE MAINTAINED.
8. WATERMAIN / WATER SERVICE COVER LESS THAN 1.7m BELOW FINISHED GROUND SURFACE OR 1.9m BELOW ROAD CENTRELINE, WHICHEVER IS GREATER TO PIPE OBVERT WILL REQUIRE FROST PROTECTION, SEE INSULATION FOR SHALLOW PIPE DETAIL.
9. VALVE, VALVE BOXES AND CHAMBERS SHALL BE INSTALLED IN ACCORDANCE WITH OPSD STANDARDS.
10. 50mm BLOW–OFF WITH SAMPLING PORT TO BE MUELLER CO. HYDRO–GUARD BSS–02 (OR APPROVED EQUIVALENT).
11. CONTRACTOR IS RESPONSIBLE FOR ALL TIE–INS INCLUDING MATERIALS, EXCAVATION AND BACKFILL AS REQUIRED TO FACILITATE THE SWABBING AND TESTING OF THE NEW WATERMAINS UNDER THE SUPERVISION OF THE ENGINEER.
12. FIRE HYDRANTS AND VALVES SHALL ONLY BE OPERATED BY MUNICIPAL WATER DEPARTMENT STAFF.
13. MECHANICAL JOINT RESTRAINTS ARE TO BE INSTALLED AT ALL TEES, HORIZONTAL BENDS, VERTICAL BENDS, HYDRANTS, END OF MAINS AND VALVES. CONCRETE THRUST BLOCKS ARE NOT PERMITTED UNLESS APPROVED BY THE ENGINEER. ALL MECHANICAL RESTRAINT SYSTEMS SHALL BE INSTALLED WITH CATHODIC PROTECTION AS PER THE TOWN STANDARD AND TREATED WITH DENSO TAPE.
14. THE CONTRACTOR SHALL SWAB, PRESSURE TEST, CHLORINATE AND FLUSH THE NEW WATERMAINS. ANY SWABBING, PRESSURE TESTING, CHLORINATING AND FLUSHING BEYOND THE INITIAL PROCEDURE WILL BE THE CONTRACTORS' RESPONSIBILITY. TESTING PROCEDURES TO BE IN ACCORDANCE WITH MUNICIPALITY STANDARDS.
15. ALL EXISTING WELLS LOCATED ON THE PROPOSED DEVELOPMENT LANDS ARE TO BE ABANDONED AND DECOMMISSIONED IN ACCORDANCE WITH ONTARIO REGULATION 903 UPON FINAL TESTING AND APPROVAL BY THE HYDROGEOLOGIST.



IN DETERMINING THE WIDTH OF SLAB REQUIRED, THE MINISTRY RECOMMENDS THAT THE FOLLOWING FORMULA BE USED;
$W=2(X-D)+d$, WHERE:

W = WIDTH OF SLAB IN METERS
X = FROST PENETRATION DEPTH IN METERS
D = DEPTH OF COVER OVER INSULATION IN METERS
d = OUTSIDE DIAMETER OF PIPE IN METERS

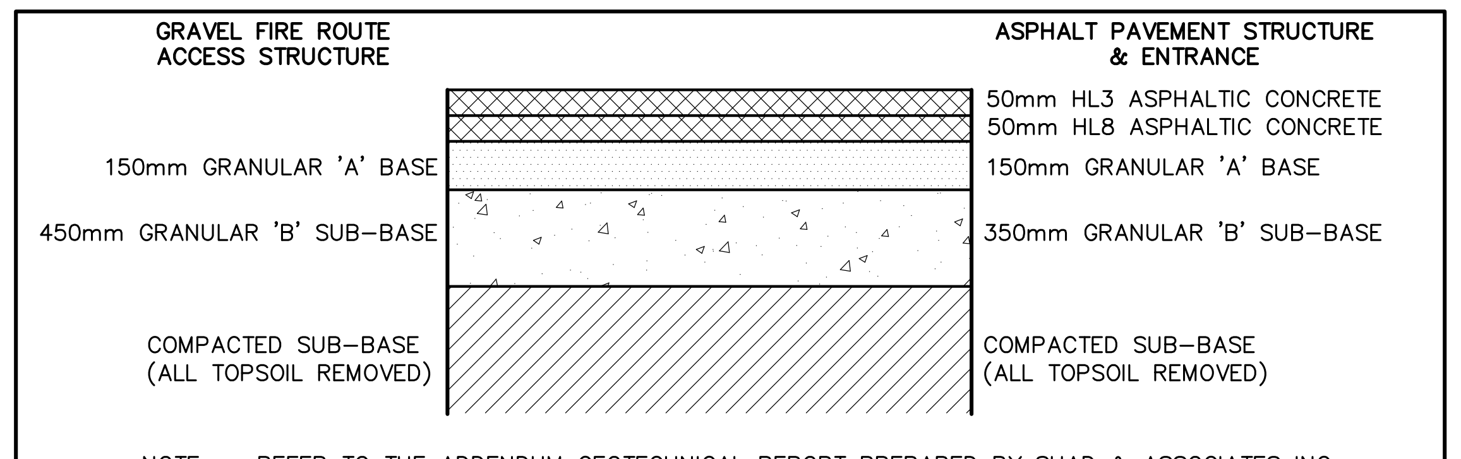
NOTES:

–INSULATION SHALL BE PLACED WITH ENDS CLOSELY BUTTED TOGETHER. ALL JOINT ENDS SHALL BE STAGGERED WHEN MORE THAN ONE LAYER OF INSULATION IS BEING INSTALLED.

–FORMULA TAKEN FROM MOE GUIDELINES FOR SERVICING IN AREAS SUBJECT TO ADVERSE CONDITIONS DATED JANUARY 1985.

–FOR EVERY 300mm REDUCTION IN FROST COVER USE 25mm OF EXTRUDED POLYSTYRENE INSULATION.

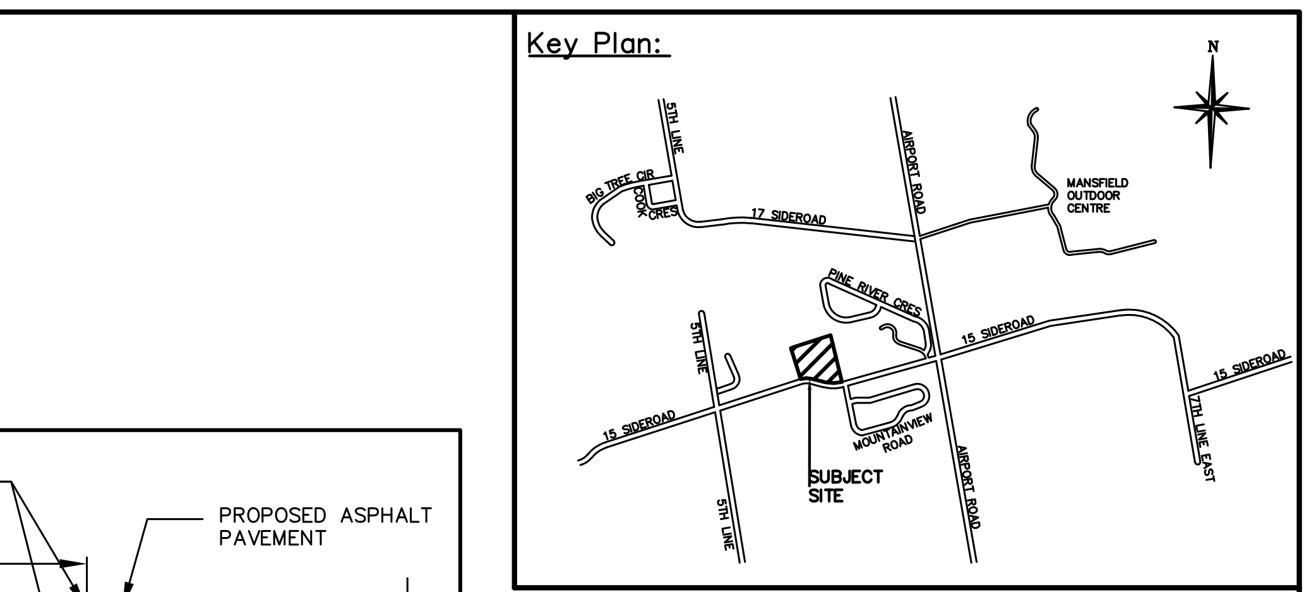
INSULATION FOR SHALLOW PIPES

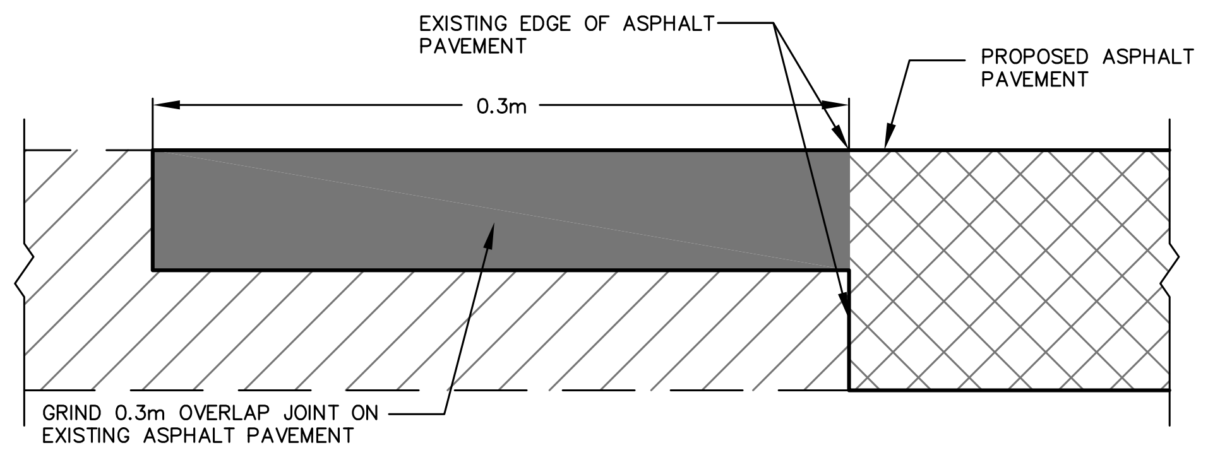


NOTE: – REFER TO THE ADDENDUM GEOTECHNICAL REPORT PREPARED BY SHAD & ASSOCIATES INC. DATED APRIL 22, 2020 FOR FURTHER PAVEMENT DETAILS. ALSO REFER TO THE RECOMMENDED GRAVEL FIRE ROUTE PAVEMENT THICKNESS PREPARED BY SHAD & ASSOCIATES DATED MARCH 20, 2020.

PAVEMENT CROSS–SECTIONS

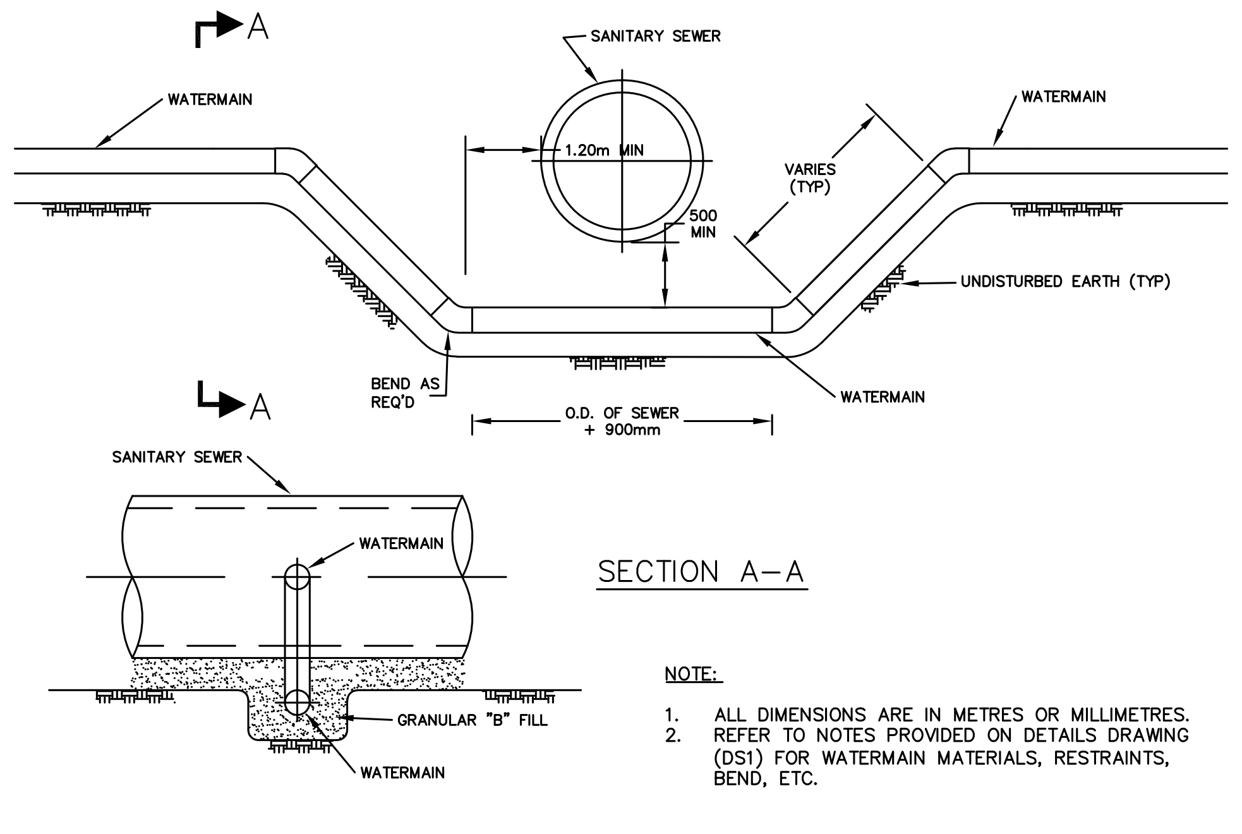
N.T.S.





PAVEMENT LAP JOINT

N.T.S.

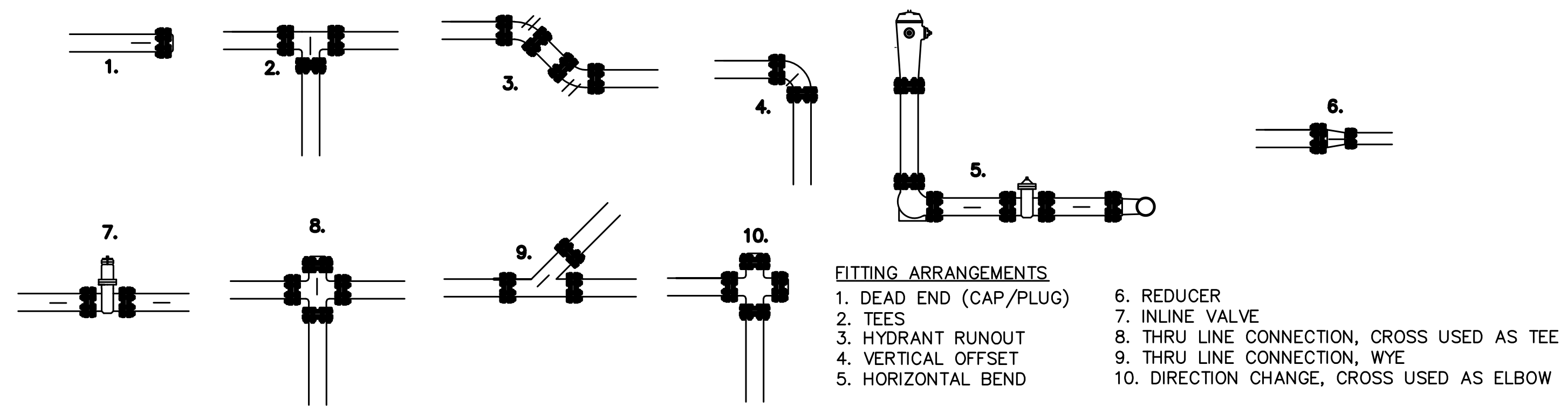


NOTE:

1. ALL DIMENSIONS ARE IN METRES OR MILLIMETRES.
2. REFER TO NOTES PROVIDED ON DETAILS DRAWING (DS1) FOR WATERMAIN MATERIALS, RESTRAINTS, BEND, ETC.

TYPICAL WATERMAIN DEFLECTION DETAIL

N.T.S.



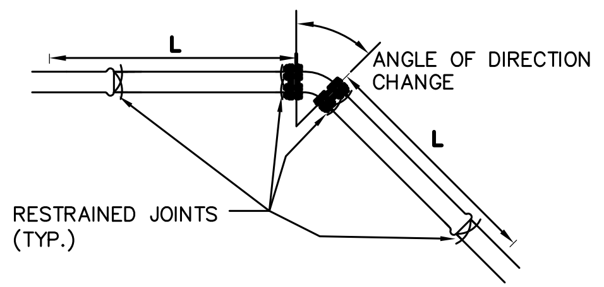
FITTING ARRANGEMENTS

1. DEAD END (CAP/PLUG)
2. TEES
3. HYDRANT RUNOUT
4. VERTICAL OFFSET
5. HORIZONTAL BEND
6. REDUCER
7. INLINE VALVE
8. THRU LINE CONNECTION, CROSS USED AS TEE
9. THRU LINE CONNECTION, WYE
10. DIRECTION CHANGE, CROSS USED AS ELBOW

TABLE 1.0

PIPE DIA.	L – MIN. LENGTH TO BE RESTRAINED ON EACH SIDE OF FITTING ARRANGEMENTS (M)						
	ELBOWS (DEG.) FITTING ARRANGEMENT No. 3 & 4				INLINE VALVES, Y's & TEES. FITTING ARRANGEMENTS No. 2, 7 & 9	DEADENDS FITTING ARRANGEMENTS No. 1, 5, 8 & 10	REDUCER FITTING ARRANGEMENTS No. 6
	11 1/4	22 1/2	45	90			
mm							
100	8.0	8.0	8.0	8.0	8.0	12.4	8.0
150	8.0	8.0	8.0	8.0	8.0	17.8	9.2
200	8.0	8.0	8.0	8.0	8.7	23.1	9.5
250	8.0	8.0	8.0	8.7	13.6	28.3	9.7
300	8.0	8.0	8.0	10.2	18.0	33.5	9.8
350	8.0	8.0	8.0	11.7	23.7	38.7	9.9
400	8.0	8.0	8.0	13.3	28.6	43.6	10

* NOTE THE MINIMUM LENGTH OF PIPE ALLOWED ON EACH SIDE OF THE FITTING (BEFORE NEXT FITTING) TO BE 1.5m



NOTE:

- ALL JOINTS MUST BE RESTRAINED IN ALL APPLICATIONS. TABLE 1 SHOWS RESTRAINED JOINTS REQUIRED ON BOTH SIDE OF THE RESTRAINED FITTINGS
- WHERE CONNECTING TO EXISTING WATERMAIN, EXCAVATE AND INSTALL RESTRAINTS ON EXISTING WATERMAIN FOR LENGTHS IDENTIFIED IN TABLE 1.0
- LENGTHS TO BE RESTRAINED SHOWN IN TABLE 1.0 ARE MINIMUMS. CONTRACTOR TO CONFIRM WITH RESTRAINT AND/OR PIPE SUPPLIER THE NEED FOR ADDITIONAL RESTRAINT. MINIMUM FACTOR OF SAFETY TO BE USED IS 2.5 FOR A TEST PRESSURE OF 1034kPa (150 psi)

RESTRAINED JOINTS DETAIL

N.T.S.

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Benchmark: 463.937m

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J.W.LIGHTHEART
100140403
DEC. 15, 2020

No.	Issue / Revision	Date
1	SPA FIRST SUBMISSION	AUG. 17, 2020
2	SPA SECOND SUBMISSION	DEC. 15, 2020

Mansfield Ski Club

DETAIL SHEET 1

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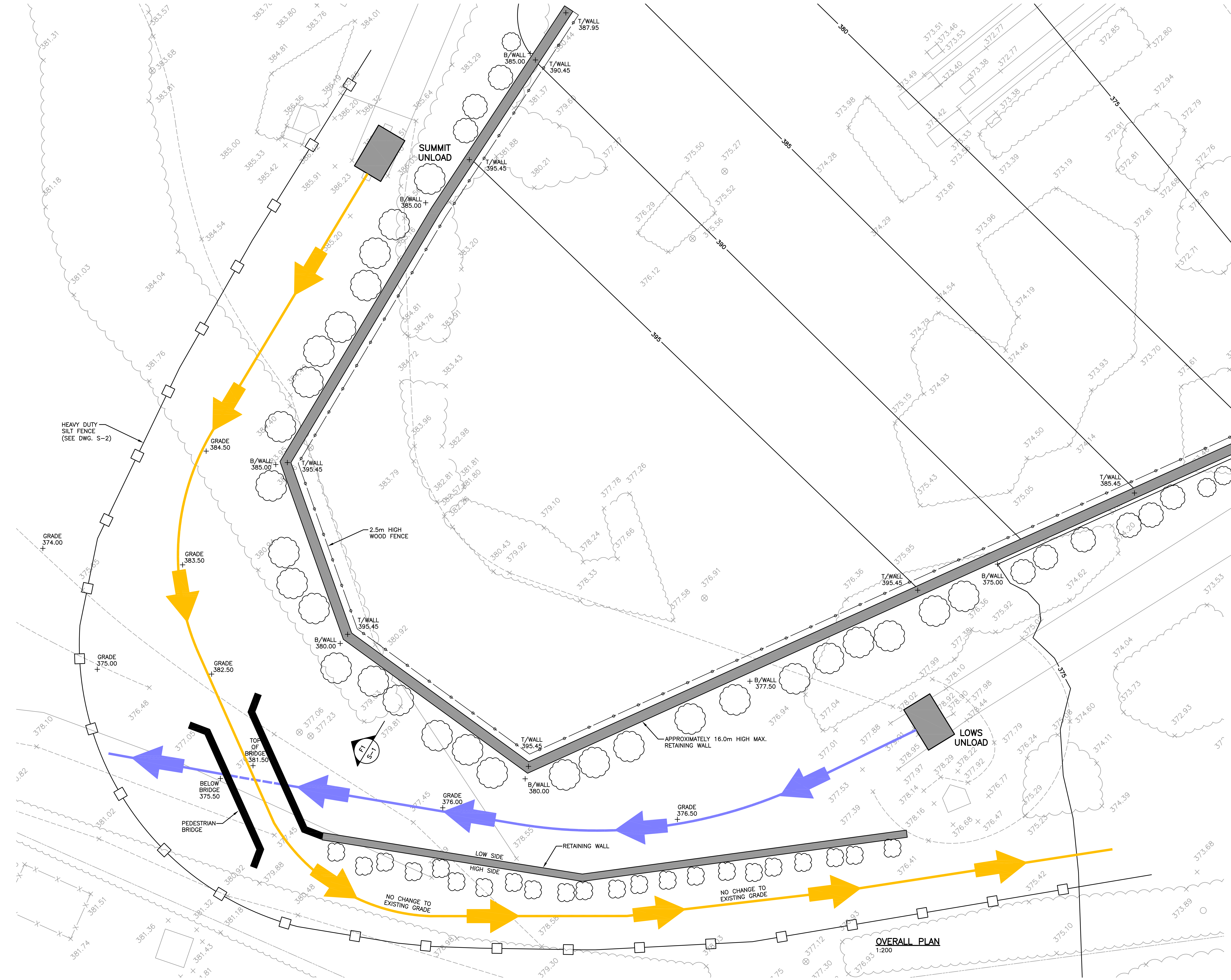
Drawn By AW
Checked By JWL
Drawing No. DS1
Scale N.T.S.
Project No. 15–319



OVERALL PLAN
1:200

MSE WALL

SEGMENTAL RETAINING WALL

DISCLAIMER AND COPYRIGHT

CONTRACTOR MUST VERIFY ALL DIMENSIONS AND BE RESPONSIBLE FOR SAME. ANY DISCREPANCIES MUST BE REPORTED TO THE ENGINEER BEFORE COMMENCING WORK. DRAWINGS ARE NOT TO BE SCALED.

BENCHMARKS

NOTES

No.	REVISION DESCRIPTION	DATE
1.	ISSUED FOR CLIENT REVIEW	NOV 5/20
2.	RE-ISSUED FOR CLIENT REVIEW	NOV 11/20

ENGINEER STAMP

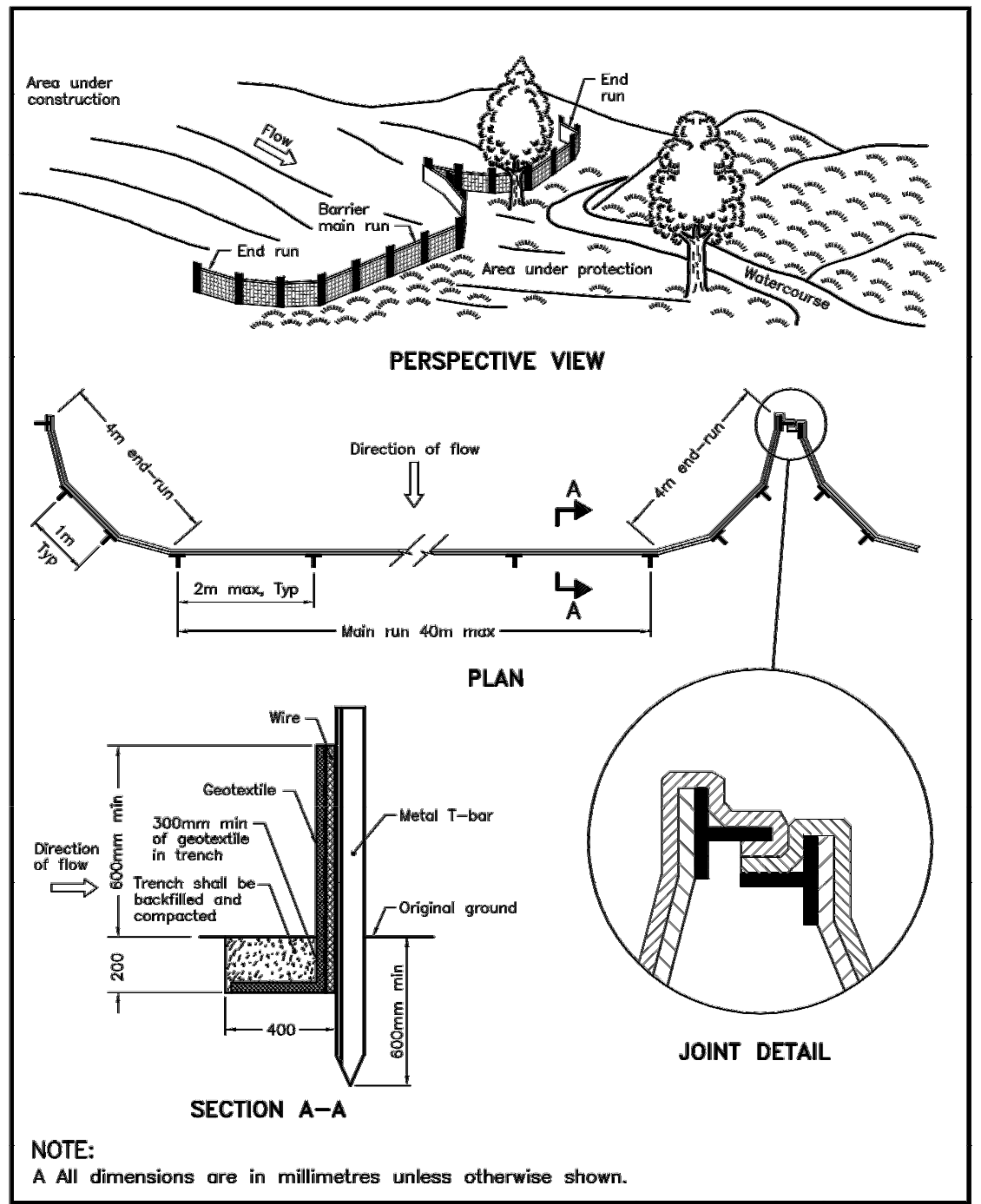
MANSFIELD SKI CLUB
SKI HILL RETAINING WALL
MULMUR HILLS

OVERALL PLAN

TATHAM
ENGINEERING

DESIGN: JJ	FILE: 119040	DWG:
DRAWN: WHG	DATE: JUL/20	**S-1**
CHECK: JJ	SCALE: AS NOTED	

Drawing Name: 119040 — S001.dwg, Plotted: Nov 11, 2020

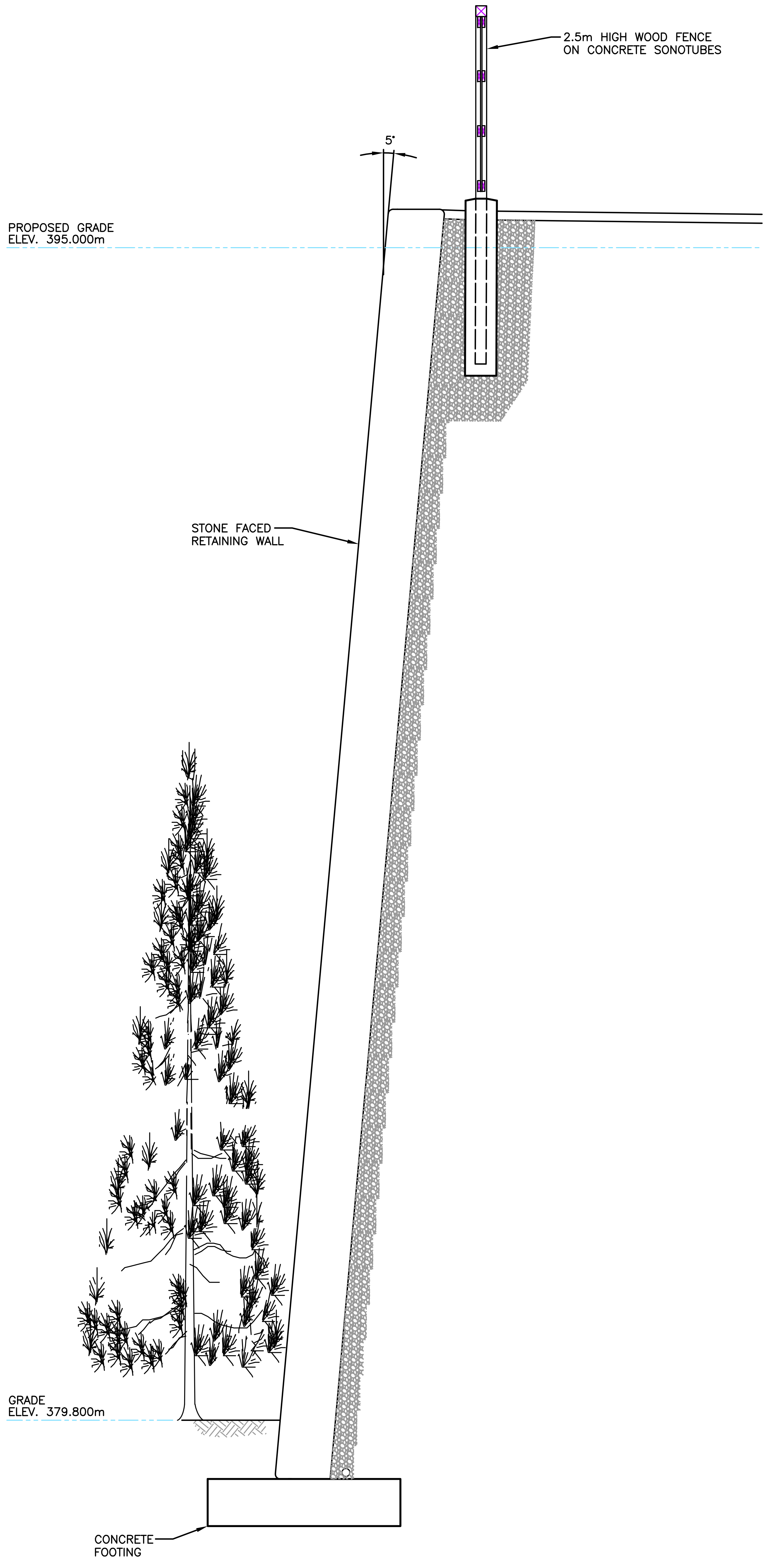


NOTE:
A All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING | Nov 2015 | Rev 0

HEAVY–DUTY WIRE–BACKED SILT FENCE BARRIER

OPSD 219.131



F1 S–2 SECTION
1:50

GENERAL NOTES

1. ALL WORK SHALL CONFORM TO THE REQUIREMENTS OF THE 2012 ONTARIO BUILDING CODE (OBC 2012) AND THE OCCUPATIONAL HEALTH AND SAFETY ACT OF ONTARIO.
2. ALL DIMENSIONS ARE IN METRIC UNLESS NOTED OTHERWISE. THE CONTRACTOR SHALL EXAMINE ALL DRAWINGS, CONFIRM ALL DIMENSIONS, COORDINATE AND REPORT ANY DISCREPANCIES TO THE ENGINEER PRIOR TO COMMENCING WORK.
3. THE CONTRACTOR SHALL ESTABLISH ALL LEGAL PROPERTY BOUNDARIES PRIOR TO CONSTRUCTION.
4. THE LOCATION OF EXISTING UTILITIES MUST BE VERIFIED PRIOR TO CONSTRUCTION. THE CONTRACTOR SHALL NOTIFY THE ENGINEER OF ANY CONFLICTS.
5. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ALL TEMPORARY FENCING, BARRICADES, AND TRAFFIC CONTROL TO MAINTAIN ADEQUATE CARE AND CONTROL OF THE SITE.
6. THE CONTRACTOR SHALL BE RESPONSIBLE FOR SAFETY ON THE JOB SITE AND FOR THE DESIGN, INSTALLATION, AND SUPERVISION OF ALL TEMPORARY BRACING AND FALSEWORK TO SUIT THEIR CONSTRUCTION METHODS.
7. THE CONTRACTOR SHALL COMPLETE SITE RESTORATION TO THE APPROVAL OF THE OWNER/CLIENT.

DISCLAIMER AND COPYRIGHT

BENCHMARKS

NOTES

No.	REVISION DESCRIPTION	DATE
1.	ISSUED FOR CLIENT REVIEW	NOV 5/20
2.	RE–ISSUED FOR CLIENT REVIEW	NOV 11/20

ENGINEER STAMP

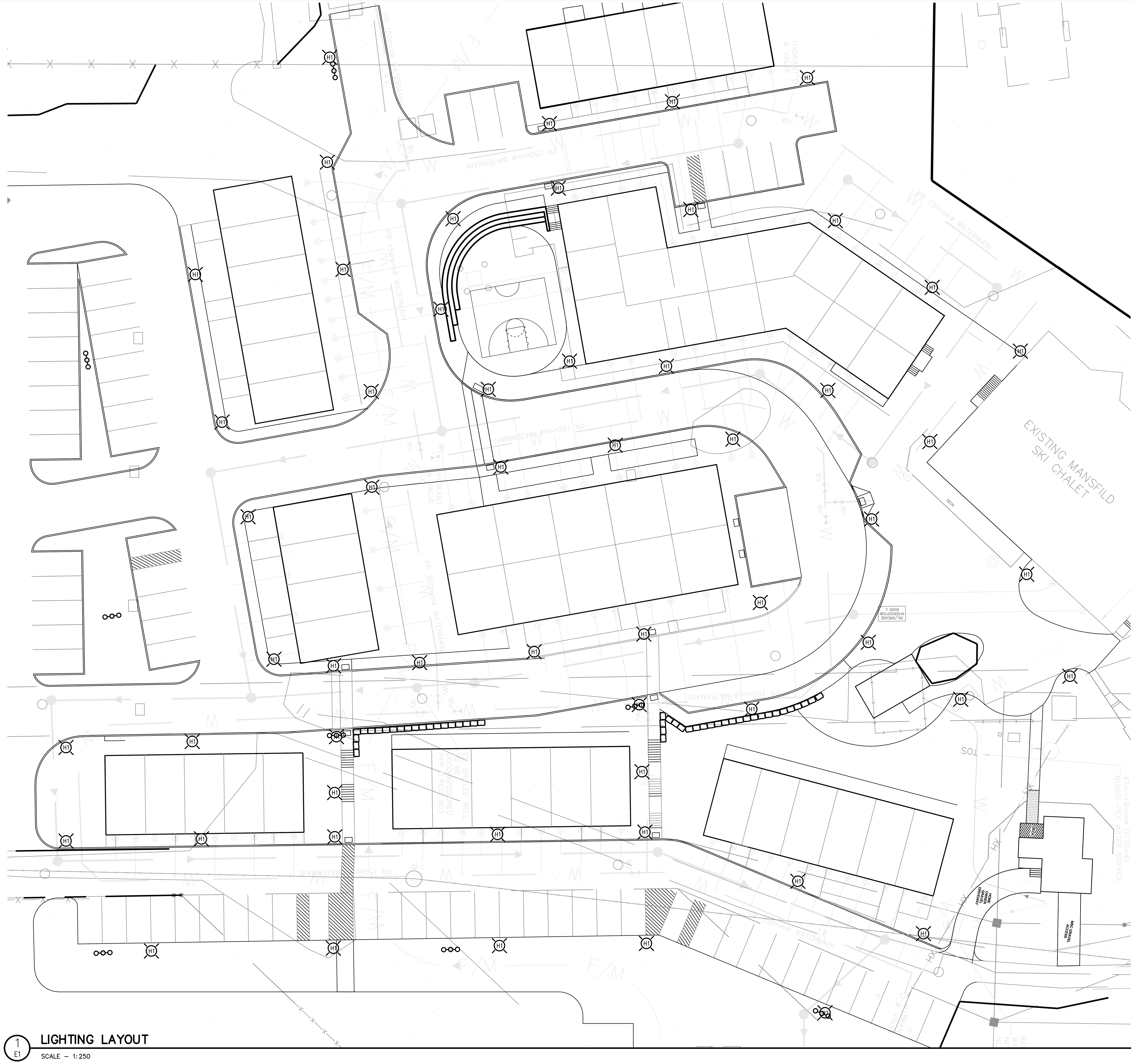
MANSFIELD SKI CLUB
SKI HILL RETAINING WALL
MULMUR HILLS

TATHAM ENGINEERING

DETAILS

DESIGN: JJ	FILE: 119040	DWG:
DRAWN: WHG	DATE: JUL/20	S-2
CHECK: JJ	SCALE: AS NOTED	

Drawing Name: 119040 – S001.dwg, Plotted: Nov 11, 2020



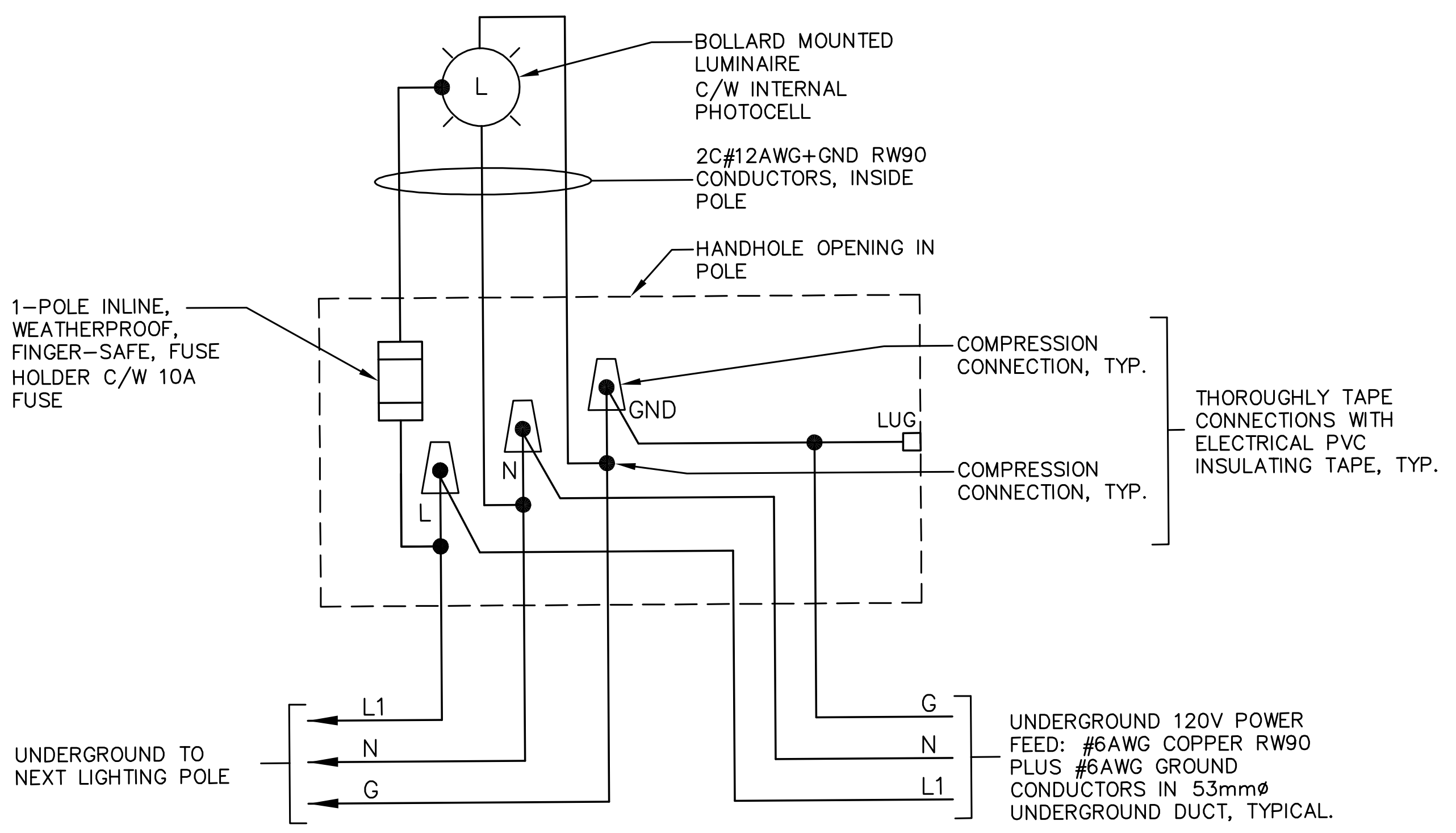
LIGHTING LAYOUT

1 E1

SCALE – 1:250

LEGEND:

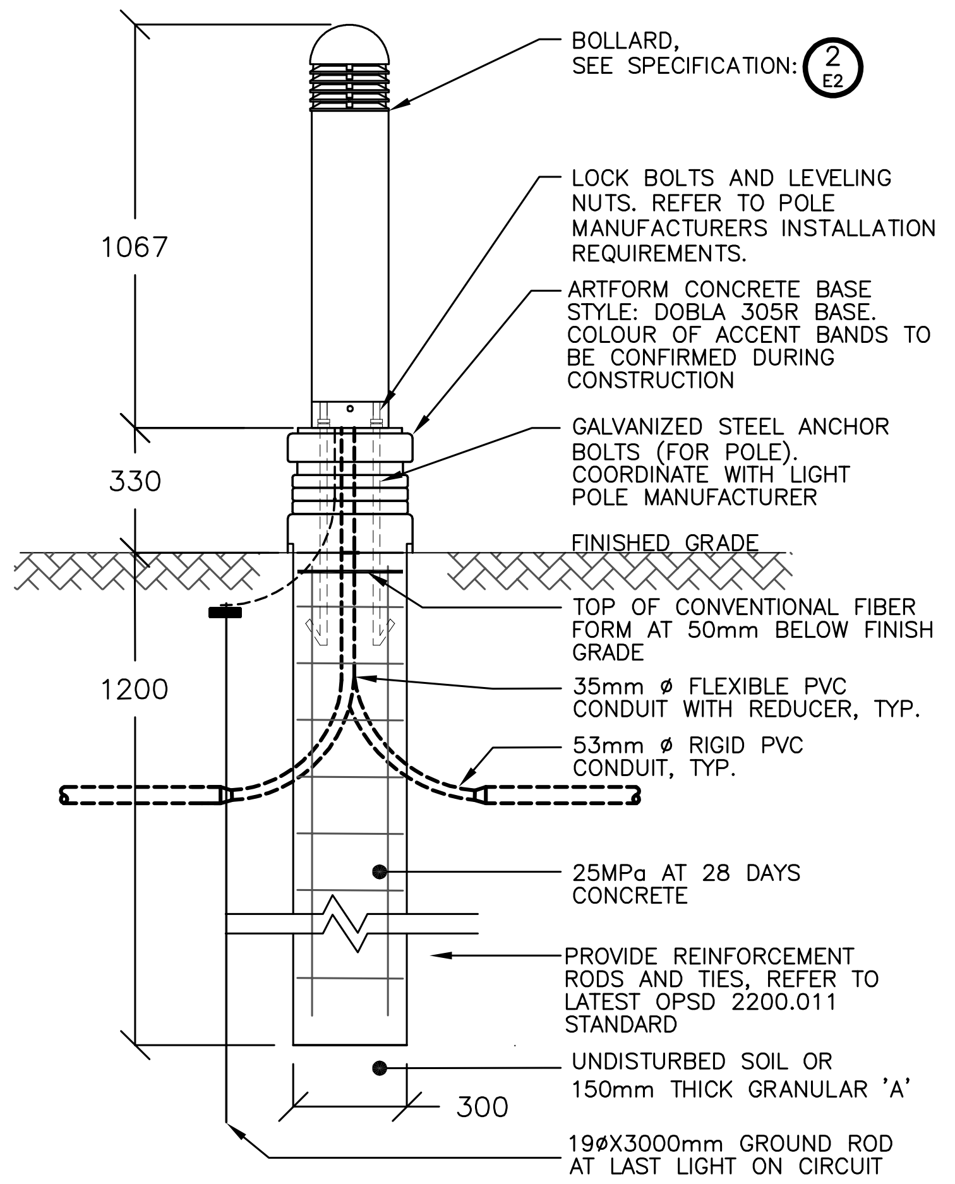
H1	PROPOSED BOLLARD LIGHT. SEE DETAIL 3/E1 AND 2/E2



LIGHTING WIRING DIAGRAM

4 E1

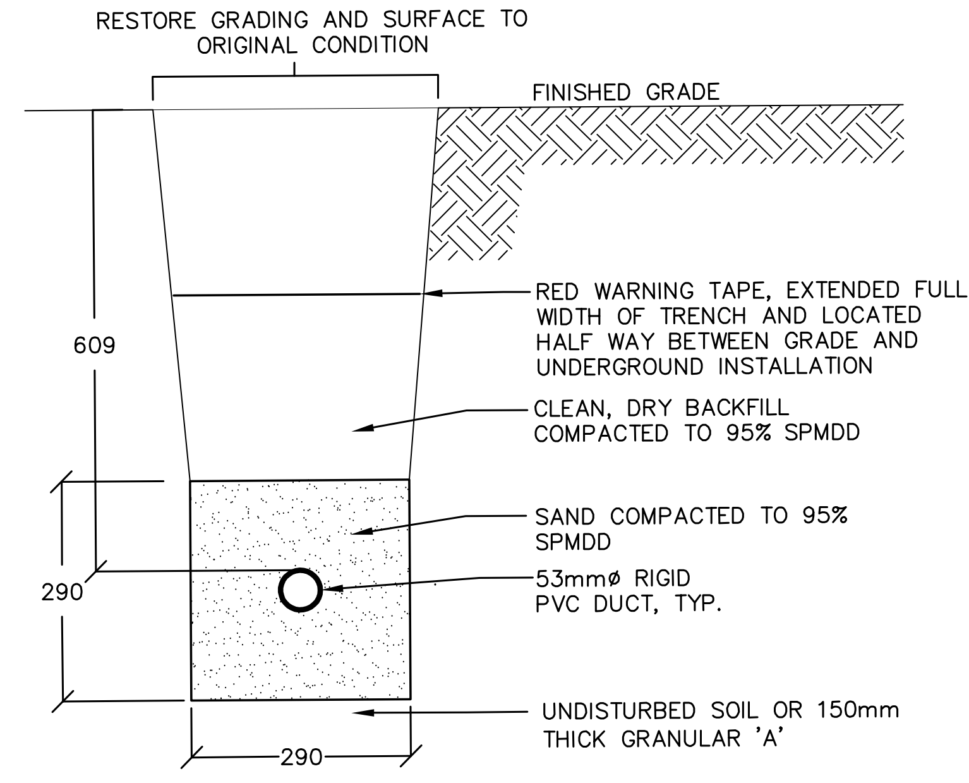
– NTS



BOLLARD LIGHTING TYPICAL INSTALLATION

3 E1

– NTS
– FOR INSTALLATION DETAILS REFER TO OPSD 2200.041



TYPICAL LIGHTING DUCTBANK DETAIL

2 E1

NTS

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A.DIXON
100223176
31JAN'20

G. G. RUNGE
31JAN'20

No.	ISSUE OR REVISION	DATE DD/MM/YY	ISSUER
1	ISSUED FOR CLIENT APPROVAL	30/01/20	AD
2	ISSUED FOR TOWN APPROVAL	31/01/20	AD

RUNGE ENGINEERING

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864 Hurontario Street
P.O. Box 387
Collingwood, ON L9Y 3Z7
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f: (705) 446–3588
www.raiengineers.ca

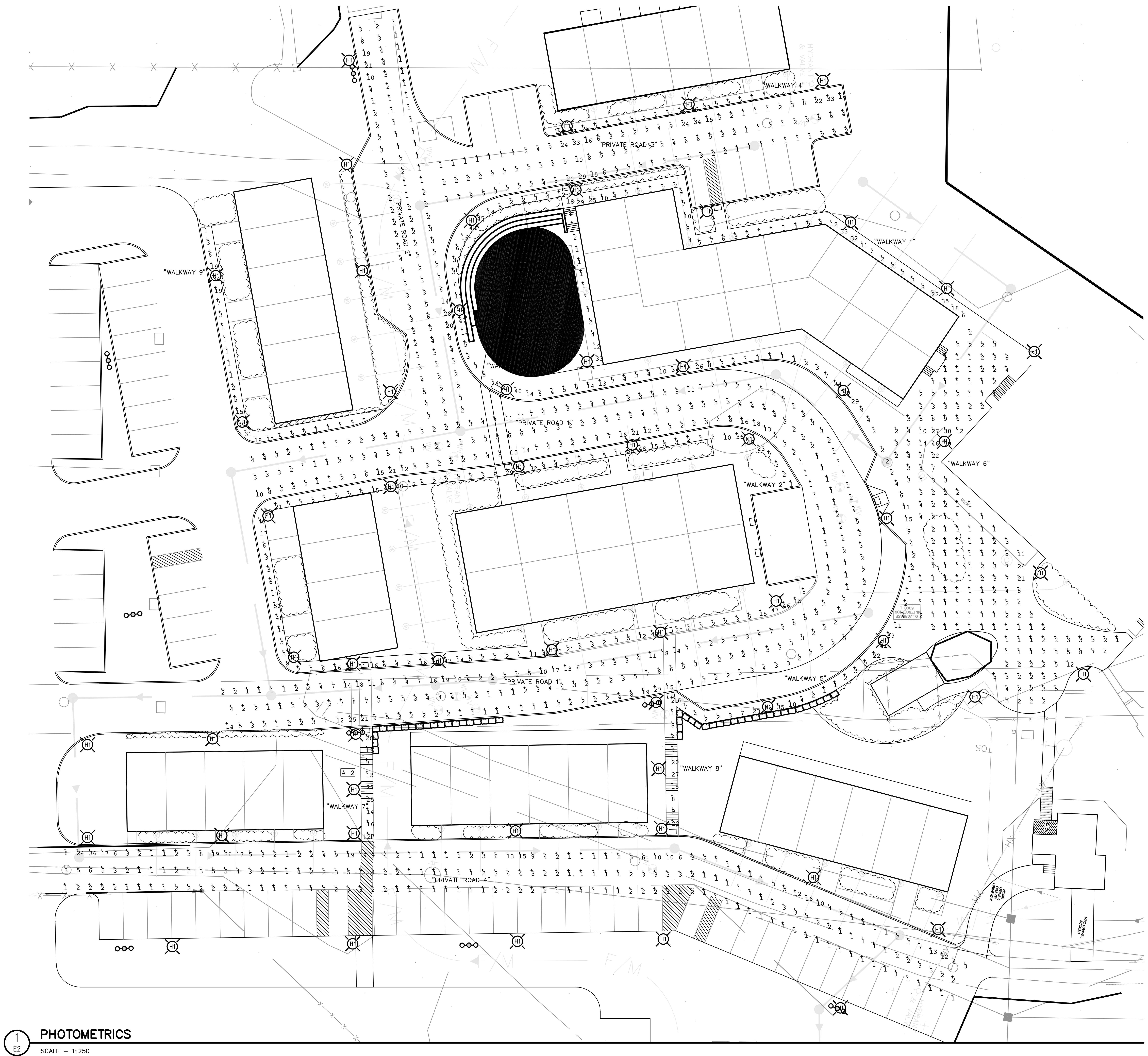
Client
MASNFIELD SKI CLUB

628213 SIDE ROAD 15
MULMUR, ONTARIO
L9V 0T9

Project Name
MANSFIELD SKI CLUB VILLAGE

Drawing Title
LIGHTING LAYOUT

Drawn By: AD
Checked By: GGR
Drawing No.: E1
Scale:
Project No.: 19179P

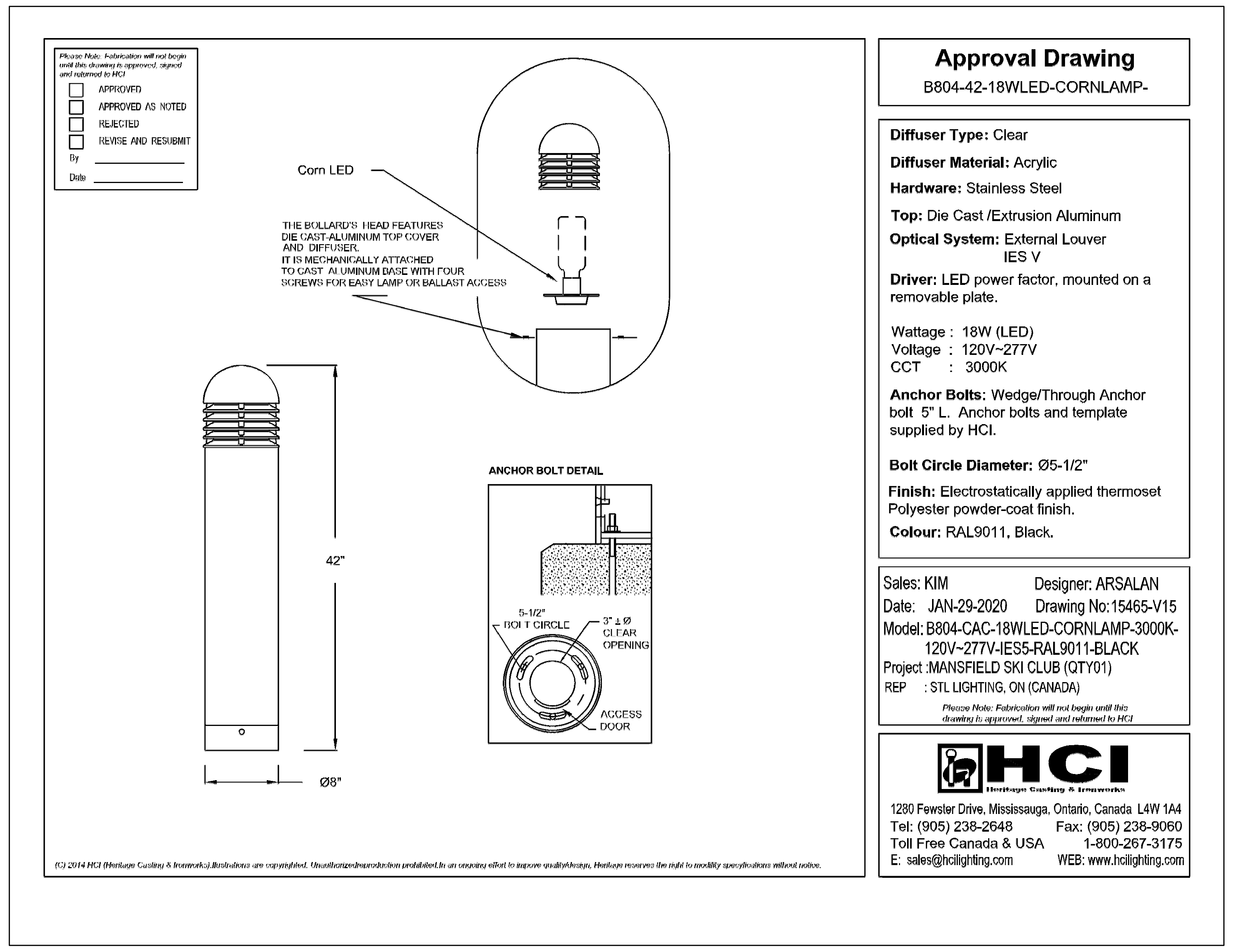


PHOTOMETRICS

1 / E2

SCALE – 1:250

Calculation Summary						
Label	CalcType	Units	Avg	Max	Min	Avg/Min
Private Road 1	Illuminance	Lux	4.26	27	1	4.26
Private Road 2	Illuminance	Lux	3.52	28	1	3.52
Private Road 3	Illuminance	Lux	5.46	34	1	5.46
Private Road 4	Illuminance	Lux	3.25	36	1	3.25
Walkway 1	Illuminance	Lux	8.54	35	1	8.54
Walkway 10	Illuminance	Lux	6.29	33	1	6.29
Walkway 2	Illuminance	Lux	14.68	51	1	14.68
Walkway 3	Illuminance	Lux	12.70	50	1	12.70
Walkway 4	Illuminance	Lux	12.33	37	1	12.33
Walkway 5	Illuminance	Lux	9.68	49	1	9.68
Walkway 6	Illuminance	Lux	3.61	50	1	3.61
Walkway 7	Illuminance	Lux	19.11	28	9	2.12
Walkway 8	Illuminance	Lux	14.64	27	6	2.44
Walkway 9	Illuminance	Lux	8.07	34	1	8.07



Please Note: Fabrication will not begin until this drawing is approved, signed and returned to HCI

☐ APPROVED
☐ APPROVED AS NOTED
☐ REJECTED
☐ REVISE AND RESUBMIT

By ______

Date ______

THE BOLLARD'S HEAD FEATURES DIE CAST-ALUMINUM TOP COVER AND DIFFUSER. IT IS MECHANICALLY ATTACHED TO CAST ALUMINUM BASE WITH FOUR SCREWS FOR EASY LAMP OR BALLAST ACCESS

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Approval Drawing

B804-42-18WLED-CORNLAMP-

Diffuser Type: Clear

Diffuser Material: Acrylic

Hardware: Stainless Steel

Top: Die Cast /Extrusion Aluminum

Optical System: External Louver
IES V

Driver: LED power factor, mounted on a removable plate.

Wattage : 18W (LED)
Voltage : 120V~277V
CCT : 3000K

Anchor Bolts: Wedge/Through Anchor bolt 5" L. Anchor bolts and template supplied by HCI.

Bolt Circle Diameter: Ø5-1/2"

Finish: Electrostatically applied thermoset Polyester powder-coat finish.

Colour: RAL9011, Black.

Sales: KIM Designer: ARSALAN
Date: JAN-29-2020 Drawing No:15465-V15
Model: B804-CAC-18WLED-CORNLAMP-3000K-120V~277V-IES5-RAL9011-BLACK
Project :MANSFIELD SKI CLUB (QTY01)
REP : STL LIGHTING, ON (CANADA)

Please Note: Fabrication will not begin until this drawing is approved, signed and returned to HCI

HCI
Heritage Casting & Ironworks
1280 Fewster Drive, Mississauga, Ontario, Canada L4W 1A4
Tel: (905) 238-2648 Fax: (905) 238-9060
Toll Free Canada & USA 1-800-267-3175
E: sales@hcilighting.com WEB: www.hcilighting.com

POLE ASSEMBLY DESCRIPTION AND CATALOG NUMBERS

TYPE H1 BOLLARD ASSEMBLY

BOLLARD: HCI LIGHTING
MODEL B805 SERIES
CATALOGUE NUMBER:
- 120VAC
- 18 WATTS
- 3000 DEG. CCT
- COLOUR BLACK
- FUSE
- 10kV SPD

LAMP: CORN BULB

FOR MODEL NUMBER INFORMATION REFER TO SPECIFICATIONS ON THIS DRAWING

LIGHTING SPECIFICATIONS

2 / E2

– NTS

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Client
MASNFIELD SKI CLUB

628213 SIDE ROAD 15
MULMUR, ONTARIO
L9V 0T9

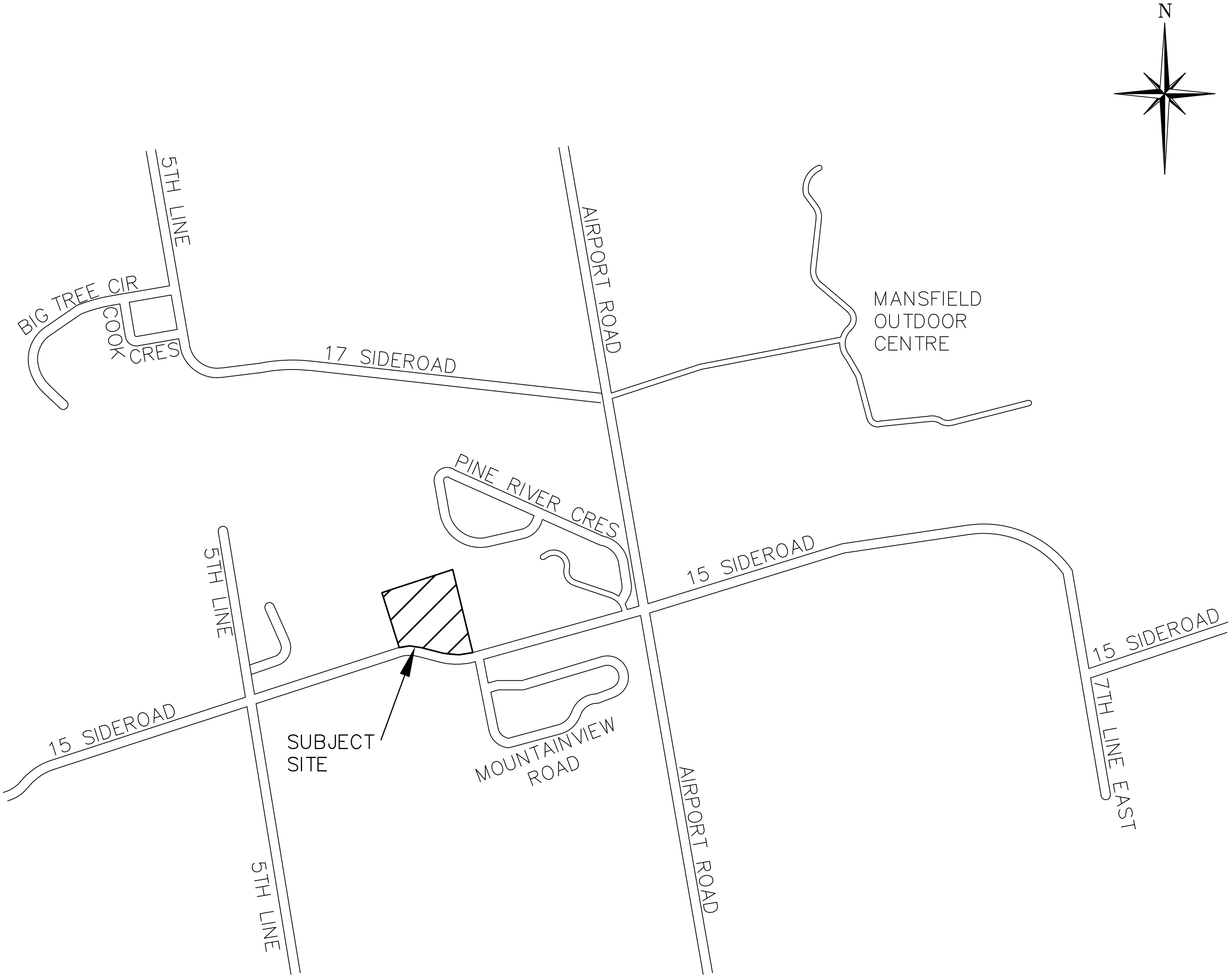
Project Name
MANSFIELD SKI CLUB VILLAGE

Drawing Title
PHOTOMETRICS

Drawn By: AD
Checked By: GGR
Drawing No.: E2
Scale:
Project No.: 19179P

APPENDIX A

FIGURES



Drawing Title

SITE LOCATION PLAN

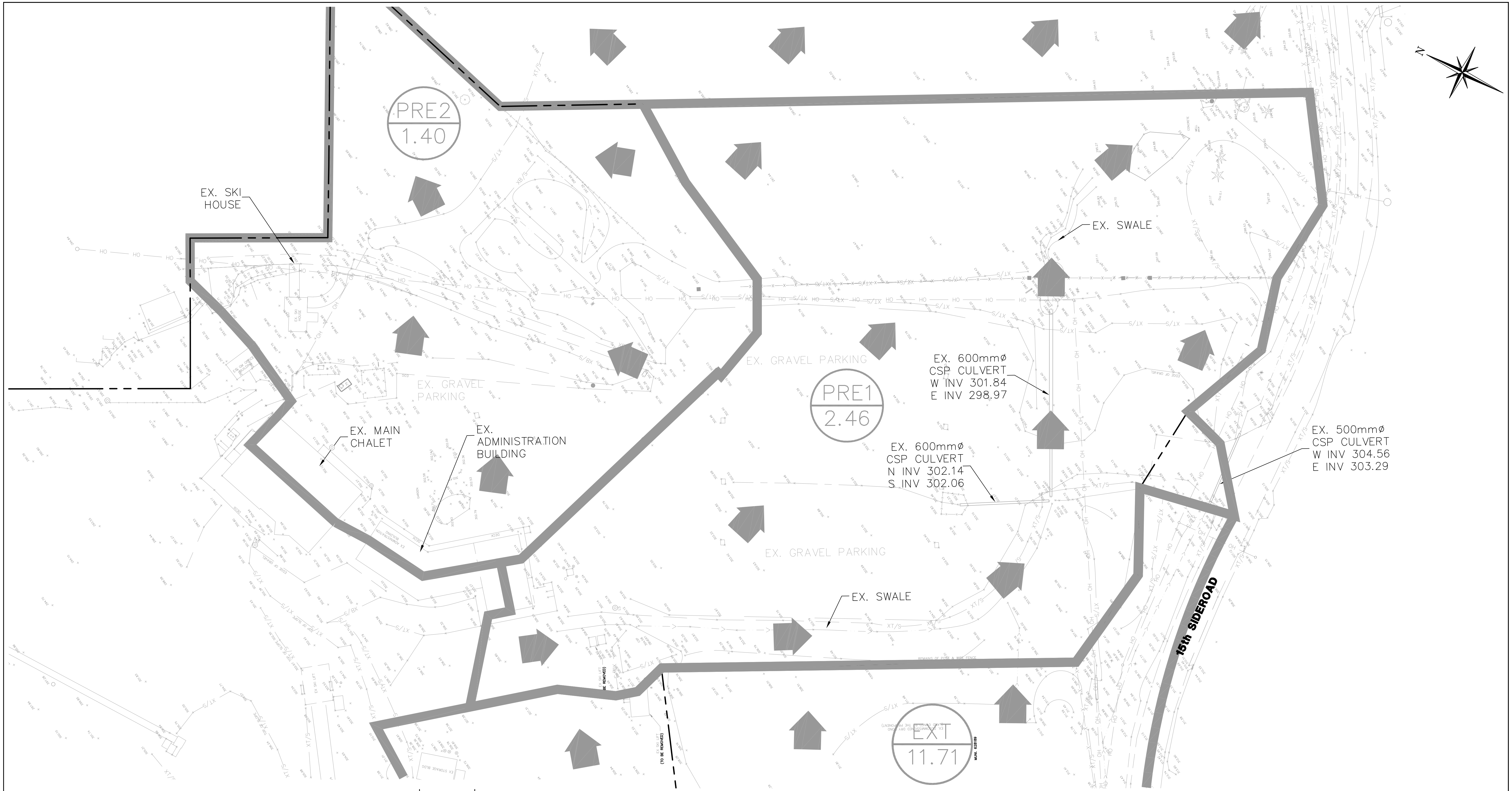
Project Title

MANSFIELD SKI CLUB

WMI & Associates Limited
119 Collier Street
Barrie, Ontario
L4M 1H5
705-797-2027
www.wmiengineering.ca

Drawn By AW	Checked By JWL	Figure No. FIG1
Scale N.T.S.	Project No. 15–319	

\\WMI-SERVER\wmi-server\Data\Projects\2015\15-319\CAD\WMI\Issue_No1\200810_Baseplan_15-319.dwg, FIG1, 1:25.4



Legend:

0 / 0.00	D.A. IDENTIFICATION D.A. (HA)
▬	DRAINAGE BOUNDARY
⬅	DRAINAGE FLOW DIRECTION

Drawing Title

PRE-DEVELOPMENT
DRAINAGE PLAN

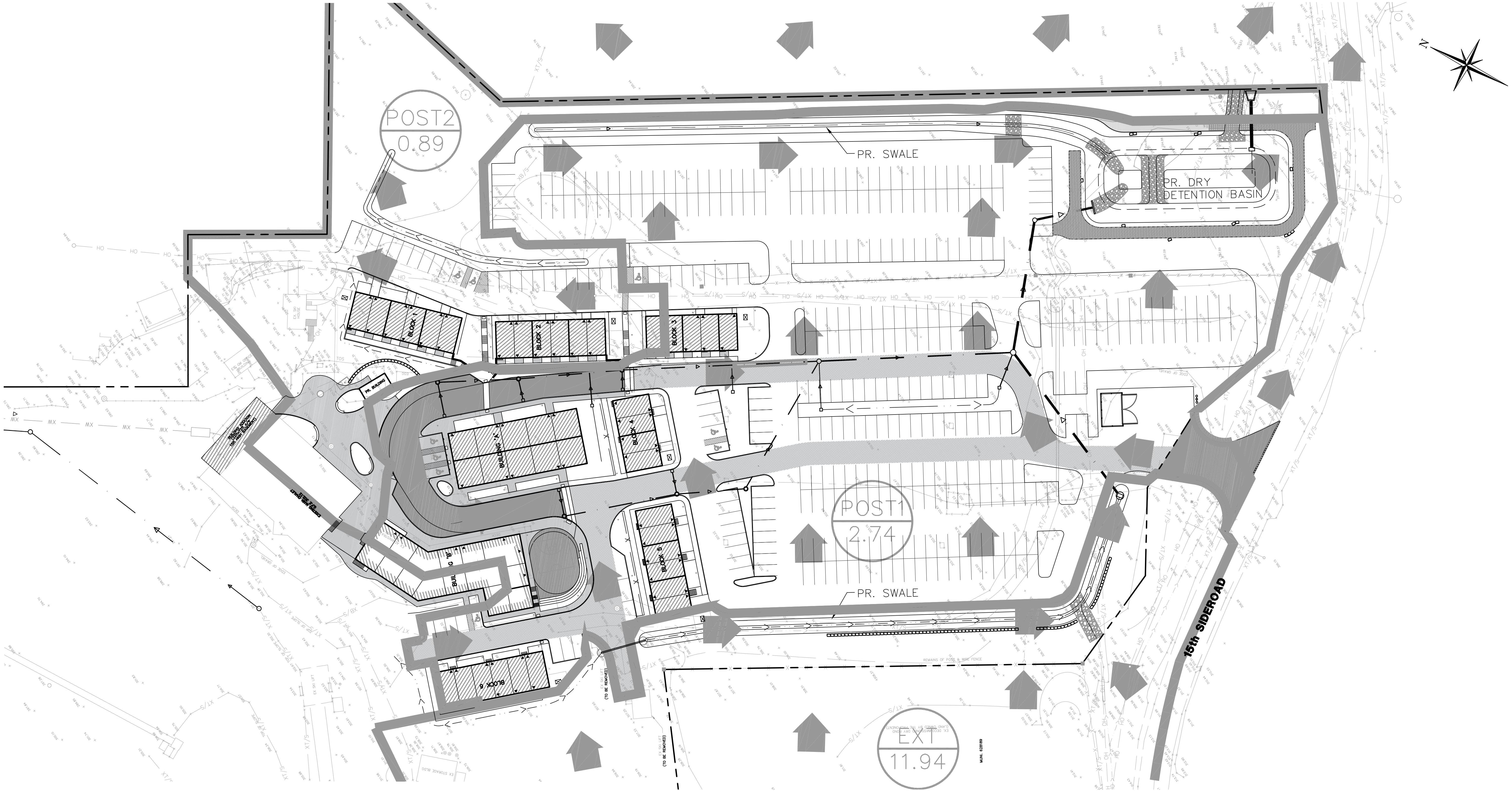
Project Title

MANSFIELD SKI CLUB

WMI & Associates Limited
119 Collier Street
Barrie, Ontario
L4M 1H5
705-797-2027
www.wmiengineering.ca

Drawn By AW	Checked By JWL	Figure No. FIG 2
Scale 1:1000	Project No. 15-319	

\\WMI-SERVER\wmi-server\Data\Projects\2015\15-319\CAD\WMI\Issue_No2\201118_Baseplan_15-319.dwg, FIG2, 1:1



Legend:

0	D.A. IDENTIFICATION
0.00	D.A. (HA)
▬	DRAINAGE BOUNDARY
←	DRAINAGE FLOW DIRECTION

Drawing Title

POST-DEVELOPMENT DRAINAGE PLAN

Project Title

MANSFIELD SKI CLUB

WMI & Associates Limited
119 Collier Street
Barrie, Ontario
L4M 1H5
705-797-2027
www.wmiengineering.ca

Drawn By AW	Checked By JWL	Figure No. FIG 3
Scale 1:1000	Project No. 15-319	

\\WMI-SERVER\wmi-server\Data\Projects\2015\15-319\CAD\WMI\Issue_No2\201118_Baseplan_15-319.dwg, FIG3, 1:1

Legend:

0	D.A. IDENTIFICATION
0.00	D.A. (HA)
─	DRAINAGE BOUNDARY
⬅	DRAINAGE FLOW DIRECTION

Drawing Title

EXTERNAL DRAINAGE PLAN

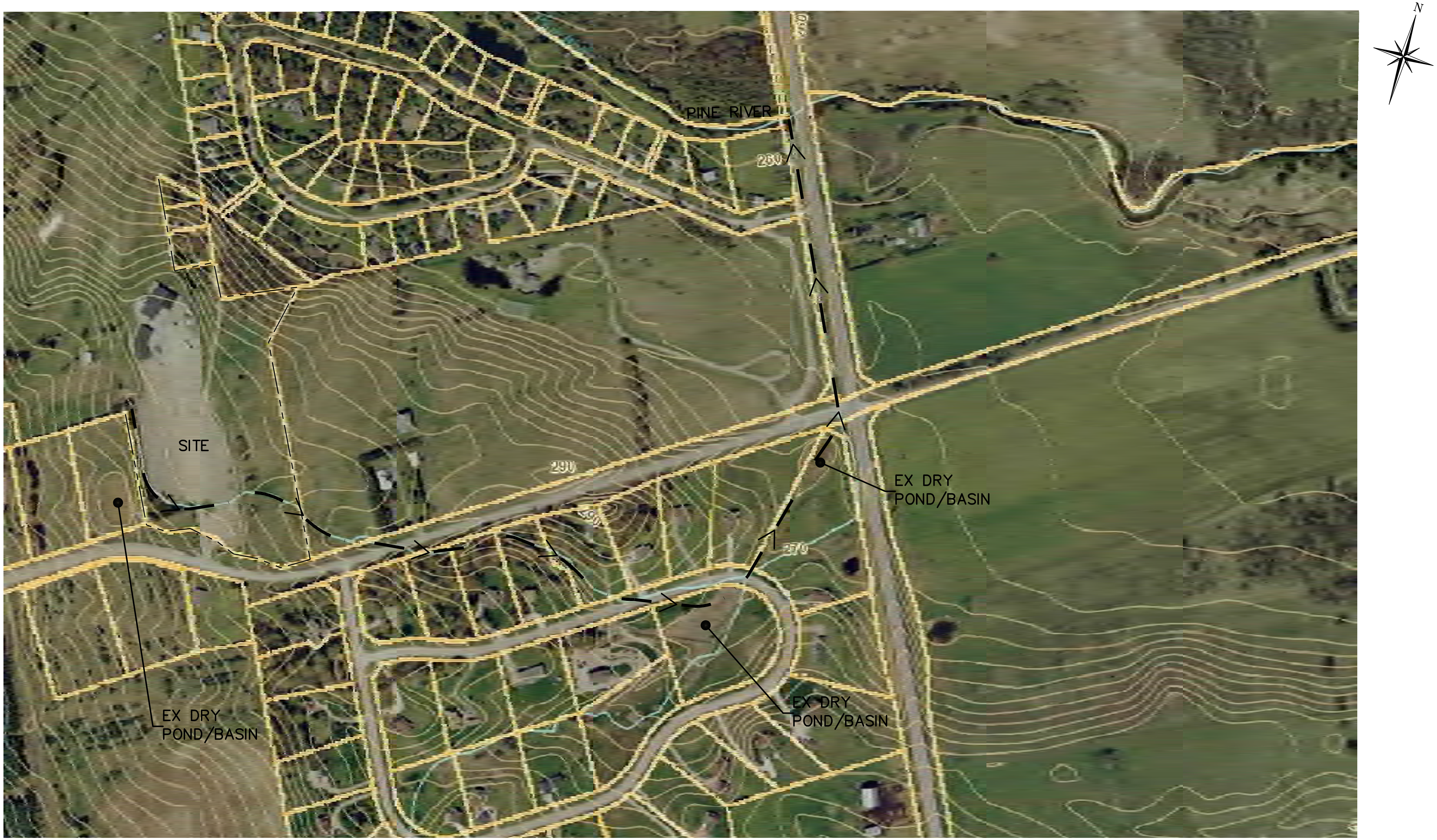
Project Title

MANSFIELD SKI CLUB

WMI & Associates Limited
119 Collier Street
Barrie, Ontario
L4M 1H5
705-797-2027
www.wmiengineering.ca

Drawn By AW	Checked By JWL	Figure No.
Scale 1:3000	Project No. 15-319	FIG 4

\\WMI-SERVER\wmi-server\Data\Projects\2015\15-319\CAD\WMI\Issue_No1\200810_Baseplan_15-319.dwg, FIG4, 1:1



Drawing Title

DOWNSTREAM DRAINAGE
OUTLET PLAN

Project Title

MANSFIELD SKI CLUB

WMI & Associates Limited
119 Collier Street
Barrie, Ontario
L4M 1H5
705-797-2027
www.wmiengineering.ca

Drawn By AW	Checked By JWL	Figure No. FIG 5
Scale 1:4000	Project No. 15-319	

\\WMI-SERVER\wmi-server\Data\Projects\2015\15-319\CAD\WMI\Issue_No1\200810_Baseplan_15-319.dwg, FIG5, 1:1

APPENDIX B

WATER & SANITARY SEWAGE CALCULATIONS

WMI & Associates Limited
119 Collier Street, Barrie, Ontario L4M 1H5
p (705) 797-2027 f (705) 797-2028

TOTAL DAILY DOMESTIC WATER SUPPLY FLOW CALCULATIONS
Mansfield Ski Club

Date: 10-Dec-20
Project No.: 15-319
Project: Mansfield Ski Club
Prepared By: JWL

▨ <<< **Elements Requiring Input Information**

Total Daily Design Flow Calculations

References:
- Ontario Building Code (OBC), 2012, Division B, Part 8, Table 8.2.1.3.A. Residential Occupancy & Table 8.2.1.3.B. Other Occupancies
- Ministry of the Environment (MOE), Design Guidelines for Drinking-Water Systems (2008), Chapter 3

Proposed Condition:

Establishment:	**# of people**	**# of water closets**	**# of fuel outlets**	**# of seats**	**Gross Floor Area (m^2)**	**Land Area (ha)**	**Total Daily Design Volume**		**Avg Day Demand ADD (L/day)**	**Max Day Demand MDD (L/day)**	**Peak Hourly Demand PHD (L/day)**
Existing Main Chalet, Admin Bldg (652m^2 ground floor + 158m^2 second floor), GM Office and Ski House							**13800**	L/day	13800	27600	55200
Subtotal =									**13800**	**27600**	**55200**
								Peaking Factor =		**2**	**4**
Peaking factor for the ADD and MDD are based on the water log consumption records from the 2019-2020 ski season. Peaking factor for the PHD was assumed to be double that of the MDD factor.											
Commercial/Institutional & Industrial Uses:											
Building A - Offices and Personal Business Space (630m^2 ground floor + 252m^2 mezzanine floor space)					**882.0**		**5**	L / 1.0m²	4410	6615	13230
Building B - Offices and Personal Business Space (Increase in ground floor space from existing)					**128.0**		**5**	L / 1.0m²	640	960	1920
Subtotal =					**1010**				**5050**	**7575**	**15150**
								Peaking Factor =		**1.5**	**3**
Residential Uses:											
Building A - Lofts (10 Units - Two (2) Bedrooms/Unit) (Second floor + third floor space)	**40**						**275**	L/person	11000	36740	55220
Building B - Lofts (15 Units - Two (2 Bedroom/Unit) (Second floor + third floor space)	**60**						**275**	L/person	16500	55110	82830
Staked Houses (66 Units - Two (2) Bedrooms/Unit)	**264**						**275**	L/person	72600	242484	364452
Subtotal =	**364**								**100100**	**334334**	**502502**
Refer to Table 3-1 and/or Table 3.3 of the MOE Design Guidelines for Drinking-Water Systems (2008) >>>								**Peaking Factor =**		**3.34**	**5.02**
								TOTAL SITE WATER DEMAND (L/day) =	**118950**	**369509**	**572852**
								(L/min) =	**82.6**	**256.6**	**397.8**

Flow Deficit during the Peak Hourly/Instantaneous Demand Rate:

Flow Deficit = Peak Hourly Demand Rate - Maximum Treatment Rate
= 397.8 L/min - 151.2 L/min
= 246.6 L/min

Required Inline Domestic Storage = Draw Down for Peak Hourly Demand Rate (1hr) x Flow Deficit
= 60 min x 246.6 L/min
= 14797 L

OR

Flow Deficit during the Max Day Demand Rate:

Flow Deficit = Max Day Demand Rate - Maximum Treatment Rate
= 256.6 L/min - 151.2 L/min
= 105.4 L/min

Required Inline Domestic Storage = Draw Down for Max Day Demand Rate (24hr) x Flow Deficit
= 1440 min x 105.4 L/min
= **151781 L GOVERNS**

Therefore, the Max Day Demand governs the required storage (Day tanks sizing). Within the domestic water treatment system there are two day tanks proposed to be installed as part of phase 1B which provide a total of 66,284L of storage. As additional storage is required throughout subsequent phases of the development, additional day tanks will be installed.

Notes:
- Number of bedrooms and offices and personal space areas are approximate and the information was provided by the architect and is subject to change.
- # of people for the Multi-Family Residential Dwellings (Townhouses, apartments, etc.) is calculated based on # of units x # of bedrooms x 2 people per bedroom.
- Residential flow is based on Apartments, Condos, Other Multi-family Dwellings (275L/day).
- Building 'A' is a total of 882m^2 (630m^2 proposed ground floor + 252m^2 proposed mezzanine floor space)
- Building 'B' is a total of 780m^2 (652m^2 existing ground floor + 128m^2 proposed ground floor space)

WMI & Associates Limited
119 Collier Street, Barrie, Ontario L4M 1H5
p (705) 797-2027 f (705) 797-2028

FIRE PROTECTION WATER STORAGE
DESIGN CALCULATIONS
BUILDING B - Supplied to Fire Hydrant 4

Date: 10-Dec-20 **Project No.:** 15-319

Project: Mansfield Ski Club **Prepared By:** AW

▨ <<< **Elements Requiring Input Information**

Fire Protection Water Storage

Reference: Office of the Fire Marshal, OFM Guideline, Fire Protection Water Supply Guideline for Part 3 in the Ontario Building Code (OBC), October 1999
Subsection 3.2.2 of the Ontario Building Code, 2012

Building Classification:

-The proposed buildings are Classified as either A-2, B-1, B-2, B-3, C or D and they will be of combustible construction with fire separations and fire resistance ratings based on email from +VG (Architect) on Apr. 17, 2020. Therefore, the K value used is 18 based on Table 1 of OBC A.3.2.5.7., Water Supply Coefficient for group C and D classification.
- Building Volumes provided by VG+ (Architect) via email on Apr. 17, 2020

Therefore, based on Table 1 of OBC A.3.2.5.7., Water Supply Coefficient, K:

K = 18 (see notes above)

Calculate Q=KVS$_{TOTAL}$

K = 18 (see Step 1 above)

Approximate Building Volume:

V = Area x Height
+ Roof Volume

V = 8190.0 m^3 (see notes above, Building B is the governing building)

Approximate Exposure Distance From Proposed Buildings To:

				from Figure 1 (OBC, A.3.2.5.7.)
West to Block 6 =	**12.0**	m	> > > > > >	S_W = 0
North to Main Chalet =	**8.8**	m	> > > > > >	S_N = 0.1
East to Building 'A' =	**14.0**	m	> > > > > >	S_E = 0
South to Block 5 =	**31.5**	m	> > > > > >	S_S = 0

S_{TOTAL} = 1 + (S_W + S_N +S_E + S_S)
= 1 + 0.1
S_{TOTAL} = 1.1

Minimum Water Supply,

Q = KVS$_{TOTAL}$
= **18** x **8190.0** x **1.1**
Q = 162,162 L

where,
Q = Minimum Water Supply (L)
K = Water Supply Coefficient
V = Building Volume (m^3)
S_{TOTAL} = Total Spatial Coefficient

Therefore, 4 x 50,000L fire storage tanks will be sufficient to provide the necessary Fire Protection Water Supply for the proposed development.

Water supply flow rate:

From Table 2, Required Minimum Water Supply Flow Rate (L/min), provided in the OBC A.3.2.5.7.,

Flow Rate = 5400 L/min

Based on OBC A.3.2.5.7., the water supply volume required should not be less than that needed to provide the minimum flow rate specified in Table 2 for a minimum duration of 30-minutes:

T = Minimum Water Supply/Flow Rate
= Q/F
= 162,162 ÷ 5400
T = 31 min > minimum 30min

where,
T = Duration (min)
Q = Minimum Water Supply (L)
F = Flow Rate (L/min)

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FIRE PROTECTION WATER STORAGE
DESIGN CALCULATIONS
Block 2 - Supplied to Fire Hydrant 3

Date: 10-Dec-20   **Project No.:** 15-319

Project: Mansfield Ski Club   **Prepared By:** AW

▨ <<< **Elements Requiring Input Information**

Fire Protection Water Storage

Reference: Office of the Fire Marshal, OFM Guideline, Fire Protection Water Supply Guideline for Part 3 in the Ontario Building Code (OBC), October 1999
Subsection 3.2.2 of the Ontario Building Code, 2012

Building Classification:

-The proposed buildings are Classified as either A-2, B-1, B-2, B-3, C or D and they will be of combustible construction with fire separations and fire resistance ratings based on email from +VG (Architect) on Apr. 17, 2020. Therefore, the K value used is 18 based on Table 1 of OBC A.3.2.5.7., Water Supply Coefficient for group C and D classification.
- Building Volumes provided by VG+ (Architect) via email on Apr. 17, 2020

Therefore, based on Table 1 of OBC A.3.2.5.7., Water Supply Coefficient, K:

K = 18 (see notes above)

Calculate Q=KVS$_{TOTAL}$

K = 18 (see Step 1 above)

Approximate Building Volume:

V = Area x Height
+ Roof Volume

V = 4095.0 m^3 (see notes above, Blcok 2 is the governing building)

Approximate Exposure Distance From Proposed Buildings To:

from Figure 1 (OBC, A.3.2.5.7.)

West to Building A =	**14.0**	m	> > > > > >	S_w =	0
North to Block 1 =	**9.0**	m		S_n =	0.1
South to Block 3 =	**11.0**	m		S_S =	0

S_{TOTAL} = 1 + (S_W + S_N +S_E + S_S)
= 1 + 0.1
S_{TOTAL} = 1.1

Minimum Water Supply,

Q = KVS$_{TOTAL}$
= **18** x **4095.0** x **1.1**
Q = 81,081 L

where,
Q = Minimum Water Supply (L)
K = Water Supply Coefficient
V = Building Volume (m^3)
S_{TOTAL} = Total Spatial Coefficient

Building 'B' is the governing building for the fire storage requirments.

Water supply flow rate:

From Table 2, Required Minimum Water Supply Flow Rate (L/min), provided in the OBC A.3.2.5.7.,

Flow Rate = 2700 L/min

Based on OBC A.3.2.5.7., the water supply volume required should not be less than that needed to provide the minimum flow rate specified in Table 2 for a minimum duration of 30-minutes:

T = Minimum Water Supply/Flow Rate
= Q/F
= 81,081 ÷ 2700
T = 31 min > minimum 30min

where,
T = Duration (min)
Q = Minimum Water Supply (L)
F = Flow Rate (L/min)

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Watermaim & Fire Supply Headloss Calculations
Mansfield Ski Club

▨ <<< **Elements Requiring Input Information**

Velocity, $V = \frac{Q}{A}$ (m/s)

where, Q = Flow (m^3/s)
A = Cross-Sectional Area (m^2)

Minor Head Loss, $H_L = (K_1+K_2+K_3\ldots) \times V^2/2g$

where, $\sum K = (K_1+K_2+K_3\ldots)$
V = mean velocity (m/s)
g = 9.81 (acceleration due to gravity, m/s^2)

Hazen -Williams Equation (re-arranged for Friction Slope)
(Friction Head Loss Calculation)

$$\text{Friction Slope, } S = \frac{(V)^{1/0.54}}{(0.85CR^{0.63})^{1/0.54}} \times 100 \text{ (m/100m)}$$

where, V = mean velocity (m/s)
k = 0.85 for SI units
C = Roughness Coefficient
R = hydraulic radius (m)

Total Head Loss = Friction Head Loss + Minor Head Loss

Pressure (psi) = Pressure Head (m) x 1.422

Total HGL = Ground Elev. + Pressure Head

Date: 10-Dec-20
Project No: 15-319
Prepared by: AW

Description	Pipe Design Coefficient C	Forcemain						Sum of Minor Loss Coeff. ∑K=	Minor Head Loss (m)	Total Head Loss (m)	Total Pressure Loss (psi)	Pressure @ Pt. A (psi)	Pressure Head @ Pt. A (m)	Ground Elev. @ Pt. A (m)	Total HGL @ Pt. A (m)	Ground Elev. @ Pt. B (m)	Total HGL @ Pt. B (m)	Pressure Head @ Pt. B (m)	Pressure @ Pt. B (psi)
		Flow (L/s)	Diameter (mm)	Velocity (m/s)	Unit Friction Head Loss (m/100m)	Distance (m)	Friction Head Loss (m)												
Fire Supply (20psi min.)																			
Hydrant 1 (at Block 6)	**110**	**90**	**250**	1.83	1.75	**241.90**	4.23	**2.52**	0.43	4.66	6.63	**0**	0.00	**339.45**	339.45	**305.90**	334.79	28.89	**41.08**
Hydrant 2 (at Building B)	**110**	**90**	**250**	1.83	1.75	**275.00**	4.81	**3.32**	0.57	5.38	7.65	**0**	0.00	**339.45**	339.45	**302.84**	334.07	31.23	**44.41**
Hydrant 3 (at Block 2)	**110**	**45**	**250**	0.92	0.48	**271.70**	1.32	**2.32**	0.10	1.42	2.01	**0**	0.00	**339.45**	339.45	**302.70**	338.03	35.33	**50.25**
	100	**45**	**150**	2.55	6.96	**24.80**	1.73	**2.12**	0.70	2.43	3.45	**50.25**	35.33	**302.70**	338.03	**298.15**	335.61	37.46	**53.27**
Hydrant 4 (at Building A)	**110**	**90**	**250**	1.83	1.75	**320.00**	5.60	**4.32**	0.74	6.34	9.01	**0.00**	0.00	**339.45**	339.45	**302.85**	333.11	30.26	**43.04**
Domestic Supply																			
of Block 6, PHD 40psi min.)	**100**	**6.6**	**100**	0.84	1.43	**107.00**	1.53	**1.84**	0.07	1.60	2.27	**48**	33.76	**302.00**	335.76	**306.00**	334.16	28.16	**40.04**
of Block 6, MDD 50psi min.)	**100**	**4.3**	**100**	0.55	0.65	**107.00**	0.69	**1.84**	0.03	0.72	1.03	**57**	40.08	**302.00**	342.08	**306.00**	341.36	35.36	**50.29**
Block 1 (MinHD 80psi)	**100**	**0.90**	**100**	0.11	0.04	**161.70**	0.06	**6.48**	0.00	0.06	0.09	**70**	49.23	**302.00**	351.23	**296.06**	351.16	55.10	**78.36**
	100	**0.90**	**50**	0.46	1.04	**42.50**	0.44	**0.12**	0.00	0.44	0.63	**78.36**	55.10	**296.06**	351.16	**294.30**	350.72	56.42	**80.23**

NOTES:

	Hydrant #1	**Hydrant #2**	**Hydrant #3**	**Hydrant #4**	**Domestic Watermain #1**	**Domestic Watermain #2**
- Loss Coefficient:	**1 - 45° Bends @ K=0.4**	**3 - 45° Bends @ K=0.4**	**6 - 45° Bends @ K=0.4**	**3 - 45° Bends @ K=0.4**	**4- 45° Bends @ K=0.4**	**5- 45° Bends @ K=0.4**
	2 - 90° Bends @ K=1	**2 - 90° Bends @ K=1**	**3 - 90° Bends @ K=1**	**3 - 90° Bends @ K=1**	**2 - Valves @ K=0.12**	**4 - 90° Bends @ K=1**
	1 - Valves @ K=0.12	**1 - Valves @ K=0.12**	**2 - Valves @ K=0.12**	**1 - Valves @ K=0.12**	**Total 1.84**	**5 - Valves @ K=0.12**
	Total 2.52	**Total 3.32**	**Total 5.64**	**Total 4.32**		**Total 6.6**

- The governing fire flow is based on Building 'B' which requires a flow of 90L/s. Hydrants 1, 2 & 4 fire supply lines are based on this flow and hydrant 3 is based on the required flow of 45L/s for Block 2.
- Assumed a starting pressure of 0 at the fire storage tanks located up the ski hill (gravity fed).
- Assumed a conservative starting elevation of 339.45 (342.15 - 2.70m = 339.45) as this is the lowest invert elevation of the 4 fire storage tanks.
- The worst case scenario for the domestic watermain was located at the southeast corner of Block 6 as this is the highest elevation of the domestic supply. The PHD flow of 6.6L/s was used in the calculation.
-80psi max. for MinHD (0.65 x ADD), 50psi min. for MDD and 40psi min. for PHD.

TECHNICAL BROCHURE
B5-25GS R8

FEATURES

Powered for Continuous Operation: All ratings are within the working limits of the motor as recommended by the motor manufacturer. Pump can be operated continuously without damage to the motor.

Field Serviceable: Units have left hand threads and are field serviceable with common tools and readily available repair parts.

Sand Handling Design: Our face clearance, floating impeller stack has proven itself for over 50 years as a superior sand handling, durable pump design.

FDA Compliant Non-Metallic Parts: Impellers, diffusers and bearing spiders are constructed of glass filled engineered composites. They are corrosion resistant and non-toxic.

Discharge Head/Check Valve: Cast 303 stainless steel for strength and durability. Two cast-in safety line loops for installer convenience. The built-in check valve is constructed of stainless steel and FDA compliant BUNA rubber for abrasion resistance and quiet operation.

Motor Adapter: Cast 303 stainless steel for rigid, accurate alignment of pump and motor. Easy access to motor mounting nuts using standard open end wrench.

Stainless Steel Casing: Polished stainless steel is strong and corrosion resistant.

Hex Shaft Design: Six sided shafts for positive impeller drive.

Engineered Polymer Bearings: The proprietary, engineered polymer bearing material is strong and resistant to abrasion and wear. The enclosed upper bearing is mounted in a durable Noryl® bearing spider for excellent abrasion resistance.

5GS, 7GS, 10GS, 13GS, 18GS & 25GS

5-25 GPM, ½ – 5 HP, 60 HZ, SUBMERSIBLE PUMPS

BUILT IN THE
USA
ENGINEERED, ASSEMBLED & TESTED

GOULDS
WATER TECHNOLOGY
a xylem brand

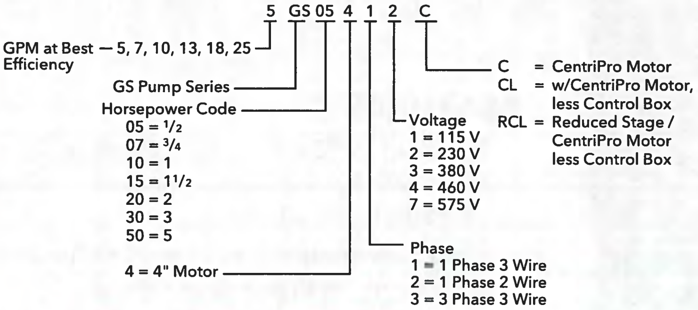
WATER END DATA

Series	Model	Required HP	Stages	Length (in)	Weight (lbs)
5GS	5GS05R	.5	9	12.9	8
	5GS05	.5	12	15.0	9
	5GS07	.75	15	17.0	11
	5GS10	1	20	21.7	13
	5GS15	1.5	26	25.8	15
	5GS20	2	33	31.6	19
7GS	7GS05R	.5	7	11.7	6
	7GS05	.5	10	13.8	7
	7GS07	.75	13	16.0	8
	7GS10	1	17	18.8	9
	7GS15	1.5	22	23.6	12
	7GS20	2	27	27.2	13
	7GS30	3	34	33.2	18
10GS	10GS05R*	0.5	8	12.2	7
	10GS05*	0.5	10	13.6	8
	10GS07*	0.75	14	16.4	9
	10GS10*	1	16	17.7	11
	10GS15	1.5	17	18.4	12
	10GS20	2	20	21.7	13
	10GS30	3	27	27.5	18
	10GS50R	5	35	33	21
	10GS50	5	42	40.2	24
13GS	13GS05	.5	5	10.1	6
	13GS07	.75	7	11.5	7
	13GS10	1	10	13.6	8
	13GS15	1.5	12	15.0	9
	13GS20	2	17	18.4	12
	13GS30	3	21	22.3	15
18GS	18GS07	.75	6	11.8	7
	18GS10	1	8	13.5	8
	18GS15	1.5	11	16.1	10
	18GS20	2	14	18.6	11
	18GS30	3	19	24.1	15
	18GS50R	5	24	28.3	17
	18GS50	5	30	34.4	21
25GS	25GS10	1	7	13.4	8
	25GS15	1.5	9	15.3	9
	25GS20	2	11	17.2	10
	25GS30	3	15	20.9	14
	25GS50R	5	22	28.7	17
	25GS50	5	26	33.4	21

*New High Head Hydraulic Design for models manufactured starting 8/2017

NOMENCLATURE

See price book for complete order numbers.



"GS" SERIES MATERIALS OF CONSTRUCTION

Part Name	Material
Discharge Head	AISI 303 SS
Check Valve Poppet	AISI 304 SS
Check Valve Seal	BUNA, FDA compliant
Check Valve Seat	AISI 304 SS
Check Valve Retaining Ring	AISI 302 SS
Bearing Spider - Upper	Noryl® GFN2
Bearing	Proprietary Engineered Polymer
Klipring	AISI 301 SS
Diffuser	Lexan®
Impeller	Noryl®
Bowl	AISI 304 SS
Intermediate Sleeve *	AISI 304 SS, Powder Metal
Intermediate Shaft Coupling *	AISI 304 SS, Powder Metal
Intermediate Bearing Spider *	Glass Filled Engineered Composite
Intermediate Bearing Spider *	AISI 303 SS
Shim	AISI 304 SS
Screws - Cable Guard	AISI 304 SS
Motor Adapter	AISI 303 SS
Casing	AISI 304 SS
Shaft	
Coupling	AISI 304 SS, Powder Metal
Cable Guard	AISI 304 SS
Suction Screen	AISI 304 SS

*See repair parts for where used.

SPECIFICATIONS

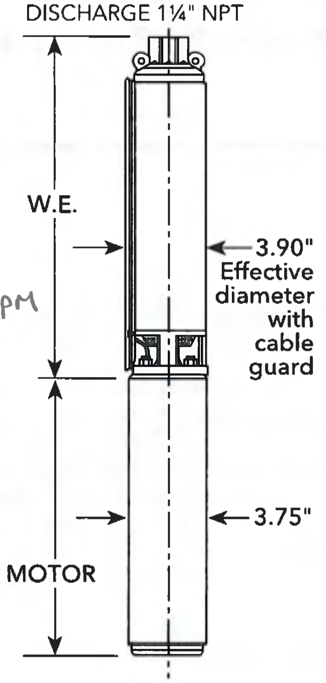
Model	Flow Range GPM	Horsepower Range	Best Efficiency GPM	Discharge Connection	Minimum Well Size	Rotation①
5GS	1.2 - 7.5	½ - 2	5	1¼	4"	CCW
7GS	1.5 - 10	½ - 3	7	1¼	4"	CCW
10GS	3 - 16	½ - 5	10	1¼	4"	CCW
13GS	4 - 20	½ - 3	13	1¼	4"	CCW
18GS	6 - 28	¾ - 5	18	1¼	4"	CCW
25GS	8 - 33	1 - 5	25	1¼	4"	CCW

① Rotation is counterclockwise when observed from pump discharge end.

running @ 16 USGPM
based on ex 38 mm
waterline

Total = 45 USGPM

would run @ 29 USGPM
based on pr 50 mm
waterline



CENTRIPRO 4" SINGLE-PHASE MOTORS

Order No.	Type	HP	Volts	Length in. (mm)	Weight lb. (kg.)
M05421	2-wire PSC	½	115	11.0 (279)	20 (9.1)
M05422		½	230	11.0 (279)	20 (9.1)
M07422		¾		12.4 (314)	23 (10.4)
M10422		1		13.3 (337)	25 (11.3)
M15422		1.5		14.9 (378)	29 (13.2)
M05411	3-wire	½	115	10.0 (253)	19 (8.6)
M05412		½	230	9.7 (246)	18 (8.2)
M07412		¾		10.8 (275)	22 (10)
M10412		1		11.7 (297)	23 (10.4)
M15412		1.5		13.6 (345)	28 (12.7)
M20412		2		15.1 (383)	31 (14.1)
M30412		3		18.3 (466)	40 (18.1)
M50412		5		27.7 (703)	70 (31.8)

NEMA MOTOR

- Corrosion resistant stainless steel construction.
- Built-in surge arrestor is provided on single phase motors through 5 HP.
- Stainless steel splined shaft.
- Hermetically sealed windings.
- Replaceable motor lead assembly.
- NEMA mounting dimensions.
- Control box is required with 3 wire single phase units.
- Three phase units require a magnetic starter with three leg Class 10 overload protection.

CENTRIPRO 4" THREE-PHASE MOTORS

Order No. by Voltage			HP	Length in. (mm)	Weight lb. (kg.)
200V	230V	460V			
M05430	M05432	M05434	½	10.8 (275)	22 (9.7)
M07430	M07432	M07434	¾	10.8 (275)	22 (9.7)
M10430	M10432	M10434	1	11.7 (297)	23 (10.4)
M15430	M15432	M15434	1.5	11.7 (297)	23 (10.4)
M20430	M20432	M20434	2	13.8 (351)	28 (12.7)
M30430	M30432	M30434	3	15.3 (389)	32 (14.5)
M50430	M50432	M50434	5	21.7 (550)	55 (24.9)
M75430	M75432	M75434	7.5	27.7 (703)	70 (1.8)

Order No.	HP	Volts	Length in. (mm)	Weight lb. (kg.)
M15437	1.5	575	11.7 (297)	23 (10.4)
M20437	2		15.3 (389)	32 (14.5)
M30437	3		15.3 (389)	32 (14.5)
M50437	5		27.7 (703)	70 (31.8)
M75437	7.5		27.7 (703)	70 (31.8)

AGENCY LISTINGS

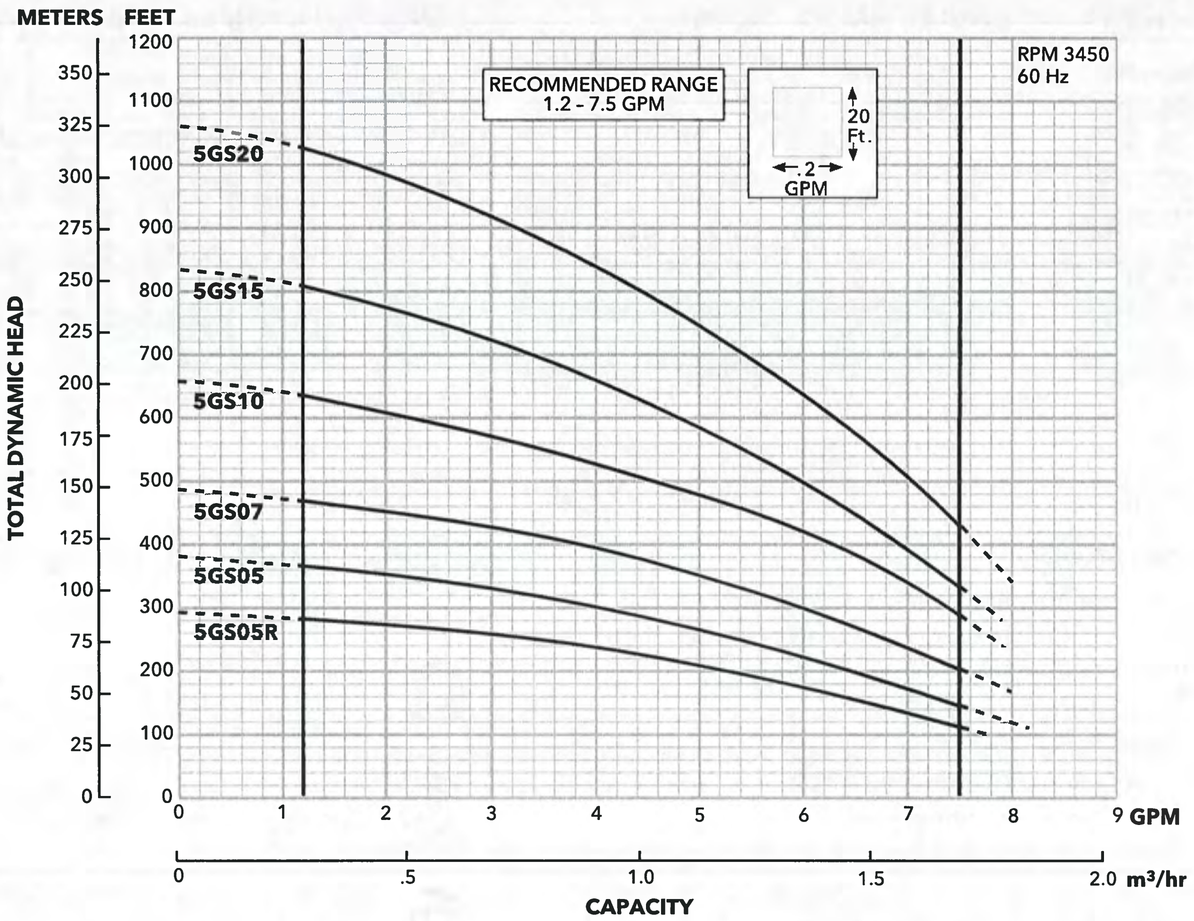
Pump/Water End and CentriPro Motor - tested to UL778 and CAN 22.2 by CSA International (Canadian Standards Association)

CentriPro Motor - Certified to NSF/ANSI 61, Annex G, Drinking Water System Components 4P49

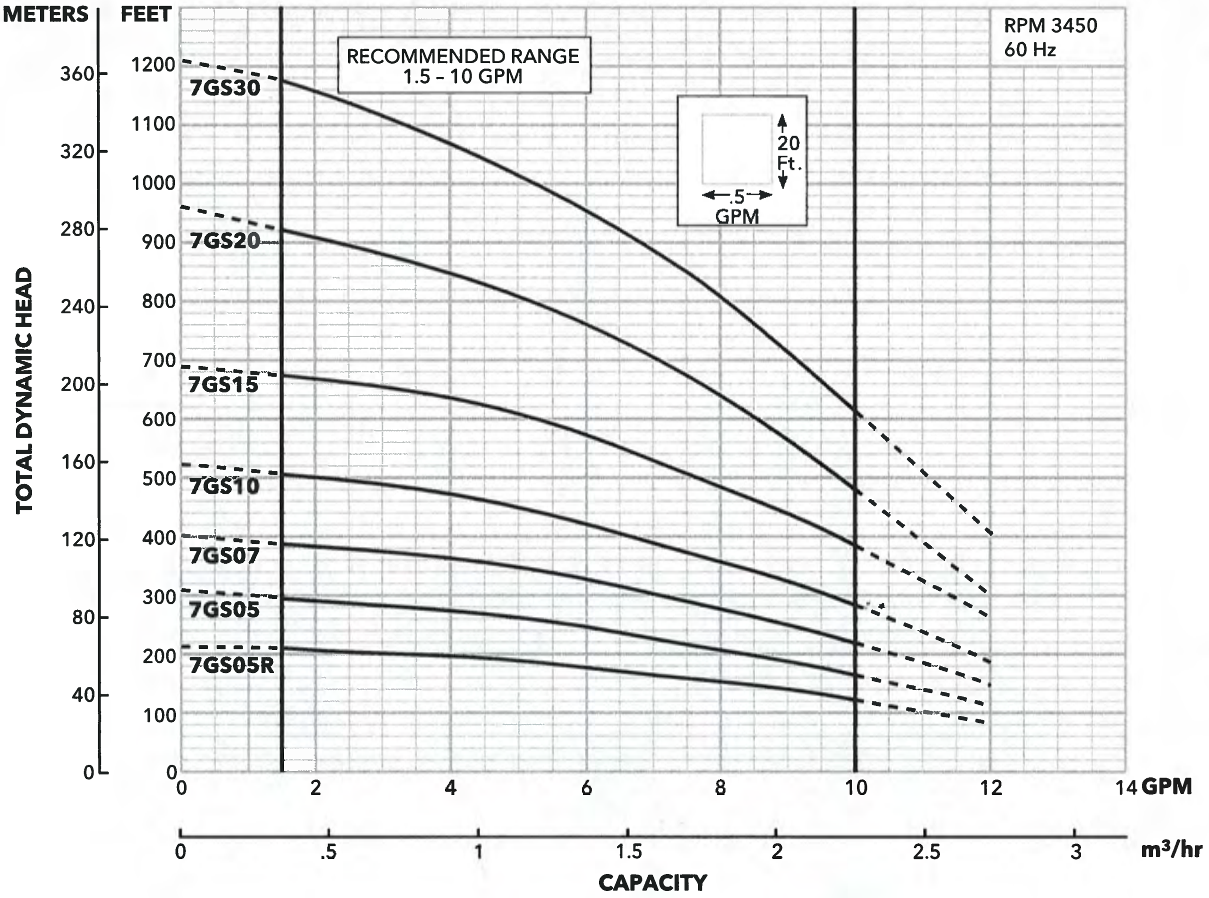
NSF/ANSI 372 – Drinking Water System Components – Lead Content

CLASS 6853 01 - Low Lead Content Certification Program - - Plumbing Products

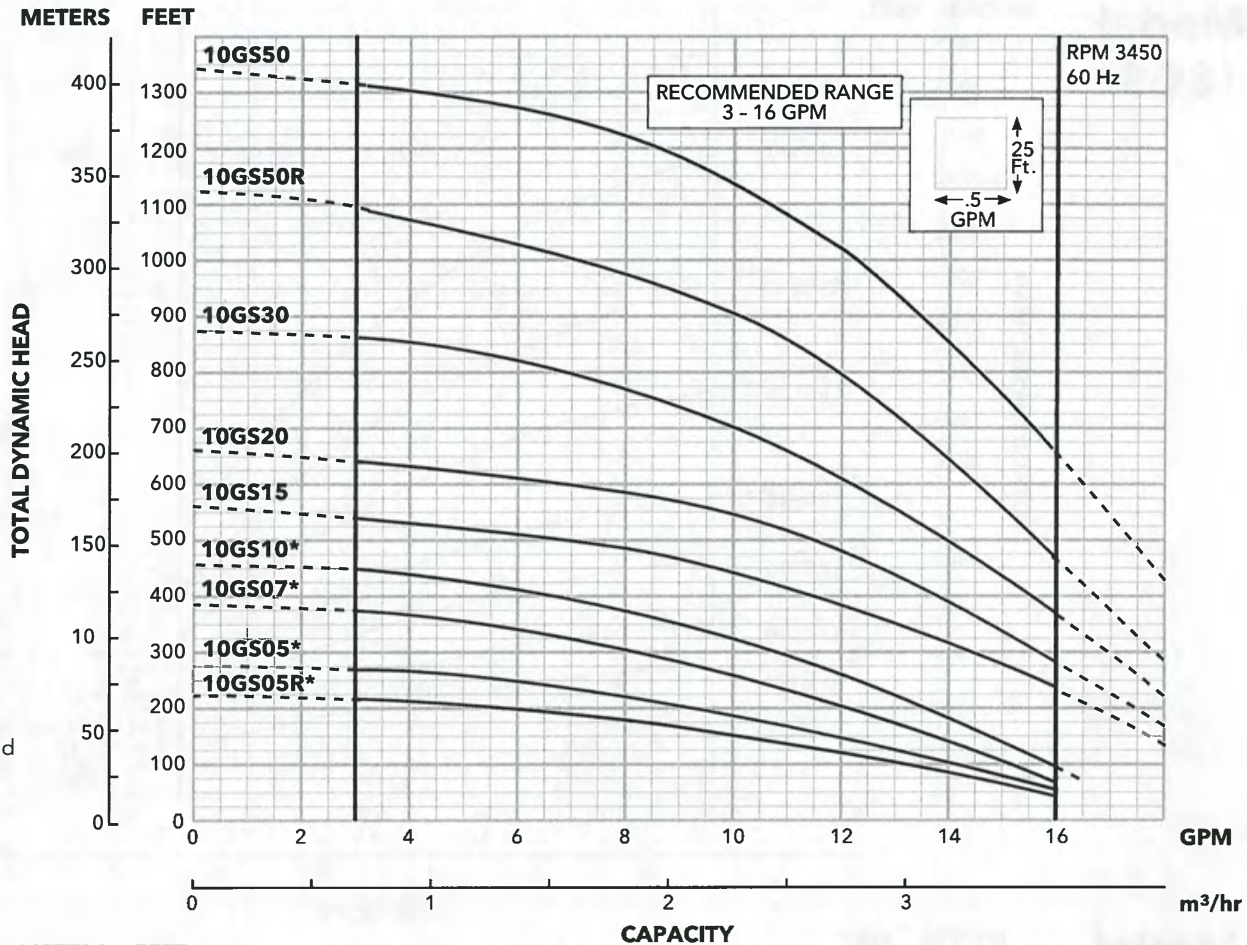
Model 5GS



Model 7GS



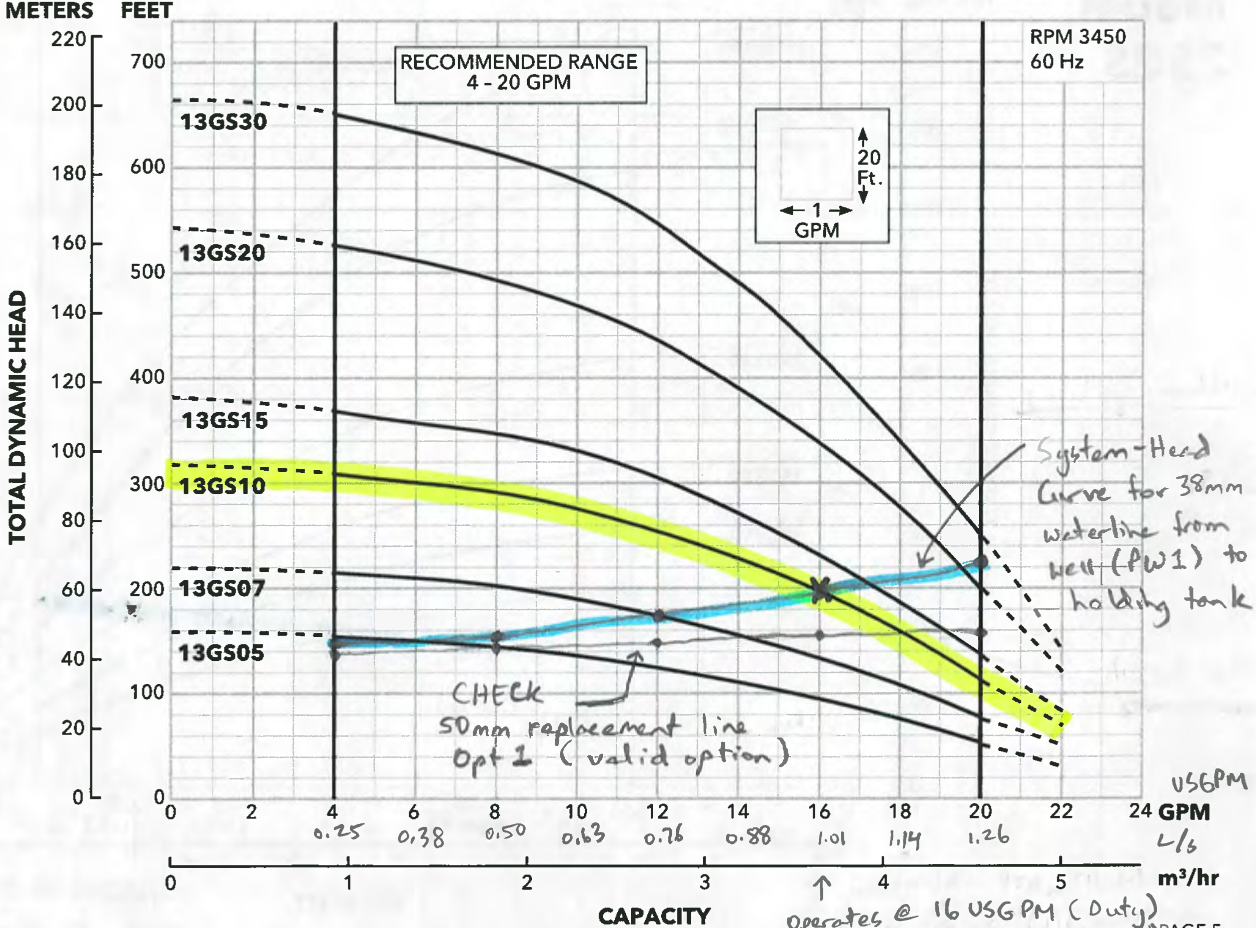
Model 10GS



New High Head Hydraulic Design for models manufactured starting 8/2017

* HH Versions

Model 13GS

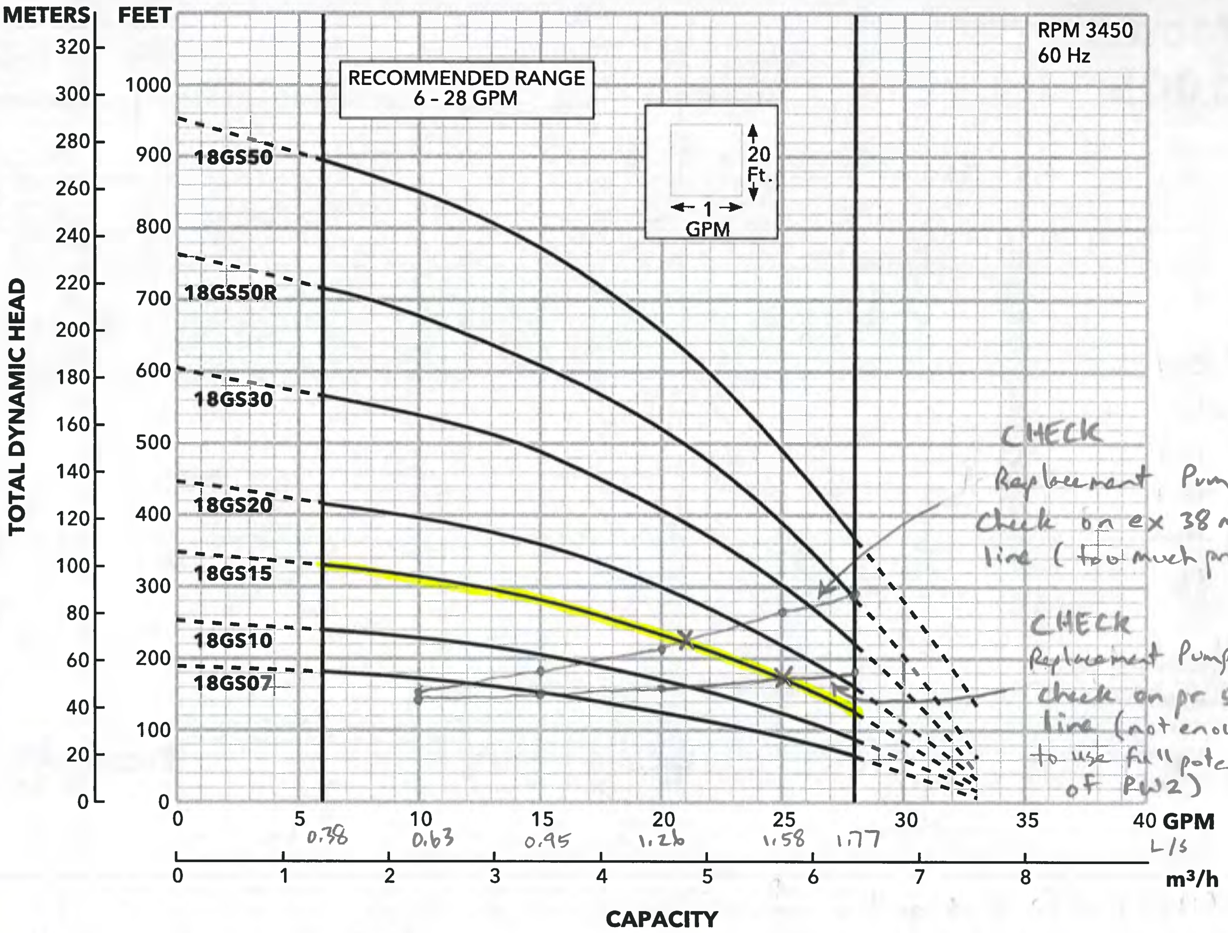


System-Head Curve for 38mm waterline from well (PW1) to holding tank

CHECK 50mm replacement line Opt 1 (valid option)

Operates @ 16 USGPM (Duty) and 61.45 m TDH (87.4 psi)

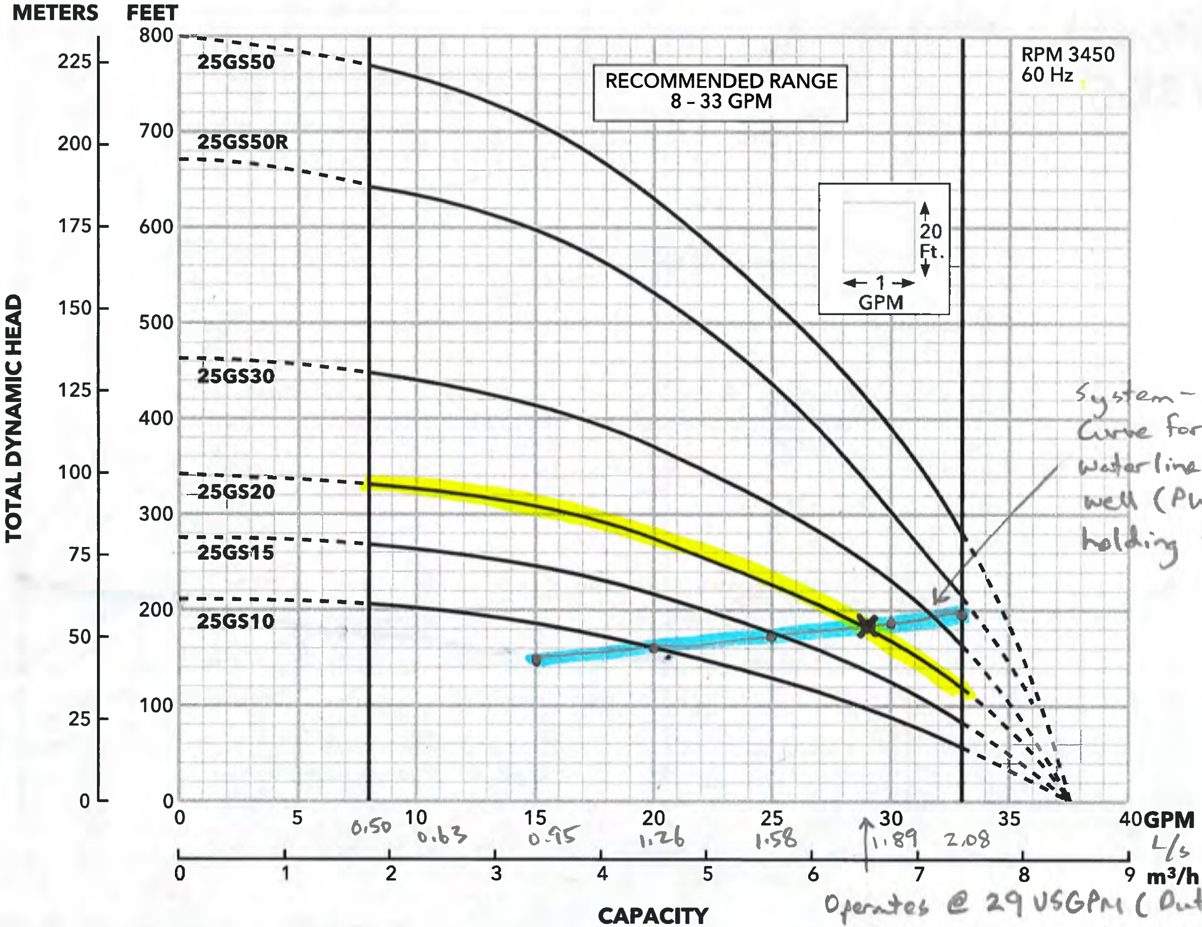
Model 18GS



CHECK
Replacement Pump Opt 2
Check on ex 38 mm
line (too much pressure)

CHECK
Replacement Pump Opt 2
check on pr 50mm
line (not enough flow
to use full potential
of PW2)

Model 25GS



System-Head
Curve for 50mm
waterline from
well (PW2) to
holding tank

Operates @ 29 USGPM (Duty)
and 54.78m TDH (77.9psi)

MODEL 5GS

SELECTION CHART

Horsepower Range ½ – 2, Recommended Range 1.2 – 7.5 GPM, 60 Hz, 3450 RPM

Pump Model	HP	PSI	Depth to Water in Feet/Ratings in GPM (Gallons per Minute)																																
			20	40	60	80	100	120	140	160	180	200	220	240	260	280	300	340	380	420	460	500	540	580	620	660	700	740	780	820	860	900	940	980	1020
5GS05R	½	0						7.4	6.9	6.3	5.8	5.3	4.7	4.0	3.0	1.4																			
		20				7.3	6.7	6.2	5.6	5.1	4.5	3.8	2.6																						
		30			7.2	6.6	6.1	5.6	5.0	4.4	3.6	2.3																							
		40		7.1	6.6	6.0	5.5	4.9	4.3	3.4	2.1																								
		50	7.0	6.5	5.9	5.4	4.9	4.2	3.3	1.8																									
		60	6.4	5.8	5.3	4.8	4.1	3.1	1.6																										
Shut-off PSI			118	109	101	92	83	75	66	57	49	40	31	23	14	5																			
5GS05	½	0							7.7	7.3	6.9	6.4	6.0	5.6	5.1	4.7	4.1	2.6																	
		20					7.5	7.1	6.7	6.3	5.9	5.4	5.0	4.5	3.9	3.2	2.3																		
		30				7.5	7.1	6.7	6.2	5.8	5.4	4.9	4.4	3.8	3.1	2.1																			
		40			7.4	7.0	6.6	6.2	5.7	5.3	4.9	4.3	3.7	2.9	1.9																				
		50	7.7	7.4	6.9	6.5	6.1	5.7	5.2	4.8	4.2	3.6	2.8	1.8																					
		60	7.3	6.9	6.5	6.0	5.6	5.2	4.7	4.2	3.5	2.6	1.6																						
Shut-off PSI			156	147	138	130	121	112	104	95	86	78	69	60	52	43	34	17																	
5GS07	¾	0										7.6	7.3	7.0	6.6	6.3	5.9	5.2	4.4	3.3	1.6														
		20								7.5	7.2	6.9	6.5	6.2	5.8	5.5	5.1	4.2	3.1	1.3															
		30							7.5	7.2	6.8	6.5	6.1	5.8	5.4	5.0	4.6	3.6	2.1																
		40						7.4	7.1	6.8	6.4	6.1	5.7	5.4	5.0	4.6	4.1	2.8																	
		50					7.4	7.1	6.7	6.4	6.0	5.7	5.3	4.9	4.5	4.0	3.4	1.8																	
		60			7.6	7.3	7.0	6.7	6.3	6.0	5.6	5.3	4.9	4.4	3.9	3.3	2.6																		
Shut-off PSI					184	175	167	158	149	141	132	123	115	106	97	89	80	63	45	28	11														
5GS10	1	0															7.5	7.0	6.5	5.9	5.3	4.6	3.8	2.8	1.6										
		20												7.6	7.4	7.2	7.0	6.4	5.9	5.2	4.5	3.7	2.6												
		30											7.6	7.4	7.2	6.9	6.7	6.1	5.5	4.8	4.0	3.1	1.9												
		40										7.6	7.4	7.1	6.9	6.6	6.3	5.8	5.1	4.4	3.5	2.5													
		50									7.5	7.3	7.1	6.8	6.6	6.3	6.0	5.4	4.7	3.9	2.9	1.7													
		60								7.5	7.3	7.1	6.8	6.5	6.3	6.0	5.7	5.0	4.3	3.4	2.3														
Shut-off PSI										214	206	197	188	180	171	162	154	136	119	102	84	67	50	32	15										
5GS15	1½	0																7.5	7.2	6.8	6.3	5.9	5.5	5.1	4.6	4.1	3.5	2.8	1.8						
		20														7.6	7.5	7.1	6.7	6.3	5.8	5.4	5.0	4.5	4.0	3.4	2.6	1.6							
		30													7.6	7.5	7.3	6.9	6.5	6.0	5.6	5.2	4.7	4.2	3.7	3.0	2.1								
		40												7.6	7.4	7.3	7.1	6.6	6.2	5.8	5.3	4.9	4.5	3.9	3.3	2.5	1.4								
		50											7.6	7.4	7.2	7.0	6.8	6.4	6.0	5.5	5.1	4.7	4.2	3.6	2.9	1.9									
		60										7.6	7.4	7.2	7.0	6.8	6.6	6.1	5.7	5.3	4.8	4.4	3.8	3.2	2.4										
Shut-off PSI												274	265	257	248	239	231	213	196	179	162	144	127	110	92	75	58	40	23						
5GS20	2	0																			7.4	7.1	6.8	6.4	6.1	5.7	5.4	5.0	4.7	4.3	3.9	3.3	2.7		
		20																		7.4	7.1	6.7	6.4	6.0	5.7	5.3	5.0	4.6	4.2	3.8	3.3	2.6	1.9		
		30																	7.5	7.2	6.9	6.5	6.2	5.8	5.5	5.1	4.8	4.4	4.0	3.5	2.9	2.2			
		40																	7.3	7.0	6.7	6.3	6.0	5.6	5.3	4.9	4.6	4.2	3.7	3.2	2.5	1.7			
		50																7.5	7.2	6.8	6.5	6.1	5.8	5.4	5.1	4.7	4.3	3.9	3.4	2.8	2.1				
		60															7.6	7.3	7.0	6.6	6.3	5.9	5.6	5.2	4.9	4.5	4.1	3.6	3.1	2.4	1.6				
Shut-off PSI																	328	311	293	276	259	242	224	207	190	172	155	138	120	103	86	68	51		

MODEL 7GS

SELECTION CHART

Horsepower Range ½ – 1, Recommended Range 1.5 – 10 GPM, 60 Hz, 3450 RPM

Pump Model	HP	PSI	Depth to Water in Feet/Ratings in GPM (Gallons per Minute)																											
			20	40	60	80	100	120	140	160	180	200	220	240	260	280	300	320	340	360	380	400	420	440	460	480	500	540	580	620
7GS05R	½	0						10.2	8.9	7.5	5.9	3.6																		
		20				9.8	8.5	7.0	5.3	2.5																				
		30			9.6	8.3	6.8	4.9	1.9																					
		40		9.4	8.1	6.5	4.6	1.2																						
		50	9.2	7.8	6.3	4.2	0.5																							
		60	7.6	6.0	3.8																									
Shut-off PSI			85	77	68	59	51	42	33	25	16	7																		
7GS05	½	0								10.1	9.2	8.3	7.4	6.3	5.0	3.4														
		20						9.8	9.0	8.1	7.1	6.0	4.6	2.7																
		30					9.7	8.8	7.9	6.9	5.8	4.3	2.4																	
		40			10.4	9.6	8.7	7.8	6.7	5.6	4.1	2.0																		
		50		10.3	9.4	8.5	7.6	6.6	5.4	3.8	1.7																			
		60	10.2	9.3	8.4	7.5	6.4	5.1	3.5																					
Shut-off PSI			125	116	107	99	90	81	73	64	55	47	38	29	21	12														
7GS07	¾	0											10.0	9.3	8.6	7.9	7.1	6.2	5.2	4.0	2.4									
		20								10.4	9.8	9.1	8.4	7.7	6.9	6.0	4.9	3.5	1.8											
		30							10.3	9.7	9.0	8.3	7.5	6.7	5.8	4.7	3.3	1.5												
		40						10.2	9.5	8.9	8.2	7.4	6.6	5.6	4.5	3.1														
		50					10.1	9.4	8.8	8.1	7.3	6.5	5.5	4.3	2.8															
		60				10.0	9.3	8.7	7.9	7.2	6.3	5.3	4.1	2.5																
Shut-off PSI						140	131	122	114	105	96	88	79	70	62	53	44	36	27	18	10									
7GS10	1	0														10.1	9.6	9.0	8.5	7.9	7.3	6.7	6.0	5.3	4.4	3.4	2.1			
		20											10.4	9.9	9.4	8.9	8.3	7.7	7.1	6.5	5.8	5.0	4.1	3.0	1.6					
		30										10.3	9.9	9.3	8.8	8.2	7.6	7.0	6.4	5.7	4.9	4.0	2.8							
		40									10.3	9.8	9.2	8.7	8.1	7.5	6.9	6.3	5.6	4.8	3.8	2.6								
		50								10.2	9.7	9.2	8.6	8.0	7.4	6.8	6.2	5.4	4.6	3.7	2.4									
		60							10.1	9.6	9.1	8.5	7.9	7.3	6.7	6.0	5.3	4.5	3.5	2.2										
Shut-off PSI									166	158	149	140	132	123	114	106	97	88	80	71	62	54	45	36	28	19	10			

Horsepower Range 1½ – 3, Recommended Range 1.5 – 10 GPM, 60 Hz, 3450 RPM

Pump Model	HP	PSI	Depth to Water in Feet/Ratings in GPM (Gallons per Minute)																										
			200	220	240	260	280	300	340	380	420	460	500	540	580	620	660	700	740	780	820	860	900	940	980	1020	1060	1100	1140
7GS15	1½	0								10.2	9.3	8.5	7.6	6.8	5.9	4.7	2.6												
		20							10.1	9.2	8.3	7.5	6.7	5.8	4.5	2.1													
		30						10.4	9.6	8.7	7.8	7.0	6.2	5.1	3.3														
		40					10.3	9.9	9.1	8.2	7.4	6.6	5.6	4.2	1.6														
		50				10.3	9.9	9.4	8.6	7.7	6.9	6.0	4.9	2.9															
		60			10.2	9.8	9.4	8.9	8.1	7.2	6.4	5.4	3.9																
Shut-off PSI					194	186	177	168	151	134	116	99	82	64	47	30	12												
7GS20	2	0											9.8	9.3	8.7	8.4	7.8	7.1	6.3	5.4	4.5	3.5	2.2						
		20										9.8	9.3	8.7	8.4	7.7	6.9	6.2	5.3	4.3	3.2	2.8							
		30									9.9	9.5	9.0	8.5	7.9	7.2	6.4	5.7	4.4	3.7									
		40								10.0	9.7	9.2	8.7	8.3	7.5	6.7	6.0	5.2	4.1	3.0									
		50								9.9	9.4	8.9	8.5	7.8	7.2	6.3	5.5	4.7	3.5										
		60							10.0	9.6	9.1	8.7	8.2	7.4	6.6	5.8	5.0	4.0											
Shut-off PSI									268	251	234	216	199	182	165	147	130	113	95	80	61	43	26						
7GS30	3	0														9.8	9.5	9.2	8.7	8.3	7.9	7.4	6.8	6.2	5.4	4.7	3.9	3.0	2.0
		20													9.8	9.4	9.2	8.7	8.3	7.8	7.2	6.7	6.2	5.3	4.5	3.7	3.3	1.7	
		30												10.0	9.6	9.2	8.8	8.5	8.0	7.5	6.9	6.3	5.7	4.8	4.1	3.2	2.3		
		40											10.0	9.7	9.4	9.0	8.6	8.2	7.7	7.2	6.6	5.9	5.2	4.4	3.6	2.7	1.7		
		50											9.9	9.5	9.2	8.7	8.4	7.9	7.4	6.8	6.3	5.5	4.8	3.9	3.1	2.2			
		60										10.0	9.7	9.3	9.0	8.6	8.1	7.6	7.0	6.5	5.8	5.1	4.2	3.4	2.5	1.5			
Shut-off PSI												320	303	286	268	251	234	216	199	182	165	147	130	113	95	78	61	43	27

MODEL 10GS

SELECTION CHART Horsepower Range ½ - 3, Recommended Range 3 - 16 GPM, 60 Hz, 3450 RPM

Pump Model	HP	PSI	Depth to Water in Feet/Ratings in GPM (Gallons per Minute)																						
			20	40	60	80	100	120	140	160	180	200	220	240	260	280	300	320	340	360	380	400	420	440	460
10GS05R*	½	0			15.3	14.2	13.1	12.0	10.9	9.8	8.4	6.1	2.1												
		20	15.0	13.9	12.8	11.6	10.6	9.4	7.8	5.1	0.3														
		30	13.7	12.6	11.5	10.4	9.2	7.5	4.6																
		40	12.4	11.3	10.2	9.0	7.2	3.9																	
		50	11.1	10.1	8.8	6.8	3.2																		
		60	9.9	8.5	6.4	2.5																			
Shut-off PSI			89	80	72	63	54	46	37	28	20	11	2												
10GS05*	½	0			15.7	14.9	14.1	13.3	12.4	11.4	10.4	9.3	8.0	6.3	3.9										
		20	15.4	14.7	13.9	13.0	12.1	11.1	10.1	8.9	7.5	5.7	2.9												
		30	14.6	13.8	12.9	12.0	11.0	9.9	8.7	7.3	5.3	2.3													
		40	13.6	12.8	11.8	10.8	9.7	8.5	7.0	4.9	1.7														
		50	12.6	11.7	10.6	9.5	8.3	6.8	4.5	1.0															
		60	11.5	10.5	9.3	8.1	6.5	4.1	0.2																
Shut-off PSI			113	105	96	87	79	70	61	53	44	35	27	18	9	1									
10GS07*	¾	0				15.7	15.2	14.6	14.0	13.4	12.7	12.0	11.4	10.8	10.1	9.5	8.7	7.7	6.4	4.6	2.1				
		20	16.0	15.5	15.0	14.5	13.8	13.2	12.5	11.8	11.2	10.6	9.9	9.2	8.4	7.3	5.9	3.9	1.2						
		30	15.5	15.0	14.4	13.7	13.1	12.4	11.7	11.1	10.5	9.8	9.1	8.3	7.1	5.6	3.5	0.7							
		40	14.9	14.3	13.6	12.9	12.3	11.6	11.0	10.4	9.7	9.0	8.1	6.9	5.3	3.1	0.2								
		50	14.2	13.5	12.8	12.2	11.5	10.9	10.3	9.6	8.9	8.0	6.7	5.0	2.7										
		60	13.4	12.7	12.1	11.4	10.8	10.2	9.5	8.7	7.8	6.5	4.7	2.3											
Shut-off PSI			161	152	143	135	126	118	109	100	92	83	74	66	57	48	40	31	22	14	5				
10GS10*	1	0					15.7	15.2	14.8	14.4	14.0	13.6	13.2	12.7	12.1	11.4	10.7	10.0	9.3	8.6	7.9	7.0	5.7	3.8	0.6
		20		16.0	15.5	15.0	14.6	14.3	13.9	13.5	13.0	12.5	11.9	11.2	10.5	9.8	9.1	8.4	7.6	6.7	5.2	2.9			
		30	16.0	15.4	15.0	14.6	14.2	13.9	13.4	13.0	12.4	11.8	11.1	10.4	9.7	9.0	8.3	7.5	6.5	4.9	2.5				
		40	15.3	14.9	14.5	14.2	13.8	13.4	12.9	12.3	11.6	11.0	10.3	9.6	8.9	8.2	7.4	6.3	4.6	2.0					
		50	14.8	14.5	14.1	13.7	13.3	12.8	12.2	11.5	10.9	10.1	9.5	8.8	8.1	7.2	6.1	4.3	1.5						
		60	14.4	14.1	13.7	13.2	12.7	12.1	11.4	10.7	10.0	9.4	8.7	7.9	7.1	5.8	3.9	0.9							
Shut-off PSI			192	184	175	166	158	149	140	132	123	114	106	97	88	80	71	62	54	45	36	28	19	10	2

Pump Model	HP	PSI	Depth to Water in Feet/Ratings in GPM (Gallons per Minute)																											
			20	40	60	80	100	120	140	160	180	200	220	240	260	280	300	340	380	420	460	500	540	580	620	660	700	740	780	820
10GS15	1½	0												15.7	15.3	14.8	14.4	13.3	12.2	10.9	9.3	7.1	3.0							
		20									16.0	15.6	15.2	14.7	14.3	13.7	13.2	11.9	10.6	9.0	6.5									
		30								15.9	15.5	15.2	14.6	14.2	13.5	13.1	12.6	11.3	9.7	7.6	4.0									
		40							15.8	15.5	15.1	14.6	14.2	13.5	13.0	12.5	11.8	10.3	8.8	6.0										
		50						15.7	15.4	14.9	14.5	14.0	13.4	12.8	12.3	11.7	11.0	9.4	7.4	3.4										
		60					15.7	15.3	14.8	14.4	13.9	13.3	12.8	12.2	11.6	10.9	10.1	8.1	5.6											
Shut-off PSI							197	188	180	171	162	154	144	136	128	119	110	93	76	58	41	24	6							
10GS20	2	0														16.0	15.7	14.9	14.2	13.4	12.4	11.4	10.0	8.2	5.8					
		20												15.9	15.5	15.3	14.8	14.1	13.2	12.2	11.0	9.9	8.0	5.2						
		30											15.8	15.4	15.1	14.7	14.4	13.5	12.7	11.7	10.3	8.8	6.5							
		40										15.8	15.4	15.1	14.7	14.4	14.0	12.9	12.2	10.9	9.5	7.8	3.9							
		50								16.1	15.7	15.3	15.0	14.6	14.2	14.0	13.4	12.5	11.5	10.1	8.5	6.0								
		60							16.0	15.7	15.3	14.9	14.5	14.2	13.8	13.4	12.8	11.8	10.7	9.1	7.2	3.4								
Shut-off PSI									225	216	208	199	190	182	173	164	156	139	121	104	87	69	52	35	17					
10GS30	3	0																	15.8	15.2	14.6	14.0	13.3	12.6	11.9	11.0	10.0	9.0	7.5	5.8
		20																15.7	15.1	14.5	13.9	13.2	12.5	11.8	10.9	9.9	8.8	7.2	5.4	
		30															15.9	15.4	14.8	14.2	13.4	12.8	12.0	11.3	10.3	9.3	8.1	6.2	3.8	
		40														15.9	15.6	15.0	14.4	13.8	13.1	12.4	11.5	10.8	9.7	8.6	7.1	4.7		
		50												16.0	15.8	15.6	15.3	14.7	14.1	13.3	12.7	11.9	11.0	10.2	9.1	7.8	6.0	3.0		
		60											16.0	15.8	15.5	15.2	14.8	14.3	13.7	12.9	12.3	11.4	10.6	9.6	8.3	6.8	4.5			
Shut-off PSI											284	275	267	258	249	232	215	197	180	163	145	128	111	94	76	59	42	24

Horsepower Range 5, Recommended Range 3 - 16 GPM, 60 Hz, 3450 RPM

Pump Model	HP	PSI	Depth to Water in Feet/Ratings in GPM (Gallons per Minute)																		
			340	380	420	460	500	540	580	620	660	700	740	780	820	860	900	940	980	1020	1060
10GS50R	5	0					15.6	15.1	14.6	14.2	13.7	13.3	12.8	12.3	11.7	11.0	10.2	9.2	7.9	6.3	4.3
		20			16.0	15.5	15.0	14.6	14.1	13.6	13.2	12.7	12.2	11.6	10.9	10.1	9.0	7.6	6.0	3.9	
		30			15.7	15.3	14.8	14.3	13.8	13.4	12.9	12.4	11.9	11.2	10.4	9.5	8.2	6.7	4.9		
		40		16.0	15.5	15.0	14.5	14.0	13.6	13.1	12.6	12.1	11.5	10.8	9.9	8.8	7.4	5.7	3.6		
		50		15.7	15.2	14.7	14.2	13.8	13.3	12.9	12.4	11.8	11.1	10.3	9.3	8.0	6.5	4.5			
		60	15.9	15.4	14.9	14.4	14.0	13.5	13.0	12.6	12.0	11.4	10.7	9.7	8.6	7.2	5.4	3.2			
Shut-off PSI			341	324	306	289	272	255	237	220	203	185	168	151	133	116	99	81	64	47	29

Pump Model	HP	PSI	Depth to Water in Feet/Ratings in GPM (Gallons per Minute)																						
			440	480	520	560	600	640	680	720	760	800	840	880	920	960	1000	1040	1080	1120	1160	1200	1240	1280	1320
10GS50	5	0						16	15.5	15.2	14.9	14.5	14	13.5	13	12.5	12	11.5	10.8	10.2	9.5	8.5	7	5.2	
		20					15.9	15.4	15.1	14.8	14.5	13.9	13.4	12.9	12.4	11.9	11.3	10.7	10.1	9.4	8.2	6.8	4.3		
		30					15.6	15.2	14.9	14.6	14.2	13.7	13.1	12.6	12.1	11.6	11.0	10.4	9.8	8.8	7.5	6.0	3.0		
		40				15.8	15.3	15.1	14.7	14.4	13.8	13.3	12.8	12.3	11.8	11.2	10.6	10.0	9.2	7.9	6.6	4.1			
		50				15.5	15.2	14.9	14.6	14.1	13.6	13.0	12.5	12.1	11.5	10.9	10.3	9.7	8.6	7.3	5.6				
		60			15.7	15.3	15.0	14.7	14.3	13.7	13.2	12.7	12.2	11.7	11.1	10.5	9.9	9.0	7.7	6.5	3.2				
Shut-off PSI					346	329	312	294	277	260	242	225	208	191	173	156	139	121	104	87	69	52	35	17	

* HH Versions

MODEL 13GS

SELECTION CHART

Horsepower Range ½ – 3, Recommended Range 4 – 20 GPM, 60 Hz, 3450 RPM

Pump Model	HP	PSI	Depth to Water in Feet/Ratings in GPM (Gallons per Minute)																											
			20	40	60	80	100	120	140	160	180	200	220	240	260	280	300	340	380	420	460	500	540	580	620	660	700	740	780	820
13GS05	½	0			19.0	17.5	15.3	12.5	8.2																					
		20	18.8	16.5	14.5	12.0	8.0																							
		30	16.0	13.4	11.0	4.1																								
		40	13.3	10.6	4.0																									
		50	9.8																											
		60																												
Shut-off PSI			60	52	43	35	26	17	9																					
13GS07	¾	0				19.7	18.5	17.0	15.0	13.2	11.5	8.5																		
		20		19.4	18.0	16.4	14.8	12.9	10.5	6.0																				
		30	18.9	17.5	16.0	14.6	12.5	10.0	5.0																					
		40	17.4	15.9	14.4	12.4	9.7	4.0																						
		50	15.4	13.8	12.0	9.5																								
		60	13.2	11.5	8.5																									
Shut-off PSI			86	78	69	61	52	43	35	26	17	8																		
13GS10	1	0						19.6	18.4	17.6	16.6	15.4	14.1	12.8	11.4	9.5	6.0													
		20			20.0	19.4	18.5	17.2	16.3	15.0	13.8	12.5	11.0	8.5	4.0															
		30		20.0	19.2	18.2	17.1	15.8	14.7	13.6	12.2	10.5	7.5																	
		40	19.9	19.0	18.0	17.0	15.7	14.6	13.5	12.0	10.1	7.3																		
		50	18.8	17.8	16.8	15.5	14.5	13.0	11.6	9.9	7.0																			
		60	17.6	16.6	15.4	14.1	12.8	11.4	9.5	6.0																				
Shut-off PSI			128	119	110	102	93	84	76	67	58	50	41	32	24	15	6													
13GS15	1½	0							19.7	18.9	18.2	17.3	16.3	15.2	14.2	13.2	12.1	8.7												
		20					19.5	18.4	17.9	17.0	16.0	15.1	14.1	12.9	11.8	10.2	8.8													
		30			20.2	19.4	18.6	17.6	16.8	15.8	14.9	14.0	12.6	11.5	9.9	7.9	4.0													
		40		20.0	19.3	18.5	17.5	16.6	15.7	14.8	13.9	12.5	11.4	9.5	7.3	4.0														
		50	20.0	19.1	18.3	17.4	16.4	15.5	14.5	13.6	12.3	11.0	9.2	6.3																
		60	18.9	18.2	17.3	16.3	15.2	14.2	13.3	12.1	11.0	8.7	5.6																	
Shut-off PSI			156	147	139	130	121	113	104	95	87	78	69	61	52	43	35	17												
13GS20	2	0										20.0	19.5	19.0	18.3	17.9	17.2	15.8	14.4	12.6	10.5	7.7								
		20								19.8	19.4	18.8	18.2	17.6	17.0	16.3	15.6	14.1	12.4	10.2	6.8									
		30							19.7	19.3	18.7	18.2	17.4	16.8	16.2	15.5	14.8	13.1	11.1	8.8										
		40						19.6	19.2	18.6	18.1	17.3	16.7	16.1	15.4	14.7	13.8	12.0	9.8	6.0										
		50				20.1	19.5	19.1	18.4	18.0	17.2	16.6	16.0	15.2	14.6	13.7	12.9	10.8	8.5											
		60			20.0	19.5	19.0	18.3	17.9	17.2	16.5	15.8	15.1	14.4	13.6	12.6	11.5	9.2	5.0											
Shut-off PSI					206	198	189	180	172	163	155	146	137	129	120	111	103	85	68	51	33	16								
13GS30	3	0													19.8	19.4	18.9	18.0	17.1	16.0	14.6	13.5	11.9	10.0	7.3					
		20											19.6	19.2	18.9	18.3	17.9	17.0	15.9	14.7	13.3	11.8	9.7	6.9						
		30									20.0	19.5	19.1	18.8	18.2	17.8	17.4	16.4	15.2	13.9	12.3	10.5	8.3	4.0						
		40								20.0	19.4	19.1	18.7	18.2	17.8	17.3	16.8	15.6	14.5	13.0	11.4	9.5	6.0							
		50							19.9	19.5	19.0	18.6	18.1	17.7	17.2	16.7	16.1	14.9	13.7	12.0	10.1	7.9								
		60						19.8	19.4	18.9	18.5	18.0	17.5	17.1	16.6	16.0	15.4	14.2	12.9	11.0	9.0	5.0								
Shut-off PSI								235	226	217	209	200	191	183	174	165	157	139	122	104	87	70	53	35	18					

MODEL 18GS

SELECTION CHART

Horsepower Range ¾ – 5, Recommended Range 6 – 28 GPM, 60 Hz, 3450 RPM

Pump Model	HP	PSI	Depth to Water in Feet/Ratings in GPM (Gallons per Minute)																											
			20	40	60	80	100	120	140	160	180	200	220	240	260	280	300	340	380	420	460	500	540	580	620	660	700	740	780	820	860
18GS07	¾	0			28.2	26.5	24.0	21.0	17.9	13.5																					
		20	27.7	25.9	23.0	20.0	16.5	10.8																							
		30	25.0	22.0	18.8	15.7	9.5																								
		40	22.2	18.9	15.1	9.0																									
		50	18.4	15.0	7.5																										
		60	13.5	5.0																											
Shut-off PSI			74	66	58	49	40	32	23	14																					
18GS10	1	0					27.0	25.5	23.6	21.2	18.8	15.9	12.0																		
		20		28.0	26.6	25.1	22.7	20.0	17.6	14.0	10.0																				
		30	27.9	26.1	24.3	22.2	19.8	17.1	13.8	8.3																					
		40	26.0	24.1	22.0	19.7	17.0	13.1	8.0																						
		50	24.0	22.0	19.1	16.5	13.0	7.1																							
		60	21.0	18.6	15.8	12.0																									
Shut-off PSI			103	94	86	77	68	60	51	42	34	25	16																		
18GS15	1½	0						28.4	27.2	26.0	24.8	23.0	21.4	19.6	17.5	15.0	12.1														
		20				27.8	26.8	25.4	24.0	22.2	20.6	18.8	16.7	14.0	10.0																
		30			27.7	26.5	25.3	23.8	22.0	20.2	18.5	16.1	13.5	10.0																	
		40		27.5	26.3	25.0	23.6	22.0	20.1	18.1	16.0	13.1	9.5																		
		50	27.6	26.4	25.0	23.4	21.8	20.0	18.0	15.5	13.0	9.2																			
		60	26.0	24.6	23.0	21.2	19.5	17.5	15.0	12.0	7.9																				
Shut-off PSI			143	134	126	117	108	100	91	82	74	65	56	48	39	30	22														
18GS20	2	0								28.0	27.1	26.2	25.1	24.0	22.9	21.4	20.0	16.8	12.8												
		20						27.8	26.8	25.8	24.6	23.7	22.6	21.0	19.5	18.0	16.0	11.6													
		30					27.5	26.5	25.5	24.5	23.3	22.1	20.6	19.0	17.5	15.8	13.6	6.5													
		40			28.5	27.4	26.4	25.4	24.4	23.2	22.0	20.5	18.9	17.4	15.7	13.5	11.0														
		50		28.0	27.2	26.2	25.3	24.3	23.0	21.8	20.3	18.7	17.0	15.3	13.1	10.5	6.0														
		60	28.0	27.1	26.2	25.1	24.0	22.9	21.4	20.0	18.3	16.8	14.8	12.8	9.5																
Shut-off PSI			183	174	165	157	148	139	131	122	113	105	96	87	79	70	61	44	27												
18GS30	3	0											28.0	27.4	26.7	26.0	25.0	23.5	21.5	19.2	16.9	14.2	10.5								
		20									27.7	27.0	26.3	25.8	24.9	24.0	23.0	21.0	18.9	16.5	13.5	9.0									
		30								27.6	26.9	26.2	25.5	24.8	23.9	22.9	21.9	19.8	17.5	14.9	11.2										
		40							27.5	26.9	26.2	25.4	24.6	23.8	22.8	21.8	20.9	18.5	16.0	13.3	8.0										
		50						27.4	26.8	26.0	25.2	24.5	23.6	22.6	21.7	20.6	19.5	17.3	14.5	11.0											
		60				28.0	27.4	26.7	26.0	25.0	24.3	23.5	22.5	21.5	20.5	19.2	18.0	15.7	12.8	7.0											
Shut-off PSI						225	216	208	199	190	182	173	164	156	147	139	130	113	95	78	61	43	26								
18GS50R	5	0															27.7	26.6	25.4	24.0	22.5	20.8	19.0	16.9	14.5	11.7	8.1				
		20													27.6	27.0	26.4	25.2	23.8	22.2	20.5	18.7	16.6	14.1	11.2	7.4					
		30											28.0	27.5	26.9	26.3	25.7	24.4	22.9	21.3	19.5	17.5	15.2	12.5	9.1						
		40										27.9	27.4	26.8	26.2	25.6	25.0	23.5	22.0	20.3	18.4	16.2	13.7	10.6	6.7						
		50									27.9	27.3	26.7	26.1	25.5	24.8	24.1	22.7	21.0	19.2	17.2	14.8	12.0	8.5							
		60								27.8	27.2	26.7	26.1	25.4	24.7	24.0	23.3	21.7	20.0	18.1	15.9	13.3	10.1	6.0							
Shut-off PSI										261	252	244	235	226	218	209	200	183	166	148	131	114	96	79	62	44	27				
18GS50	5	0																	27.9	26.8	25.8	24.8	23.7	22.6	21.2	19.9	18.4	16.8	14.8	12.4	9.7
		20																27.5	26.6	25.6	24.5	23.3	22.2	21.0	19.8	18.0	16.2	14.3	12.0	8.8	
		30															28.0	26.9	26.0	25.0	23.9	22.9	21.6	20.3	18.6	17.0	15.0	13.0	10.2	6.2	
		40														28.0	27.4	26.3	25.3	24.4	23.2	22.1	20.1	19.4	17.9	16.0	14.0	11.6	8.0		
		50													27.9	27.3	26.8	25.9	24.9	23.8	22.7	21.3	20.1	18.5	16.9	14.9	12.8	10.0	6.0		
		60												27.9	27.2	26.8	26.2	25.2	24.1	23.0	21.9	20.7	19.2	17.5	15.8	13.6	11.0	7.8			
Shut-off PSI														307	298	290	281	264	246	229	212	195	177	160	143	125	108	91	73	56	39

MODEL 25GS

SELECTION CHART

Horsepower Range 1 – 5, Recommended Range 8 – 33 GPM, 60 Hz, 3450 RPM

Pump Model	HP	PSI	Depth to Water in Feet/Ratings in GPM (Gallons per Minute)																									
			20	40	60	80	100	120	140	160	180	200	220	240	260	280	300	340	380	420	460	500	540	580	620	660	700	740
25GS10	1	0			32.8	30.8	28.6	26.2	23.5	20.0	16.2	11.0																
		20	31.8	30.0	27.5	25.2	22.0	19.0	15.0	8.0																		
		30	29.6	27.2	25.0	21.6	18.0	14.0																				
		40	27.1	24.9	21.5	17.9	13.9																					
		50	24.3	21.0	17.5	13.0																						
		60	20.0	16.2	11.0																							
Shut-off PSI			82	74	65	56	48	39	30	22	13	4																
25GS15	1½	0				33.0	31.8	30.3	28.8	26.9	24.8	22.0	19.8	16.5	11.0													
		20		32.6	31.2	29.6	28.0	26.0	23.8	21.0	18.1	14.8	8.0															
		30	32.5	31.0	29.5	27.6	25.6	23.2	20.9	17.9	14.0																	
		40	30.9	29.4	27.5	25.5	23.1	20.8	17.7	13.6																		
		50	29.0	27.2	25.1	22.9	20.4	17.2	13.0																			
		60	26.9	24.8	22.0	19.8	16.5	11.0																				
Shut-off PSI			111	103	94	85	77	68	59	51	42	33	25	16	7													
25GS20	2	0						33.0	31.8	30.4	29.0	27.4	25.7	22.6	21.5	19.3	15.4											
		20				32.7	31.3	30.0	28.6	26.8	25.0	22.9	20.9	18.3	14.3	9.0												
		30			32.3	31.0	29.6	28.5	26.4	24.5	22.6	20.5	18.0	14.0	8.0													
		40			30.9	29.5	28.2	26.3	24.3	22.4	20.4	17.8	13.6	8.0														
		50		30.5	29.4	28.0	26.0	24.1	22.1	20.0	17.2	13.2																
		60	30.4	29.0	27.4	25.7	22.6	21.5	19.3	15.4	12.2																	
Shut-off PSI			139	130	121	113	104	95	87	78	69	61	52	43	35	26	17											
25GS30	3	0								33.0	32.2	31.5	30.5	29.6	28.3	27.1	25.8	22.6	19.0	14.0								
		20						32.8	32.0	31.0	30.0	29.0	27.9	26.6	25.0	23.8	21.9	20.0	12.6									
		30					32.6	31.8	30.9	30.0	28.8	27.6	26.5	24.9	23.4	21.6	19.9	15.2	8.0									
		40				32.5	31.7	30.9	29.9	28.8	27.5	26.2	24.7	23.3	21.5	19.9	17.8	11.9										
		50			32.3	31.6	30.8	29.8	28.5	27.3	26.0	24.5	23.0	21.2	19.5	17.4	11.5											
		60	33.0	32.2	31.5	30.5	29.6	28.3	27.1	25.8	24.1	22.6	20.9	19.0	16.9	14.0	10.0											
Shut-off PSI			191	183	174	165	157	148	139	131	122	113	105	96	87	79	70	53	35	18								
25GS50R	5	0											32.7	32.2	31.7	31.2	30.5	29.1	27.3	25.3	23.3	21.4	19.3	16.5	11.7			
		20								33.0	32.5	32.1	31.5	31.0	30.3	29.6	28.8	27.0	25.0	23.0	21.1	18.9	15.9	10.6				
		30							32.9	32.5	32.0	31.5	30.9	30.2	29.5	28.7	27.8	25.9	23.9	21.9	19.9	17.4	13.3					
		40						32.9	32.4	31.9	31.4	30.8	30.1	29.4	28.5	27.6	26.7	24.7	22.7	20.8	18.6	15.3						
		50					32.8	32.3	31.8	31.3	30.7	30.0	29.2	28.4	27.5	26.5	25.6	23.6	21.6	19.6	16.9							
		60				32.7	32.2	31.7	31.2	30.6	29.9	29.1	28.3	27.4	26.4	25.4	24.4	22.4	20.4	18.2	14.6							
Shut-off PSI						252	243	234	226	217	208	200	191	182	174	165	156	139	122	104	87	70	52	35	18			
25GS50	5	0														33.0	32.5	31.5	30.2	29.0	27.6	26.0	24.2	22.4	20.5	18.3	15.8	12.0
		20												32.9	32.3	31.8	31.3	30.0	28.8	27.2	25.8	23.9	22.0	20.0	17.8	15.0	11.0	
		30											32.8	32.2	31.8	31.2	30.5	29.3	27.9	26.4	24.8	22.9	21.0	18.9	16.2	13.0	8.0	
		40										32.7	32.1	31.7	31.1	30.4	29.9	28.5	27.1	25.4	23.7	21.9	19.9	17.5	14.5	10.5		
		50									32.6	32.1	31.6	31.0	30.3	29.9	29.2	27.8	26.3	24.5	22.6	21.8	18.7	16.0	12.7			
		60							33.0	32.5	32.0	31.5	30.8	30.2	29.8	29.0	28.3	26.9	25.1	23.3	21.5	19.5	17.0	14.0	9.5			
Shut-off PSI									286	277	268	260	251	242	234	225	216	199	182	165	147	130	113	95	78	61	43	26

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Existing 38mm Waterline from Well PW1 (13GS10 pump) - System Head Curve
Mansfield Ski Club

▨ <<< **Elements Requiring Input Information**

Date: **10-Dec-20**
Project No: **15-319**
Prepared by: **JWL**

Velocity, $V = \frac{Q_P}{A}$ (m/s, MOE Requirements: 0.8m/s - 2.5m/s)

where,
Q_P = Peak Sewage Flow (m^3/s)
A = Cross-Sectional Area (m^2)

Minor Head Loss, $H_L = (K_1+K_2+K_3\ldots) \times V^2/2g$

where,
$\sum K = (K_1+K_2+K_3\ldots)$
V = mean velocity (m/s), (F/M allowable range is 0.8-2.5m/s)
g = 9.81 (acceleration due to gravity, m/s^2)

Hazen -Williams Equation (re-arranged for Friction Slope)
(Forcemain Head Loss Calculation)

$$\text{Friction Slope, } S = \frac{(V)^{1/0.54}}{(0.85CR^{0.63})^{1/0.54}} \times 100 \text{ (m/100m)}$$

where,
V = mean velocity (m/s)
k = 0.85 for SI units
C = Roughness Coefficient
R = hydraulic radius (m)

Static Head, $h_{S,\ MAX} = h_F - h_{LWL}$ (m)
Static Head, $h_{S,\ MEDIAN} = h_F - h_{MWL}$ (m)
Static Head, $h_{S,\ MIN} = h_F - h_{HWL}$ (m)

where,
h_F = Forcemain Max. Elev. Along Length (m
h_{LWL} = Wet Well Low Water Level (m)
h_{MWL} = Wet Well Median Water Level (m)
h_{HWL} = Wet Well High Water Level (m)

Total Dynamic Head, $h_{D,\ MAX} = h_{S,\ MAX} + h_{T.H.L.}$ (m)
Total Dynamic Head, $h_{D,\ MEDIAN} = h_{S,\ MEDIAN} + h_{T.H.L.}$ (m)
Total Dynamic Head, $h_{D,\ MIN} = h_{S,\ MIN} + h_{T.H.L.}$ (m)

where,
$h_{S,\ MAX}$ = Maximum Static Head (m)
$h_{S,\ MEDIAN}$ = Median Static Head (m)
$h_{S,\ MIN}$ = Minimum Static Head (m)
$h_{T.H.L.}$ = Total Head Loss (m)

Pipe Design Coefficient C	Forcemain						Fittings Head Loss (m)	Pump Station Head Loss (m)	Total Head Loss (m)	Wet Well Low Water Level (m)	Wet Well Median Water Level (m)	Wet Well High Water Level (m)	Forcemain Max. Elev. Along Length (m)	Static Head			Total Dynamic Head		
	Flow (L/s)	Diameter (mm)	Velocity (m/s)	Head Loss (m/100m)	Distance (m)	Head Loss (m)								MAX. (m)	Median (m)	MIN. (m)	MAX. (m)	Median (m)	MIN. (m)
Wet Well							$\sum K_F$=	$\sum K_{PS}$=											
Low Water Level							8.36												
120	**0.25**	**38**	0.22	0.27	**593.90**	1.57	0.02	0.00	1.60	**256.66**	258.66	**260.66**	**301.75**	45.09	43.09	41.09	46.69	44.69	42.69
120	**0.5**	38	0.44	0.96	593.90	5.68	0.08	0.00	5.77	256.66	258.66	260.66	301.75	45.09	43.09	41.09	50.86	48.86	46.86
120	**0.76**	38	0.67	2.08	593.90	12.34	0.19	0.00	12.54	256.66	258.66	260.66	301.75	45.09	43.09	41.09	57.63	55.63	53.63
120	**1.01**	38	0.89	3.52	593.90	20.90	0.34	0.00	21.24	256.66	258.66	260.66	301.75	45.09	43.09	41.09	66.33	64.33	62.33
120	**1.26**	38	1.11	5.30	593.90	31.48	0.53	0.00	32.01	256.66	258.66	260.66	301.75	45.09	43.09	41.09	77.10	75.10	73.10
Wet Well																			
Median Water Level																			
130	0.25	38	0.22	0.23	593.90	1.36	0.02	0.00	1.38	256.66	258.66	260.66	301.75	45.09	43.09	41.09	46.47	**44.47**	42.47
130	0.5	38	0.44	0.83	593.90	4.90	0.08	0.00	4.98	256.66	258.66	260.66	301.75	45.09	43.09	41.09	50.07	**48.07**	46.07
130	**0.76**	38	0.67	1.79	593.90	10.64	0.19	0.00	10.84	256.66	258.66	260.66	301.75	45.09	43.09	41.09	55.93	**53.93**	51.93
130	1.01	38	**0.89**	3.03	593.90	18.02	0.34	0.00	18.36	256.66	258.66	260.66	301.75	45.09	43.09	41.09	63.45	**61.45**	59.45
130	1.26	38	1.11	4.57	593.90	27.14	0.53	0.00	27.67	256.66	258.66	260.66	301.75	45.09	43.09	41.09	72.76	**70.76**	68.76
Wet Well																			
High Water Level																			
140	0.25	38	0.22	0.20	593.90	1.18	0.02	0.00	1.20	256.66	258.66	260.66	301.75	45.09	43.09	41.09	46.29	44.29	42.29
140	0.5	38	0.44	0.72	593.90	4.27	0.08	0.00	4.36	256.66	258.66	260.66	301.75	45.09	43.09	41.09	49.45	47.45	45.45
140	**0.76**	38	0.67	1.56	593.90	9.28	0.19	0.00	9.47	256.66	258.66	260.66	301.75	45.09	43.09	41.09	54.56	52.56	50.56
140	1.01	38	0.89	2.65	593.90	15.71	0.34	0.00	16.05	256.66	258.66	260.66	301.75	45.09	43.09	41.09	61.14	59.14	57.14
140	1.26	38	1.11	3.98	593.90	23.66	0.53	0.00	24.19	256.66	258.66	260.66	301.75	45.09	43.09	41.09	69.28	67.28	65.28

NOTES:

- Loss Coefficients: **Wells - Holding Tank**
7 - 90° Bends @ K=1.0, pitless adapter and into shop through pressure tank and back out of shop
3 - Valves @ K=0.12, 2 curb stops outside of shop and 1 valve at pressure tank
1- Exit loss into holding tank @ K=1.0

- Maximum Pressure Ratings for various watermain pipe diameters: **50mm** 200psi SDR 21 **75mm** 200psi SDR 21 **100mm** 235psi DR18 305psi DR14

- The water treatment system capacity is 40 USGPM. The two (2) existing wells (PW1 (north) and PW2 (south)) will be attached to separate water lines running from each well to the existing holding tank at the Main Chalet. The two (2) wells will operate together as needed to supply water to the treatment system and will eventually alternate duty with the two (2) additional proposed wells once constructed. PW1 is considered to have a yield of 17 IPGM (20.4 USGPM OR 1.29 L/s) at a depth of 4.2m below ground grade (262.86m-4.2m=258.66m) based on its pump test.

- The well low water level and high water level have been set at 2.0m below and above the water depth determined during the pump test on the well. Ground grade in the area of the existing holding tank has been used as the Max. Elevation of the waterline to be conservative.

- This system-head curve when plotted against the pump-head curve for the existing well pump (Goulds 13GS1010412C), the operating flow capacity of the existing 38mm waterline is 13.3 IPGM (16 USGPM OR 1.01 L/s) @ TDH of 201.6 ft (61.45 m OR 87.4 psi). The pressue is good (ideally between 80-90 psi) and the cleansing velocity is good (0.70m/s min. for hard water).

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Proposed 50mm Waterline from Well PW2 (25GS20 pump) - System Head Curve
Mansfield Ski Club

▨ <<< **Elements Requiring Input Information**

Date: **10-Dec-20**
Project No: **15-319**
Prepared by: **JWL**

Velocity, $V = \frac{Q_P}{A}$ (m/s, MOE Requirements: 0.8m/s - 2.5m/s)

where, Q_P = Peak Sewage Flow (m^3/s)
A = Cross-Sectional Area (m^2)

Minor Head Loss, $H_L = (K_1+K_2+K_3\ldots) \times V^2/2g$

where, $\sum K = (K_1+K_2+K_3\ldots)$
V = mean velocity (m/s), (F/M allowable range is 0.8-2.5m/s)
g = 9.81 (acceleration due to gravity, m/s^2)

Hazen -Williams Equation (re-arranged for Friction Slope)
(Forcemain Head Loss Calculation)

Friction Slope, $S = \frac{(V)^{1/0.54}}{(0.85CR^{0.63})^{1/0.54}} \times 100$ (m/100m)

where, V = mean velocity (m/s)
k = 0.85 for SI units
C = Roughness Coefficient
R = hydraulic radius (m)

Static Head, $h_{S,\ MAX} = h_F - h_{LWL}$ (m)
Static Head, $h_{S,\ MEDIAN} = h_F - h_{MWL}$ (m)
Static Head, $h_{S,\ MIN} = h_F - h_{HWL}$ (m)

where, h_F = Forcemain Max. Elev. Along Length (m
h_{LWL} = Wet Well Low Water Level (m)
h_{MWL} = Wet Well Median Water Level (m)
h_{HWL} = Wet Well High Water Level (m)

Total Dynamic Head, $h_{D,\ MAX} = h_{S,\ MAX} + h_{T.H.L.}$ (m)
Total Dynamic Head, $h_{D,\ MEDIAN} = h_{S,\ MEDIAN} + h_{T.H.L.}$ (m)
Total Dynamic Head, $h_{D,\ MIN} = h_{S,\ MIN} + h_{T.H.L.}$ (m)

where, $h_{S,\ MAX}$ = Maximum Static Head (m)
$h_{S,\ MEDIAN}$ = Median Static Head (m)
$h_{S,\ MIN}$ = Minimum Static Head (m)
$h_{T.H.L.}$ = Total Head Loss (m)

Pipe Design Coefficient C	Forcemain						Fittings Head Loss (m)	Pump Station Head Loss (m)	Total Head Loss (m)	Wet Well Low Water Level (m)	Wet Well Median Water Level (m)	Wet Well High Water Level (m)	Forcemain Max. Elev. Along Length (m)	Static Head			Total Dynamic Head		
	Flow (L/s)	Diameter (mm)	Velocity (m/s)	Head Loss (m/100m)	Distance (m)	Head Loss (m)								MAX. (m)	Median (m)	MIN. (m)	MAX. (m)	Median (m)	MIN. (m)
Wet Well							$\sum K_F$=	$\sum K_{PS}$=											
Low Water Level							**8.36**												
120	**0.95**	**50**	0.48	0.83	**540.50**	4.46	0.10	0.00	4.56	**258.34**	260.34	**262.34**	**301.75**	43.41	41.41	39.41	47.97	45.97	43.97
120	**1.26**	50	0.64	1.39	540.50	7.53	0.18	0.00	7.70	258.34	260.34	262.34	301.75	43.41	41.41	39.41	51.11	49.11	47.11
120	**1.58**	50	0.80	2.12	540.50	11.45	0.28	0.00	11.72	258.34	260.34	262.34	301.75	43.41	41.41	39.41	55.13	53.13	51.13
120	**1.89**	50	0.96	2.95	540.50	15.95	0.39	0.00	16.34	258.34	260.34	262.34	301.75	43.41	41.41	39.41	59.75	57.75	55.75
120	**2.08**	50	1.06	3.52	540.50	19.05	0.48	0.00	19.52	258.34	260.34	262.34	301.75	43.41	41.41	39.41	62.93	60.93	58.93
Wet Well Median Water Level																			
130	0.95	50	0.48	0.71	540.50	3.85	0.10	0.00	3.95	258.34	260.34	262.34	301.75	43.41	41.41	39.41	47.36	**45.36**	43.36
130	1.26	50	0.64	1.20	540.50	6.49	0.18	0.00	6.67	258.34	260.34	262.34	301.75	43.41	41.41	39.41	50.08	**48.08**	46.08
130	1.58	50	**0.80**	1.83	540.50	9.87	0.28	0.00	10.15	258.34	260.34	262.34	301.75	43.41	41.41	39.41	53.56	**51.56**	49.56
130	1.89	50	**0.96**	2.54	540.50	13.75	0.39	0.00	14.15	258.34	260.34	262.34	301.75	43.41	41.41	39.41	57.56	**55.56**	53.56
130	2.08	50	1.06	3.04	540.50	16.42	0.48	0.00	16.90	258.34	260.34	262.34	301.75	43.41	41.41	39.41	60.31	**58.31**	56.31
Wet Well High Water Level																			
140	0.95	50	0.48	0.62	540.50	3.35	0.10	0.00	3.45	258.34	260.34	262.34	301.75	43.41	41.41	39.41	46.86	44.86	42.86
140	1.26	50	0.64	1.05	540.50	5.66	0.18	0.00	5.83	258.34	260.34	262.34	301.75	43.41	41.41	39.41	49.24	47.24	45.24
140	**1.58**	50	0.80	1.59	540.50	8.60	0.28	0.00	8.88	258.34	260.34	262.34	301.75	43.41	41.41	39.41	52.29	50.29	48.29
140	1.89	50	0.96	2.22	540.50	11.99	0.39	0.00	12.38	258.34	260.34	262.34	301.75	43.41	41.41	39.41	55.79	53.79	51.79
140	2.08	50	1.06	2.65	540.50	14.32	0.48	0.00	14.79	258.34	260.34	262.34	301.75	43.41	41.41	39.41	58.20	56.20	54.20

NOTES:

- Loss Coefficients: **Wells - Holding Tank**
7 - 90° Bends @ K=1.0, pitless adapter and into shop through pressure tank and back out of shop
3 - Valves @ K=0.12, 2 curb stops outside of shop and 1 valve at pressure tank
1- Exit loss into holding tank @ K=1.0

- Maximum Pressure Ratings for various watermain pipe diameters: **50mm** 200psi SDR 21 **75mm** 200psi SDR 21 **100mm** 235psi DR18 305psi DR14

- The water treatment system capacity is 40 USGPM. The two (2) existing wells (PW1 (north) and PW2 (south)) will be attached to separate water lines running from each well to the existing holding tank at the Main Chalet. The two (2) wells will operate together as needed to supply water to the treatment system and will eventually alternate duty with the two (2) additional proposed wells once constructed. PW2 is considered to have a yield of 25 IPGM (30.0 USGPM OR 1.89 L/s) at a depth of 2.8m below ground grade (263.14m-2.8m=260.34m) based on its pump test.

- The well low water level and high water level have been set at 2.0m below and above the water depth determined during the pump test on the well. Ground grade in the area of the existing holding tank has been used as the Max. Elevation of the waterline to be conservative.

- This system-head curve when plotted against the pump-head curve for the proposed well pump (Goulds 25GS20412C), the operating flow capacity of the proposed 50mm waterline is 24.1 IPGM (29 USGPM OR 1.83 L/s) @ 179.7 ft (54.78 m OR 77.9 psi). The pressue is good (ideally between 80-90 psi) and the cleansing velocity is good (0.70m/s min. for hard water).

\\WMI-SERVER\wmi-server\Data\Projects\2015\15-319\Design\Water\Issue_No2\[200811_Well_Waterline-System_Head_Curves.xlsx]PW2-Pr50mmPr25GS20-preferred

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Sanitary Sewer Design Sheet
Mansfield Ski Club

▨ <<< **Elements Requiring Input Information**

Peak Flow Formulas:

Q_{pop} = (P*q*M)/86.4 (L/s)

$Q_{Comm/Inst}$ = Design Flow x Peaking Factor (L/s)

Q_{Ind} = Design Flow x Peaking Factor (L/s)

Q_{Infilt} = i*A (L/s), where A = Area (ha)

$Q_d = Q_{pop} + Q_{Comm/Inst} + Q_{Ind} + Q_{Infilt}$ (L/s)

MOE Velocity Requirements: 0.6m/s - 3.0m/s

where, P = population in 1000's
q = residential sewage unit flow rate
M = Ultimate Flow Factor (residential peaking factor)
(Harmon) $M=1+(14/(4+P^{0.5}))$
Q_{pop} = peak population flow (L/s)
$Q_{Comm/Inst}$ = peak commercial/institutional flow (L/s)
Q_{Ind} = peak industrial flow (L/s)
Q_{Infilt} = peak extraneous (i.e. infiltration) flow (L/s)
i = **peak** extraneous (i.e. infiltration) unit flow rate
Q_d = total peak design flow (L/s)

Comm/Inst Peaking Factor: **3**
Ex Main Chalet Peaking Factor: **4**
Res - SFD Single Family Dwellings: q: L/cap./day ppd =
Res - MFD Multi-Family Dwellings: q: **275** L/cap./day ppu = **4**

Infiltration
i: **1.38** L/mm Ø/100m/hr
(as per MOE Guidelines use 1.38 for sewer design & 0.31 (avg) - 0.78 (peak) for PS/STS)

Mannings Coefficient
n: **0.013**

Date: **10-Dec-20**
Project No: **15-319**
Prepared by: **AW**

Location			Sewage Flow Calculation Data															Sewer Calculation Data					Sewer Profile Data					
Block/ Building	Upstream MH	Downstream MH	Res - SFD # of Units	Res - SFD # of People	Res - MFD # of Units	Res - MFD # of People	Comm/Inst Total Daily Flow (L/day)	Ex Uses Total Daily Flow (L/day)	Cum. Res - SFD # of People	Cum. Res - MFD # of People	Cum. Comm/Inst Total Daily Flow (L/day)	Cum. Industrial Total Daily Flow (L/day)	Residential Peaking Factor	Sewage Flow (L/s)	Infiltration		Total Flow (L/s)	Dia. (mm)	Slope (%)	Length (m)	Capacity (L/s)	Velocity (m/s)	Fall in Sewer (m)	Drop in MH (m)	Top of Grate Elevation (m)		Invert Elevation (m)	
															Individual (L/s)	Cumulative (L/s)								DS	US	DS	US	DS
Block 6	**MH K**	**MH J**		0	**12**	48			0	48	0	0	4.32	0.66	0.015	0.015	0.68	**200**	**3.8**	**19.7**	66.70	2.06	0.75	**0.90**	**305.72**	305.10	302.67	301.92
Block 5	**MH J**	**MH H**		0	**12**	48			0	96	0	0	4.25	1.30	0.021	0.036	1.33	**200**	**6.0**	**27.2**	83.81	2.58	1.63	**0.90**	**305.10**	302.71	301.02	299.39
Ex Uses	**MH L**	**MH I**		0		0		**13800**	0	0	0	13800		0.64	0.036	0.036	0.67	**200**	**1.0**	**47.0**	34.22	1.06	0.47	**0.05**	**301.60**	302.72	299.45	298.98
Bldg B	**MH I**	**MH H**		0	**15**	60	**640**		0	60	640	13800	4.30	1.48	0.030	0.066	1.55	**200**	**1.0**	**38.6**	34.22	1.06	0.39	**0.05**	**302.72**	302.71	298.93	298.54
Bldg A	**MH H**	**MH G**		0	**10**	40	**4410**		0	196	5050	13800	4.15	3.40	0.021	0.123	3.53	**200**	**1.0**	**27.7**	34.22	1.06	0.28	**0.10**	**302.71**	302.25	298.49	298.21
Block 4	**MH G**	**MH F**		0		0			0	196	5050	13800	4.15	3.40	0.016	0.138	3.54	**200**	**1.3**	**20.3**	39.46	1.22	0.27	**0.10**	**302.25**	301.43	298.11	297.84
	MH F	**MH E**		0	**8**	32			0	228	5050	13800	4.13	3.81	0.013	0.152	3.96	**200**	**2.8**	**17.4**	57.26	1.77	0.49	**0.08**	**301.43**	300.45	297.74	297.25
	MH E	**MH D**		0		0			0	228	5050	13800	4.13	3.81	0.019	0.171	3.98	**200**	**5.5**	**24.6**	80.24	2.47	1.35	**0.10**	**300.45**	298.02	297.17	295.82
Block 3 & 2	**MH D**	**MH C**		0	**22**	88			0	316	5050	13800	4.07	4.91	0.055	0.225	5.13	**200**	**3.8**	**71.5**	66.70	2.06	2.72	**0.05**	**298.02**	296.06	295.72	293.00
Block 1	**MH C**	**MH B**		0		0			0	316	5050	13800	4.07	4.91	0.018	0.244	5.15	**200**	**2.1**	**23.9**	49.23	1.52	0.49	**0.05**	**296.06**	294.63	292.95	292.46
	MH B	**MH A**		0	**12**	48			0	364	5050	13800	4.04	5.49	0.007	0.251	5.75	**200**	**0.6**	**9.7**	26.50	0.82	0.06	**0.05**	**294.63**	294.35	292.41	292.35
	MH A	**BIO**		0		0			0	364	5050	13800	4.04	5.49	0.004	0.255	5.75	**200**	**4.9**	**4.7**	75.74	2.34	0.23	**0.05**	**294.35**	**294.48**	292.30	**292.07**
			Individual Totals:	0	91	364	5050	13800																				
			Cumulative # of People (SFD + MFD):	364																								

NOTES: - # of people for the Multi-Family Residential Dwellings (Townhouses, apartments, etc.) is calculated based on # of units x population density (people per unit = # of bedrooms x 2 people per bedroom).
- The flows from the existing buildings (Main Chalet, Admin Building, GM office & Ski house) have all be conservatively assumed to enter the sewage system from the existing Main Chalet Building for the purposes of sizing the sanitary sewer system.
- Refer to the Total Daily Domestic Water Supply Flow Calcs spreadsheet for the determination of all input flow data within this spreadsheet. The slight difference in peak flows between these two spreadsheets is solely the result of the use of the Harmon equation to determine the peaking factors used for sanitary sewer calculations <u>AND</u> Tables 3-1 and Table 3.3 of the MOE Design Guidelines for Drinking-Water Systems (2008) which uses slightly different peaking factors.

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Sewage Pump Station Design - System Head Curve
Mansfield Ski Club - Sewage Treatment System Discharge Pump Station

▨ <<< **Elements Requiring Input Information**

Date: **10-Dec-20**
Project No: **15-319**
Prepared by: **JWL**

Velocity, $V = \frac{Q_P}{A}$ (m/s, MOE Requirements: 0.8m/s - 2.5m/s)

where, Q_P = Peak Sewage Flow (m^3/s)
A = Cross-Sectional Area (m^2)

Minor Head Loss, $H_L = (K_1+K_2+K_3\ldots) \times V^2/2g$

where, $\sum K = (K_1+K_2+K_3\ldots)$
V = mean velocity (m/s), (F/M allowable range is 0.8-2.5m/s)
g = 9.81 (acceleration due to gravity, m/s^2)

Hazen -Williams Equation (re-arranged for Friction Slope)
(Forcemain Head Loss Calculation)

Friction Slope, $S = \frac{(V)^{1/0.54}}{(0.85CR^{0.63})^{1/0.54}} \times 100$ (m/100m)

where, V = mean velocity (m/s)
k = 0.85 for SI units
C = Roughness Coefficient
R = hydraulic radius (m)

Static Head, $h_{S,\,MAX} = h_F - h_{LWL}$ (m)
Static Head, $h_{S,\,MEDIAN} = h_F - h_{MWL}$ (m)
Static Head, $h_{S,\,MIN} = h_F - h_{HWL}$ (m)

where, h_F = Forcemain Max. Elev. Along Length (m
h_{LWL} = Wet Well Low Water Level (m)
h_{MWL} = Wet Well Median Water Level (m)
h_{HWL} = Wet Well High Water Level (m)

Total Dynamic Head, $h_{D,\,MAX} = h_{S,\,MAX} + h_{T.H.L.}$ (m)
Total Dynamic Head, $h_{D,\,MEDIAN} = h_{S,\,MEDIAN} + h_{T.H.L.}$ (m)
Total Dynamic Head, $h_{D,\,MIN} = h_{S,\,MIN} + h_{T.H.L.}$ (m)

where, $h_{S,\,MAX}$ = Maximum Static Head (m)
$h_{S,\,MEDIAN}$ = Median Static Head (m)
$h_{S,\,MIN}$ = Minimum Static Head (m)
$h_{T.H.L.}$ = Total Head Loss (m)

Pipe Design Coefficient C	Forcemain						Fittings Head Loss (m)	Pump Station Head Loss (m)	Total Head Loss (m)	Wet Well Low Water Level (m)	Wet Well Median Water Level (m)	Wet Well High Water Level (m)	Forcemain Max. Elev. Along Length (m)	Static Head			Total Dynamic Head		
	Flow (L/s)	Diameter (mm)	Velocity (m/s)	Head Loss (m/100m)	Distance (m)	Head Loss (m)								MAX. (m)	Median (m)	MIN. (m)	MAX. (m)	Median (m)	MIN. (m)
Wet Well Low Water Level							$\sum K_F$=	$\sum K_{PS}$=											
							2												
120	**1**	**50**	0.51	0.91	**133.60**	1.21	0.03	0.00	1.24	**290.80**	291.40	**292.00**	**299.93**	9.13	8.53	7.93	10.37	9.77	9.17
120	**2**	50	1.02	3.28	133.60	4.38	0.11	0.00	4.48	290.80	291.40	292.00	299.93	9.13	8.53	7.93	13.61	13.01	12.41
120	**2.5**	50	1.27	4.95	133.60	6.62	0.17	0.00	6.78	290.80	291.40	292.00	299.93	9.13	8.53	7.93	15.91	15.31	14.71
120	**3**	50	1.53	6.94	133.60	9.28	0.24	0.00	9.51	290.80	291.40	292.00	299.93	9.13	8.53	7.93	18.64	18.04	17.44
120	**4**	50	2.04	11.83	133.60	15.80	0.42	0.00	16.23	290.80	291.40	292.00	299.93	9.13	8.53	7.93	25.36	24.76	24.16
Wet Well Median Water Level																			
130	1	50	0.51	0.78	133.60	1.05	0.03	0.00	1.07	290.80	291.40	292.00	299.93	9.13	8.53	7.93	10.20	**9.60**	9.00
130	2	50	1.02	2.83	133.60	3.77	0.11	0.00	3.88	290.80	291.40	292.00	299.93	9.13	8.53	7.93	13.01	**12.41**	11.81
130	**2.5**	50	1.27	4.27	133.60	5.71	0.17	0.00	5.87	290.80	291.40	292.00	299.93	9.13	8.53	7.93	15.00	**14.40**	13.80
130	3	50	1.53	5.99	133.60	8.00	0.24	0.00	8.24	290.80	291.40	292.00	299.93	9.13	8.53	7.93	17.37	**16.77**	16.17
130	4	50	2.04	10.20	133.60	13.63	0.42	0.00	14.05	290.80	291.40	292.00	299.93	9.13	8.53	7.93	23.18	**22.58**	21.98
Wet Well High Water Level																			
140	1	50	0.51	0.68	133.60	0.91	0.03	0.00	0.94	290.80	291.40	292.00	299.93	9.13	8.53	7.93	10.07	9.47	8.87
140	2	50	1.02	2.46	133.60	3.29	0.11	0.00	3.40	290.80	291.40	292.00	299.93	9.13	8.53	7.93	12.53	11.93	11.33
140	**2.5**	50	1.27	3.72	133.60	4.97	0.17	0.00	5.14	290.80	291.40	292.00	299.93	9.13	8.53	7.93	14.27	13.67	13.07
140	3	50	1.53	5.22	133.60	6.97	0.24	0.00	7.21	290.80	291.40	292.00	299.93	9.13	8.53	7.93	16.34	15.74	15.14
140	4	50	2.04	8.89	133.60	11.88	0.42	0.00	12.30	290.80	291.40	292.00	299.93	9.13	8.53	7.93	21.43	20.83	20.23

NOTES:

- The Forcemain Flow (restricted flow through 4-UV systems is 2.5L/s and was provided by Waterloo Biofilter via email on May 14, 2020) used to design the Pump Station should be bound above and below with a range of values to provide a sufficient assessment of the System Head Curve for the particular pump station under all three (3) Pipe Design Conditions/Coefficients.
- Pump station head loss is assumed to be negligible based on discussions with John Brooks Company Ltd.
- Inlet pipe invert is 292.36m.
- Fitting headloss consists of a 90 elbow at the discharge point (K=1) and exit loss (K=1).

APPENDIX C

STORMWATER MANAGEMENT CALCULATIONS

Ontario IDF CURVE LOOKUP

Active coordinate

44° 11' 44" N, 80° 3' 14" W (44.195833,-80.054167)

Retrieved: Fri, 28 Jul 2017 19:56:22 GMT

Location summary

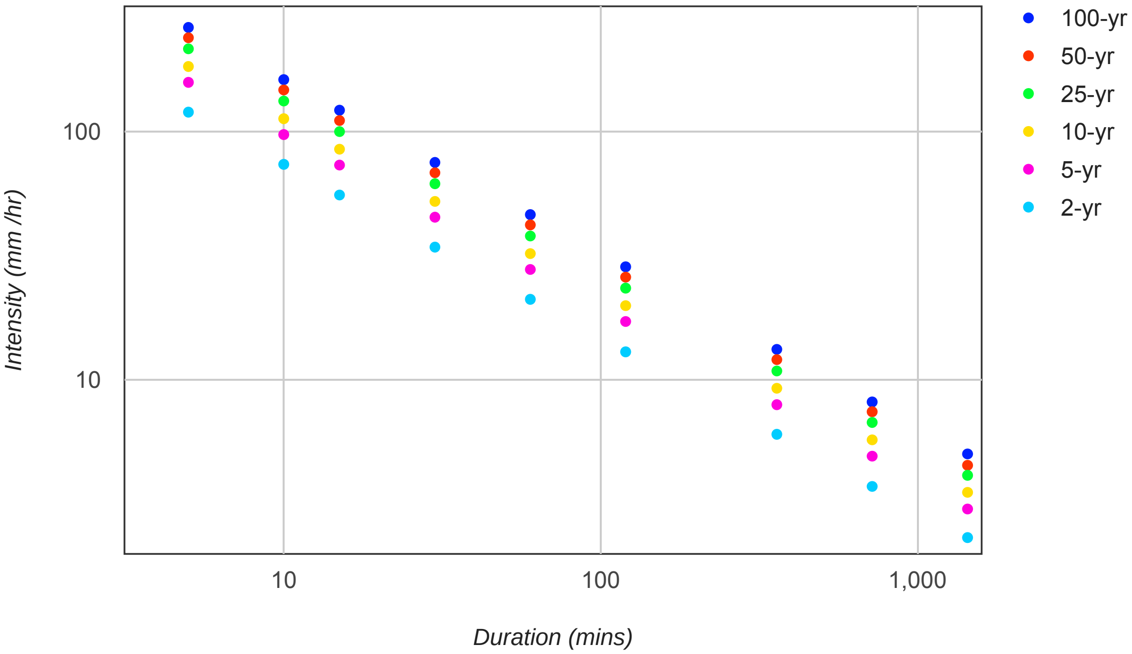
These are the locations in the selection.

IDF Curve: 44° 11' 44" N, 80° 3' 14" W (44.195833,-80.054167)

Results

An IDF curve was found.

Coordinate: 44.195833, -80.054167
IDF curve year: 2010



Coefficient summary

IDF Curve: 44° 11' 44" N, 80° 3' 14" W (44.195833,-80.054167)

Retrieved: Fri, 28 Jul 2017 19:56:22 GMT

Data year: 2010
IDF curve year: 2010

Return period	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr
A	21.0	27.7	32.1	37.8	41.9	46.1
B	-0.699	-0.699	-0.699	-0.699	-0.699	-0.699

Statistics

Rainfall intensity (mm hr^{-1})

Duration	5-min	10-min	15-min	30-min	1-hr	2-hr	6-hr	12-hr	24-hr
2-yr	119.3	73.5	55.3	34.1	21.0	12.9	6.0	3.7	2.3
5-yr	157.3	96.9	73.0	45.0	27.7	17.1	7.9	4.9	3.0
10-yr	182.3	112.3	84.6	52.1	32.1	19.8	9.2	5.7	3.5
25-yr	214.7	132.3	99.6	61.4	37.8	23.3	10.8	6.7	4.1
50-yr	238.0	146.6	110.4	68.0	41.9	25.8	12.0	7.4	4.5
100-yr	261.8	161.3	121.5	74.8	46.1	28.4	13.2	8.1	5.0

Rainfall depth (mm)

Duration	5-min	10-min	15-min	30-min	1-hr	2-hr	6-hr	12-hr	24-hr
2-yr	9.9	12.2	13.8	17.0	21.0	25.9	36.0	44.4	54.7
5-yr	13.1	16.2	18.2	22.5	27.7	34.1	47.5	58.5	72.1
10-yr	15.2	18.7	21.1	26.1	32.1	39.5	55.0	67.8	83.6
25-yr	17.9	22.0	24.9	30.7	37.8	46.6	64.8	79.9	98.4
50-yr	19.8	24.4	27.6	34.0	41.9	51.6	71.9	88.5	109.1
100-yr	21.8	26.9	30.4	37.4	46.1	56.8	79.1	97.4	120.0

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STORMWATER MANAGEMENT CALCULATIONS
PRE-DEVELOPMENT CONDITION PARAMETERS

Date: 16-Nov-20
Project No.: 15-319
Project: Mansfield Ski Club
Prepared By: BD

Pre-Development Condition

Internal Drainage Areas				External Drainage Areas			
PRE1	=	2.46	ha	EXT	=	11.71	ha
PRE2	=	1.40	ha				
Total Internal Area	=	3.86	ha	Total External Area	=	11.71	ha

Soil Characteristics

(Soil Map of Simcoe County, Ontario, North Sheet, Soil Survey Report No. 29)

PRE & EXT
- -> Duc
- -> Dunedin
- -> clay
- -> Good Drainage
- -> Hydrologic Soil Group (D)

To provide an accurate comparison between the pre- and post-development condition considering that both will consist of large gravel parking areas, the STANDHYD command was used for both conditions. To account for the large gravel area present within the pre-development condition, a composite "C" value was determined for the Buildings and parking area. Using the calculated composite "C" value, a "CA" ratio for the Building and Parking areas was determined and then working backwards, an equivalent "CA" ratio assuming all impervious surfaces was used to calculate an equivalent TIMP value for the pre-development conditions STANDHYD command to accurately account for the large packed gravel parking area.

SAMPLE CALCULATION:

PRE1 = 2.46 ha

$$C = \frac{(\text{Gravel "C"} \times \text{Gravel Area}) + (\text{Building "C"} \times \text{Building Area})}{(\text{Gravel Area} + \text{Building Area})}$$

$$= \frac{(0.6)(0.90ha) \times (0.95)(0.07ha)}{0.97ha}$$

$$C = 0.63$$

ACTUAL (gravel) >>> CA_{RATIO} = (0.63)(0.97ha) = 0.61

TIMP $= \frac{0.07ha}{2.66ha}$ = 2.63%

$$A_{EQUIVALENT} = \frac{CA_{RATIO}}{C_{IMPERVIOUS}} = \frac{0.61}{0.95} = 0.64 \text{ ha}$$

EQUIV. (Imp.) >>> CA_{RATIO} = (0.95)(0.64ha) = 0.61

TIMP $= \frac{0.64ha}{2.66ha}$ = **24.10%**

PRE1 (Calib Standhyd Command)

Total Area	=	2.46	ha				
Impervious Areas:				Pervious Areas:			
Buildings	=	0.06	ha	Unimproved	=	1.47	ha
Gravel	=	0.83	ha	Treed	=	0.09	ha

See above notes and sample calculations for the determination of the Equivalent TIMP value which accounts for the Buildings and Gravel areas.

Total Impervious Area	=	0.64	ha	Total Pervious Area	=	1.82	ha
XIMP	=	1	%*	CN	=	81	*
TIMP	=	24	%	I_A	=	8.1	mm
LGI	=	100.0	m	LGP	=	80.0	m
SLPI	=	2.0	%	SLPP	=	10.0	%

* XIMP was based on the assumption that the directly connected areas are the following:

- None of the Areas

* Refer to the CN & IA spreadsheet

EXT (Calib Nashyd Command)

Total Area	=	11.71	ha	CN	=	83	*
				I_A	=	6.8	mm*
Buildings & Roads	=	0.80	ha				
Pasture	=	2.60	ha				
Lawn	=	2.75	ha	C	=	0.41	
Treed	=	3.38	ha				
Unimproved	=	2.18	ha				
				T_P	=	0.24	hr*

* Refer to the CN & I_A spreadsheet

* Refer to the C spreadsheet

*Refer to T_C & T_P Spreadsheet

PRE2 (Calib Standhyd Command)

Total Area	=	1.40	ha				
Impervious Areas:				Pervious Areas:			
Buildings	=	0.06	ha	Unimproved	=	0.91	ha
Gravel	=	0.43	ha				

See above notes and sample calculations for the determination of the Equivalent TIMP value which accounts for the Buildings and Gravel areas.

Total Impervious Area	=	0.33	ha	Total Pervious Area	=	1.07	ha
XIMP	=	1	%*	CN	=	81	*
TIMP	=	24	%	I_A	=	8.0	mm
LGI	=	45.0	m	LGP	=	70.0	m
SLPI	=	3.5	%	SLPP	=	13.0	%

* XIMP was based on the assumption that the directly connected areas are the following:

- None of the Areas

* Refer to the CN & IA spreadsheet

SWMHYMO Results

Site Drainage Analysis:

The **24-hour SCS Type II Storm Distribution** was determined to govern the design of the proposed SWM Facility design based on the greater storage volumes required to attenuate the post-development peak flows to their corresponding pre-development target rates over those which were determined based on the other storm distributions.

24-hour SCS Type II Storm Distribution

PRE1

Peak Flow Rates

Q_2 = 0.154 m^3/s
Q_5 = 0.261 m^3/s
Q_{25} = 0.446 m^3/s
Q_{100} = 0.598 m^3/s

PRE2

Peak Flow Rates

Q_2 = 0.100 m^3/s
Q_5 = 0.165 m^3/s
Q_{25} = 0.280 m^3/s
Q_{100} = 0.373 m^3/s

Runoff Volumes

V_2 = 354 m^3
V_5 = 550 m^3
V_{25} = 868 m^3
V_{100} = 1142 m^3

Site + External Drainage Analysis:

The **24-hour SCS Type II Storm Distribution** was determined to govern the design of the proposed by-pass swale, by-pass storm sewer section and dry detention basin design based on the greater peak flows generated in comparison to the other storm distributions.

24-hour SCS Type II Storm Distribution

EXT

Q_2 = 0.592 m^3/s
Q_5 = 0.948 m^3/s
Q_{25} = 1.529 m^3/s
Q_{100} = 2.025 m^3/s

TOTAL (PRE1 + EXT)

Q_2 = 0.743 m^3/s
Q_5 = 1.192 m^3/s
Q_{25} = 1.914 m^3/s
Q_{100} = 2.537 m^3/s

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STORMWATER MANAGEMENT CALCULATIONS
POST-DEVELOPMENT CONDITION PARAMETERS

Date: 16-Nov-20
Project No.: 15-319
Project: Mansfield Ski Club
Prepared By: BD

Post-Development Condition

Internal Drainage Areas				External Drainage Areas			
POST1	=	2.74	ha	EXT	=	11.94	ha
POST2	=	0.89	ha				
Total Internal Area	=	3.63	ha	Total External Area	=	11.94	ha

POST1

(Calib Standhyd Command)

Total Area = 2.74 ha

Impervious Areas:				Pervious Areas:			
Buildings/Parking	=	1.89	ha	Lawn	=	0.85	ha

All parking areas will be gravel with the exception of a small section of paver stones adjacent to the existing Main Chalet Building. As per NVCA design standards, the post-development peak flows are conservatively based on the gravel areas being considered as asphalt.

Total Impervious Area	=	1.89	ha	Total Pervious Area	=	0.85	ha
XIMP	=	59	%*	CN	=	84	*
TIMP	=	69	%	I_A	=	5.0	mm
LGI	=	300.0	m	LGP	=	6.0	m
SLPI	=	3.5	%	SLPP	=	33.3	%

* XIMP was based on the assumption that the directly connected areas are the following:

- All areas not directed towards the landscaped parking islands (grass filter strips).

* Refer to the CN & IA spreadsheet

POST2

(Calib Standhyd Command)

Total Area = 0.89 ha

Impervious Areas:				Pervious Areas:			
Buildings/Parking	=	0.19	ha	Lawn	=	0.70	ha

All parking areas will be gravel with the exception of a small section of paver stones adjacent to the existing Main Chalet Building. As per NVCA design standards, the post-development peak flows are conservatively based on the gravel areas being considered as asphalt.

Total Impervious Area	=	0.19	ha	Total Pervious Area	=	0.70	ha
XIMP	=	10.5	%*	CN	=	84	*
TIMP	=	21	%	I_A	=	5.0	mm
LGI	=	120.0	m	LGP	=	50.0	m
SLPI	=	6.0	%	SLPP	=	11.1	%

* XIMP was based on the assumption that the directly connected areas are the following:

- The east half of the buildings and the driveway/access road.

* Refer to the CN & IA spreadsheet

EXT (Calib Nashyd Command)

Total Area = 11.94 ha

Buildings & Roads = 0.80 ha
Pasture = 2.60 ha
Lawn = 2.75 ha
Treed = 3.38 ha
Unimproved = 2.41 ha

CN = 83 *
I_A = 6.8 mm*
* Refer to the CN & I_A spreadsheet

C = 0.41
* Refer to the C spreadsheet

T_P = 0.24 hr*

*Refer to T_C & T_P Spreadsheet

SWMHYMO Results

Site Drainage Analysis:

The **24-hour SCS Type II Storm Distribution** was determined to govern the design of the proposed SWM Facility design based on the greater storage volumes required to attenuate the post-development peak flows to their corresponding pre-development target rates over those which were determined based on the other storm distributions.

24-hour SCS Type II Storm Distribution

SWM Facility

Uncontrolled Peak Flow Rates
Q_2 = 0.861 m^3/s
Q_5 = 1.315 m^3/s
Q_{25} = 2.015 m^3/s
Q_{100} = 2.628 m^3/s

Controlled Peak Flow Rates
Q_2 = 0.709 m^3/s
Q_5 = 1.120 m^3/s
Q_{25} = 1.784 m^3/s
Q_{100} = 2.275 m^3/s

Storage Volumes
V_2 = 741.9 m^3
V_5 = 921.8 m^3
V_{25} = 1158.0 m^3
V_{100} = 1364.0 m^3

POST2

Uncontrolled Peak Flow Rates
Q_2 = 0.073 m^3/s
Q_5 = 0.116 m^3/s
Q_{25} = 0.192 m^3/s
Q_{100} = 0.251 m^3/s

Runoff Volumes
V_2 = 266 m^3
V_5 = 396 m^3
V_{25} = 605 m^3
V_{100} = 783 m^3

\\WMI-SERVER\wmi-server\Data\Projects\2015\15-319\Design\Storm\Issue_No2\[4_201116-SWMHYMO_Input_Parameters.xlsx]Pre-Development Condition

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RUNOFF COEFFICIENT CALCULATIONS
"C" SPREADSHEET

Date: 2020-11-16
Project No.: 15-319
Project: Mansfield Ski Club
Prepared By: BD

RUNOFF COEFFICIENT NUMBERS

Land Cover		Hydrologic Soil Groups		
		A-AB	B-BC	C-D
Cultivated Land	0 - 5% grade	0.22	0.35	0.55
	5 - 10% grade	0.3	0.45	0.6
	10 - 30% grade	0.4	0.65	0.7
Pasture Land	0 - 5% grade	0.1	0.28	0.4
	5 - 10% grade	0.15	0.35	0.45
	10 - 30% grade	0.22	0.4	0.55
Woodlot or Cutover	0 - 5% grade	0.08	0.25	0.35
	5 - 10% grade	0.12	0.3	0.42
	10 - 30% grade	0.18	0.35	0.52
Lakes and Wetlands		0.05	0.05	0.05
Impervious Area	(i.e. buildings, roads, parking lot, etc.)	0.95	0.95	0.95
Gravel	(not used for proposed parking or storage areas)	0.4	0.5	0.6
Residential	Single Family	0.3	0.4	0.5
	Multiple (i.e. semi, townhouse, apartment, etc.)	0.5	0.6	0.7
Industrial	Light	0.55	0.65	0.75
	Heavy	0.65	0.75	0.85
Commercial		0.6	0.7	0.8
Unimproved Areas		0.1	0.2	0.3
Lawn	< 2% grade	0.05	0.11	0.17
	2 - 7% grade	0.1	0.16	0.22
	> 7% grade	0.15	0.25	0.35

Ref: Runoff Coefficient Numbers - Adapted from Design Chart 1.07, Ontario Ministry of Transportation, "MTO Drainage Management Manual", MTO. (1997)

▨ <<< **Elements Requiring Input Information**

PRE-DEVELOPMENT CONDITION - SITE (PRE1)

Land Cover		Hydrologic Soil Groups		
		A-AB	B-BC	C-D
Cultivated Land	0 - 5% grade			
	5 - 10% grade			
	10 - 30% grade			
Pasture Land	0 - 5% grade			
	5 - 10% grade			
	10 - 30% grade			
Woodlot or Cutover	0 - 5% grade			0.09
	5 - 10% grade			
	10 - 30% grade			
Lakes and Wetlands				
Impervious Area	(i.e. buildings, roads, parking lot, etc.)			0.06
Gravel	(not used for proposed parking or storage areas)			0.83
Residential	Single Family			
	Multiple (i.e. semi, townhouse, apartment, etc.)			
Industrial	Light			
	Heavy			
Commercial				
Unimproved Areas				1.47
Lawn	< 2% grade			
	2 - 7% grade			
	> 7% grade			

Total Area (ha) = 2.46

Runoff Coefficient, C = **0.42**

PRE-DEVELOPMENT CONDITION - SITE (PRE2)

Land Cover		Hydrologic Soil Groups		
		A-AB	B-BC	C-D
Cultivated Land	0 - 5% grade			
	5 - 10% grade			
	10 - 30% grade			
Pasture Land	0 - 5% grade			
	5 - 10% grade			
	10 - 30% grade			
Woodlot or Cutover	0 - 5% grade			
	5 - 10% grade			
	10 - 30% grade			
Lakes and Wetlands				
Impervious Area	(i.e. buildings, roads, parking lot, etc.)			0.06
Gravel	(not used for proposed parking or storage areas)			0.43
Residential	Single Family			
	Multiple (i.e. semi, townhouse, apartment, etc.)			
Industrial	Light			
	Heavy			
Commercial				
Unimproved Areas				0.91
Lawn	< 2% grade			
	2 - 7% grade			
	> 7% grade			

Total Area (ha) = 1.40 **Runoff Coefficient, C =** **0.42**

POST-DEVELOPMENT CONDITION - SITE (POST1)

Land Cover		Hydrologic Soil Groups		
		A-AB	B-BC	C-D
Cultivated Land	0 - 5% grade			
	5 - 10% grade			
	10 - 30% grade			
Pasture Land	0 - 5% grade			
	5 - 10% grade			
	10 - 30% grade			
Woodlot or Cutover	0 - 5% grade			
	5 - 10% grade			
	10 - 30% grade			
Lakes and Wetlands				
Impervious Area	(i.e. buildings, roads, parking lot, etc.)			1.89
Gravel	(not used for proposed parking or storage areas)			
Residential	Single Family			
	Multiple (i.e. semi, townhouse, apartment, etc.)			
Industrial	Light			
	Heavy			
Commercial				
Unimproved Areas				
Lawn	< 2% grade			
	2 - 7% grade			
	> 7% grade			0.85

Total Area (ha) = 2.74 **Runoff Coefficient, C =** **0.76**

POST-DEVELOPMENT CONDITION - SITE (POST2)

Land Cover		Hydrologic Soil Groups		
		A-AB	B-BC	C-D
Cultivated Land	0 - 5% grade			
	5 - 10% grade			
	10 - 30% grade			
Pasture Land	0 - 5% grade			
	5 - 10% grade			
	10 - 30% grade			
Woodlot or Cutover	0 - 5% grade			
	5 - 10% grade			
	10 - 30% grade			
Lakes and Wetlands				
Impervious Area	(i.e. buildings, roads, parking lot, etc.)			0.19
Gravel	(not used for proposed parking or storage areas)			
Residential	Single Family			
	Multiple (i.e. semi, townhouse, apartment, etc.)			
Industrial	Light			
	Heavy			
Commercial				
Unimproved Areas				
Lawn	< 2% grade			
	2 - 7% grade			
	> 7% grade			0.70

Total Area (ha) = 0.89 **Runoff Coefficient, C = 0.48**

EXTERNAL DRAINAGE AREA (EXT)

Land Cover		Hydrologic Soil Groups		
		A-AB	B-BC	C-D
Cultivated Land	0 - 5% grade			
	5 - 10% grade			
	10 - 30% grade			
Pasture Land	0 - 5% grade			2.6
	5 - 10% grade			
	10 - 30% grade			
Woodlot or Cutover	0 - 5% grade			
	5 - 10% grade			
	10 - 30% grade			3.38
Lakes and Wetlands				
Impervious Area	(i.e. buildings, roads, parking lot, etc.)			0.8
Gravel	(not used for proposed parking or storage areas)			
Residential	Single Family			
	Multiple (i.e. semi, townhouse, apartment, etc.)			
Industrial	Light			
	Heavy			
Commercial				
Unimproved Areas				2.41
Lawn	< 2% grade			
	2 - 7% grade			2.75
	> 7% grade			

Total Area (ha) = 11.94 **Runoff Coefficient, C = 0.41**

#N/A

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CURVE NUMBER & INITIAL ABSTRACTION CALCULATIONS
CN & IA SPREADSHEET

Date: 2020-11-16 **Project No.:** 15-319

Project: Mansfield Ski Club **Prepared By:** BD

SCS CURVE NUMBERS (AMC II (NORMAL) CONDITION) **INITIAL RAINFALL ABSTRACTION**

	Hydrologic Soil Groups							IA (mm)
Land Cover	**A**	**AB**	**B**	**BC**	**C**	**CD**	**D**	
Wetlands/Lakes/SWMF's	50	50	50	50	50	50	50	
Woods	32	46	60	67	73	76	79	10
Meadows	38	51	65	71	76	79	81	8
Pasture/Lawn	49	59	69	74	79	82	84	5
Cultivated	62	68	74	78	82	84	86	7
Impervious Areas	100	100	100	100	100	100	100	2

Ref: SCS Curve Numbers - Adapted from Design Chart 1.09, Ontario Ministry of Transportation, "MTO Drainage Management Manual", MTO.(1997)
Ref: Initial Rainfall Abstraction Values - UNESCO, Manual on Drainage in Urbanized Areas, (1987)
Ref: AMC I & III Condition SCS Curve Number Values - Modern Sewer Design, Third Edition (Canadian), pg. 69, Table 3.6, (1996)

NOTES:
- **AMC II Condition** SCS Curve Number values are not applicable to frozen soils or to the period where snowmelt contributes to stormwater runoff.
- **STANDHYD COMMANDS** (Swmhymo) - CN values are based solely on the **pervious surfaces** within the catchment.
- **NASHYD COMMANDS** (Swmhymo) - CN values are based on both the **pervious and impervious surfaces** within the catchment (composite CN value).

▨ <<< **Elements Requiring Input Information**

PRE-DEVELOPMENT CONDITION - SITE (PRE1)

(gravel area was accounted for in an equivalent impervious area calculation to account for the existing compacted gravel surface on-site)

Area per Land Cover Type and Hydrologic Soil Group

	Hydrologic Soil Groups						
Land Cover	**A**	**AB**	**B**	**BC**	**C**	**CD**	**D**
Wetlands/Lakes/SWMF's							
Woods							0.09
Meadows							1.47
Pasture/Lawn							
Cultivated							
Impervious Areas							

(for Standhyd Command)
Pervious Area (ha) = 1.56

CN(I) = 64
CN(II) = 81
CN(III) = 92

IA (mm) = 8.1

PRE-DEVELOPMENT CONDITION - SITE (PRE2)

(gravel area was accounted for in an equivalent impervious area calculation to account for the existing compacted gravel surface on-site)

Area per Land Cover Type and Hydrologic Soil Group

	Hydrologic Soil Groups						
Land Cover	**A**	**AB**	**B**	**BC**	**C**	**CD**	**D**
Wetlands/Lakes/SWMF's							
Woods							
Meadows							0.91
Pasture/Lawn							
Cultivated							
Impervious Areas							

(for Standhyd Command)
Pervious Area (ha) = 0.91

CN(I) = 64
CN(II) = 81
CN(III) = 92

IA (mm) = 8.0

POST-DEVELOPMENT CONDITION - SITE (POST1)

Area per Land Cover Type and Hydrologic Soil Group

	Hydrologic Soil Groups						
Land Cover	**A**	**AB**	**B**	**BC**	**C**	**CD**	**D**
Wetlands/Lakes/SWMF's							
Woods							
Meadows							
Pasture/Lawn							0.85
Cultivated							
Impervious Areas							

(for Standhyd Command)

Pervious Area (ha) = 0.85

CN(I) = 68
CN(II) = 84
CN(III) = 93

IA (mm) = 5.0

POST-DEVELOPMENT CONDITION - SITE (POST2)

Area per Land Cover Type and Hydrologic Soil Group

	Hydrologic Soil Groups						
Land Cover	**A**	**AB**	**B**	**BC**	**C**	**CD**	**D**
Wetlands/Lakes/SWMF's							
Woods							
Meadows							
Pasture/Lawn							0.7
Cultivated							
Impervious Areas							

(for Standhyd Command)

Pervious Area (ha) = 0.70

CN(I) = 68
CN(II) = 84
CN(III) = 93

IA (mm) = 5.0

External Drainage Area (EXT)

Area per Land Cover Type and Hydrologic Soil Group

	Hydrologic Soil Groups						
Land Cover	**A**	**AB**	**B**	**BC**	**C**	**CD**	**D**
Wetlands/Lakes/SWMF's							
Woods							3.38
Meadows							2.41
Pasture/Lawn							5.35
Cultivated							
Impervious Areas							0.8

(for Nashyd Command)

Total Area (ha) = 11.94

CN(I) = 67
CN(II) = 83
CN(III) = 93

IA (mm) = 6.8

#N/A

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TIME OF CONCENTRATION & TIME TO PEAK CALCULATIONS
T_C & T_P SPREADSHEET

Date: 31-Jul-17 **Project No.:** 15-319

Project: Mansfield Ski Club **Prepared By:** TG

OVERLAND SHEET FLOW TIME OF CONCENTRATION (T_C) CALCULATION, $T_{C,\ OVER}$

The Runoff Coefficient 'C' governs which Time of Concentration Formula is used:
C > 0.40 Bransby Williams Formula
C <= 0.40 Airport Formula (FAA Equation)
Ref: MTO, Drainage Management Manual, pg 28, Ch. 8, 1997

▨ <<< **Elements Requiring Input Information**

Catchment I.D.	Area (ha)	h_1 (m)	h_2 (m)	Length (m)	Runoff Coefficient	h_{DELTA} (m)	Slope (%)
EXT	11.94	388	308	755.3	0.41	80.0	10.6

$T_{C,\ OVER}$ (min.)	
Airport Formula	Bransby Williams Formula
	21.0

Airport Formula (FAA Equation)

$$T_{C,\ OVER} = \frac{3.26\ (1.1\text{-}C)\ (L)^{0.5}}{(S)^{0.33}} \quad \text{(min.)}$$

where,
C = Runoff Coefficient
L = Length of Overland Flow Path, (m)
S = Avg. Slope of Overland Flow Path, (%)

Bransby Williams Formula

$$T_{C,\ OVER} = \frac{0.057\ (L)}{(S)^{0.2}\ (A)^{0.1}} \quad \text{(min.)}$$

where,
L = Length of Overland Flow Path, (m)
S = Avg. Slope of Overland Flow Path, (%)
A = Catchment Area, (ha)

CHANNELIZED FLOW TIME OF CONCENTRATION (T_C) CALCULATION, $T_{C,\ CHAN}$

Refer to separate sheet attached for the calculation of the Velocity values (i.e. Flow Master Output, Manning's Channel Spreadsheet, etc.).

Catchment I.D.	Length (m)	Velocity (m/s)

$T_{C,\ CHAN}$ (min.)

$$T_{C,\ CHAN} = \frac{L}{V} \quad \text{(min.)}$$

where,
L = Length of Channel, (m)
V = Flow Velocity in Channel, (m/s)

PIPED FLOW TIME OF CONCENTRATION (T_C) CALCULATION, $T_{C,\ PIPE}$

Refer to separate sheet attached for the calculation of the Velocity values (i.e. Culvert Master Output, Manning's Pipe Spreadsheet, etc.).

Catchment I.D.	Length (m)	Velocity (m/s)

$T_{C,\ PIPE}$ (min.)

$$T_{C,\ PIPE} = \frac{L}{V} \quad \text{(min.)}$$

where,
L = Length of Pipe, (m)
V = Flow Velocity in Pipe, (m/s)

TOTAL TIME OF CONCENTRATION (T_C) AND TIME TO PEAK (T_P) CALCULATION, $T_{C,\ TOTAL}$, $T_{P,\ TOTAL}$

The Total Time of Concentration and Time to Peak values consist of a combination of the Overland, Channel and/or Pipe travel times.

Catchment I.D.	$T_{C,\ OVER}$ (min.)	$T_{C,\ CHAN}$ (min.)	$T_{C,\ PIPE}$ (min.)
EXT	21.0		

$T_{C,\ TOTAL}$ (min.)	$T_{P,\ TOTAL}$ (min.)
21.0	**14.1**

$$T_{C,\ TOTAL} = T_{C,\ OVER} + T_{C,\ CHAN} + T_{C,\ PIPE} \quad \text{(min.)}$$

$$T_{P,\ TOTAL} = 0.67 \times T_{C,\ TOTAL} \quad \text{(min.)}$$

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STAGE-STORAGE CALCULATIONS
SWM FACILITY DESIGN SPREADSHEET

Date: 16-Nov-20 **Project No.:** 15-319

Project: Mansfield Ski Club **Prepared By:** BD

▨ <<< **Elements Requiring Input Information**

Required Permanent Pool Volume = m^3
Provided Permanent Pool Volume = m^3

Bottom Elevation, Base = 294.35 m
Normal Water Level Elevation, NWL = 294.35 m (for dry facilities, NWL is assumed at Base)
Top Elevation, Top = 296.90 m

Stage-Storage Information:

Description	**Elevation (m)**	**Stage (m)**	**Area 1 (m^2)**	**Area 2 (m^2)**	**Total Area (m^2)**	**Avg. Area (m^2)**	**Incremental Storage Volume (m^3)**	**Total Storage Volume (m^3)**	**Total Storage Volume Above NWL (m^3)**
Base	294.35	0.00	121.3		121.3	-	-	0.0	0.0
	295.35	1.00	385.8		385.8	253.6	253.6	253.6	0.0
	295.35	1.00	561.1		561.1	473.5	0.5	254.0	0.0
	296.60	2.25	1232.9		1232.9	897.0	1120.4	1374.4	0.0
Top	296.90	2.55	1421.5		1421.5	1327.2	398.2	1772.5	0.0

^
Only increments of 0.01m are valid

Determining the Water Surface Elevation of a known Storage Volume:

		Total Storage Incl. P.P.	Active Storage Only
Extended Detention	Storage Volume =	442.9	
	W.S. Elevation =	295.70	
2-year	Storage Volume =	741.9	
	W.S. Elevation =	296.12	
5-year	Storage Volume =	921.8	
	W.S. Elevation =	296.32	
25-year	Storage Volume =	1158	
	W.S. Elevation =	296.56	
100-year	Storage Volume =	1364	
	W.S. Elevation =	296.61	
Regional	Storage Volume =	1080	
	W.S. Elevation =	296.48	

Determining the Storage Volume at a known Water Surface Elevation:

		Total Storage Incl. P.P.	Active Storage Only
Description	W.S. Elevation =		
	Storage Volume =		

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EXTENDED DETENTION VOLUME DRAWDOWN TIME & PEAK FLOW CALCULATIONS
SWM FACILITY DESIGN SPREADSHEET

Date: 16-Nov-20 **Project No.:** 15-319

Project: Mansfield Ski Club **Prepared By:** BD

▨ <<< **Elements Requiring Input Information**

Active Storage Stage-Area Relationship (from Table above):

	Elevation (m)	**Stage (m)**	**Total Area (m^2)**
NWL	294.35	0.00	121.3
	295.35	1.00	385.8
	295.35	1.00	561.1
	296.60	2.25	1232.9
Top	296.90	2.55	1421.5

Extended Detention Drawdown Time:

t = $0.66C_2h^{1.5}+2C_3h^{0.5}/2.75Ao$ (MOE Equation 4.11)

where, t = drawdown time (sec)
C_2 = slope coeff. from area-depth linear regression
C_3 = intercept from area-depth linear regression
h_{CL} = maximum head (extended detention volume) acting on centroid of orifice (m)
Extended Detention Elev = extended detention water surface elevation (m)
Orifice Invert Elev = control orifice invert elevation (m)
A_O = orifice cross-sectional area (m^2)

Orifice Coefficient, C = 0.63 (typically C=0.63 for orifice plate design)
Orifice Plate Diameter, D_O = 75 mm (minimum recommended orifice size is a **75mm** diameter)
A_O = 0.00442 m^2
Extended Detention Elev = 295.70 m
Orifice Invert Elev = 294.35 m
h_{CL} = 1.312 m
C_2 = 501.03 <<<
C_3 = 42.81 <<<

within each of these two (2) formulas the arrays must be changed to match the range of values listed in the table above (i.e. Stage & Total Area columns)

t = 49000 sec
t = **13.6** hr

NOTE: The recommended drawdown time is 24hr but if an orifice size smaller than the required minimum (75mm dia.) is necessary to achieve the 24hr drawdown time than a minimum 12hr drawdown time is considered to be acceptable).

Quality Storm Peak Release Rate from Facility:

Q_P = $CA_O(2gh_{CL})^{0.5}$ (Orifice Flow Equation)

where, g = acceleration due to gravity (m/s^2)
h_{CL} = maximum head (extended detention volume) acting on centroid of orifice (m)

g = 9.81 m/s^2

Q_P = **0.0141** m^3/s

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STAGE-STORAGE-DISCHARGE (S-S-D) CALCULATIONS
SWM FACILITY

Date: 16-Nov-20
Project No.: 15-319
Project: Mansfield Ski Club
Prepared By: BD

▨ <<< **Elements Requiring Input Information**

Unsubmerged Orifice (Weir Flow)

$Q = C_W L H^{3/2}$ (m^3/s)

where, Q = Flow through unsubmerged orifice (m^3/s)
C_W = Weir Coefficient
H = Head/Depth of water acting on weir measured from above the crest/invert of orifice (m)
L = Length of weir (m)
D = Diameter of Pipe/Orifice (m)
For circular vertical weir,
L = Wetted Perimeter
$L = D \times \cos^{-1}((D/2 - H)/(D/2))$
For circular horizontal weir,
L = Circumference
L = 3.14 x D

Submerged Orifice (Orifice Flow)

$Q = C_O A_O (2gH)^{1/2}$ (m^3/s)

where, Q = Flow through submerged orifice (m^3/s)
C_O = Orifice Discharge Coefficient
A_O = Cross-sectional area of orifice (m^2)
g = Gravitational acceleration ($9.81 m^2/s$)
For circular vertical orifice,
H = Head/Depth of water acting on orifice measured from centroid of the opening (m)
For circular horizontal orifice,
H = Head/Depth of water acting on orifice measured from above the invert (m)

Unsubmerged Weir (Weir Flow)

Rectangular Broad- & Sharp-Crested Weirs
$Q = C_W L H^{3/2}$ (m^3/s)
Triangular Broad-Crested Weirs
$Q = 1.225 H^{5/2} \tan(\text{Theta}/2)$ (m^3/s)
Triangular Sharp-Crested Weirs
$Q = 0.581(8/15)(2g)^{1/2} \tan(\text{Theta}/2) H^{5/2}$ (m^3/s)
Trapezoidal Broad- & Sharp-Crested Weirs
$Q_{TRAPEZOIDAL} = Q_{RECTANGULAR} + Q_{TRIANGULAR}$ (m^3/s)

where, Q = Flow through unsubmerged weir (m^3/s)
C_W = Weir Coefficient
(1.65 for Broad-Crested)
(1.80 for Sharp-Crested)
H = Head/Depth of water acting on weir measured from above the crest (m)
L = Length of weir measured perpendicular to flow direction (m)
Theta/2 = Angle of side slope measured from vertical axis (degrees)
g = Gravitational acceleration ($9.81 m^2/s$)

Submerged Weir (Orifice Flow)

Submerged Sharp-Crested Weirs
$Q = C_O A_O (2gH)^{1/2}$ (m^3/s)

where, Q = Flow through submerged weir opening (m^3/s)
C_O = Orifice Discharge Coefficient
A_O = Cross-sectional area of opening (m^2)
g = Gravitational acceleration ($9.81 m^2/s$)
H = Head/Depth of water acting on orifice measured from centroid of the opening (m)

NOTES:

Orifice Flow Notes

- **Vertical Orifice Flow** calculations assume weir flow up to the centroid/center of orifice and then orifice flow above the crown/top of the orifice. Between the centroid and crown of the orifice is a flow transition stage from weir to orifice flow and is calculated based on a linear interpolation between the known weir flow at the centroid of the orifice and the known orifice flow at the crown.
- **Horizontal Orifice Flow** calculations assume weir flow up to one-quarter of the orifices diameter (0.25xD) and then orifice flow above three-quarters of the orifices diameter (0.75xD). Between (0.25xD) and (0.75xD) exists a flow transition stage which is calculated based on a linear interpolation between the known weir flow at (0.25xD) and the known orifice flow at (0.75xD).

Weir Flow Notes

- **Orifice control** is only applicable if the weir opening is submerged and not exposed to atmospheric pressure for all ranges of water elevations.
- For all Weir Types, **orifice control** occurs when the water surface elevation is equal to or greater than the crown/top of the opening.

\\WMI-SERVER\wmi-server\Data\Projects\2015\15-319\Design\Storm\Issue_No2\[6_201116_Detailed_S-S-D_Table.xlsx]S-S-D Table

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Starting Water Elevation, m = **294.35**
Incremental Depth, m = **0.05**

	Orifice 1	Orifice 2	Orifice 3	Weir 1	Weir 2	Weir 3	
Orifice Type =	**Vertical**			**Rectangular Sharp-Crested**	**Triangular Broad-Crested**	**Trapezoidal Broad-Crested**	= Weir Type
Orifice Invert Elev., m =	**294.35**			**295.55**	**296.25**	**296.55**	= Weir Crest Elev., m
Incremental Depth, m =	0.05	0.05	0.05	0.05	0.05	0.05	= Incremental Depth, m
Water Elev. @ Inflow, m =	**294.35**						= Weir Openings Crown Elev., m (if appl.)
Orifice Diameter, m =	**0.075**			**0.90**		**4.00**	= Weir Length, m
Centroid of Orifice, m =	294.388			**1.80**	**1.65**	**1.65**	= Weir Coefficient
Orifice Area, m^2 =	0.0044				**2**	**10**	= Side Slope (H:1)
Orifice Coefficient =	**0.63**				63	84	= Theta/2, Degrees
Weir Coefficient =	**1.80**						= Centroid of Orifice, m (if appl.)
							= Orifice Area, m^2 (if appl.)
							= Orifice Coefficient (if appl.)

NOTES:

Elevation (m)	Area 1 (m^2)	Area 2 (m^2)	Total Area (m^2)	Storage Volume (m^3)
294.35	121.3		121.3	**0.0**
295.35	385.8		385.8	**253.6**
295.35	561.1		561.1	**254.0**
296.60	1232.9		1232.9	**1374.4**
296.90	1421.5		1421.5	**1772.5**

^
Only increments of 0.01m are valid

Description	Elevation (m)	Orifice 1 Flow (m^3/s)	Orifice 2 Flow (m^3/s)	Orifice 3 Flow (m^3/s)	Weir 1 Flow (m^3/s)	Weir 2 Flow (m^3/s)	Weir 3 Flow (m^3/s)	Total Flow (m^3/s)	Total Storage Volume (m^3)	Notes
Base	**294.35**	0.0000						**0.0000**	**0.0**	
	294.40	0.0015						**0.0015**	**6.3**	
	294.45	0.0031						**0.0031**	**13.1**	
	294.50	0.0041						**0.0041**	**20.5**	
	294.55	0.0050						**0.0050**	**28.4**	
	294.60	0.0057						**0.0057**	**36.8**	
	294.65	0.0063						**0.0063**	**45.9**	
	294.70	0.0069						**0.0069**	**55.7**	
	294.75	0.0074						**0.0074**	**66.1**	
	294.80	0.0079						**0.0079**	**77.2**	
	294.85	0.0084						**0.0084**	**89.1**	
	294.90	0.0088						**0.0088**	**101.7**	
	294.95	0.0092						**0.0092**	**115.0**	
	295.00	0.0096						**0.0096**	**129.2**	
	295.05	0.0100						**0.0100**	**144.2**	
	295.10	0.0104						**0.0104**	**160.1**	
	295.15	0.0108						**0.0108**	**176.9**	
	295.20	0.0111						**0.0111**	**194.6**	
	295.25	0.0114						**0.0114**	**213.3**	
	295.30	0.0118						**0.0118**	**232.9**	
	295.35	0.0121						**0.0121**	**253.5**	
	295.40	0.0124						**0.0124**	**277.7**	
	295.45	0.0127						**0.0127**	**302.7**	
	295.50	0.0130						**0.0130**	**328.7**	
	295.55	0.0133			0.000			**0.0133**	**355.7**	
	295.60	0.0136			0.018			**0.0317**	**383.7**	
	295.65	0.0139			0.051			**0.0651**	**412.8**	
	295.70	0.0141			0.094			**0.1082**	**443.0**	**Extended Detention (Q=0.108m3/s, V=442.9m3 at 295.70m)**
	295.75	0.0144			0.145			**0.1593**	**474.3**	
	295.80	0.0147			0.203			**0.2172**	**506.7**	
	295.85	0.0149			0.266			**0.2811**	**540.3**	
	295.90	0.0152			0.335			**0.3506**	**575.1**	
	295.95	0.0154			0.410			**0.4252**	**611.2**	
	296.00	0.0157			0.489			**0.5047**	**648.6**	
	296.05	0.0159			0.573			**0.5887**	**687.2**	
	296.10	0.0161			0.661			**0.6769**	**727.2**	**2-year storm (Q=0.709m3/s, V=741.9m3 at 296.12m)**
	296.15	0.0164			0.753			**0.7693**	**768.6**	
	296.20	0.0166			0.849			**0.8656**	**811.3**	
	296.25	0.0168			0.949	0.000		**0.9656**	**855.5**	
	296.30	0.0170			1.052	0.001		**1.0706**	**901.1**	
	296.35	0.0173			1.159	0.008		**1.1842**	**948.3**	**5-year storm (Q=1.120m3/s, V=921.8m3 at 296.32m)**
	296.40	0.0175			1.270	0.021		**1.3084**	**997.0**	
	296.45	0.0177			1.383	0.044		**1.4447**	**1047.2**	**Regional storm (Q=1.540m3/s, V=1080.0m3 at 296.48m)**
	296.50	0.0179			1.500	0.077		**1.5945**	**1099.0**	
	296.55	0.0181			1.620	0.121	0.000	**1.7589**	**1152.4**	**25-year storm (Q=1.784m3/s, V=1158.0m3 at 296.56m)**
Freeboard	296.60	0.0183			1.743	0.178	0.081	**2.0195**	**1207.5**	**100-year storm (Q=2.275m3/s, V=1364.0m3 at 296.61m)**
	296.65	0.0185			1.869	0.248	0.247	**2.3829**	**1430.0**	
	296.70	0.0187			1.998	0.333	0.490	**2.8396**	**1487.0**	
	296.75	0.0189			2.130	0.433	0.809	**3.3911**	**1545.4**	
	296.80	0.0191			2.264	0.550	1.208	**4.0406**	**1605.3**	
	296.85	0.0193			2.401	0.683	1.688	**4.7921**	**1666.6**	
Top	296.90	0.0195			2.541	0.835	2.254	**5.6495**	**1729.3**	

Culvert Calculator Report
15-319 SWM Facility Outlet Pipe

Comments: Outlet Pipe sized to convey the attenuated 100-year peak flow rate (2.275cu.m/s) released from the SWM Facility.

Solve For: Headwater Elevation

Culvert Summary

Allowable HW Elevation	296.61	m	Headwater Depth/Height	2.38	
Computed Headwater Eleva	296.38	m	Discharge	2.2750	m³/s
Inlet Control HW Elev.	296.38	m	Tailwater Elevation	294.07	m
Outlet Control HW Elev.	296.05	m	Control Type	Inlet Control	

Grades

Upstream Invert	294.20	m	Downstream Invert	294.07	m
Length	12.50	m	Constructed Slope	0.010400	m/m

Hydraulic Profile

Profile	CompositeM2PressureProfile		Depth, Downstream	0.85	m
Slope Type	Mild		Normal Depth	N/A	m
Flow Regime	Subcritical		Critical Depth	0.85	m
Velocity Downstream	3.59	m/s	Critical Slope	0.012573	m/m

Section

Section Shape	Circular		Mannings Coefficient	0.013	
Section Material	Concrete		Span	0.91	m
Section Size	900 mm		Rise	0.91	m
Number Sections	1				

Outlet Control Properties

Outlet Control HW Elev.	296.05	m	Upstream Velocity Head	0.61	m
Ke	0.50		Entrance Loss	0.31	m

Inlet Control Properties

Inlet Control HW Elev.	296.38	m	Flow Control	Submerged	
Inlet Type	Square edge w/headwall		Area Full	0.7	m²
K	0.00980		HDS 5 Chart	1	
M	2.00000		HDS 5 Scale	1	
C	0.03980		Equation Form	1	
Y	0.67000				

Worksheet for Trapezoidal Channel - Basin Overflow Spillway E-E

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Roughness Coefficient	0.069	
Channel Slope	33.30	%
Normal Depth	0.30	m
Left Side Slope	4.0	H:V
Right Side Slope	4.0	H:V
Bottom Width	2.00	m

Results

Discharge	2.878	m^3/s
Flow Area	0.96	m^2
Wetted Perimeter	4.47	m
Hydraulic Radius	0.21	m
Top Width	4.40	m
Critical Depth	0.44	m
Critical Slope	7.15	%
Velocity	3.00	m/s
Velocity Head	0.46	m
Specific Energy	0.76	m
Froude Number	2.05	
Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	m
Length	0.00	m
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	m
Profile Description		
Profile Headloss	0.00	m
Downstream Velocity	Infinity	m/s
Upstream Velocity	Infinity	m/s
Normal Depth	0.30	m
Critical Depth	0.44	m
Channel Slope	33.30	%

Worksheet for Trapezoidal Channel - Basin Overflow Spillway E-E

GVF Output Data

Critical Slope	7.15	%

Messages

Notes

The governing release rate from the basin is the 100-year design storm controlled peak flow (24 hour SCS Type-II Distribution) which is 2.275cms

The Basin Overflow Spillway Capacity is 2.878cms.

Rating Table for Trapezoidal Channel - Basin Overflow Spillway E-E

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Roughness Coefficient	0.069	
Channel Slope	33.30	%
Normal Depth	0.30	m
Left Side Slope	4.0	H:V
Right Side Slope	4.0	H:V
Bottom Width	2.00	m

Normal Depth (m)	Discharge (m³/s)	Velocity (m/s)	Flow Area (m²)	Wetted Perimeter (m)	Top Width (m)
0.00		0.00	0.00	2.00	2.00
0.01	0.008	0.38	0.02	2.08	2.08
0.02	0.025	0.60	0.04	2.16	2.16
0.03	0.049	0.78	0.06	2.25	2.24
0.04	0.080	0.93	0.09	2.33	2.32
0.05	0.117	1.07	0.11	2.41	2.40
0.06	0.160	1.19	0.13	2.49	2.48
0.07	0.209	1.31	0.16	2.58	2.56
0.08	0.263	1.42	0.19	2.66	2.64
0.09	0.323	1.52	0.21	2.74	2.72
0.10	0.388	1.62	0.24	2.82	2.80
0.11	0.459	1.71	0.27	2.91	2.88
0.12	0.535	1.80	0.30	2.99	2.96
0.13	0.616	1.88	0.33	3.07	3.04
0.14	0.703	1.96	0.36	3.15	3.12
0.15	0.796	2.04	0.39	3.24	3.20
0.16	0.894	2.12	0.42	3.32	3.28
0.17	0.997	2.19	0.46	3.40	3.36
0.18	1.107	2.26	0.49	3.48	3.44
0.19	1.222	2.33	0.52	3.57	3.52
0.20	1.342	2.40	0.56	3.65	3.60
0.21	1.469	2.46	0.60	3.73	3.68
0.22	1.601	2.53	0.63	3.81	3.76

Rating Table for Trapezoidal Channel - Basin Overflow Spillway E-E

Input Data

Normal Depth (m)	Discharge (m³/s)	Velocity (m/s)	Flow Area (m²)	Wetted Perimeter (m)	Top Width (m)
0.23	1.740	2.59	0.67	3.90	3.84
0.24	1.884	2.65	0.71	3.98	3.92
0.25	2.034	2.71	0.75	4.06	4.00
0.26	2.190	2.77	0.79	4.14	4.08
0.27	2.353	2.83	0.83	4.23	4.16
0.28	2.521	2.89	0.87	4.31	4.24
0.29	2.696	2.94	0.92	4.39	4.32
0.30	2.878	3.00	0.96	4.47	4.40

100-yr controlled release rate from the basin is 2.275cms

Cross Section for Trapezoidal Channel - Basin Overflow Spillway E-E

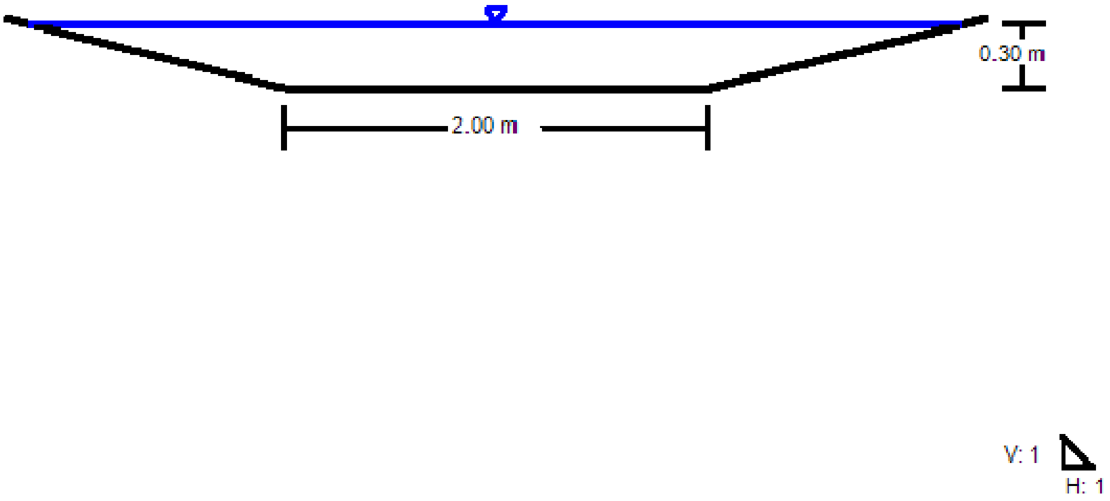
Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Roughness Coefficient	0.069	
Channel Slope	33.30	%
Normal Depth	0.30	m
Left Side Slope	4.0	H:V
Right Side Slope	4.0	H:V
Bottom Width	2.00	m
Discharge	2.878	m³/s

Cross Section Image



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Storm Sewer Design Sheet
Mansfield Ski Club

▭ <<< **Elements Requiring Input Information**

Rational Method Calculation:

$Q = 2.78*(C_F*C*I*A)$

where,

Q = peak flow rate (L/s)

C_F = runoff coefficient factor for storms **> 10-yr** (C_F = 1.0 for the 2, 5 & 10-yr storm events and C_F = 1.1, 1.2 & 1.25 for the 25, 50 & 100-yr storm events respectively)

C = runoff coefficient

I = rainfall intensity (mm/hr)

A = area (ha)

Manning's Formula Calculation:

$V = (k*R^{2/3}*S^{1/2}) / n$ $Q = V*A$

MOE Velocity Requirements: 0.8m/s - 6.0m/s

where,

V = mean velocity (m/s)

k = 1.0 for SI units

R = hydraulic radius (m)

S = friction slope (m/m)

n = Mannings Coefficient **0.013**

Rainfall Intensity Calculation:

$I = A*T^B$

Rainfall IDF Data: http://www.mto.gov.on.ca/IDF_Curves/terms.shtml

where,

I = Rainfall Intensity (mm/hr)

T = Time of Concentration (hr)

A = Rainfall IDF Coefficient

B = Rainfall IDF Coefficient

	5-year	25-year
A =	**27.7**	**37.8**
B =	**-0.699**	**-0.699**
Runoff Coeff. Factors, C_F =	1.00	1.10

Date: **10-Dec-20**
Project No: **15-319**
Prepared by: **AW**

Location			Runoff Calculation Data										Sewer Calculation Data							Sewer Profile Data					
Street	Upstream MH	Downstream MH	Drainage Areas (ha)				Individual 2.78CA	Accumulated 2.78CA	Time of Concentration	Storm Event	Rainfall Intensity	Peak Runoff Flow	Diameter	Slope	Length	Capacity	Velocity	Pipe Flow Time	Pipe Storage Volume	Fall in Sewer	Drop in MH (m)	Top of Grate Elevation (m)		Invert Elevation (m)	
			C = **0.20**	C = **0.40**	C = **0.65**	C = **0.75**			(mins)		(mm/hr)	(L/s)	(mm)	(%)	(m)	(L/s)	(m/s)	(mins)	(m^3)	(m)	DS	US	DS	US	DS
Site Drainage to SWM basin	**CBMH 11**	**CBMH 12**				**0.14**	0.29	0.29	**10.00**	**5-year**	96.92	28.29	**300**	**0.5**	**20.50**	71.33	0.98	0.35	1.5	0.10	**0.05**	**301.82**	301.71	299.95	299.85
	CBMH 12	**CBMH 14**				**0.05**	0.10	0.40	10.35	**5-year**	94.62	37.48	**300**	**0.5**	**26.60**	71.33	0.98	0.45	1.9	0.13	**0.05**	**301.71**	301.53	299.80	299.67
	CBMH 14	**MH 18**				**0.06**	0.13	0.52	10.80	**5-year**	91.83	47.86	**300**	**3.4**	**51.60**	185.47	2.54	0.34	3.8	1.74	**0.05**	**301.53**	299.75	299.62	297.88
	CBMH 21	**CBMH 15**				**0.07**	0.15	0.15	**10.00**	**5-year**	96.92	14.15	**300**	**1.4**	**29.50**	118.08	1.62	0.30	2.2	0.40	**0.05**	**302.71**	302.35	301.10	300.70
	CBMH 15	**CBMH 16**				**0.25**	0.52	0.67	10.30	**5-year**	94.91	63.33	**300**	**4.6**	**17.30**	216.13	2.96	0.10	1.3	0.79	**0.05**	**302.35**	301.36	300.65	299.86
	CBMH 16	**MH 18**				**0.10**	0.21	0.88	10.40	**5-year**	94.29	82.57	**300**	**5.0**	**38.20**	226.48	3.10	0.21	2.8	1.93	**0.05**	**301.36**	299.75	299.81	297.88
										5-year															
	MH 18	**MH 20**				**0.14**	0.29	1.69	11.14	**5-year**	89.87	151.77	**450**	**0.5**	**50.70**	210.32	1.28	0.66	8.3	0.25	**0.05**	**299.75**	300.02	297.83	297.58
	CB 20A	**MH 20**				**0.17**	0.35	0.35	**10.00**	**5-year**	96.92	34.35	**300**	**4.0**	**9.00**	201.76	2.77	0.05	0.7	0.36	**0.40**	**300.19**	300.02	298.29	297.93
	DICB 23	**MH 20**								**25-year**		**1559.00**	**675**	**5.0**	**46.00**	1960.88	5.31	0.14	17.0	2.30	**0.05**	**302.07**	300.02	299.88	297.58
	MH 20	**MH 21**				**0.00**	0.00	2.04	11.80	**25-year**	117.80	1823.77	**675**	**4.5**	**34.50**	1860.26	5.04	0.11	12.7	1.55	**0.03**	**300.02**	297.85	297.53	295.98
	MH 21	**HEADWALL**				**0.00**	0.00	2.04	11.92	**25-year**	117.01	1822.00	**675**	**4.6**	**15.30**	1880.81	5.09	0.05	5.7	0.70	**0.00**	**297.85**	**296.15**	295.95	**295.25**
Septic Effluent Discharge to Pine River	**MH 1**	**MH 2**										**2.50**	**200**	**13.9**	**76.1**	127.57	3.93	0.32	2.5	10.58	**0.90**	**301.43**	290.80	299.88	289.30
	MH 2	**MH 3**										**2.50**	**200**	**16.3**	**50.1**	138.02	4.26	0.20	1.6	8.15	**0.90**	**290.80**	281.75	288.40	280.25
	MH 3	**MH 4**										**2.50**	**200**	**13.2**	**100.5**	124.46	3.84	0.44	3.3	13.30	**0.90**	**281.75**	267.55	279.35	266.05
	MH 4	**MH 5**										**2.50**	**200**	**2.4**	**84.0**	53.45	1.65	0.85	2.7	2.05	**0.05**	**267.55**	264.55	265.15	263.10
	MH 5	**MH 6**										**2.50**	**200**	**3.8**	**49.5**	66.96	2.06	0.40	1.6	1.90	**0.05**	**264.55**	262.65	263.05	261.15
	MH 6	**MH 7**										**2.50**	**200**	**0.9**	**55.9**	31.73	0.98	0.95	1.8	0.48	**0.04**	**262.65**	261.30	261.10	260.62
	MH 7	**MH 8**										**2.50**	**200**	**0.5**	**50.1**	24.19	0.75	1.12	1.6	0.25	**0.03**	**261.30**	260.86	260.58	260.33
	MH 8	**MH 9**										**2.50**	**200**	**0.5**	**37.8**	24.19	0.75	0.84	1.2	0.19	**0.03**	**260.86**	261.05	260.30	260.11
	MH 9	**OUTLET**										**2.50**	**200**	**0.8**	**5.1**	30.60	0.94	0.09	0.2	0.04	**0.00**	**261.05**	**260.04**	260.08	**260.04**
		Sum of Drainage Areas (ha):	0.00	0.00	0.00	0.98																			
		Total Drainage Area (ha):	0.98																						

NOTES:
- The septic effluent forcemain flow (restricted flow through 4-UV systems is 2.5L/s and was provided by Waterloo Biofilter via email on May 14, 2020) and was used to design the Pump Station, forcemain and downstream storm sewer.
- The peak flow into DICB 23 (by-pass swale flow) is 1559L/s and is based on the SWMHYMO hydrologic model (25-yr design storm peak flow based on the 24-hr SCS Type-II storm distribution from the external drainage area (EXT)).

\\WMI-SERVER\wmi-server\Data\Projects\2015\15-319\Design\Storm\Issue_No2\[7_201116_stmdesignsheet_AB.xlsx]STM SHEET

Worksheet for Trapezoidal Channel - External By-Pass Swale A-A

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Roughness Coefficient	0.040	
Channel Slope	1.00	%
Normal Depth	0.50	m
Left Side Slope	3.0	H:V
Right Side Slope	3.0	H:V
Bottom Width	1.00	m

Results

Discharge	1.401	m³/s
Flow Area	1.25	m²
Wetted Perimeter	4.16	m
Hydraulic Radius	0.30	m
Top Width	4.00	m
Critical Depth	0.40	m
Critical Slope	2.59	%
Velocity	1.12	m/s
Velocity Head	0.06	m
Specific Energy	0.56	m
Froude Number	0.64	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	m
Length	0.00	m
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	m
Profile Description		
Profile Headloss	0.00	m
Downstream Velocity	Infinity	m/s
Upstream Velocity	Infinity	m/s
Normal Depth	0.50	m
Critical Depth	0.40	m
Channel Slope	1.00	%

Worksheet for Trapezoidal Channel - External By-Pass Swale A-A

GVF Output Data

Critical Slope	2.59	%

Messages

Notes

The governing 100-year design storm peak flow (24 SCS Type-II Distribution) from the upstream external drainage area is 2.065cms.

Only the downstream section of the External By-pass swale (section graded at 2.4% longitudinal slope) will experience the total 100-year flow noted above. The rest of the External By-pass swale (section graded at 1.0% longitudinal slope) will only receive drainage from the backslope of the existing dry ponds east bank and some local drainage at the upstream end of the swale off of the base of the ski hill which is considerably less runoff.

Rating Table for Trapezoidal Channel - External By-Pass Swale A-A

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Roughness Coefficient	0.040	
Channel Slope	1.00	%
Normal Depth	0.50	m
Left Side Slope	3.0	H:V
Right Side Slope	3.0	H:V
Bottom Width	1.00	m

Normal Depth (m)	Discharge (m³/s)	Velocity (m/s)	Flow Area (m²)	Wetted Perimeter (m)	Top Width (m)
0.00		0.00	0.00	1.00	1.00
0.01	0.001	0.11	0.01	1.06	1.06
0.02	0.004	0.18	0.02	1.13	1.12
0.03	0.007	0.23	0.03	1.19	1.18
0.04	0.012	0.27	0.04	1.25	1.24
0.05	0.018	0.31	0.06	1.32	1.30
0.06	0.024	0.35	0.07	1.38	1.36
0.07	0.032	0.38	0.08	1.44	1.42
0.08	0.040	0.41	0.10	1.51	1.48
0.09	0.050	0.44	0.11	1.57	1.54
0.10	0.060	0.46	0.13	1.63	1.60
0.11	0.071	0.49	0.15	1.70	1.66
0.12	0.084	0.51	0.16	1.76	1.72
0.13	0.097	0.54	0.18	1.82	1.78
0.14	0.111	0.56	0.20	1.89	1.84
0.15	0.126	0.58	0.22	1.95	1.90
0.16	0.142	0.60	0.24	2.01	1.96
0.17	0.159	0.62	0.26	2.08	2.02
0.18	0.178	0.64	0.28	2.14	2.08
0.19	0.197	0.66	0.30	2.20	2.14
0.20	0.217	0.68	0.32	2.26	2.20
0.21	0.238	0.70	0.34	2.33	2.26
0.22	0.261	0.71	0.37	2.39	2.32

Rating Table for Trapezoidal Channel - External By-Pass Swale A-A

Input Data

Normal Depth (m)	Discharge (m^3/s)	Velocity (m/s)	Flow Area (m^2)	Wetted Perimeter (m)	Top Width (m)
0.23	0.284	0.73	0.39	2.45	2.38
0.24	0.309	0.75	0.41	2.52	2.44
0.25	0.335	0.77	0.44	2.58	2.50
0.26	0.362	0.78	0.46	2.64	2.56
0.27	0.390	0.80	0.49	2.71	2.62
0.28	0.420	0.81	0.52	2.77	2.68
0.29	0.450	0.83	0.54	2.83	2.74
0.30	0.482	0.85	0.57	2.90	2.80
0.31	0.515	0.86	0.60	2.96	2.86
0.32	0.549	0.88	0.63	3.02	2.92
0.33	0.585	0.89	0.66	3.09	2.98
0.34	0.622	0.91	0.69	3.15	3.04
0.35	0.660	0.92	0.72	3.21	3.10
0.36	0.700	0.93	0.75	3.28	3.16
0.37	0.741	0.95	0.78	3.34	3.22
0.38	0.783	0.96	0.81	3.40	3.28
0.39	0.826	0.98	0.85	3.47	3.34
0.40	0.871	0.99	0.88	3.53	3.40
0.41	0.918	1.00	0.91	3.59	3.46
0.42	0.966	1.02	0.95	3.66	3.52
0.43	1.015	1.03	0.98	3.72	3.58
0.44	1.066	1.04	1.02	3.78	3.64
0.45	1.118	1.06	1.06	3.85	3.70
0.46	1.172	1.07	1.09	3.91	3.76
0.47	1.227	1.08	1.13	3.97	3.82
0.48	1.283	1.10	1.17	4.04	3.88
0.49	1.342	1.11	1.21	4.10	3.94
0.50	1.401	1.12	1.25	4.16	4.00

68% of total EXT 100-yr flow of 2.065cms which is more than will be directed to this section of the swale

Cross Section for Trapezoidal Channel - External By-Pass Swale A-A

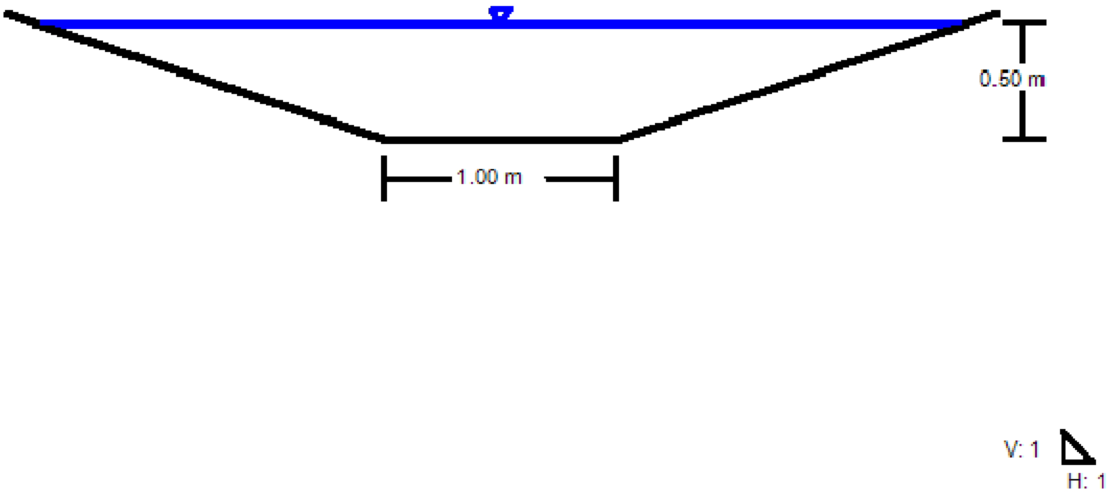
Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Roughness Coefficient	0.040	
Channel Slope	1.00	%
Normal Depth	0.50	m
Left Side Slope	3.0	H:V
Right Side Slope	3.0	H:V
Bottom Width	1.00	m
Discharge	1.401	m³/s

Cross Section Image



Worksheet for Trapezoidal Channel - External By-Pass Swale B-B

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Roughness Coefficient	0.040	
Channel Slope	2.40	%
Normal Depth	0.50	m
Left Side Slope	3.0	H:V
Right Side Slope	3.0	H:V
Bottom Width	1.00	m

Results

Discharge	2.171	m³/s
Flow Area	1.25	m²
Wetted Perimeter	4.16	m
Hydraulic Radius	0.30	m
Top Width	4.00	m
Critical Depth	0.50	m
Critical Slope	2.44	%
Velocity	1.74	m/s
Velocity Head	0.15	m
Specific Energy	0.65	m
Froude Number	0.99	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	m
Length	0.00	m
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	m
Profile Description		
Profile Headloss	0.00	m
Downstream Velocity	Infinity	m/s
Upstream Velocity	Infinity	m/s
Normal Depth	0.50	m
Critical Depth	0.50	m
Channel Slope	2.40	%

Worksheet for Trapezoidal Channel - External By-Pass Swale B-B

GVF Output Data

Critical Slope	2.44	%

Messages

Notes

The governing 100-year design storm peak flow (24 SCS Type-II Distribution) from the upstream external drainage area is 2.065cms.

Section B-B is located at DICBMH 23 which is where the total flow from the upstream external lands (EXT) will be collected.

Rating Table for Trapezoidal Channel - External By-Pass Swale B-B

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Roughness Coefficient	0.040	
Channel Slope	2.40	%
Normal Depth	0.50	m
Left Side Slope	3.0	H:V
Right Side Slope	3.0	H:V
Bottom Width	1.00	m

Normal Depth (m)	Discharge (m³/s)	Velocity (m/s)	Flow Area (m²)	Wetted Perimeter (m)	Top Width (m)
0.00		0.00	0.00	1.00	1.00
0.01	0.002	0.18	0.01	1.06	1.06
0.02	0.006	0.27	0.02	1.13	1.12
0.03	0.012	0.35	0.03	1.19	1.18
0.04	0.019	0.42	0.04	1.25	1.24
0.05	0.028	0.48	0.06	1.32	1.30
0.06	0.038	0.53	0.07	1.38	1.36
0.07	0.050	0.59	0.08	1.44	1.42
0.08	0.063	0.63	0.10	1.51	1.48
0.09	0.077	0.68	0.11	1.57	1.54
0.10	0.093	0.72	0.13	1.63	1.60
0.11	0.111	0.76	0.15	1.70	1.66
0.12	0.130	0.79	0.16	1.76	1.72
0.13	0.150	0.83	0.18	1.82	1.78
0.14	0.172	0.86	0.20	1.89	1.84
0.15	0.195	0.90	0.22	1.95	1.90
0.16	0.220	0.93	0.24	2.01	1.96
0.17	0.247	0.96	0.26	2.08	2.02
0.18	0.275	0.99	0.28	2.14	2.08
0.19	0.305	1.02	0.30	2.20	2.14
0.20	0.336	1.05	0.32	2.26	2.20
0.21	0.369	1.08	0.34	2.33	2.26
0.22	0.404	1.11	0.37	2.39	2.32

Rating Table for Trapezoidal Channel - External By-Pass Swale B-B

Input Data

Normal Depth (m)	Discharge (m³/s)	Velocity (m/s)	Flow Area (m²)	Wetted Perimeter (m)	Top Width (m)
0.23	0.441	1.13	0.39	2.45	2.38
0.24	0.479	1.16	0.41	2.52	2.44
0.25	0.519	1.19	0.44	2.58	2.50
0.26	0.561	1.21	0.46	2.64	2.56
0.27	0.604	1.24	0.49	2.71	2.62
0.28	0.650	1.26	0.52	2.77	2.68
0.29	0.697	1.29	0.54	2.83	2.74
0.30	0.747	1.31	0.57	2.90	2.80
0.31	0.798	1.33	0.60	2.96	2.86
0.32	0.851	1.36	0.63	3.02	2.92
0.33	0.906	1.38	0.66	3.09	2.98
0.34	0.964	1.40	0.69	3.15	3.04
0.35	1.023	1.43	0.72	3.21	3.10
0.36	1.084	1.45	0.75	3.28	3.16
0.37	1.147	1.47	0.78	3.34	3.22
0.38	1.213	1.49	0.81	3.40	3.28
0.39	1.280	1.51	0.85	3.47	3.34
0.40	1.350	1.53	0.88	3.53	3.40
0.41	1.422	1.56	0.91	3.59	3.46
0.42	1.496	1.58	0.95	3.66	3.52
0.43	1.572	1.60	0.98	3.72	3.58
0.44	1.651	1.62	1.02	3.78	3.64
0.45	1.732	1.64	1.06	3.85	3.70
0.46	1.815	1.66	1.09	3.91	3.76
0.47	1.900	1.68	1.13	3.97	3.82
0.48	1.988	1.70	1.17	4.04	3.88
0.49	2.078	1.72	1.21	4.10	3.94
0.50	2.171	1.74	1.25	4.16	4.00

100-yr peak flow
from EXT is
2.065cms

Cross Section for Trapezoidal Channel - External By-Pass Swale B-B

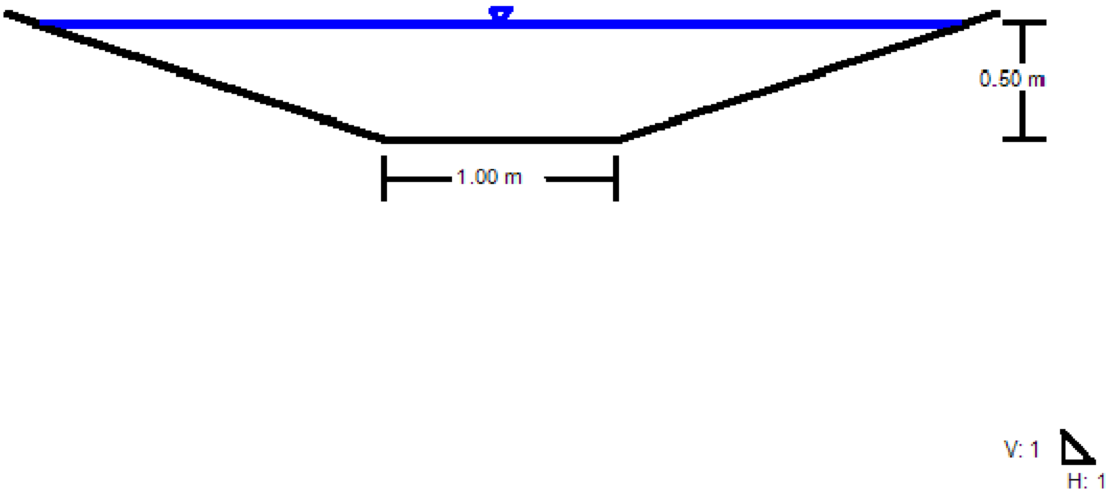
Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Roughness Coefficient	0.040	
Channel Slope	2.40	%
Normal Depth	0.50	m
Left Side Slope	3.0	H:V
Right Side Slope	3.0	H:V
Bottom Width	1.00	m
Discharge	2.171	m³/s

Cross Section Image



Worksheet for External By-Pass Spill Overland Flow

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Roughness Coefficient	0.030	
Channel Slope	6.00	%
Normal Depth	0.10	m
Left Side Slope	50.0	H:V
Right Side Slope	50.0	H:V

Results

Discharge	0.506	m³/s
Flow Area	0.47	m²
Wetted Perimeter	9.67	m
Hydraulic Radius	0.05	m
Top Width	9.67	m
Critical Depth	0.12	m
Critical Slope	2.28	%
Velocity	1.08	m/s
Velocity Head	0.06	m
Specific Energy	0.16	m
Froude Number	1.57	
Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	m
Length	0.00	m
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	m
Profile Description		
Profile Headloss	0.00	m
Downstream Velocity	Infinity	m/s
Upstream Velocity	Infinity	m/s
Normal Depth	0.10	m
Critical Depth	0.12	m
Channel Slope	6.00	%
Critical Slope	2.28	%

Worksheet for External By-Pass Spill Overland Flow

Messages

Notes

The 100-year peak flow from the upstream external drainage area (EXT) is 2.065cms. The External by-pass section storm sewer has been sized to convey the 25-year peak flow (1.559cms) from the external drainage area (EXT).

Therefore, a peak flow of 0.506cms (2.065-1.559cms) has been used to calculate the External By-pass spill (overland flow to the basin).

Rating Table for External By-Pass Spill Overland Flow

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Roughness Coefficient	0.030	
Channel Slope	6.00	%
Normal Depth	0.10	m
Left Side Slope	50.0	H:V
Right Side Slope	50.0	H:V

Normal Depth (m)	Discharge (m³/s)	Velocity (m/s)	Flow Area (m²)	Wetted Perimeter (m)	Top Width (m)
0.00			0.00	0.00	0.00
0.01	0.001	0.24	0.01	1.00	1.00
0.02	0.008	0.38	0.02	2.00	2.00
0.03	0.022	0.50	0.05	3.00	3.00
0.04	0.048	0.60	0.08	4.00	4.00
0.05	0.087	0.70	0.13	5.00	5.00
0.06	0.142	0.79	0.18	6.00	6.00
0.07	0.214	0.87	0.25	7.00	7.00
0.08	0.306	0.95	0.32	8.00	8.00
0.09	0.418	1.03	0.41	9.00	9.00
0.10	0.554	1.11	0.50	10.00	10.00

100yr - 25yr peak flow from EXT is 0.506cms

Cross Section for External By-Pass Spill Overland Flow

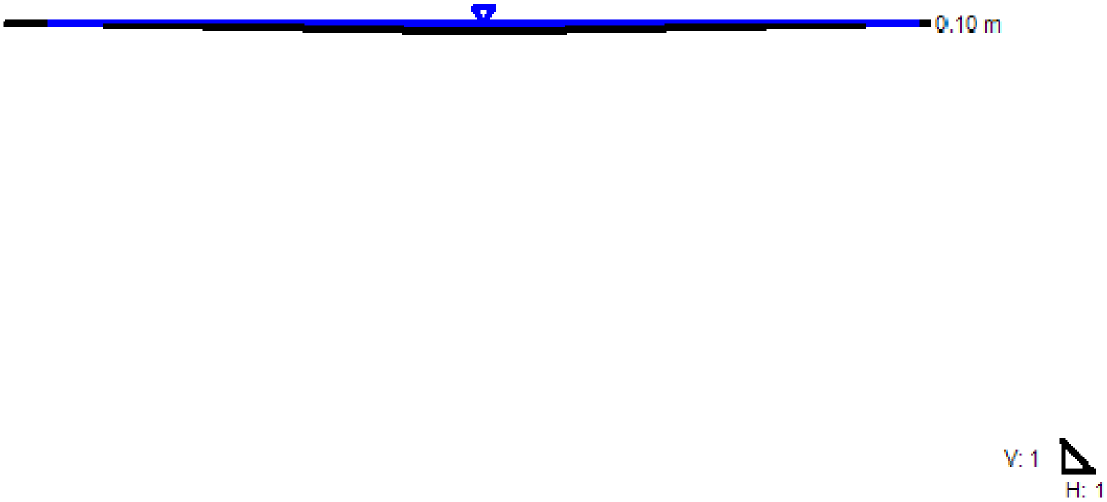
Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Roughness Coefficient	0.030	
Channel Slope	6.00	%
Normal Depth	0.10	m
Left Side Slope	50.0	H:V
Right Side Slope	50.0	H:V
Discharge	0.506	m³/s

Cross Section Image



Worksheet for Trapezoidal Channel - North Enhanced Grass Swale

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Roughness Coefficient	0.040	
Channel Slope	1.00	%
Normal Depth	0.50	m
Left Side Slope	3.0	H:V
Right Side Slope	3.0	H:V
Bottom Width	1.00	m

Results

Discharge	1.401	m³/s
Flow Area	1.25	m²
Wetted Perimeter	4.16	m
Hydraulic Radius	0.30	m
Top Width	4.00	m
Critical Depth	0.40	m
Critical Slope	2.59	%
Velocity	1.12	m/s
Velocity Head	0.06	m
Specific Energy	0.56	m
Froude Number	0.64	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	m
Length	0.00	m
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	m
Profile Description		
Profile Headloss	0.00	m
Downstream Velocity	Infinity	m/s
Upstream Velocity	Infinity	m/s
Normal Depth	0.50	m
Critical Depth	0.40	m
Channel Slope	1.00	%

Worksheet for Trapezoidal Channel - North Enhanced Grass Swale

GVF Output Data

Critical Slope	2.59	%

Messages

Notes

The governing 100-year design storm peak flow (24 hour SCS Type-II Distribution) from the upstream Site drainage area (POST1) is 0.949cms and the 25mm Chicago Storm peak flow is 0.255cms.

Of the 2.74ha of POST1, 0.85ha is captured and conveyed to the basin by the EGS at the east limit of the site since the upstream storm sewer will collect the remaining area during a 25mm design storm event. Considering this, 31% of the above noted flows will be experienced within the EGS.

Pro-ration:
25mm peak flow = 0.079cms

Conservatively the EGS has been designed to accommodate the entire 100-year design storm peak flow from POST1 (0.949cms) although a portion of this will be intercepted and conveyed to the basin via the proposed storm sewer system.

Rating Table for Trapezoidal Channel - North Enhanced Grass Swale

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Roughness Coefficient	0.040	
Channel Slope	1.00	%
Normal Depth	0.50	m
Left Side Slope	3.0	H:V
Right Side Slope	3.0	H:V
Bottom Width	1.00	m

Normal Depth (m)	Discharge (m³/s)	Velocity (m/s)	Flow Area (m²)	Wetted Perimeter (m)	Top Width (m)
0.00		0.00	0.00	1.00	1.00
0.01	0.001	0.11	0.01	1.06	1.06
0.02	0.004	0.18	0.02	1.13	1.12
0.03	0.007	0.23	0.03	1.19	1.18
0.04	0.012	0.27	0.04	1.25	1.24
0.05	0.018	0.31	0.06	1.32	1.30
0.06	0.024	0.35	0.07	1.38	1.36
0.07	0.032	0.38	0.08	1.44	1.42
0.08	0.040	0.41	0.10	1.51	1.48
0.09	0.050	0.44	0.11	1.57	1.54
0.10	0.060	0.46	0.13	1.63	1.60
0.11	0.071	0.49	0.15	1.70	1.66
0.12	0.084	0.51	0.16	1.76	1.72
0.13	0.097	0.54	0.18	1.82	1.78
0.14	0.111	0.56	0.20	1.89	1.84
0.15	0.126	0.58	0.22	1.95	1.90
0.16	0.142	0.60	0.24	2.01	1.96
0.17	0.159	0.62	0.26	2.08	2.02
0.18	0.178	0.64	0.28	2.14	2.08
0.19	0.197	0.66	0.30	2.20	2.14
0.20	0.217	0.68	0.32	2.26	2.20
0.21	0.238	0.70	0.34	2.33	2.26
0.22	0.261	0.71	0.37	2.39	2.32

25mm peak flow to the EGS is 0.079cms

Rating Table for Trapezoidal Channel - North Enhanced Grass Swale

Input Data

Normal Depth (m)	Discharge (m³/s)	Velocity (m/s)	Flow Area (m²)	Wetted Perimeter (m)	Top Width (m)
0.23	0.284	0.73	0.39	2.45	2.38
0.24	0.309	0.75	0.41	2.52	2.44
0.25	0.335	0.77	0.44	2.58	2.50
0.26	0.362	0.78	0.46	2.64	2.56
0.27	0.390	0.80	0.49	2.71	2.62
0.28	0.420	0.81	0.52	2.77	2.68
0.29	0.450	0.83	0.54	2.83	2.74
0.30	0.482	0.85	0.57	2.90	2.80
0.31	0.515	0.86	0.60	2.96	2.86
0.32	0.549	0.88	0.63	3.02	2.92
0.33	0.585	0.89	0.66	3.09	2.98
0.34	0.622	0.91	0.69	3.15	3.04
0.35	0.660	0.92	0.72	3.21	3.10
0.36	0.700	0.93	0.75	3.28	3.16
0.37	0.741	0.95	0.78	3.34	3.22
0.38	0.783	0.96	0.81	3.40	3.28
0.39	0.826	0.98	0.85	3.47	3.34
0.40	0.871	0.99	0.88	3.53	3.40
0.41	0.918	1.00	0.91	3.59	3.46
0.42	0.966	1.02	0.95	3.66	3.52
0.43	1.015	1.03	0.98	3.72	3.58
0.44	1.066	1.04	1.02	3.78	3.64
0.45	1.118	1.06	1.06	3.85	3.70
0.46	1.172	1.07	1.09	3.91	3.76
0.47	1.227	1.08	1.13	3.97	3.82
0.48	1.283	1.10	1.17	4.04	3.88
0.49	1.342	1.11	1.21	4.10	3.94
0.50	1.401	1.12	1.25	4.16	4.00

100-yr peak flow to EGS is 0.949cms (conservative estimate)

Cross Section for Trapezoidal Channel - North Enhanced Grass Swale

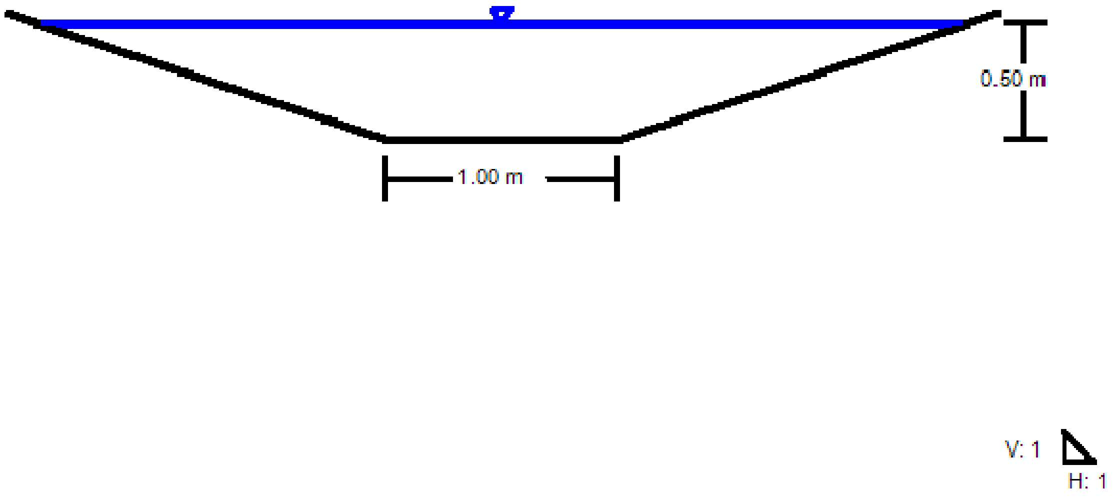
Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Roughness Coefficient	0.040	
Channel Slope	1.00	%
Normal Depth	0.50	m
Left Side Slope	3.0	H:V
Right Side Slope	3.0	H:V
Bottom Width	1.00	m
Discharge	1.401	m³/s

Cross Section Image



Worksheet for Trapezoidal Channel - South Enhanced Grass Swale

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Roughness Coefficient	0.040	
Channel Slope	1.00	%
Normal Depth	0.75	m
Left Side Slope	3.0	H:V
Right Side Slope	3.0	H:V
Bottom Width	1.00	m

Results

Discharge	3.441	m³/s
Flow Area	2.44	m²
Wetted Perimeter	5.74	m
Hydraulic Radius	0.42	m
Top Width	5.50	m
Critical Depth	0.62	m
Critical Slope	2.30	%
Velocity	1.41	m/s
Velocity Head	0.10	m
Specific Energy	0.85	m
Froude Number	0.68	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	m
Length	0.00	m
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	m
Profile Description		
Profile Headloss	0.00	m
Downstream Velocity	Infinity	m/s
Upstream Velocity	Infinity	m/s
Normal Depth	0.75	m
Critical Depth	0.62	m
Channel Slope	1.00	%

Worksheet for Trapezoidal Channel - South Enhanced Grass Swale

GVF Output Data

Critical Slope	2.30	%

Messages

Notes

The governing 100-year design storm peak flow (24 hour SCS Type-II Distribution) from the upstream Site drainage area (POST1) is 0.949cms and the 25mm Chicago Storm peak flow is 0.255cms.

Of the 2.74ha of POST1, 0.85ha is captured and conveyed to the basin by the EGS at the east limit of the site since the upstream storm sewer will collect the remaining area during a 25mm design storm event. Considering this, 31% of the above noted flows will be experienced within the EGS.

Pro-ration:
25mm peak flow = 0.079cms

Conservatively the EGS has been designed to accommodate the entire 100-year design storm peak flow from POST1 (0.949cms) although a portion of this will be intercepted and conveyed to the basin via the proposed storm sewer system.
The downstream portion of the EGS has been sized to convey the External By-pass Spill Overland Flow (0.506cms) and the governing 100-year deisgn peak flow (0.949cms) from POST1 for a total of 1.455cms.

Rating Table for Trapezoidal Channel - South Enhanced Grass Swale

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Roughness Coefficient	0.040	
Channel Slope	1.00	%
Normal Depth	0.75	m
Left Side Slope	3.0	H:V
Right Side Slope	3.0	H:V
Bottom Width	1.00	m

Normal Depth (m)	Discharge (m³/s)	Velocity (m/s)	Flow Area (m²)	Wetted Perimeter (m)	Top Width (m)
0.00		0.00	0.00	1.00	1.00
0.01	0.001	0.11	0.01	1.06	1.06
0.02	0.004	0.18	0.02	1.13	1.12
0.03	0.007	0.23	0.03	1.19	1.18
0.04	0.012	0.27	0.04	1.25	1.24
0.05	0.018	0.31	0.06	1.32	1.30
0.06	0.024	0.35	0.07	1.38	1.36
0.07	0.032	0.38	0.08	1.44	1.42
0.08	0.040	0.41	0.10	1.51	1.48
0.09	0.050	0.44	0.11	1.57	1.54
0.10	0.060	0.46	0.13	1.63	1.60
0.11	0.071	0.49	0.15	1.70	1.66
0.12	0.084	0.51	0.16	1.76	1.72
0.13	0.097	0.54	0.18	1.82	1.78
0.14	0.111	0.56	0.20	1.89	1.84
0.15	0.126	0.58	0.22	1.95	1.90
0.16	0.142	0.60	0.24	2.01	1.96
0.17	0.159	0.62	0.26	2.08	2.02
0.18	0.178	0.64	0.28	2.14	2.08
0.19	0.197	0.66	0.30	2.20	2.14
0.20	0.217	0.68	0.32	2.26	2.20
0.21	0.238	0.70	0.34	2.33	2.26
0.22	0.261	0.71	0.37	2.39	2.32

25mm peak flow to the EGS is 0.079cms

Rating Table for Trapezoidal Channel - South Enhanced Grass Swale

Input Data

Normal Depth (m)	Discharge (m³/s)	Velocity (m/s)	Flow Area (m²)	Wetted Perimeter (m)	Top Width (m)
0.23	0.284	0.73	0.39	2.45	2.38
0.24	0.309	0.75	0.41	2.52	2.44
0.25	0.335	0.77	0.44	2.58	2.50
0.26	0.362	0.78	0.46	2.64	2.56
0.27	0.390	0.80	0.49	2.71	2.62
0.28	0.420	0.81	0.52	2.77	2.68
0.29	0.450	0.83	0.54	2.83	2.74
0.30	0.482	0.85	0.57	2.90	2.80
0.31	0.515	0.86	0.60	2.96	2.86
0.32	0.549	0.88	0.63	3.02	2.92
0.33	0.585	0.89	0.66	3.09	2.98
0.34	0.622	0.91	0.69	3.15	3.04
0.35	0.660	0.92	0.72	3.21	3.10
0.36	0.700	0.93	0.75	3.28	3.16
0.37	0.741	0.95	0.78	3.34	3.22
0.38	0.783	0.96	0.81	3.40	3.28
0.39	0.826	0.98	0.85	3.47	3.34
0.40	0.871	0.99	0.88	3.53	3.40
0.41	0.918	1.00	0.91	3.59	3.46
0.42	0.966	1.02	0.95	3.66	3.52
0.43	1.015	1.03	0.98	3.72	3.58
0.44	1.066	1.04	1.02	3.78	3.64
0.45	1.118	1.06	1.06	3.85	3.70
0.46	1.172	1.07	1.09	3.91	3.76
0.47	1.227	1.08	1.13	3.97	3.82
0.48	1.283	1.10	1.17	4.04	3.88
0.49	1.342	1.11	1.21	4.10	3.94
0.50	1.401	1.12	1.25	4.16	4.00
0.51	1.463	1.13	1.29	4.23	4.06
0.52	1.526	1.15	1.33	4.29	4.12
0.53	1.590	1.16	1.37	4.35	4.18
0.54	1.656	1.17	1.41	4.42	4.24
0.55	1.724	1.18	1.46	4.48	4.30
0.56	1.793	1.19	1.50	4.54	4.36
0.57	1.864	1.21	1.54	4.60	4.42
0.58	1.937	1.22	1.59	4.67	4.48
0.59	2.011	1.23	1.63	4.73	4.54

100-yr peak flow to EGS is 1.455cms (conservative estimate)

Rating Table for Trapezoidal Channel - South Enhanced Grass Swale

Input Data

Normal Depth (m)	Discharge (m³/s)	Velocity (m/s)	Flow Area (m²)	Wetted Perimeter (m)	Top Width (m)
0.60	2.087	1.24	1.68	4.79	4.60
0.61	2.165	1.25	1.73	4.86	4.66
0.62	2.245	1.27	1.77	4.92	4.72
0.63	2.326	1.28	1.82	4.98	4.78
0.64	2.409	1.29	1.87	5.05	4.84
0.65	2.494	1.30	1.92	5.11	4.90
0.66	2.580	1.31	1.97	5.17	4.96
0.67	2.668	1.32	2.02	5.24	5.02
0.68	2.759	1.33	2.07	5.30	5.08
0.69	2.851	1.35	2.12	5.36	5.14
0.70	2.944	1.36	2.17	5.43	5.20
0.71	3.040	1.37	2.22	5.49	5.26
0.72	3.138	1.38	2.28	5.55	5.32
0.73	3.237	1.39	2.33	5.62	5.38
0.74	3.338	1.40	2.38	5.68	5.44
0.75	3.441	1.41	2.44	5.74	5.50

Cross Section for Trapezoidal Channel - South Enhanced Grass Swale

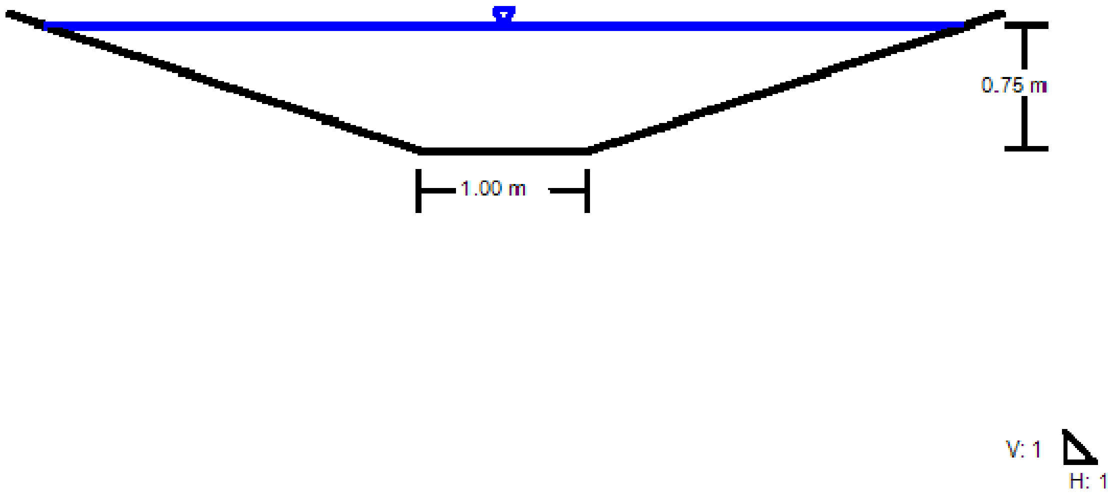
Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Roughness Coefficient	0.040	
Channel Slope	1.00	%
Normal Depth	0.75	m
Left Side Slope	3.0	H:V
Right Side Slope	3.0	H:V
Bottom Width	1.00	m
Discharge	3.441	m³/s

Cross Section Image



Development Export Summary

Development :15-319 Mansfield Ski Club

Pre-Development Phosphorus Export

DEVELOPMENT : 15-319 Mansfield Ski Club

Landuse		Area (ha)	P coeff (kg/ha)	Pload (kg/yr)
Urban				
Commercial		3.86	0.20	0.81
	Urban Land use Class Total :	**3.86**		**0.81**
	Development Total :	**3.86**		**0.81**

Cropland Site Sediment & Phosphorus Pre-Development Export

DEVELOPMENT : 15-319 Mansfield Ski Club

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-Development Phosphorus Export

DEVELOPMENT : 15-319 Mansfield Ski Club

Landuse		Area (ha)	P coeff (kg/ha)	Pload (kg/yr)
Urban				
Commercial		3.63	0.20	1.16
	Urban Land use Class Total :	**3.63**		**1.16**
	Development Total :	**3.63**		**1.16**

12/11/2020

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Updated : Sept 2014

Cropland Site Sediment & Phosphorus Post-Development Export

DEVELOPMENT : 15-319 Mansfield Ski Club

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) :

12/11/2020

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Post Dev BMP

Area (ha)	Treated Area %	P coefficient	P coefficient	P Load Reduction (kg/yr)	Rationale
Best Management Practices (BMP) Applied (and Rationale)					
Commercial					
0.93	100	0.20	65 %	0.12	POST1. Treatment train of enhanced grass swales (55%), and dry detention basin (10%). Total Treatment Train efficiency of (65%)
User Entry					
Commercial					
1.52	100	0.20	10 %	0.03	POST1
Dry Detention Ponds					
Commercial					
0.29	100	0.20	75 %	0.04	POST1. Treatment train of grass filter strips (65%), and dry detention basin (10%). Total Treatment Train efficiency of (75%)
User Entry					
Commercial					
0.89	100	0.20	65 %	0.12	POST2
Vegetated Filter Strips/Stream Buffers					

Updated : Sept 2014

Development Area P and BMP Summary

Total PreDevelopment Area (ha):	3.86
PreDevelopment Area excluding Wetlands (ha):	3.86
Total PostDevelopment Area (ha):	3.63
Total Area treated by BMP's (ha):	3.63
Treated Area total:	3.63
Total PreDevelopment Load (kg/yr):	0.81
Total PostDevelopment Load (kg/yr):	1.16
Total P Load Reduction with BMP's (kg/yr):	0.31
Minimum P Load Reduction Required:	0.35
Total PostDevelopment Load with BMP's (kg/yr)	0.85

Conclusion : Net increase in P load, additional reduction is required.

Updated : Sept 2014

Post Dev Construction

APPENDIX D

HYDROLOGIC MODELING (SWMHYMO)

- **Pre-Development Condition**
- **Post-Development Condition**

SENSITIVITY ANALYSIS COMPARISON CHARTS

ACTUAL

24HR SCS **PRE DEVELOPMENT**

STORM	PRE1	EXT1	PRE1 + EXT1	PRE2
	cms	cms	cms	cms
2	0.154	0.592	0.743	0.100
5	0.261	0.948	1.192	0.165
25	0.446	1.529	1.914	0.280
100	0.598	2.025	2.537	0.373

24HR SCS **POST DEVELOPMENT**

STORM	POST1	EXT1	SWM Facility	STORAGE	POST2
	cms	cms	cms	cum	cms
2	0.378	0.604	0.709	741.9	0.073
5	0.526	0.966	1.120	921.8	0.116
25	0.76	1.559	1.784	1158.0	0.192
100	0.949	2.065	2.275	1364.0	0.251

12HR SCS **PRE DEVELOPMENT**

STORM	PRE1	EXT1	PRE1 + EXT1	PRE2
	cms	cms	cms	cms
2	0.101	0.437	0.538	0.064
5	0.177	0.727	0.902	0.110
25	0.306	1.217	1.511	0.186
100	0.419	1.642	2.038	0.252

12HR SCS **POST DEVELOPMENT**

STORM	POST1	EXT1	SWM Facility	STORAGE	POST2
	cms	cms	cms	cum	cms
2	0.252	0.446	0.536	663.0	0.050
5	0.349	0.742	0.892	823.2	0.08
25	0.499	1.241	1.483	1061.0	0.129
100	0.622	1.674	2.036	1218.0	0.171

6HR SCS **PRE DEVELOPMENT**

STORM	PRE1	EXT1	PRE1 + EXT1	PRE2
	cms	cms	cms	cms
2	0.069	0.304	0.373	0.045
5	0.130	0.537	0.665	0.082
25	0.237	0.942	1.172	0.148
100	0.336	1.307	1.627	0.207

6HR SCS **POST DEVELOPMENT**

STORM	POST1	EXT1	SWM Facility	STORAGE	POST2
	cms	cms	cms	cum	cms
2	0.221	0.310	0.362	580.7	0.037
5	0.309	0.547	0.660	719.7	0.062
25	0.445	0.960	1.140	930.2	0.106
100	0.558	1.333	1.590	1098.0	0.144

4HR CHI **PRE DEVELOPMENT**

STORM	PRE1	EXT1	PRE1 + EXT1	PRE2
	cms	cms	cms	cms
2	0.054	0.224	0.277	0.036
5	0.118	0.424	0.529	0.080
25	0.252	0.795	0.988	0.167
100	0.387	1.146	1.415	0.255

4HR CHI **POST DEVELOPMENT**

STORM	POST1	EXT1	SWM Facility	STORAGE	POST2
	cms	cms	cms	cum	cms
2	0.359	0.229	0.252	525.0	0.032
5	0.516	0.433	0.494	643.6	0.065
25	0.773	0.810	0.915	833.5	0.120
100	0.99	1.168	1.312	998.3	0.182

Pre-Development Condition
24-hour SCS Type-II Storm Distribution

```
2     Metric units
*#******************************************************************************
*#  Project Name: [Mansfield Ski Club]    Project Number: [15-319]
*#  Date        : 07-31-2017
*#  Modeller    : [J. Lightheart]
*#  Company     : WMI & Associates Ltd.
*#  License #   :  2880720
*#******************************************************************************
*
* Pre-Development Condition - Mansfield Ski Club
*
*% 2-year SCS Type-II Storm Dist. based on Mansfield, ON. rainfall (24-hr)
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[1]
*%                   ["2SCS24.stm"] <--storm filename
*%-----------------|-----------------------------------------------------------|
READ STORM          STORM_FILENAME=["STORM.001"]
*%-----------------|-----------------------------------------------------------|
* SITE
* To account for the existing packed gravel surfaces on-site, the TIMP value
* was calibrated (see design calcs)
CALIB STANDHYD      ID=[1], NHYD=["PRE1"], DT=[1](min), AREA=[2.46](ha),
                    XIMP=[0.01], TIMP=[0.24], DWF=[0](cms), LOSS=[2],
                    SCS curve number CN=[81],
                    Pervious   surfaces: IAper=[8.1](mm), SLPP=[10](%),
                                         LGP=[80](m), MNP=[0.25], SCP=[0](min),
                    Impervious surfaces: IAimp=[2.0](mm), SLPI=[2.0](%),
                                         LGI=[100](m), MNI=[0.013], SCI=[0](min),
                    RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
*%-----------------|-----------------------------------------------------------|
* EXTERNAL
CALIB NASHYD        ID=[2], NHYD=["EXT"], DT=[1]min, AREA=[11.71](ha),
                    DWF=[0](cms),  CN/C=[83], IA=[6.8](mm),
                    N=[3], TP=[0.24]hrs,
                    RAINFALL=[ ,  ,  ,  , ](mm/hr),  END=-1
*%-----------------|-----------------------------------------------------------|
* TOTAL
ADD HYD             IDsum=[3], NHYD=["TOTAL"], IDs to add=[1+2]
*%-----------------|-----------------------------------------------------------|
* SITE
* To account for the existing packed gravel surfaces on-site, the TIMP value
* was calibrated (see design calcs)
CALIB STANDHYD      ID=[4], NHYD=["PRE2"], DT=[1](min), AREA=[1.40](ha),
                    XIMP=[0.01], TIMP=[0.24], DWF=[0](cms), LOSS=[2],
                    SCS curve number CN=[81],
                    Pervious   surfaces: IAper=[8.0](mm), SLPP=[13](%),
                                         LGP=[70](m), MNP=[0.25], SCP=[0](min),
                    Impervious surfaces: IAimp=[2.0](mm), SLPI=[3.5](%),
                                         LGI=[45](m), MNI=[0.013], SCI=[0](min),
                    RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
*%-----------------|-----------------------------------------------------------|
*% 5-year SCS Type-II Storm Dist. based on Mansfield, ON. rainfall (24-hr)
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[2]
*%                   ["5SCS24.stm"] <--storm filename
```

```
*%-----------------|-----------------------------------------------------------|
*% 25-year SCS Type-II Storm Dist. based on Mansfield, ON. rainfall (24-hr)
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[3]
*%                   ["25SCS24.stm"] <--storm filename
*%-----------------|-----------------------------------------------------------|
*% 100-year SCS Type-II Storm Dist. based on Mansfield, ON. rainfall (24-hr)
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[4]
*%                   ["100SCS24.stm"] <--storm filename
*%-----------------|-----------------------------------------------------------|
*% Timmins Regional Storm (12-hr)
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[5]
*%                   ["12regtim.o89"] <--storm filename
*%-----------------|-----------------------------------------------------------|
FINISH
```

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

 SSSSS   W   W   M   M   H   H   Y   Y   M   M    OOO          222     000    11   77777 ==
 S       W W W   MM MM   H   H    Y Y    MM MM   O   O           2    0   0   11   7   7
 SSSSS   W W W   M M M   HHHHH     Y     M M M   O   O           2    0   0   11       7
     S    W W    M   M   H   H     Y     M   M   O   O          222     0   0   11      7
 SSSSS    W W    M   M   H   H     Y     M   M    OOO          2       0   0   11     7   ==
                                                               2       0   0   11    7    #
       StormWater Management HYdrologic Model                 222     000    11    7    ==

 ******************************************************************************************
 **************************************  SWMHYMO Ver4.05.0  *******************************
 ******************  A single event and continuous hydrologic simulation model  ***********
 ******************     based on the principles of HYMO and its successors      ***********
 ******************                 OTTHYMO-83 and OTTHYMO-89.                  ***********
 ******************************************************************************************
 ****************** Distributed by:  J.F. Sabourin and Associates Inc.          ***********
 ******************                  Ottawa,  Ontario: (613) 836-3884           ***********
 ******************                  Gatineau, Quebec: (819) 243-6858           ***********
 ******************                  E-Mail: swmhymo@jfsa.com                   ***********
 ******************************************************************************************

 ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
 ++++++++++++++++++ Licensed user: WMI & Associates Ltd.                        +++++++++++
 ++++++++++++++++++                Barrie                SERIAL#:2880720        +++++++++++
 ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

 ******************************************************************************************
 ******************           ++++++ PROGRAM ARRAY DIMENSIONS ++++++            ***********
 ******************           Maximum value for ID numbers  :     11            ***********
 ******************           Max. number of rainfall points: 105408            ***********
 ******************           Max. number of flow points    : 105408            ***********
 ******************************************************************************************


 *******************************   D E T A I L E D   O U T P U T   ************************
 ******************************************************************************************
 *                 RUN DATE: 2020-11-16     TIME: 11:19:20     RUN COUNTER: 000002
 ******************************************************************************************
 * Input   file: C:\Temp\15-319\EX\24-hour_SCS\2-CYRSCS.dat
 * Output  file: C:\Temp\15-319\EX\24-hour_SCS\2-CYRSCS.out
 * Summary file: C:\Temp\15-319\EX\24-hour_SCS\2-CYRSCS.sum
 * User comments:
 * 1:______________________________________________________________________________________
 * 2:______________________________________________________________________________________
 * 3:______________________________________________________________________________________
 ******************************************************************************************

-------------------------------------------------------------------------------------------
R0001:C00001-------------------------------------------------------------------------------
*#******************************************************************************
*#  Project Name: [Mansfield Ski Club]    Project Number: [15-319]
*#  Date        : 07-31-2017
```

```
*#  Modeller    : [J. Lightheart]
*#  Company     : WMI & Associates Ltd.
*#  License #   :  2880720
*#******************************************************************************
*
* Pre-Development Condition - Mansfield Ski Club
*
--------------------
| START            | Project  dir.:C:\Temp\15-319\EX\24-hour_SCS\
-------------------- Rainfall dir.:C:\Temp\15-319\EX\24-hour_SCS\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 0001
    NSTORM=   1
           #  1=2SCS24.stm
-------------------------------------------------------------------------------------------
R0001:C00002-------------------------------------------------------------------------------
--------------------
| READ STORM       |  Filename: C:\Temp\15-319\EX\24-hour_SCS\2SCS24.stm
| Ptotal=  54.70 mm|  Comments: 2-Year SCS Type-II Storm Distribution (24-hour) Mansfield,
--------------------
      TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME
     hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm
      0:12    .547|   4:12   1.094|   8:12   1.641|  12:12  10.940|  16:12   1.368|  20:12
      0:24    .547|   4:24   1.094|   8:24   1.641|  12:24   6.838|  16:24   1.367|  20:24
      0:36    .547|   4:36   1.094|   8:36   1.641|  12:36   4.923|  16:36   1.367|  20:36
      0:48    .547|   4:48   1.094|   8:48   1.641|  12:48   4.650|  16:48   1.367|  20:48
      1:00    .547|   5:00   1.094|   9:00   1.641|  13:00   3.282|  17:00    .820|  21:00
      1:12    .547|   5:12   1.094|   9:12   1.641|  13:12   2.735|  17:12    .821|  21:12
      1:24    .547|   5:24   1.094|   9:24   1.641|  13:24   2.735|  17:24   1.094|  21:24
      1:36    .547|   5:36   1.094|   9:36   1.641|  13:36   2.735|  17:36    .821|  21:36
      1:48    .547|   5:48   1.094|   9:48   1.641|  13:48   2.735|  17:48   1.094|  21:48
      2:00    .547|   6:00   1.094|  10:00   1.641|  14:00   2.735|  18:00    .821|  22:00
      2:12    .547|   6:12   1.094|  10:12   3.008|  14:12   1.641|  18:12    .821|  22:12
      2:24    .547|   6:24   1.094|  10:24   3.009|  14:24   1.641|  18:24    .820|  22:24
      2:36    .547|   6:36   1.094|  10:36   3.008|  14:36   1.641|  18:36   1.094|  22:36
      2:48    .547|   6:48   1.094|  10:48   3.009|  14:48   1.641|  18:48    .821|  22:48
      3:00    .547|   7:00   1.094|  11:00   3.008|  15:00   1.641|  19:00    .821|  23:00
      3:12    .547|   7:12   1.094|  11:12   4.102|  15:12   1.367|  19:12   1.094|  23:12
      3:24    .547|   7:24   1.094|  11:24   6.017|  15:24   1.367|  19:24    .821|  23:24
      3:36    .547|   7:36   1.094|  11:36  14.495|  15:36   1.367|  19:36   1.094|  23:36
      3:48    .547|   7:48   1.094|  11:48  30.085|  15:48   1.367|  19:48    .821|  23:48
      4:00    .547|   8:00   1.094|  12:00  61.538|  16:00   1.367|  20:00   1.094|  24:00

-------------------------------------------------------------------------------------------
R0001:C00003-------------------------------------------------------------------------------
* SITE
* To account for the existing packed gravel surfaces on-site, the TIMP value
* was calibrated (see design calcs)
--------------------------
| CALIB STANDHYD         |   Area    (ha)=    2.46
| 01:PRE1       DT= 1.00 |   Total Imp(%)=   24.00   Dir. Conn.(%)=    1.00
--------------------------
```

```
                                    IMPERVIOUS    PERVIOUS (i)
           Surface Area     (ha)=        .59         1.87
           Dep. Storage     (mm)=       2.00         8.10
           Average Slope     (%)=       2.00        10.00
           Length            (m)=     100.00        80.00
           Mannings n          =        .013         .250

           Max.eff.Inten.(mm/hr)=      61.54        45.14
                      over (min)        3.00        12.00
           Storage Coeff.  (min)=       2.52 (ii)   11.59 (ii)
           Unit Hyd. Tpeak (min)=       3.00        12.00
           Unit Hyd. peak  (cms)=        .42          .10
                                                                   *TOTALS*
           PEAK FLOW       (cms)=        .00          .15            .154 (iii)
           TIME TO PEAK    (hrs)=      12.00        12.10          12.100
           RUNOFF VOLUME    (mm)=      52.70        24.94          25.225
           TOTAL RAINFALL   (mm)=      54.70        54.70          54.700
           RUNOFF COEFFICIENT   =        .96          .46            .461

             (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
                 CN* =  81.0    Ia = Dep. Storage  (Above)
            (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
           (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

      -------------------------------------------------------------------------------------------
      R0001:C00004-------------------------------------------------------------------------------
      * EXTERNAL
      --------------------------
      | CALIB NASHYD           |   Area    (ha)=   11.710   Curve Number   (CN)= 83.00
      | 02:EXT        DT= 1.00 |   Ia      (mm)=    6.800   # of Linear Res.(N)=  3.00
      --------------------------   U.H. Tp(hrs)=     .240

           Unit Hyd Qpeak  (cms)=    1.864

           PEAK FLOW       (cms)=     .592 (i)
           TIME TO PEAK    (hrs)=   12.150
           DURATION        (hrs)=   25.667, (dddd|hh:mm:)=   1|01:40
           AVERAGE FLOW    (cms)=     .029
           RUNOFF VOLUME    (mm)=   22.962
           TOTAL RAINFALL   (mm)=   54.700
           RUNOFF COEFFICIENT   =     .420

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

      -------------------------------------------------------------------------------------------
      R0001:C00005-------------------------------------------------------------------------------
      * TOTAL
      ------------------------
      | ADD HYD              |
      | 03:TOTAL             |   ID:NHYD            AREA     QPEAK    TPEAK      R.V.     DWF
      ------------------------                      (ha)     (cms)    (hrs)      (mm)   (cms)
                           ID 1 01:PRE1           2.460      .154   12.100    25.225    .000
                          +ID 2 02:EXT           11.710      .592   12.150    22.962    .000
```

```
                           ===================================================================
                           SUM   03:TOTAL         14.170      .743   12.133    23.355    .000

         NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

      -------------------------------------------------------------------------------------------
      R0001:C00006-------------------------------------------------------------------------------
      * SITE
      * To account for the existing packed gravel surfaces on-site, the TIMP value
      * was calibrated (see design calcs)
      --------------------------
      | CALIB STANDHYD         |   Area    (ha)=    1.40
      | 04:PRE2       DT= 1.00 |   Total Imp(%)=   24.00   Dir. Conn.(%)=    1.00
      --------------------------
                                    IMPERVIOUS    PERVIOUS (i)
           Surface Area     (ha)=        .34         1.06
           Dep. Storage     (mm)=       2.00         8.00
           Average Slope     (%)=       3.50        13.00
           Length            (m)=      45.00        70.00
           Mannings n          =        .013         .250

           Max.eff.Inten.(mm/hr)=      61.54        46.83
                      over (min)        1.00         9.00
           Storage Coeff.  (min)=       1.32 (ii)    8.95 (ii)
           Unit Hyd. Tpeak (min)=       1.00         9.00
           Unit Hyd. peak  (cms)=        .90          .13
                                                                   *TOTALS*
           PEAK FLOW       (cms)=        .00          .10            .100 (iii)
           TIME TO PEAK    (hrs)=      12.00        12.07          12.067
           RUNOFF VOLUME    (mm)=      52.58        25.01          25.281
           TOTAL RAINFALL   (mm)=      54.70        54.70          54.700
           RUNOFF COEFFICIENT   =        .96          .46            .462

             (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
                 CN* =  81.0    Ia = Dep. Storage  (Above)
            (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
           (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

      -------------------------------------------------------------------------------------------
      R0001:C00007-------------------------------------------------------------------------------
        ** END OF RUN :    0

      *******************************************************************************************




      --------------------
      | START            | Project  dir.:C:\Temp\15-319\EX\24-hour_SCS\
      -------------------- Rainfall dir.:C:\Temp\15-319\EX\24-hour_SCS\
          TZERO =   .00 hrs on        0
          METOUT=   2 (output = METRIC)
```

```
          NRUN  = 0002
          NSTORM=   1
                 #  1=5SCS24.stm
    ---------------------------------------------------------------------------------------------
    R0002:C00002---------------------------------------------------------------------------------
    *#*************************************************************************************
    *#  Project Name: [Mansfield Ski Club]    Project Number: [15-319]
    *#  Date        : 07-31-2017
    *#  Modeller    : [J. Lightheart]
    *#  Company     : WMI & Associates Ltd.
    *#  License #   :  2880720
    *#*************************************************************************************
    *
    * Pre-Development Condition - Mansfield Ski Club
    *
    ---------------------------------------------------------------------------------------------
    R0002:C00002---------------------------------------------------------------------------------
    --------------------
    | READ STORM       |  Filename: C:\Temp\15-319\EX\24-hour_SCS\5SCS24.stm
    | Ptotal=  72.10 mm|  Comments: 5-Year SCS Type-II Storm Distribution (24-hour) Mansfield,
    --------------------
          TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME
         hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm
          0:12    .721|   4:12   1.442|   8:12   2.163|  12:12  14.420|  16:12   1.803|  20:12
          0:24    .721|   4:24   1.442|   8:24   2.163|  12:24   9.013|  16:24   1.802|  20:24
          0:36    .721|   4:36   1.442|   8:36   2.163|  12:36   6.489|  16:36   1.802|  20:36
          0:48    .721|   4:48   1.442|   8:48   2.163|  12:48   6.129|  16:48   1.802|  20:48
          1:00    .721|   5:00   1.442|   9:00   2.163|  13:00   4.326|  17:00   1.081|  21:00
          1:12    .721|   5:12   1.442|   9:12   2.163|  13:12   3.605|  17:12   1.082|  21:12
          1:24    .721|   5:24   1.442|   9:24   2.163|  13:24   3.605|  17:24   1.442|  21:24
          1:36    .721|   5:36   1.442|   9:36   2.163|  13:36   3.605|  17:36   1.082|  21:36
          1:48    .721|   5:48   1.442|   9:48   2.163|  13:48   3.605|  17:48   1.442|  21:48
          2:00    .721|   6:00   1.442|  10:00   2.163|  14:00   3.605|  18:00   1.082|  22:00
          2:12    .721|   6:12   1.442|  10:12   3.965|  14:12   2.163|  18:12   1.082|  22:12
          2:24    .721|   6:24   1.442|  10:24   3.966|  14:24   2.163|  18:24   1.081|  22:24
          2:36    .721|   6:36   1.442|  10:36   3.965|  14:36   2.163|  18:36   1.442|  22:36
          2:48    .721|   6:48   1.442|  10:48   3.966|  14:48   2.163|  18:48   1.082|  22:48
          3:00    .721|   7:00   1.442|  11:00   3.965|  15:00   2.163|  19:00   1.082|  23:00
          3:12    .721|   7:12   1.442|  11:12   5.408|  15:12   1.802|  19:12   1.442|  23:12
          3:24    .721|   7:24   1.442|  11:24   7.931|  15:24   1.802|  19:24   1.082|  23:24
          3:36    .721|   7:36   1.442|  11:36  19.106|  15:36   1.802|  19:36   1.442|  23:36
          3:48    .721|   7:48   1.442|  11:48  39.655|  15:48   1.802|  19:48   1.082|  23:48
          4:00    .721|   8:00   1.442|  12:00  81.113|  16:00   1.802|  20:00   1.442|  24:00

    ---------------------------------------------------------------------------------------------
    R0002:C00003---------------------------------------------------------------------------------
    * SITE
    * To account for the existing packed gravel surfaces on-site, the TIMP value
    * was calibrated (see design calcs)
    --------------------------
    | CALIB STANDHYD         |   Area    (ha)=    2.46
    | 01:PRE1       DT= 1.00 |   Total Imp(%)=   24.00   Dir. Conn.(%)=    1.00
    --------------------------
```

```
                                    IMPERVIOUS    PERVIOUS (i)
         Surface Area     (ha)=        .59         1.87
         Dep. Storage     (mm)=       2.00         8.10
         Average Slope     (%)=       2.00        10.00
         Length            (m)=     100.00        80.00
         Mannings n           =       .013         .250

         Max.eff.Inten.(mm/hr)=      81.11        71.18
                    over (min)       2.00        10.00
         Storage Coeff.  (min)=       2.26 (ii)    9.82 (ii)
         Unit Hyd. Tpeak (min)=       2.00        10.00
         Unit Hyd. peak  (cms)=        .52          .11
                                                                *TOTALS*
         PEAK FLOW      (cms)=        .01          .26           .261 (iii)
         TIME TO PEAK   (hrs)=      12.00        12.07         12.067
         RUNOFF VOLUME   (mm)=      70.10        38.88         39.198
         TOTAL RAINFALL  (mm)=      72.10        72.10         72.101
         RUNOFF COEFFICIENT   =        .97          .54           .544

           (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
               CN* =  81.0    Ia = Dep. Storage  (Above)
          (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
         (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

    ---------------------------------------------------------------------------------------------
    R0002:C00004---------------------------------------------------------------------------------
    * EXTERNAL
    --------------------------
    | CALIB NASHYD           |   Area    (ha)=   11.710   Curve Number   (CN)= 83.00
    | 02:EXT        DT= 1.00 |   Ia      (mm)=    6.800   # of Linear Res.(N)=  3.00
    --------------------------   U.H. Tp(hrs)=     .240

         Unit Hyd Qpeak  (cms)=    1.864

         PEAK FLOW      (cms)=     .948 (i)
         TIME TO PEAK   (hrs)=   12.133
         DURATION       (hrs)=   25.667, (dddd|hh:mm:)=   1|01:40
         AVERAGE FLOW   (cms)=     .046
         RUNOFF VOLUME   (mm)=   36.345
         TOTAL RAINFALL  (mm)=   72.101
         RUNOFF COEFFICIENT   =     .504

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

    ---------------------------------------------------------------------------------------------
    R0002:C00005---------------------------------------------------------------------------------
    * TOTAL
    ------------------------
    | ADD HYD              |
    | 03:TOTAL             |   ID:NHYD           AREA     QPEAK    TPEAK      R.V.     DWF
    ------------------------                     (ha)     (cms)    (hrs)      (mm)   (cms)
                          ID 1 01:PRE1          2.460      .261   12.067    39.198    .000
                         +ID 2 02:EXT          11.710      .948   12.133    36.345    .000
```

```
                     ==================================================================
                     SUM   03:TOTAL         14.170     1.192   12.117    36.840    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------------------
R0002:C00006-------------------------------------------------------------------------------
* SITE
* To account for the existing packed gravel surfaces on-site, the TIMP value
* was calibrated (see design calcs)
--------------------------
| CALIB STANDHYD         |   Area    (ha)=    1.40
| 04:PRE2       DT= 1.00 |   Total Imp(%)=   24.00   Dir. Conn.(%)=    1.00
--------------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .34         1.06
     Dep. Storage     (mm)=       2.00         8.00
     Average Slope     (%)=       3.50        13.00
     Length            (m)=      45.00        70.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      81.11        72.46
                over (min)       1.00         8.00
     Storage Coeff.  (min)=       1.18 (ii)    7.59 (ii)
     Unit Hyd. Tpeak (min)=       1.00         8.00
     Unit Hyd. peak  (cms)=        .97          .15
                                                             *TOTALS*
     PEAK FLOW       (cms)=        .00          .16           .165 (iii)
     TIME TO PEAK    (hrs)=      11.93        12.05         12.033
     RUNOFF VOLUME    (mm)=      70.02        38.95         39.260
     TOTAL RAINFALL   (mm)=      72.10        72.10         72.101
     RUNOFF COEFFICIENT   =        .97          .54           .545

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
             CN* =  81.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------------------
R0002:C00007-------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------
R0002:C00002-------------------------------------------------------------------------------
  ** END OF RUN :    1

*******************************************************************************************




--------------------
| START            | Project  dir.:C:\Temp\15-319\EX\24-hour_SCS\
-------------------- Rainfall dir.:C:\Temp\15-319\EX\24-hour_SCS\
```

```
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 0003
    NSTORM=   1
           #  1=25SCS24.stm
-------------------------------------------------------------------------------------------
R0003:C00002-------------------------------------------------------------------------------
*#******************************************************************************
*#  Project Name: [Mansfield Ski Club]    Project Number: [15-319]
*#  Date        : 07-31-2017
*#  Modeller    : [J. Lightheart]
*#  Company     : WMI & Associates Ltd.
*#  License #   :  2880720
*#******************************************************************************
*
* Pre-Development Condition - Mansfield Ski Club
*
-------------------------------------------------------------------------------------------
R0003:C00002-------------------------------------------------------------------------------
--------------------
| READ STORM       |  Filename: C:\Temp\15-319\EX\24-hour_SCS\25SCS24.stm
| Ptotal=  98.40 mm|  Comments: 25-Year SCS Type-II Storm Distribution (24-hour) Mansfield,
--------------------
      TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME
     hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm
      0:12    .984|   4:12   1.968|   8:12   2.952|  12:12  19.680|  16:12   2.460|  20:12
      0:24    .984|   4:24   1.968|   8:24   2.952|  12:24  12.300|  16:24   2.460|  20:24
      0:36    .984|   4:36   1.968|   8:36   2.952|  12:36   8.856|  16:36   2.460|  20:36
      0:48    .984|   4:48   1.968|   8:48   2.952|  12:48   8.364|  16:48   2.460|  20:48
      1:00    .984|   5:00   1.968|   9:00   2.952|  13:00   5.904|  17:00   1.476|  21:00
      1:12    .984|   5:12   1.968|   9:12   2.952|  13:12   4.920|  17:12   1.476|  21:12
      1:24    .984|   5:24   1.968|   9:24   2.952|  13:24   4.920|  17:24   1.968|  21:24
      1:36    .984|   5:36   1.968|   9:36   2.952|  13:36   4.920|  17:36   1.476|  21:36
      1:48    .984|   5:48   1.968|   9:48   2.952|  13:48   4.920|  17:48   1.968|  21:48
      2:00    .984|   6:00   1.968|  10:00   2.952|  14:00   4.920|  18:00   1.476|  22:00
      2:12    .984|   6:12   1.968|  10:12   5.412|  14:12   2.952|  18:12   1.476|  22:12
      2:24    .984|   6:24   1.968|  10:24   5.412|  14:24   2.952|  18:24   1.476|  22:24
      2:36    .984|   6:36   1.968|  10:36   5.412|  14:36   2.952|  18:36   1.968|  22:36
      2:48    .984|   6:48   1.968|  10:48   5.412|  14:48   2.952|  18:48   1.476|  22:48
      3:00    .984|   7:00   1.968|  11:00   5.412|  15:00   2.952|  19:00   1.476|  23:00
      3:12    .984|   7:12   1.968|  11:12   7.380|  15:12   2.460|  19:12   1.968|  23:12
      3:24    .984|   7:24   1.968|  11:24  10.824|  15:24   2.460|  19:24   1.476|  23:24
      3:36    .984|   7:36   1.968|  11:36  26.076|  15:36   2.460|  19:36   1.968|  23:36
      3:48    .984|   7:48   1.968|  11:48  54.120|  15:48   2.460|  19:48   1.476|  23:48
      4:00    .984|   8:00   1.968|  12:00 110.700|  16:00   2.460|  20:00   1.968|  24:00

-------------------------------------------------------------------------------------------
R0003:C00003-------------------------------------------------------------------------------
* SITE
* To account for the existing packed gravel surfaces on-site, the TIMP value
* was calibrated (see design calcs)
--------------------------
| CALIB STANDHYD         |   Area    (ha)=    2.46
```

```
      | 01:PRE1       DT= 1.00 |   Total Imp(%)=   24.00   Dir. Conn.(%)=    1.00
      -------------------------
                                IMPERVIOUS    PERVIOUS (i)
           Surface Area     (ha)=        .59        1.87
           Dep. Storage     (mm)=       2.00        8.10
           Average Slope     (%)=       2.00       10.00
           Length            (m)=     100.00       80.00
           Mannings n           =       .013        .250

           Max.eff.Inten.(mm/hr)=     110.70      112.01
                      over (min)        2.00        8.00
           Storage Coeff.  (min)=       1.99 (ii)    8.30 (ii)
           Unit Hyd. Tpeak (min)=       2.00        8.00
           Unit Hyd. peak  (cms)=        .56         .14
                                                              *TOTALS*
           PEAK FLOW       (cms)=        .01         .44           .446 (iii)
           TIME TO PEAK    (hrs)=      12.00       12.05         12.033
           RUNOFF VOLUME    (mm)=      96.40       61.61         61.961
           TOTAL RAINFALL   (mm)=      98.40       98.40         98.399
           RUNOFF COEFFICIENT   =        .98         .63           .630

             (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
                 CN* =  81.0    Ia = Dep. Storage  (Above)
            (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
           (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

      -------------------------------------------------------------------------------------------
      R0003:C00004-------------------------------------------------------------------------------
      * EXTERNAL
      -------------------------
      | CALIB NASHYD           |   Area    (ha)=   11.710   Curve Number   (CN)= 83.00
      | 02:EXT        DT= 1.00 |   Ia      (mm)=    6.800   # of Linear Res.(N)=  3.00
      -------------------------   U.H. Tp(hrs)=     .240

           Unit Hyd Qpeak  (cms)=    1.864

           PEAK FLOW       (cms)=    1.529 (i)
           TIME TO PEAK    (hrs)=   12.133
           DURATION        (hrs)=   25.667, (dddd|hh:mm:)=   1|01:40
           AVERAGE FLOW    (cms)=     .074
           RUNOFF VOLUME    (mm)=   58.420
           TOTAL RAINFALL   (mm)=   98.399
           RUNOFF COEFFICIENT   =     .594

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

      -------------------------------------------------------------------------------------------
      R0003:C00005-------------------------------------------------------------------------------
      * TOTAL
      ------------------------
      | ADD HYD              |
      | 03:TOTAL             |   ID:NHYD           AREA     QPEAK    TPEAK      R.V.     DWF
      ------------------------                     (ha)     (cms)    (hrs)      (mm)   (cms)
```

```
                            ID 1 01:PRE1           2.460      .446   12.033    61.961    .000
                           +ID 2 02:EXT           11.710     1.529   12.133    58.420    .000
                           ==================================================================
                           SUM   03:TOTAL         14.170     1.914   12.100    59.034    .000

         NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

      -------------------------------------------------------------------------------------------
      R0003:C00006-------------------------------------------------------------------------------
      * SITE
      * To account for the existing packed gravel surfaces on-site, the TIMP value
      * was calibrated (see design calcs)
      -------------------------
      | CALIB STANDHYD         |   Area    (ha)=    1.40
      | 04:PRE2       DT= 1.00 |   Total Imp(%)=   24.00   Dir. Conn.(%)=    1.00
      -------------------------
                                IMPERVIOUS    PERVIOUS (i)
           Surface Area     (ha)=        .34        1.06
           Dep. Storage     (mm)=       2.00        8.00
           Average Slope     (%)=       3.50       13.00
           Length            (m)=      45.00       70.00
           Mannings n           =       .013        .250

           Max.eff.Inten.(mm/hr)=     110.70      113.33
                      over (min)        1.00        6.00
           Storage Coeff.  (min)=       1.04 (ii)    6.40 (ii)
           Unit Hyd. Tpeak (min)=       1.00        6.00
           Unit Hyd. peak  (cms)=       1.05         .18
                                                              *TOTALS*
           PEAK FLOW       (cms)=        .00         .28           .280 (iii)
           TIME TO PEAK    (hrs)=      11.92       12.02         12.017
           RUNOFF VOLUME    (mm)=      96.28       61.68         62.027
           TOTAL RAINFALL   (mm)=      98.40       98.40         98.399
           RUNOFF COEFFICIENT   =        .98         .63           .630

             (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
                 CN* =  81.0    Ia = Dep. Storage  (Above)
            (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
           (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

      -------------------------------------------------------------------------------------------
      R0003:C00007-------------------------------------------------------------------------------
      -------------------------------------------------------------------------------------------
      R0003:C00002-------------------------------------------------------------------------------
      -------------------------------------------------------------------------------------------
      R0003:C00002-------------------------------------------------------------------------------
        ** END OF RUN :    2

      *******************************************************************************************
```

```
--------------------
| START            | Project  dir.:C:\Temp\15-319\EX\24-hour_SCS\
-------------------- Rainfall dir.:C:\Temp\15-319\EX\24-hour_SCS\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 0004
    NSTORM=   1
           #  1=100SCS24.stm
-------------------------------------------------------------------------------------------
R0004:C00002-------------------------------------------------------------------------------
*#*****************************************************************************
*#  Project Name: [Mansfield Ski Club]    Project Number: [15-319]
*#  Date        : 07-31-2017
*#  Modeller    : [J. Lightheart]
*#  Company     : WMI & Associates Ltd.
*#  License #   :  2880720
*#*****************************************************************************
*
* Pre-Development Condition - Mansfield Ski Club
*
-------------------------------------------------------------------------------------------
R0004:C00002-------------------------------------------------------------------------------
--------------------
| READ STORM       |  Filename: C:\Temp\15-319\EX\24-hour_SCS\100SCS24.stm
| Ptotal= 120.00 mm|  Comments: 100-Year SCS Type-II Storm Distribution (24-hour)
--------------------
      TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME
     hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm
      0:12   1.200|   4:12   2.400|   8:12   3.600|  12:12  24.000|  16:12   3.000|  20:12
      0:24   1.200|   4:24   2.400|   8:24   3.600|  12:24  15.000|  16:24   3.000|  20:24
      0:36   1.200|   4:36   2.400|   8:36   3.600|  12:36  10.800|  16:36   3.000|  20:36
      0:48   1.200|   4:48   2.400|   8:48   3.600|  12:48  10.200|  16:48   3.000|  20:48
      1:00   1.200|   5:00   2.400|   9:00   3.600|  13:00   7.200|  17:00   1.800|  21:00
      1:12   1.200|   5:12   2.400|   9:12   3.600|  13:12   6.000|  17:12   1.800|  21:12
      1:24   1.200|   5:24   2.400|   9:24   3.600|  13:24   6.000|  17:24   2.400|  21:24
      1:36   1.200|   5:36   2.400|   9:36   3.600|  13:36   6.000|  17:36   1.800|  21:36
      1:48   1.200|   5:48   2.400|   9:48   3.600|  13:48   6.000|  17:48   2.400|  21:48
      2:00   1.200|   6:00   2.400|  10:00   3.600|  14:00   6.000|  18:00   1.800|  22:00
      2:12   1.200|   6:12   2.400|  10:12   6.600|  14:12   3.600|  18:12   1.800|  22:12
      2:24   1.200|   6:24   2.400|  10:24   6.600|  14:24   3.600|  18:24   1.800|  22:24
      2:36   1.200|   6:36   2.400|  10:36   6.600|  14:36   3.600|  18:36   2.400|  22:36
      2:48   1.200|   6:48   2.400|  10:48   6.600|  14:48   3.600|  18:48   1.800|  22:48
      3:00   1.200|   7:00   2.400|  11:00   6.600|  15:00   3.600|  19:00   1.800|  23:00
      3:12   1.200|   7:12   2.400|  11:12   9.000|  15:12   3.000|  19:12   2.400|  23:12
      3:24   1.200|   7:24   2.400|  11:24  13.200|  15:24   3.000|  19:24   1.800|  23:24
      3:36   1.200|   7:36   2.400|  11:36  31.800|  15:36   3.000|  19:36   2.400|  23:36
      3:48   1.200|   7:48   2.400|  11:48  66.000|  15:48   3.000|  19:48   1.800|  23:48
      4:00   1.200|   8:00   2.400|  12:00 135.000|  16:00   3.000|  20:00   2.400|  24:00

-------------------------------------------------------------------------------------------
R0004:C00003-------------------------------------------------------------------------------
* SITE
```

```
* To account for the existing packed gravel surfaces on-site, the TIMP value
* was calibrated (see design calcs)
--------------------------
| CALIB STANDHYD         |   Area    (ha)=    2.46
| 01:PRE1       DT= 1.00 |   Total Imp(%)=   24.00   Dir. Conn.(%)=    1.00
--------------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .59         1.87
     Dep. Storage     (mm)=       2.00         8.10
     Average Slope     (%)=       2.00        10.00
     Length            (m)=     100.00        80.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=     135.00       145.09
                over (min)       2.00         8.00
     Storage Coeff.  (min)=       1.84 (ii)    7.53 (ii)
     Unit Hyd. Tpeak (min)=       2.00         8.00
     Unit Hyd. peak  (cms)=        .59          .15
                                                          *TOTALS*
     PEAK FLOW       (cms)=        .01          .59           .598 (iii)
     TIME TO PEAK    (hrs)=      12.00        12.03         12.033
     RUNOFF VOLUME    (mm)=     118.00        81.15         81.527
     TOTAL RAINFALL   (mm)=     120.00       120.00        120.000
     RUNOFF COEFFICIENT   =        .98          .68           .679

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  81.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------------------
R0004:C00004-------------------------------------------------------------------------------
* EXTERNAL
--------------------------
| CALIB NASHYD           |   Area    (ha)=   11.710   Curve Number   (CN)= 83.00
| 02:EXT        DT= 1.00 |   Ia      (mm)=    6.800   # of Linear Res.(N)=  3.00
--------------------------   U.H. Tp(hrs)=     .240

     Unit Hyd Qpeak  (cms)=    1.864

     PEAK FLOW       (cms)=    2.025 (i)
     TIME TO PEAK    (hrs)=   12.133
     DURATION        (hrs)=   25.667, (dddd|hh:mm:)=   1|01:40
     AVERAGE FLOW    (cms)=     .098
     RUNOFF VOLUME    (mm)=   77.557
     TOTAL RAINFALL   (mm)=  120.000
     RUNOFF COEFFICIENT   =     .646

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

-------------------------------------------------------------------------------------------
R0004:C00005-------------------------------------------------------------------------------
* TOTAL
```

```
------------------------
| ADD HYD              |
| 03:TOTAL             |   ID:NHYD            AREA     QPEAK    TPEAK      R.V.     DWF
------------------------                      (ha)     (cms)    (hrs)      (mm)   (cms)
                      ID 1 01:PRE1           2.460      .598   12.033    81.527    .000
                     +ID 2 02:EXT           11.710     2.025   12.133    77.557    .000
                     ==================================================================
                     SUM   03:TOTAL         14.170     2.537   12.100    78.246    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------------------
R0004:C00006-------------------------------------------------------------------------------
* SITE
* To account for the existing packed gravel surfaces on-site, the TIMP value
* was calibrated (see design calcs)
--------------------------
| CALIB STANDHYD         |   Area    (ha)=    1.40
| 04:PRE2       DT= 1.00 |   Total Imp(%)=   24.00   Dir. Conn.(%)=    1.00
--------------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .34        1.06
     Dep. Storage     (mm)=       2.00        8.00
     Average Slope     (%)=       3.50       13.00
     Length            (m)=      45.00       70.00
     Mannings n           =       .013        .250

     Max.eff.Inten.(mm/hr)=     135.00      146.45
                over (min)        1.00        6.00
     Storage Coeff.  (min)=        .96 (ii)    5.80 (ii)
     Unit Hyd. Tpeak (min)=       1.00        6.00
     Unit Hyd. peak  (cms)=       1.10         .19
                                                           *TOTALS*
     PEAK FLOW       (cms)=        .01         .37           .373 (iii)
     TIME TO PEAK    (hrs)=      11.92       12.02         12.017
     RUNOFF VOLUME    (mm)=     117.92       81.22         81.596
     TOTAL RAINFALL   (mm)=     120.00      120.00        120.000
     RUNOFF COEFFICIENT   =        .98         .68           .680

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  81.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------------------
R0004:C00007-------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------
R0004:C00002-------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------
R0004:C00002-------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------
R0004:C00002-------------------------------------------------------------------------------
  ** END OF RUN :    3
```

```
*******************************************************************************************




--------------------
| START            | Project  dir.:C:\Temp\15-319\EX\24-hour_SCS\
-------------------- Rainfall dir.:C:\Temp\15-319\EX\24-hour_SCS\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 0005
    NSTORM=   1
           #  1=12regtim.o89
-------------------------------------------------------------------------------------------
R0005:C00002-------------------------------------------------------------------------------
*#******************************************************************************
*#  Project Name: [Mansfield Ski Club]    Project Number: [15-319]
*#  Date        : 07-31-2017
*#  Modeller    : [J. Lightheart]
*#  Company     : WMI & Associates Ltd.
*#  License #   :  2880720
*#******************************************************************************
*
* Pre-Development Condition - Mansfield Ski Club
*
-------------------------------------------------------------------------------------------
R0005:C00002-------------------------------------------------------------------------------
--------------------
| READ STORM       |  Filename: C:\Temp\15-319\EX\24-hour_SCS\12regtim.o89
| Ptotal= 193.00 mm|  Comments: TIMMINS REGIONAL STORM (12-hour)
--------------------
      TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME
     hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm
      1:00  15.000|   3:00  10.000|   5:00   5.000|   7:00  43.000|   9:00  23.000|  11:00
      2:00  20.000|   4:00   3.000|   6:00  20.000|   8:00  20.000|  10:00  13.000|  12:00

-------------------------------------------------------------------------------------------
R0005:C00003-------------------------------------------------------------------------------
* SITE
* To account for the existing packed gravel surfaces on-site, the TIMP value
* was calibrated (see design calcs)
--------------------------
| CALIB STANDHYD         |   Area    (ha)=    2.46
| 01:PRE1       DT= 1.00 |   Total Imp(%)=   24.00   Dir. Conn.(%)=    1.00
--------------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .59        1.87
     Dep. Storage     (mm)=       2.00        8.10
     Average Slope     (%)=       2.00       10.00
     Length            (m)=     100.00       80.00
     Mannings n           =       .013        .250
```

```
           Max.eff.Inten.(mm/hr)=      43.00        50.88
                      over (min)        3.00        12.00
           Storage Coeff.  (min)=       2.91 (ii)   11.56 (ii)
           Unit Hyd. Tpeak (min)=       3.00        12.00
           Unit Hyd. peak  (cms)=        .39          .10
                                                                 *TOTALS*
           PEAK FLOW       (cms)=        .00          .26           .262 (iii)
           TIME TO PEAK    (hrs)=       6.95         7.00          7.000
           RUNOFF VOLUME    (mm)=     191.00       150.04        150.449
           TOTAL RAINFALL   (mm)=     193.00       193.00        193.000
           RUNOFF COEFFICIENT   =        .99          .78           .780

             (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
                 CN* =  81.0    Ia = Dep. Storage  (Above)
            (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
           (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

      -------------------------------------------------------------------------------------------
      R0005:C00004-------------------------------------------------------------------------------
      * EXTERNAL
      --------------------------
      | CALIB NASHYD           |   Area    (ha)=   11.710   Curve Number   (CN)= 83.00
      | 02:EXT       DT= 1.00 |   Ia      (mm)=    6.800   # of Linear Res.(N)=  3.00
      --------------------------   U.H. Tp(hrs)=     .240

           Unit Hyd Qpeak  (cms)=    1.864

           PEAK FLOW       (cms)=    1.215 (i)
           TIME TO PEAK    (hrs)=    7.017
           DURATION        (hrs)=   13.667, (dddd|hh:mm:)=   0|13:40
           AVERAGE FLOW    (cms)=     .346
           RUNOFF VOLUME    (mm)=  145.537
           TOTAL RAINFALL   (mm)=  193.000
           RUNOFF COEFFICIENT   =     .754

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

      -------------------------------------------------------------------------------------------
      R0005:C00005-------------------------------------------------------------------------------
      * TOTAL
      ------------------------
      | ADD HYD              |
      | 03:TOTAL             |   ID:NHYD            AREA     QPEAK    TPEAK      R.V.     DWF
      ------------------------                      (ha)     (cms)    (hrs)      (mm)   (cms)
                            ID 1 01:PRE1           2.460      .262    7.000   150.449    .000
                           +ID 2 02:EXT           11.710     1.215    7.017   145.537    .000
                           ==================================================================
                           SUM   03:TOTAL         14.170     1.477    7.017   146.390    .000

         NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

      -------------------------------------------------------------------------------------------
```

```
      R0005:C00006-------------------------------------------------------------------------------
      * SITE
      * To account for the existing packed gravel surfaces on-site, the TIMP value
      * was calibrated (see design calcs)
      --------------------------
      | CALIB STANDHYD         |   Area    (ha)=    1.40
      | 04:PRE2       DT= 1.00 |   Total Imp(%)=   24.00   Dir. Conn.(%)=    1.00
      --------------------------
                                    IMPERVIOUS    PERVIOUS (i)
           Surface Area     (ha)=        .34         1.06
           Dep. Storage     (mm)=       2.00         8.00
           Average Slope     (%)=       3.50        13.00
           Length            (m)=      45.00        70.00
           Mannings n           =       .013         .250

           Max.eff.Inten.(mm/hr)=      43.00        50.96
                      over (min)        2.00         9.00
           Storage Coeff.  (min)=       1.52 (ii)    8.90 (ii)
           Unit Hyd. Tpeak (min)=       2.00         9.00
           Unit Hyd. peak  (cms)=        .66          .13
                                                                 *TOTALS*
           PEAK FLOW       (cms)=        .00          .15           .151 (iii)
           TIME TO PEAK    (hrs)=       6.87         7.00          7.000
           RUNOFF VOLUME    (mm)=     191.00       150.11        150.522
           TOTAL RAINFALL   (mm)=     193.00       193.00        193.000
           RUNOFF COEFFICIENT   =        .99          .78           .780

             (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
                 CN* =  81.0    Ia = Dep. Storage  (Above)
            (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
           (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

      -------------------------------------------------------------------------------------------
      R0005:C00007-------------------------------------------------------------------------------
      -------------------------------------------------------------------------------------------
      R0005:C00002-------------------------------------------------------------------------------
      -------------------------------------------------------------------------------------------
      R0005:C00002-------------------------------------------------------------------------------
      -------------------------------------------------------------------------------------------
      R0005:C00002-------------------------------------------------------------------------------
      -------------------------------------------------------------------------------------------
      R0005:C00002-------------------------------------------------------------------------------
      --------------------
      | FINISH           |
      --------------------
      -------------------------------------------------------------------------------------------
      *******************************************************************************************
           WARNINGS / ERRORS / NOTES
           -------------------------
         Simulation ended on 2020-11-16     at 11:19:20
      ===========================================================================================
```

Pre-Development Condition
12-hour SCS Type-II Storm Distribution

```
2     Metric units
*#******************************************************************************
*#  Project Name: [Mansfield Ski Club]    Project Number: [15-319]
*#  Date        : 07-31-2017
*#  Modeller    : [J. Lightheart]
*#  Company     : WMI & Associates Ltd.
*#  License #   :  2880720
*#******************************************************************************
*
* Pre-Development Condition - Mansfield Ski Club
*
*% 2-year SCS Type-II Storm Dist. based on Mansfield, ON. rainfall (12-hr)
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[1]
*%                   ["2SCS12.stm"] <--storm filename
*%-----------------|-----------------------------------------------------------|
READ STORM          STORM_FILENAME=["STORM.001"]
*%-----------------|-----------------------------------------------------------|
* SITE
* To account for the existing packed gravel surfaces on-site, the TIMP value
* was calibrated (see design calcs)
CALIB STANDHYD      ID=[1], NHYD=["PRE1"], DT=[1](min), AREA=[2.46](ha),
                    XIMP=[0.01], TIMP=[0.24], DWF=[0](cms), LOSS=[2],
                    SCS curve number CN=[81],
                    Pervious   surfaces: IAper=[8.1](mm), SLPP=[10](%),
                                         LGP=[80](m), MNP=[0.25], SCP=[0](min),
                    Impervious surfaces: IAimp=[2.0](mm), SLPI=[2.0](%),
                                         LGI=[100](m), MNI=[0.013], SCI=[0](min),
                    RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
*%-----------------|-----------------------------------------------------------|
* EXTERNAL
CALIB NASHYD        ID=[2], NHYD=["EXT"], DT=[1]min, AREA=[11.71](ha),
                    DWF=[0](cms),  CN/C=[83], IA=[6.8](mm),
                    N=[3], TP=[0.24]hrs,
                    RAINFALL=[ ,  ,  ,  , ](mm/hr),  END=-1
*%-----------------|-----------------------------------------------------------|
* TOTAL
ADD HYD             IDsum=[3], NHYD=["TOTAL"], IDs to add=[1+2]
*%-----------------|-----------------------------------------------------------|
* SITE
* To account for the existing packed gravel surfaces on-site, the TIMP value
* was calibrated (see design calcs)
CALIB STANDHYD      ID=[4], NHYD=["PRE2"], DT=[1](min), AREA=[1.40](ha),
                    XIMP=[0.01], TIMP=[0.24], DWF=[0](cms), LOSS=[2],
                    SCS curve number CN=[81],
                    Pervious   surfaces: IAper=[8.0](mm), SLPP=[13](%),
                                         LGP=[70](m), MNP=[0.25], SCP=[0](min),
                    Impervious surfaces: IAimp=[2.0](mm), SLPI=[3.5](%),
                                         LGI=[45](m), MNI=[0.013], SCI=[0](min),
                    RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
*%-----------------|-----------------------------------------------------------|
*% 5-year SCS Type-II Storm Dist. based on Mansfield, ON. rainfall (12-hr)
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[2]
*%                   ["5SCS12.stm"] <--storm filename
```

```
*%-----------------|-----------------------------------------------------------|
*% 25-year SCS Type-II Storm Dist. based on Mansfield, ON. rainfall (12-hr)
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[3]
*%                   ["25SCS12.stm"] <--storm filename
*%-----------------|-----------------------------------------------------------|
*% 100-year SCS Type-II Storm Dist. based on Mansfield, ON. rainfall (12-hr)
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[4]
*%                   ["100SCS12.stm"] <--storm filename
*%-----------------|-----------------------------------------------------------|
*% Timmins Regional Storm (12-hr)
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[5]
*%                   ["12regtim.o89"] <--storm filename
*%-----------------|-----------------------------------------------------------|
FINISH
```

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

 SSSSS   W   W   M   M   H   H   Y   Y   M   M    OOO          222     000    11   77777 ==
 S       W W W   MM MM   H   H    Y Y    MM MM   O   O           2     0   0  11   7   7
 SSSSS   W W W   M M M   HHHHH     Y     M M M   O   O           2     0   0  11       7
     S    W W    M   M   H   H     Y     M   M   O   O        222      0   0  11      7
 SSSSS    W W    M   M   H   H     Y     M   M    OOO         2        0   0  11     7   ==
                                                              2        0   0  11    7    #
       StormWater Management HYdrologic Model                  222     000    11    7    ==

 ******************************************************************************************
 *************************************  SWMHYMO Ver4.05.0  *******************************
 ******************  A single event and continuous hydrologic simulation model  ***********
 ******************    based on the principles of HYMO and its successors      ***********
 ******************                OTTHYMO-83 and OTTHYMO-89.                  ***********
 ******************************************************************************************
 ****************** Distributed by:  J.F. Sabourin and Associates Inc.         ***********
 ******************                  Ottawa,  Ontario: (613) 836-3884          ***********
 ******************                  Gatineau, Quebec: (819) 243-6858          ***********
 ******************                  E-Mail: swmhymo@jfsa.com                  ***********
 ******************************************************************************************

 ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
 ++++++++++++++++++ Licensed user: WMI & Associates Ltd.                       +++++++++++
 ++++++++++++++++++               Barrie                SERIAL#:2880720        +++++++++++
 ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

 ******************************************************************************************
 ******************           ++++++ PROGRAM ARRAY DIMENSIONS ++++++           ***********
 ******************           Maximum value for ID numbers  :     11           ***********
 ******************           Max. number of rainfall points: 105408           ***********
 ******************           Max. number of flow points    : 105408           ***********
 ******************************************************************************************


 *******************************   D E T A I L E D   O U T P U T   ***********************
 ******************************************************************************************
 *                 RUN DATE: 2020-11-16     TIME: 11:20:26     RUN COUNTER: 000004
 ******************************************************************************************
 * Input   file: C:\Temp\15-319\EX\12-hour_SCS\2-CYRSCS.dat
 * Output  file: C:\Temp\15-319\EX\12-hour_SCS\2-CYRSCS.out
 * Summary file: C:\Temp\15-319\EX\12-hour_SCS\2-CYRSCS.sum
 * User comments:
 * 1:_______________________________________________________________________________________
 * 2:_______________________________________________________________________________________
 * 3:_______________________________________________________________________________________
 ******************************************************************************************

-------------------------------------------------------------------------------------------
R0001:C00001-------------------------------------------------------------------------------
*#******************************************************************************
*#  Project Name: [Mansfield Ski Club]    Project Number: [15-319]
*#  Date        : 07-31-2017
```

```
*#  Modeller    : [J. Lightheart]
*#  Company     : WMI & Associates Ltd.
*#  License #   :  2880720
*#******************************************************************************
*
* Pre-Development Condition - Mansfield Ski Club
*
--------------------
| START            | Project  dir.:C:\Temp\15-319\EX\12-hour_SCS\
-------------------- Rainfall dir.:C:\Temp\15-319\EX\12-hour_SCS\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 0001
    NSTORM=   1
           #  1=2SCS12.stm
-------------------------------------------------------------------------------------------
R0001:C00002-------------------------------------------------------------------------------
--------------------
| READ STORM       |  Filename: C:\Temp\15-319\EX\12-hour_SCS\2SCS12.stm
| Ptotal=  44.40 mm|  Comments: 2-Year SCS Type-II Storm Distribution (12-hour) Mansfield,
--------------------
       TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME
      hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm
       0:30    .888|   2:30   1.776|   4:30   2.664|   6:30   7.992|   8:30   1.776|  10:30
       1:00    .888|   3:00   1.776|   5:00   3.552|   7:00   3.552|   9:00   1.776|  11:00
       1:30    .888|   3:30   1.776|   5:30   5.328|   7:30   2.664|   9:30   1.776|  11:30
       2:00    .888|   4:00   1.776|   6:00  39.960|   8:00   2.664|  10:00    .888|  12:00

-------------------------------------------------------------------------------------------
R0001:C00003-------------------------------------------------------------------------------
* SITE
* To account for the existing packed gravel surfaces on-site, the TIMP value
* was calibrated (see design calcs)
--------------------------
| CALIB STANDHYD         |   Area    (ha)=    2.46
| 01:PRE1       DT= 1.00 |   Total Imp(%)=   24.00   Dir. Conn.(%)=    1.00
--------------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .59         1.87
     Dep. Storage     (mm)=       2.00         8.10
     Average Slope     (%)=       2.00        10.00
     Length            (m)=     100.00        80.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      39.96        26.88
                over (min)        3.00        14.00
     Storage Coeff.  (min)=       2.99 (ii)   14.16 (ii)
     Unit Hyd. Tpeak (min)=       3.00        14.00
     Unit Hyd. peak  (cms)=        .38          .08
                                                            *TOTALS*
     PEAK FLOW       (cms)=        .00          .10           .101 (iii)
     TIME TO PEAK    (hrs)=       5.77         6.10          6.100
     RUNOFF VOLUME    (mm)=      42.40        17.37         17.622
```

```
     TOTAL RAINFALL   (mm)=      44.40        44.40         44.400
     RUNOFF COEFFICIENT   =        .95          .39           .397

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  81.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------------------
R0001:C00004-------------------------------------------------------------------------------
* EXTERNAL
--------------------------
| CALIB NASHYD           |   Area    (ha)=   11.710   Curve Number   (CN)= 83.00
| 02:EXT        DT= 1.00 |   Ia      (mm)=    6.800   # of Linear Res.(N)=  3.00
--------------------------   U.H. Tp(hrs)=     .240

     Unit Hyd Qpeak  (cms)=    1.864

     PEAK FLOW       (cms)=     .437 (i)
     TIME TO PEAK    (hrs)=    6.117
     DURATION        (hrs)=   13.667, (dddd|hh:mm:)=   0|13:40
     AVERAGE FLOW    (cms)=     .038
     RUNOFF VOLUME    (mm)=   15.774
     TOTAL RAINFALL   (mm)=   44.400
     RUNOFF COEFFICIENT   =     .355

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

-------------------------------------------------------------------------------------------
R0001:C00005-------------------------------------------------------------------------------
* TOTAL
------------------------
| ADD HYD              |
| 03:TOTAL             |   ID:NHYD            AREA     QPEAK    TPEAK      R.V.     DWF
------------------------                      (ha)     (cms)    (hrs)      (mm)   (cms)
                      ID 1 01:PRE1           2.460      .101    6.100    17.622    .000
                     +ID 2 02:EXT           11.710      .437    6.117    15.774    .000
                     ==================================================================
                     SUM   03:TOTAL         14.170      .538    6.117    16.095    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------------------
R0001:C00006-------------------------------------------------------------------------------
* SITE
* To account for the existing packed gravel surfaces on-site, the TIMP value
* was calibrated (see design calcs)
--------------------------
| CALIB STANDHYD         |   Area    (ha)=    1.40
| 04:PRE2       DT= 1.00 |   Total Imp(%)=   24.00   Dir. Conn.(%)=    1.00
--------------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .34         1.06
```

```
     Dep. Storage     (mm)=       2.00         8.00
     Average Slope     (%)=       3.50        13.00
     Length            (m)=      45.00        70.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      39.96        27.73
                over (min)        2.00        11.00
     Storage Coeff.  (min)=       1.57 (ii)   10.97 (ii)
     Unit Hyd. Tpeak (min)=       2.00        11.00
     Unit Hyd. peak  (cms)=        .65          .10
                                                          *TOTALS*
     PEAK FLOW       (cms)=        .00          .06           .064 (iii)
     TIME TO PEAK    (hrs)=       5.68         6.07          6.067
     RUNOFF VOLUME    (mm)=      42.40        17.43         17.676
     TOTAL RAINFALL   (mm)=      44.40        44.40         44.400
     RUNOFF COEFFICIENT   =        .95          .39           .398

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  81.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------------------
R0001:C00007-------------------------------------------------------------------------------
  ** END OF RUN :    0

*******************************************************************************************




--------------------
| START            | Project  dir.:C:\Temp\15-319\EX\12-hour_SCS\
-------------------- Rainfall dir.:C:\Temp\15-319\EX\12-hour_SCS\
    TZERO =   .00 hrs on       0
    METOUT=   2 (output = METRIC)
    NRUN  = 0002
    NSTORM=   1
           #  1=5SCS12.stm
-------------------------------------------------------------------------------------------
R0002:C00002-------------------------------------------------------------------------------
*#*******************************************************************************
*#  Project Name: [Mansfield Ski Club]    Project Number: [15-319]
*#  Date        : 07-31-2017
*#  Modeller    : [J. Lightheart]
*#  Company     : WMI & Associates Ltd.
*#  License #   :  2880720
*#*******************************************************************************
*
* Pre-Development Condition - Mansfield Ski Club
*
-------------------------------------------------------------------------------------------
```

```
R0002:C00002-------------------------------------------------------------------------------
--------------------
| READ STORM       |  Filename: C:\Temp\15-319\EX\12-hour_SCS\5SCS12.stm
| Ptotal=  58.50 mm|  Comments: 5-Year SCS Type-II Storm Distribution (12-hour) Mansfield,
--------------------
      TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME
     hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm
      0:30   1.170|   2:30   2.340|   4:30   3.510|   6:30  10.530|   8:30   2.340|  10:30
      1:00   1.170|   3:00   2.340|   5:00   4.680|   7:00   4.680|   9:00   2.340|  11:00
      1:30   1.170|   3:30   2.340|   5:30   7.020|   7:30   3.510|   9:30   2.340|  11:30
      2:00   1.170|   4:00   2.340|   6:00  52.650|   8:00   3.510|  10:00   1.170|  12:00

-------------------------------------------------------------------------------------------
R0002:C00003-------------------------------------------------------------------------------
* SITE
* To account for the existing packed gravel surfaces on-site, the TIMP value
* was calibrated (see design calcs)
--------------------------
| CALIB STANDHYD        |   Area    (ha)=    2.46
| 01:PRE1       DT= 1.00 |   Total Imp(%)=   24.00   Dir. Conn.(%)=    1.00
--------------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .59         1.87
     Dep. Storage     (mm)=       2.00         8.10
     Average Slope     (%)=       2.00        10.00
     Length            (m)=     100.00        80.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      52.65        43.09
                over (min)        3.00        12.00
     Storage Coeff.  (min)=       2.68 (ii)   11.93 (ii)
     Unit Hyd. Tpeak (min)=       3.00        12.00
     Unit Hyd. peak  (cms)=        .41          .09
                                                           *TOTALS*
     PEAK FLOW       (cms)=        .00          .17           .177 (iii)
     TIME TO PEAK    (hrs)=       5.75         6.07          6.067
     RUNOFF VOLUME    (mm)=      56.50        27.89         28.172
     TOTAL RAINFALL   (mm)=      58.50        58.50         58.500
     RUNOFF COEFFICIENT   =        .97          .48           .482

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  81.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------------------
R0002:C00004-------------------------------------------------------------------------------
* EXTERNAL
--------------------------
| CALIB NASHYD          |   Area    (ha)=   11.710   Curve Number   (CN)= 83.00
| 02:EXT        DT= 1.00 |   Ia      (mm)=    6.800   # of Linear Res.(N)=  3.00
--------------------------   U.H. Tp(hrs)=     .240
```

```
     Unit Hyd Qpeak  (cms)=    1.864

     PEAK FLOW       (cms)=     .727 (i)
     TIME TO PEAK    (hrs)=    6.100
     DURATION        (hrs)=   13.667, (dddd|hh:mm:)=   0|13:40
     AVERAGE FLOW    (cms)=     .061
     RUNOFF VOLUME    (mm)=   25.769
     TOTAL RAINFALL   (mm)=   58.500
     RUNOFF COEFFICIENT   =     .440

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

-------------------------------------------------------------------------------------------
R0002:C00005-------------------------------------------------------------------------------
* TOTAL
------------------------
| ADD HYD              |
| 03:TOTAL             |   ID:NHYD            AREA     QPEAK    TPEAK      R.V.     DWF
                                              (ha)     (cms)    (hrs)      (mm)   (cms)
------------------------
                      ID 1 01:PRE1           2.460      .177    6.067    28.172    .000
                     +ID 2 02:EXT           11.710      .727    6.100    25.769    .000
                     ==================================================================
                     SUM   03:TOTAL         14.170      .902    6.100    26.186    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------------------
R0002:C00006-------------------------------------------------------------------------------
* SITE
* To account for the existing packed gravel surfaces on-site, the TIMP value
* was calibrated (see design calcs)
--------------------------
| CALIB STANDHYD        |   Area    (ha)=    1.40
| 04:PRE2       DT= 1.00 |   Total Imp(%)=   24.00   Dir. Conn.(%)=    1.00
--------------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .34         1.06
     Dep. Storage     (mm)=       2.00         8.00
     Average Slope     (%)=       3.50        13.00
     Length            (m)=      45.00        70.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      52.65        44.06
                over (min)        1.00         9.00
     Storage Coeff.  (min)=       1.40 (ii)    9.22 (ii)
     Unit Hyd. Tpeak (min)=       1.00         9.00
     Unit Hyd. peak  (cms)=        .87          .12
                                                           *TOTALS*
     PEAK FLOW       (cms)=        .00          .11           .110 (iii)
     TIME TO PEAK    (hrs)=       5.63         6.03          6.033
     RUNOFF VOLUME    (mm)=      56.31        27.95         28.230
     TOTAL RAINFALL   (mm)=      58.50        58.50         58.500
     RUNOFF COEFFICIENT   =        .96          .48           .483
```

```
       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  81.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

---------------------------------------------------------------------------------------------
R0002:C00007---------------------------------------------------------------------------------
---------------------------------------------------------------------------------------------
R0002:C00002---------------------------------------------------------------------------------
  ** END OF RUN :    1

*********************************************************************************************






--------------------
| START            | Project  dir.:C:\Temp\15-319\EX\12-hour_SCS\
-------------------- Rainfall dir.:C:\Temp\15-319\EX\12-hour_SCS\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 0003
    NSTORM=   1
           #  1=25SCS12.stm
---------------------------------------------------------------------------------------------
R0003:C00002---------------------------------------------------------------------------------
*#*******************************************************************************
*#  Project Name: [Mansfield Ski Club]    Project Number: [15-319]
*#  Date        : 07-31-2017
*#  Modeller    : [J. Lightheart]
*#  Company     : WMI & Associates Ltd.
*#  License #   :  2880720
*#*******************************************************************************
*
* Pre-Development Condition - Mansfield Ski Club
*
---------------------------------------------------------------------------------------------
R0003:C00002---------------------------------------------------------------------------------
--------------------
| READ STORM       |  Filename: C:\Temp\15-319\EX\12-hour_SCS\25SCS12.stm
| Ptotal=  79.90 mm|  Comments: 25-Year SCS Type-II Storm Distribution (12-hour) Mansfield,
--------------------
       TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME
      hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm
       0:30   1.598|   2:30   3.196|   4:30   4.794|   6:30  14.382|   8:30   3.196|  10:30
       1:00   1.598|   3:00   3.196|   5:00   6.392|   7:00   6.392|   9:00   3.196|  11:00
       1:30   1.598|   3:30   3.196|   5:30   9.588|   7:30   4.794|   9:30   3.196|  11:30
       2:00   1.598|   4:00   3.196|   6:00  71.910|   8:00   4.794|  10:00   1.598|  12:00

---------------------------------------------------------------------------------------------
R0003:C00003---------------------------------------------------------------------------------
```

```
* SITE
* To account for the existing packed gravel surfaces on-site, the TIMP value
* was calibrated (see design calcs)
--------------------------
| CALIB STANDHYD         |   Area    (ha)=    2.46
| 01:PRE1       DT= 1.00 |   Total Imp(%)=   24.00   Dir. Conn.(%)=    1.00
--------------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .59         1.87
     Dep. Storage     (mm)=       2.00         8.10
     Average Slope     (%)=       2.00        10.00
     Length            (m)=     100.00        80.00
     Mannings n          =       .013         .250

     Max.eff.Inten.(mm/hr)=      71.91        69.07
                over (min)       2.00        10.00
     Storage Coeff.  (min)=       2.37 (ii)   10.02 (ii)
     Unit Hyd. Tpeak (min)=       2.00        10.00
     Unit Hyd. peak  (cms)=        .50          .11
                                                           *TOTALS*
     PEAK FLOW       (cms)=        .00          .30           .306 (iii)
     TIME TO PEAK    (hrs)=       5.73         6.03          6.033
     RUNOFF VOLUME    (mm)=      77.90        45.46         45.786
     TOTAL RAINFALL   (mm)=      79.90        79.90         79.900
     RUNOFF COEFFICIENT   =        .97          .57           .573

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  81.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

---------------------------------------------------------------------------------------------
R0003:C00004---------------------------------------------------------------------------------
* EXTERNAL
--------------------------
| CALIB NASHYD           |   Area    (ha)=   11.710   Curve Number   (CN)= 83.00
| 02:EXT        DT= 1.00 |   Ia      (mm)=    6.800   # of Linear Res.(N)=  3.00
--------------------------   U.H. Tp(hrs)=     .240

     Unit Hyd Qpeak  (cms)=    1.864

     PEAK FLOW       (cms)=    1.217 (i)
     TIME TO PEAK    (hrs)=    6.100
     DURATION        (hrs)=   13.667, (dddd|hh:mm:)=   0|13:40
     AVERAGE FLOW    (cms)=     .102
     RUNOFF VOLUME    (mm)=   42.707
     TOTAL RAINFALL   (mm)=   79.900
     RUNOFF COEFFICIENT   =     .534

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

---------------------------------------------------------------------------------------------
R0003:C00005---------------------------------------------------------------------------------
```

```
* TOTAL
------------------------
| ADD HYD              |
| 03:TOTAL             |   ID:NHYD            AREA     QPEAK    TPEAK      R.V.     DWF
------------------------                      (ha)     (cms)    (hrs)      (mm)   (cms)
                      ID 1 01:PRE1           2.460      .306    6.033    45.786    .000
                     +ID 2 02:EXT           11.710     1.217    6.100    42.707    .000
                     =================================================================
                     SUM   03:TOTAL         14.170     1.511    6.083    43.241    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------------------
R0003:C00006-------------------------------------------------------------------------------
* SITE
* To account for the existing packed gravel surfaces on-site, the TIMP value
* was calibrated (see design calcs)
--------------------------
| CALIB STANDHYD         |   Area    (ha)=    1.40
| 04:PRE2       DT= 1.00 |   Total Imp(%)=   24.00   Dir. Conn.(%)=    1.00
--------------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .34         1.06
     Dep. Storage     (mm)=       2.00         8.00
     Average Slope     (%)=       3.50        13.00
     Length            (m)=      45.00        70.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      71.91        69.80
                over (min)       1.00         8.00
     Storage Coeff.  (min)=       1.24 (ii)    7.74 (ii)
     Unit Hyd. Tpeak (min)=       1.00         8.00
     Unit Hyd. peak  (cms)=        .94          .14
                                                               *TOTALS*
     PEAK FLOW       (cms)=        .00          .18             .186 (iii)
     TIME TO PEAK    (hrs)=       5.73         6.02            6.000
     RUNOFF VOLUME    (mm)=      77.78        45.53           45.850
     TOTAL RAINFALL   (mm)=      79.90        79.90           79.900
     RUNOFF COEFFICIENT   =        .97          .57             .574

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  81.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------------------
R0003:C00007-------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------
R0003:C00002-------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------
R0003:C00002-------------------------------------------------------------------------------
  ** END OF RUN :    2
```

```
*******************************************************************************************




--------------------
| START            | Project  dir.:C:\Temp\15-319\EX\12-hour_SCS\
-------------------- Rainfall dir.:C:\Temp\15-319\EX\12-hour_SCS\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 0004
    NSTORM=   1
           #  1=100SCS12.stm
-------------------------------------------------------------------------------------------
R0004:C00002-------------------------------------------------------------------------------
*#****************************************************************************
*#  Project Name: [Mansfield Ski Club]    Project Number: [15-319]
*#  Date        : 07-31-2017
*#  Modeller    : [J. Lightheart]
*#  Company     : WMI & Associates Ltd.
*#  License #   :  2880720
*#****************************************************************************
*
* Pre-Development Condition - Mansfield Ski Club
*
-------------------------------------------------------------------------------------------
R0004:C00002-------------------------------------------------------------------------------
--------------------
| READ STORM       |  Filename: C:\Temp\15-319\EX\12-hour_SCS\100SCS12.stm
| Ptotal=  97.40 mm|  Comments: 100-Year SCS Type-II Storm Distribution (12-hour)
--------------------
      TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME
     hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm
      0:30   1.948|   2:30   3.896|   4:30   5.844|   6:30  17.532|   8:30   3.896|  10:30
      1:00   1.948|   3:00   3.896|   5:00   7.792|   7:00   7.792|   9:00   3.896|  11:00
      1:30   1.948|   3:30   3.896|   5:30  11.688|   7:30   5.844|   9:30   3.896|  11:30
      2:00   1.948|   4:00   3.896|   6:00  87.660|   8:00   5.844|  10:00   1.948|  12:00

-------------------------------------------------------------------------------------------
R0004:C00003-------------------------------------------------------------------------------
* SITE
* To account for the existing packed gravel surfaces on-site, the TIMP value
* was calibrated (see design calcs)
--------------------------
| CALIB STANDHYD         |   Area    (ha)=    2.46
| 01:PRE1       DT= 1.00 |   Total Imp(%)=   24.00   Dir. Conn.(%)=    1.00
--------------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .59         1.87
     Dep. Storage     (mm)=       2.00         8.10
     Average Slope     (%)=       2.00        10.00
     Length            (m)=     100.00        80.00
```

```
     Mannings n          =      .013        .250

     Max.eff.Inten.(mm/hr)=     87.66       90.73
                over (min)       2.00        9.00
     Storage Coeff.  (min)=      2.19 (ii)   9.05 (ii)
     Unit Hyd. Tpeak (min)=      2.00        9.00
     Unit Hyd. peak  (cms)=       .53         .13
                                                        *TOTALS*
     PEAK FLOW       (cms)=       .01         .41          .419 (iii)
     TIME TO PEAK    (hrs)=      5.85        6.02         6.017
     RUNOFF VOLUME    (mm)=     95.40       60.72        61.070
     TOTAL RAINFALL   (mm)=     97.40       97.40        97.400
     RUNOFF COEFFICIENT   =       .98         .62          .627

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  81.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

 ------------------------------------------------------------------------------------------
 R0004:C00004------------------------------------------------------------------------------
 * EXTERNAL
 -------------------------
 | CALIB NASHYD          |   Area    (ha)=   11.710   Curve Number   (CN)= 83.00
 | 02:EXT       DT= 1.00 |   Ia      (mm)=    6.800   # of Linear Res.(N)=  3.00
 -------------------------   U.H. Tp(hrs)=     .240

     Unit Hyd Qpeak  (cms)=    1.864

     PEAK FLOW       (cms)=    1.642 (i)
     TIME TO PEAK    (hrs)=    6.083
     DURATION        (hrs)=   13.667, (dddd|hh:mm:)=   0|13:40
     AVERAGE FLOW    (cms)=     .137
     RUNOFF VOLUME    (mm)=   57.552
     TOTAL RAINFALL   (mm)=   97.400
     RUNOFF COEFFICIENT   =     .591

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

 ------------------------------------------------------------------------------------------
 R0004:C00005------------------------------------------------------------------------------
 * TOTAL
 -----------------------
 | ADD HYD             |
 | 03:TOTAL            |   ID:NHYD           AREA     QPEAK    TPEAK      R.V.     DWF
 -----------------------                     (ha)     (cms)    (hrs)      (mm)   (cms)
                      ID 1 01:PRE1          2.460      .419    6.017    61.070    .000
                     +ID 2 02:EXT          11.710     1.642    6.083    57.552    .000
                     ================================================================
                     SUM   03:TOTAL        14.170     2.038    6.067    58.163    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
```

```
 ------------------------------------------------------------------------------------------
 R0004:C00006------------------------------------------------------------------------------
 * SITE
 * To account for the existing packed gravel surfaces on-site, the TIMP value
 * was calibrated (see design calcs)
 -------------------------
 | CALIB STANDHYD        |   Area    (ha)=    1.40
 | 04:PRE2      DT= 1.00 |   Total Imp(%)=   24.00   Dir. Conn.(%)=    1.00
 -------------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       .34        1.06
     Dep. Storage     (mm)=      2.00        8.00
     Average Slope     (%)=      3.50       13.00
     Length            (m)=     45.00       70.00
     Mannings n          =      .013        .250

     Max.eff.Inten.(mm/hr)=     87.66       91.47
                over (min)       1.00        7.00
     Storage Coeff.  (min)=      1.15 (ii)   6.98 (ii)
     Unit Hyd. Tpeak (min)=      1.00        7.00
     Unit Hyd. peak  (cms)=       .99         .16
                                                        *TOTALS*
     PEAK FLOW       (cms)=       .00         .25          .252 (iii)
     TIME TO PEAK    (hrs)=      5.83        6.00         6.000
     RUNOFF VOLUME    (mm)=     95.31       60.79        61.136
     TOTAL RAINFALL   (mm)=     97.40       97.40        97.400
     RUNOFF COEFFICIENT   =       .98         .62          .628

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  81.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

 ------------------------------------------------------------------------------------------
 R0004:C00007------------------------------------------------------------------------------
 ------------------------------------------------------------------------------------------
 R0004:C00002------------------------------------------------------------------------------
 ------------------------------------------------------------------------------------------
 R0004:C00002------------------------------------------------------------------------------
 ------------------------------------------------------------------------------------------
 R0004:C00002------------------------------------------------------------------------------
   ** END OF RUN :    3

 ******************************************************************************************






 --------------------
 | START            | Project  dir.:C:\Temp\15-319\EX\12-hour_SCS\
 -------------------- Rainfall dir.:C:\Temp\15-319\EX\12-hour_SCS\
     TZERO =   .00 hrs on        0
```

```
    METOUT=   2 (output = METRIC)
    NRUN  = 0005
    NSTORM=   1
           #  1=12regtim.o89
-------------------------------------------------------------------------------------------
R0005:C00002-------------------------------------------------------------------------------
*#******************************************************************************
*#  Project Name: [Mansfield Ski Club]    Project Number: [15-319]
*#  Date        : 07-31-2017
*#  Modeller    : [J. Lightheart]
*#  Company     : WMI & Associates Ltd.
*#  License #   :  2880720
*#******************************************************************************
*
* Pre-Development Condition - Mansfield Ski Club
*
-------------------------------------------------------------------------------------------
R0005:C00002-------------------------------------------------------------------------------
--------------------
| READ STORM       |  Filename: C:\Temp\15-319\EX\12-hour_SCS\12regtim.o89
| Ptotal= 193.00 mm|  Comments: TIMMINS REGIONAL STORM (12-hour)
--------------------
      TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME
     hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm
      1:00  15.000|   3:00  10.000|   5:00   5.000|   7:00  43.000|   9:00  23.000|  11:00
      2:00  20.000|   4:00   3.000|   6:00  20.000|   8:00  20.000|  10:00  13.000|  12:00

-------------------------------------------------------------------------------------------
R0005:C00003-------------------------------------------------------------------------------
* SITE
* To account for the existing packed gravel surfaces on-site, the TIMP value
* was calibrated (see design calcs)
--------------------------
| CALIB STANDHYD         |   Area    (ha)=    2.46
| 01:PRE1       DT= 1.00 |   Total Imp(%)=   24.00   Dir. Conn.(%)=    1.00
--------------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .59         1.87
     Dep. Storage     (mm)=       2.00         8.10
     Average Slope     (%)=       2.00        10.00
     Length            (m)=     100.00        80.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      43.00        50.88
                over (min)       3.00        12.00
     Storage Coeff.  (min)=       2.91 (ii)   11.56 (ii)
     Unit Hyd. Tpeak (min)=       3.00        12.00
     Unit Hyd. peak  (cms)=        .39          .10
                                                            *TOTALS*
     PEAK FLOW       (cms)=        .00          .26           .262 (iii)
     TIME TO PEAK    (hrs)=       6.95         7.00          7.000
     RUNOFF VOLUME    (mm)=     191.00       150.04        150.449
     TOTAL RAINFALL   (mm)=     193.00       193.00        193.000
```

```
     RUNOFF COEFFICIENT   =        .99          .78           .780

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  81.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------------------
R0005:C00004-------------------------------------------------------------------------------
* EXTERNAL
--------------------------
| CALIB NASHYD           |   Area    (ha)=   11.710   Curve Number   (CN)= 83.00
| 02:EXT       DT= 1.00 |   Ia      (mm)=    6.800   # of Linear Res.(N)=  3.00
--------------------------   U.H. Tp(hrs)=     .240

     Unit Hyd Qpeak  (cms)=    1.864

     PEAK FLOW       (cms)=    1.215 (i)
     TIME TO PEAK    (hrs)=    7.017
     DURATION        (hrs)=   13.667, (dddd|hh:mm:)=   0|13:40
     AVERAGE FLOW    (cms)=     .346
     RUNOFF VOLUME    (mm)=  145.537
     TOTAL RAINFALL   (mm)=  193.000
     RUNOFF COEFFICIENT   =     .754

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

-------------------------------------------------------------------------------------------
R0005:C00005-------------------------------------------------------------------------------
* TOTAL
------------------------
| ADD HYD              |
| 03:TOTAL             |   ID:NHYD            AREA     QPEAK    TPEAK      R.V.     DWF
------------------------                     (ha)     (cms)    (hrs)      (mm)   (cms)
                     ID 1 01:PRE1          2.460      .262    7.000   150.449    .000
                    +ID 2 02:EXT          11.710     1.215    7.017   145.537    .000
                    ===============================================================
                    SUM   03:TOTAL        14.170     1.477    7.017   146.390    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------------------
R0005:C00006-------------------------------------------------------------------------------
* SITE
* To account for the existing packed gravel surfaces on-site, the TIMP value
* was calibrated (see design calcs)
--------------------------
| CALIB STANDHYD         |   Area    (ha)=    1.40
| 04:PRE2       DT= 1.00 |   Total Imp(%)=   24.00   Dir. Conn.(%)=    1.00
--------------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .34         1.06
     Dep. Storage     (mm)=       2.00         8.00
```

```
          Average Slope     (%)=       3.50        13.00
          Length            (m)=      45.00        70.00
          Mannings n           =       .013         .250

          Max.eff.Inten.(mm/hr)=      43.00        50.96
                     over (min)        2.00         9.00
          Storage Coeff.  (min)=       1.52 (ii)    8.90 (ii)
          Unit Hyd. Tpeak (min)=       2.00         9.00
          Unit Hyd. peak  (cms)=        .66          .13
                                                                *TOTALS*
          PEAK FLOW       (cms)=        .00          .15           .151 (iii)
          TIME TO PEAK    (hrs)=       6.87         7.00          7.000
          RUNOFF VOLUME    (mm)=     191.00       150.11        150.522
          TOTAL RAINFALL   (mm)=     193.00       193.00        193.000
          RUNOFF COEFFICIENT   =        .99          .78           .780

            (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
                CN* =  81.0    Ia = Dep. Storage  (Above)
           (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
          (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

     -------------------------------------------------------------------------------------------
     R0005:C00007-------------------------------------------------------------------------------
     -------------------------------------------------------------------------------------------
     R0005:C00002-------------------------------------------------------------------------------
     -------------------------------------------------------------------------------------------
     R0005:C00002-------------------------------------------------------------------------------
     -------------------------------------------------------------------------------------------
     R0005:C00002-------------------------------------------------------------------------------
     -------------------------------------------------------------------------------------------
     R0005:C00002-------------------------------------------------------------------------------
     --------------------
     | FINISH           |
     --------------------
     -------------------------------------------------------------------------------------------
     *******************************************************************************************
          WARNINGS / ERRORS / NOTES
          -------------------------
        Simulation ended on 2020-11-16     at 11:20:26
     ===========================================================================================
```

Pre-Development Condition
6-hour SCS Type-II Storm Distribution

```
2     Metric units
*#******************************************************************************
*#  Project Name: [Mansfield Ski Club]    Project Number: [15-319]
*#  Date        : 07-31-2017
*#  Modeller    : [J. Lightheart]
*#  Company     : WMI & Associates Ltd.
*#  License #   :  2880720
*#******************************************************************************
*
* Pre-Development Condition - Mansfield Ski Club
*
*% 2-year SCS Type-II Storm Dist. based on Mansfield, ON. rainfall (6-hr)
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[1]
*%                   ["2SCS6.stm"] <--storm filename
*%-----------------|-----------------------------------------------------------|
READ STORM          STORM_FILENAME=["STORM.001"]
*%-----------------|-----------------------------------------------------------|
* SITE
* To account for the existing packed gravel surfaces on-site, the TIMP value
* was calibrated (see design calcs)
CALIB STANDHYD      ID=[1], NHYD=["PRE1"], DT=[1](min), AREA=[2.46](ha),
                    XIMP=[0.01], TIMP=[0.24], DWF=[0](cms), LOSS=[2],
                    SCS curve number CN=[81],
                    Pervious   surfaces: IAper=[8.1](mm), SLPP=[10](%),
                                         LGP=[80](m), MNP=[0.25], SCP=[0](min),
                    Impervious surfaces: IAimp=[2.0](mm), SLPI=[2.0](%),
                                         LGI=[100](m), MNI=[0.013], SCI=[0](min),
                    RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
*%-----------------|-----------------------------------------------------------|
* EXTERNAL
CALIB NASHYD        ID=[2], NHYD=["EXT"], DT=[1]min, AREA=[11.71](ha),
                    DWF=[0](cms),  CN/C=[83], IA=[6.8](mm),
                    N=[3], TP=[0.24]hrs,
                    RAINFALL=[ ,  ,  ,  , ](mm/hr),  END=-1
*%-----------------|-----------------------------------------------------------|
* TOTAL
ADD HYD             IDsum=[3], NHYD=["TOTAL"], IDs to add=[1+2]
*%-----------------|-----------------------------------------------------------|
* SITE
* To account for the existing packed gravel surfaces on-site, the TIMP value
* was calibrated (see design calcs)
CALIB STANDHYD      ID=[4], NHYD=["PRE2"], DT=[1](min), AREA=[1.40](ha),
                    XIMP=[0.01], TIMP=[0.24], DWF=[0](cms), LOSS=[2],
                    SCS curve number CN=[81],
                    Pervious   surfaces: IAper=[8.0](mm), SLPP=[13](%),
                                         LGP=[70](m), MNP=[0.25], SCP=[0](min),
                    Impervious surfaces: IAimp=[2.0](mm), SLPI=[3.5](%),
                                         LGI=[45](m), MNI=[0.013], SCI=[0](min),
                    RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
*%-----------------|-----------------------------------------------------------|
*% 5-year SCS Type-II Storm Dist. based on Mansfield, ON. rainfall (6-hr)
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[2]
*%                   ["5SCS6.stm"] <--storm filename
```

```
*%-----------------|-----------------------------------------------------------|
*% 25-year SCS Type-II Storm Dist. based on Mansfield, ON. rainfall (6-hr)
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[3]
*%                   ["25SCS6.stm"] <--storm filename
*%-----------------|-----------------------------------------------------------|
*% 100-year SCS Type-II Storm Dist. based on Mansfield, ON. rainfall (6-hr)
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[4]
*%                   ["100SCS6.stm"] <--storm filename
*%-----------------|-----------------------------------------------------------|
*% Timmins Regional Storm (12-hr)
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[5]
*%                   ["12regtim.o89"] <--storm filename
*%-----------------|-----------------------------------------------------------|
FINISH
```

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

 SSSSS   W   W   M   M   H   H   Y   Y   M   M    OOO          222     000    11   77777 ==
 S       W W W   MM MM   H   H    Y Y    MM MM   O   O           2    0   0   11   7   7
 SSSSS   W W W   M M M   HHHHH     Y     M M M   O   O           2    0   0   11       7
     S    W W    M   M   H   H     Y     M   M   O   O        222    0   0   11      7
 SSSSS    W W    M   M   H   H     Y     M   M    OOO         2       0   0   11     7   ==
                                                              2       0   0   11    7    #
       StormWater Management HYdrologic Model                  222     000    11    7    ==

 ******************************************************************************************
 **************************************  SWMHYMO Ver4.05.0  *******************************
 ******************  A single event and continuous hydrologic simulation model  ***********
 ******************     based on the principles of HYMO and its successors      ***********
 ******************                 OTTHYMO-83 and OTTHYMO-89.                  ***********
 ******************************************************************************************
 ****************** Distributed by:  J.F. Sabourin and Associates Inc.          ***********
 ******************                  Ottawa,  Ontario: (613) 836-3884           ***********
 ******************                  Gatineau, Quebec: (819) 243-6858           ***********
 ******************                  E-Mail: swmhymo@jfsa.com                   ***********
 ******************************************************************************************

 ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
 ++++++++++++++++++ Licensed user: WMI & Associates Ltd.                        +++++++++++
 ++++++++++++++++++                Barrie                SERIAL#:2880720        +++++++++++
 ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

 ******************************************************************************************
 ******************           ++++++ PROGRAM ARRAY DIMENSIONS ++++++            ***********
 ******************           Maximum value for ID numbers  :     11            ***********
 ******************           Max. number of rainfall points: 105408            ***********
 ******************           Max. number of flow points    : 105408            ***********
 ******************************************************************************************


 *******************************   D E T A I L E D   O U T P U T   ************************
 ******************************************************************************************
 *                 RUN DATE: 2020-11-16     TIME: 11:20:36     RUN COUNTER: 000005
 ******************************************************************************************
 * Input   file: C:\Temp\15-319\EX\6-hour_SCS\2-CYRSCS.dat
 * Output  file: C:\Temp\15-319\EX\6-hour_SCS\2-CYRSCS.out
 * Summary file: C:\Temp\15-319\EX\6-hour_SCS\2-CYRSCS.sum
 * User comments:
 * 1:______________________________________________________________________________________
 * 2:______________________________________________________________________________________
 * 3:______________________________________________________________________________________
 ******************************************************************************************

-------------------------------------------------------------------------------------------
R0001:C00001-------------------------------------------------------------------------------
*#******************************************************************************
*#  Project Name: [Mansfield Ski Club]    Project Number: [15-319]
*#  Date        : 07-31-2017
```

```
*#  Modeller    : [J. Lightheart]
*#  Company     : WMI & Associates Ltd.
*#  License #   :  2880720
*#******************************************************************************
*
* Pre-Development Condition - Mansfield Ski Club
*
--------------------
| START            | Project  dir.:C:\Temp\15-319\EX\6-hour_SCS\
-------------------- Rainfall dir.:C:\Temp\15-319\EX\6-hour_SCS\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 0001
    NSTORM=   1
           #  1=2SCS6.stm
-------------------------------------------------------------------------------------------
R0001:C00002-------------------------------------------------------------------------------
--------------------
| READ STORM       |  Filename: C:\Temp\15-319\EX\6-hour_SCS\2SCS6.stm
| Ptotal=  36.00 mm|  Comments: 2-Year SCS Type-II Storm Distribution (6-hour) Mansfield,
--------------------
      TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME
     hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm
      0:30   1.440|   1:30   2.880|   2:30   5.040|   3:30   9.360|   4:30   2.880|   5:30
      1:00   1.440|   2:00   2.880|   3:00  36.720|   4:00   4.320|   5:00   2.160|   6:00

-------------------------------------------------------------------------------------------
R0001:C00003-------------------------------------------------------------------------------
* SITE
* To account for the existing packed gravel surfaces on-site, the TIMP value
* was calibrated (see design calcs)
--------------------------
| CALIB STANDHYD         |   Area    (ha)=    2.46
| 01:PRE1       DT= 1.00 |   Total Imp(%)=   24.00   Dir. Conn.(%)=    1.00
--------------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .59         1.87
     Dep. Storage     (mm)=       2.00         8.10
     Average Slope     (%)=       2.00        10.00
     Length            (m)=     100.00        80.00
     Mannings n          =        .013         .250

     Max.eff.Inten.(mm/hr)=      36.72        19.68
                over (min)        3.00        16.00
     Storage Coeff.  (min)=       3.10 (ii)   15.74 (ii)
     Unit Hyd. Tpeak (min)=       3.00        16.00
     Unit Hyd. peak  (cms)=        .37          .07
                                                           *TOTALS*
     PEAK FLOW       (cms)=        .00          .07           .069 (iii)
     TIME TO PEAK    (hrs)=       2.77         3.17          3.167
     RUNOFF VOLUME    (mm)=      34.00        11.74         11.967
     TOTAL RAINFALL   (mm)=      36.00        36.00         36.000
     RUNOFF COEFFICIENT   =        .94          .33           .332
```

```
       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  81.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------------------
R0001:C00004-------------------------------------------------------------------------------
* EXTERNAL
--------------------------
| CALIB NASHYD           |   Area    (ha)=   11.710   Curve Number   (CN)= 83.00
| 02:EXT        DT= 1.00 |   Ia      (mm)=    6.800   # of Linear Res.(N)=  3.00
--------------------------   U.H. Tp(hrs)=     .240

     Unit Hyd Qpeak  (cms)=    1.864

     PEAK FLOW       (cms)=     .304 (i)
     TIME TO PEAK    (hrs)=    3.150
     DURATION        (hrs)=    7.667, (dddd|hh:mm:)=   0|07:40
     AVERAGE FLOW    (cms)=     .045
     RUNOFF VOLUME    (mm)=   10.497
     TOTAL RAINFALL   (mm)=   36.000
     RUNOFF COEFFICIENT   =     .292

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

-------------------------------------------------------------------------------------------
R0001:C00005-------------------------------------------------------------------------------
* TOTAL
------------------------
| ADD HYD              |
| 03:TOTAL             |   ID:NHYD            AREA     QPEAK    TPEAK      R.V.     DWF
------------------------                      (ha)     (cms)    (hrs)      (mm)   (cms)
                      ID 1 01:PRE1           2.460      .069    3.167    11.967    .000
                     +ID 2 02:EXT           11.710      .304    3.150    10.497    .000
                     ==============================================================
                     SUM   03:TOTAL         14.170      .373    3.150    10.752    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------------------
R0001:C00006-------------------------------------------------------------------------------
* SITE
* To account for the existing packed gravel surfaces on-site, the TIMP value
* was calibrated (see design calcs)
--------------------------
| CALIB STANDHYD         |   Area    (ha)=    1.40
| 04:PRE2       DT= 1.00 |   Total Imp(%)=   24.00   Dir. Conn.(%)=    1.00
--------------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .34         1.06
     Dep. Storage     (mm)=       2.00         8.00
     Average Slope     (%)=       3.50        13.00
```

```
     Length            (m)=      45.00        70.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      36.72        20.95
                over (min)        2.00        12.00
     Storage Coeff.  (min)=       1.62 (ii)   12.14 (ii)
     Unit Hyd. Tpeak (min)=       2.00        12.00
     Unit Hyd. peak  (cms)=        .64          .09
                                                          *TOTALS*
     PEAK FLOW       (cms)=        .00          .04           .045 (iii)
     TIME TO PEAK    (hrs)=       2.72         3.10          3.100
     RUNOFF VOLUME    (mm)=      34.00        11.79         12.015
     TOTAL RAINFALL   (mm)=      36.00        36.00         36.000
     RUNOFF COEFFICIENT   =        .94          .33           .334

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  81.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------------------
R0001:C00007-------------------------------------------------------------------------------
  ** END OF RUN :    0

*******************************************************************************************




--------------------
| START            | Project  dir.:C:\Temp\15-319\EX\6-hour_SCS\
-------------------- Rainfall dir.:C:\Temp\15-319\EX\6-hour_SCS\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 0002
    NSTORM=   1
           #  1=5SCS6.stm
-------------------------------------------------------------------------------------------
R0002:C00002-------------------------------------------------------------------------------
*#*****************************************************************************
*#  Project Name: [Mansfield Ski Club]    Project Number: [15-319]
*#  Date        : 07-31-2017
*#  Modeller    : [J. Lightheart]
*#  Company     : WMI & Associates Ltd.
*#  License #   :  2880720
*#*****************************************************************************
*
* Pre-Development Condition - Mansfield Ski Club
*
-------------------------------------------------------------------------------------------
R0002:C00002-------------------------------------------------------------------------------
--------------------
```

```
| READ STORM       |  Filename: C:\Temp\15-319\EX\6-hour_SCS\5SCS6.stm
| Ptotal=  47.50 mm|  Comments: 5-Year SCS Type-II Storm Distribution (6-hour) Mansfield,
--------------------
      TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME
     hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm
      0:30   1.900|   1:30   3.800|   2:30   6.650|   3:30  12.350|   4:30   3.800|   5:30
      1:00   1.900|   2:00   3.800|   3:00  48.450|   4:00   5.700|   5:00   2.850|   6:00

-------------------------------------------------------------------------------------------
R0002:C00003-------------------------------------------------------------------------------
* SITE
* To account for the existing packed gravel surfaces on-site, the TIMP value
* was calibrated (see design calcs)
--------------------------
| CALIB STANDHYD         |   Area    (ha)=    2.46
| 01:PRE1       DT= 1.00 |   Total Imp(%)=   24.00   Dir. Conn.(%)=    1.00
--------------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .59         1.87
     Dep. Storage     (mm)=       2.00         8.10
     Average Slope     (%)=       2.00        10.00
     Length            (m)=     100.00        80.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      48.45        33.98
                over (min)       3.00        13.00
     Storage Coeff.  (min)=       2.77 (ii)   12.94 (ii)
     Unit Hyd. Tpeak (min)=       3.00        13.00
     Unit Hyd. peak  (cms)=        .40          .09
                                                           *TOTALS*
     PEAK FLOW       (cms)=        .00          .13           .130 (iii)
     TIME TO PEAK    (hrs)=       2.92         3.10          3.100
     RUNOFF VOLUME    (mm)=      45.50        19.58         19.843
     TOTAL RAINFALL   (mm)=      47.50        47.50         47.500
     RUNOFF COEFFICIENT   =        .96          .41           .418

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  81.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------------------
R0002:C00004-------------------------------------------------------------------------------
* EXTERNAL
--------------------------
| CALIB NASHYD           |   Area    (ha)=   11.710   Curve Number   (CN)= 83.00
| 02:EXT        DT= 1.00 |   Ia      (mm)=    6.800   # of Linear Res.(N)=  3.00
--------------------------   U.H. Tp(hrs)=     .240

     Unit Hyd Qpeak  (cms)=    1.864

     PEAK FLOW       (cms)=     .537 (i)
     TIME TO PEAK    (hrs)=    3.133
```

```
     DURATION        (hrs)=    7.667, (dddd|hh:mm:)=   0|07:40
     AVERAGE FLOW    (cms)=     .076
     RUNOFF VOLUME    (mm)=   17.865
     TOTAL RAINFALL   (mm)=   47.500
     RUNOFF COEFFICIENT   =     .376

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

-------------------------------------------------------------------------------------------
R0002:C00005-------------------------------------------------------------------------------
* TOTAL
------------------------
| ADD HYD               |
| 03:TOTAL              |   ID:NHYD            AREA     QPEAK    TPEAK      R.V.     DWF
------------------------                       (ha)     (cms)    (hrs)      (mm)   (cms)
                      ID 1 01:PRE1          2.460      .130    3.100    19.843    .000
                     +ID 2 02:EXT          11.710      .537    3.133    17.865    .000
                     ==============================================================
                     SUM   03:TOTAL        14.170      .665    3.117    18.208    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------------------
R0002:C00006-------------------------------------------------------------------------------
* SITE
* To account for the existing packed gravel surfaces on-site, the TIMP value
* was calibrated (see design calcs)
--------------------------
| CALIB STANDHYD         |   Area    (ha)=    1.40
| 04:PRE2       DT= 1.00 |   Total Imp(%)=   24.00   Dir. Conn.(%)=    1.00
--------------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .34         1.06
     Dep. Storage     (mm)=       2.00         8.00
     Average Slope     (%)=       3.50        13.00
     Length            (m)=      45.00        70.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      48.45        35.13
                over (min)       1.00        10.00
     Storage Coeff.  (min)=       1.45 (ii)   10.01 (ii)
     Unit Hyd. Tpeak (min)=       1.00        10.00
     Unit Hyd. peak  (cms)=        .85          .11
                                                           *TOTALS*
     PEAK FLOW       (cms)=        .00          .08           .082 (iii)
     TIME TO PEAK    (hrs)=       2.88         3.07          3.050
     RUNOFF VOLUME    (mm)=      45.32        19.64         19.896
     TOTAL RAINFALL   (mm)=      47.50        47.50         47.500
     RUNOFF COEFFICIENT   =        .95          .41           .419

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  81.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
```

```
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------------------
R0002:C00007-------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------
R0002:C00002-------------------------------------------------------------------------------
  ** END OF RUN :    1

*******************************************************************************************





--------------------
| START            | Project  dir.:C:\Temp\15-319\EX\6-hour_SCS\
-------------------- Rainfall dir.:C:\Temp\15-319\EX\6-hour_SCS\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 0003
    NSTORM=   1
           #  1=25SCS6.stm
-------------------------------------------------------------------------------------------
R0003:C00002-------------------------------------------------------------------------------
*#*****************************************************************************
*#  Project Name: [Mansfield Ski Club]    Project Number: [15-319]
*#  Date        : 07-31-2017
*#  Modeller    : [J. Lightheart]
*#  Company     : WMI & Associates Ltd.
*#  License #   :  2880720
*#*****************************************************************************
*
* Pre-Development Condition - Mansfield Ski Club
*
-------------------------------------------------------------------------------------------
R0003:C00002-------------------------------------------------------------------------------
--------------------
| READ STORM       |  Filename: C:\Temp\15-319\EX\6-hour_SCS\25SCS6.stm
| Ptotal=  64.80 mm|  Comments: 25-Year SCS Type-II Storm Distribution (6-hour) Mansfield,
--------------------
      TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME
     hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm
      0:30   2.592|   1:30   5.184|   2:30   9.072|   3:30  16.848|   4:30   5.184|   5:30
      1:00   2.592|   2:00   5.184|   3:00  66.096|   4:00   7.776|   5:00   3.888|   6:00

-------------------------------------------------------------------------------------------
R0003:C00003-------------------------------------------------------------------------------
* SITE
* To account for the existing packed gravel surfaces on-site, the TIMP value
* was calibrated (see design calcs)
-------------------------
| CALIB STANDHYD         |   Area    (ha)=    2.46
| 01:PRE1       DT= 1.00 |   Total Imp(%)=   24.00   Dir. Conn.(%)=    1.00
```

```
--------------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .59         1.87
     Dep. Storage     (mm)=       2.00         8.10
     Average Slope     (%)=       2.00        10.00
     Length            (m)=     100.00        80.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      66.10        56.93
                over (min)        2.00        11.00
     Storage Coeff.  (min)=       2.45 (ii)   10.72 (ii)
     Unit Hyd. Tpeak (min)=       2.00        11.00
     Unit Hyd. peak  (cms)=        .49          .10
                                                           *TOTALS*
     PEAK FLOW       (cms)=        .00          .24           .237 (iii)
     TIME TO PEAK    (hrs)=       2.87         3.07          3.067
     RUNOFF VOLUME    (mm)=      62.80        32.90         33.196
     TOTAL RAINFALL   (mm)=      64.80        64.80         64.800
     RUNOFF COEFFICIENT   =        .97          .51           .512

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  81.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------------------
R0003:C00004-------------------------------------------------------------------------------
* EXTERNAL
--------------------------
| CALIB NASHYD           |   Area    (ha)=   11.710   Curve Number   (CN)= 83.00
| 02:EXT        DT= 1.00 |   Ia      (mm)=    6.800   # of Linear Res.(N)=  3.00
--------------------------   U.H. Tp(hrs)=     .240

     Unit Hyd Qpeak  (cms)=    1.864

     PEAK FLOW       (cms)=     .942 (i)
     TIME TO PEAK    (hrs)=    3.117
     DURATION        (hrs)=    7.667, (dddd|hh:mm:)=   0|07:40
     AVERAGE FLOW    (cms)=     .130
     RUNOFF VOLUME    (mm)=   30.575
     TOTAL RAINFALL   (mm)=   64.800
     RUNOFF COEFFICIENT   =     .472

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

-------------------------------------------------------------------------------------------
R0003:C00005-------------------------------------------------------------------------------
* TOTAL
------------------------
| ADD HYD              |
| 03:TOTAL             |   ID:NHYD            AREA     QPEAK    TPEAK      R.V.     DWF
------------------------                      (ha)     (cms)    (hrs)      (mm)   (cms)
                      ID 1 01:PRE1           2.460      .237    3.067    33.196    .000
```

```
                     +ID 2 02:EXT           11.710      .942    3.117    30.575    .000
                     ==================================================================
                     SUM   03:TOTAL         14.170     1.172    3.100    31.030    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

---------------------------------------------------------------------------------------------
R0003:C00006---------------------------------------------------------------------------------
* SITE
* To account for the existing packed gravel surfaces on-site, the TIMP value
* was calibrated (see design calcs)
--------------------------
| CALIB STANDHYD         |   Area    (ha)=    1.40
| 04:PRE2       DT= 1.00 |   Total Imp(%)=   24.00   Dir. Conn.(%)=    1.00
--------------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .34         1.06
     Dep. Storage     (mm)=       2.00         8.00
     Average Slope     (%)=       3.50        13.00
     Length            (m)=      45.00        70.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      66.10        58.26
                over (min)       1.00         8.00
     Storage Coeff.  (min)=       1.28 (ii)    8.27 (ii)
     Unit Hyd. Tpeak (min)=       1.00         8.00
     Unit Hyd. peak  (cms)=        .92          .14
                                                            *TOTALS*
     PEAK FLOW       (cms)=        .00          .15           .148 (iii)
     TIME TO PEAK    (hrs)=       2.83         3.03          3.017
     RUNOFF VOLUME    (mm)=      62.68        32.96         33.256
     TOTAL RAINFALL   (mm)=      64.80        64.80         64.800
     RUNOFF COEFFICIENT   =        .97          .51           .513

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  81.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

---------------------------------------------------------------------------------------------
R0003:C00007---------------------------------------------------------------------------------
---------------------------------------------------------------------------------------------
R0003:C00002---------------------------------------------------------------------------------
---------------------------------------------------------------------------------------------
R0003:C00002---------------------------------------------------------------------------------
  ** END OF RUN :    2

*********************************************************************************************
```

```
--------------------
| START            | Project  dir.:C:\Temp\15-319\EX\6-hour_SCS\
-------------------- Rainfall dir.:C:\Temp\15-319\EX\6-hour_SCS\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 0004
    NSTORM=   1
           #  1=100SCS6.stm
---------------------------------------------------------------------------------------------
R0004:C00002---------------------------------------------------------------------------------
*#*******************************************************************************
*#  Project Name: [Mansfield Ski Club]    Project Number: [15-319]
*#  Date        : 07-31-2017
*#  Modeller    : [J. Lightheart]
*#  Company     : WMI & Associates Ltd.
*#  License #   :  2880720
*#*******************************************************************************
*
* Pre-Development Condition - Mansfield Ski Club
*
---------------------------------------------------------------------------------------------
R0004:C00002---------------------------------------------------------------------------------
--------------------
| READ STORM       |  Filename: C:\Temp\15-319\EX\6-hour_SCS\100SCS6.stm
| Ptotal=  79.10 mm|  Comments: 100-Year SCS Type-II Storm Distribution (6-hour) Mansfield,
--------------------
      TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME
     hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm
      0:30   3.164|   1:30   6.328|   2:30  11.074|   3:30  20.566|   4:30   6.328|   5:30
      1:00   3.164|   2:00   6.328|   3:00  80.682|   4:00   9.492|   5:00   4.746|   6:00

---------------------------------------------------------------------------------------------
R0004:C00003---------------------------------------------------------------------------------
* SITE
* To account for the existing packed gravel surfaces on-site, the TIMP value
* was calibrated (see design calcs)
--------------------------
| CALIB STANDHYD         |   Area    (ha)=    2.46
| 01:PRE1       DT= 1.00 |   Total Imp(%)=   24.00   Dir. Conn.(%)=    1.00
--------------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .59         1.87
     Dep. Storage     (mm)=       2.00         8.10
     Average Slope     (%)=       2.00        10.00
     Length            (m)=     100.00        80.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      80.68        76.65
                over (min)       2.00        10.00
     Storage Coeff.  (min)=       2.26 (ii)    9.60 (ii)
     Unit Hyd. Tpeak (min)=       2.00        10.00
     Unit Hyd. peak  (cms)=        .52          .12
                                                            *TOTALS*
```

```
     PEAK FLOW       (cms)=        .01          .33           .336 (iii)
     TIME TO PEAK    (hrs)=       2.73         3.05          3.033
     RUNOFF VOLUME    (mm)=      77.10        44.78         45.103
     TOTAL RAINFALL   (mm)=      79.10        79.10         79.100
     RUNOFF COEFFICIENT   =        .97          .57           .570

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
             CN* =  81.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------------------
R0004:C00004-------------------------------------------------------------------------------
* EXTERNAL
-------------------------
| CALIB NASHYD           |   Area    (ha)=   11.710   Curve Number   (CN)= 83.00
| 02:EXT       DT= 1.00 |   Ia      (mm)=    6.800   # of Linear Res.(N)=  3.00
-------------------------   U.H. Tp(hrs)=     .240

     Unit Hyd Qpeak  (cms)=    1.864

     PEAK FLOW       (cms)=    1.307 (i)
     TIME TO PEAK    (hrs)=    3.117
     DURATION        (hrs)=    7.667, (dddd|hh:mm:)=   0|07:40
     AVERAGE FLOW    (cms)=     .178
     RUNOFF VOLUME    (mm)=   42.046
     TOTAL RAINFALL   (mm)=   79.100
     RUNOFF COEFFICIENT   =     .532

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

-------------------------------------------------------------------------------------------
R0004:C00005-------------------------------------------------------------------------------
* TOTAL
------------------------
| ADD HYD               |
| 03:TOTAL              |   ID:NHYD            AREA     QPEAK    TPEAK      R.V.     DWF
------------------------                       (ha)     (cms)    (hrs)      (mm)   (cms)
                    ID 1 01:PRE1          2.460      .336    3.033    45.103    .000
                   +ID 2 02:EXT          11.710     1.307    3.117    42.046    .000
                   ==================================================================
                   SUM   03:TOTAL        14.170     1.627    3.100    42.577    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------------------
R0004:C00006-------------------------------------------------------------------------------
* SITE
* To account for the existing packed gravel surfaces on-site, the TIMP value
* was calibrated (see design calcs)
-------------------------
| CALIB STANDHYD         |   Area    (ha)=    1.40
| 04:PRE2      DT= 1.00 |   Total Imp(%)=   24.00   Dir. Conn.(%)=    1.00
```

```
-------------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .34         1.06
     Dep. Storage     (mm)=       2.00         8.00
     Average Slope     (%)=       3.50        13.00
     Length            (m)=      45.00        70.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      80.68        78.04
                over (min)        1.00         7.00
     Storage Coeff.  (min)=       1.18 (ii)    7.40 (ii)
     Unit Hyd. Tpeak (min)=       1.00         7.00
     Unit Hyd. peak  (cms)=        .97          .16
                                                            *TOTALS*
     PEAK FLOW       (cms)=        .00          .20           .207 (iii)
     TIME TO PEAK    (hrs)=       2.63         3.02          3.000
     RUNOFF VOLUME    (mm)=      77.01        44.84         45.166
     TOTAL RAINFALL   (mm)=      79.10        79.10         79.100
     RUNOFF COEFFICIENT   =        .97          .57           .571

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
             CN* =  81.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------------------
R0004:C00007-------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------
R0004:C00002-------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------
R0004:C00002-------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------
R0004:C00002-------------------------------------------------------------------------------
  ** END OF RUN :    3

*******************************************************************************************




--------------------
| START            | Project  dir.:C:\Temp\15-319\EX\6-hour_SCS\
-------------------- Rainfall dir.:C:\Temp\15-319\EX\6-hour_SCS\
    TZERO =   .00 hrs on       0
    METOUT=   2 (output = METRIC)
    NRUN  = 0005
    NSTORM=   1
           #  1=12regtim.o89
-------------------------------------------------------------------------------------------
R0005:C00002-------------------------------------------------------------------------------
*#*****************************************************************************
*#  Project Name: [Mansfield Ski Club]    Project Number: [15-319]
```

```
*#  Date        : 07-31-2017
*#  Modeller    : [J. Lightheart]
*#  Company     : WMI & Associates Ltd.
*#  License #   :  2880720
*#******************************************************************************
*
* Pre-Development Condition - Mansfield Ski Club
*
-------------------------------------------------------------------------------------------
R0005:C00002-------------------------------------------------------------------------------
--------------------
| READ STORM       |  Filename: C:\Temp\15-319\EX\6-hour_SCS\12regtim.o89
| Ptotal= 193.00 mm|  Comments: TIMMINS REGIONAL STORM (12-hour)
--------------------
      TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME
     hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm
      1:00  15.000|   3:00  10.000|   5:00   5.000|   7:00  43.000|   9:00  23.000|  11:00
      2:00  20.000|   4:00   3.000|   6:00  20.000|   8:00  20.000|  10:00  13.000|  12:00

-------------------------------------------------------------------------------------------
R0005:C00003-------------------------------------------------------------------------------
* SITE
* To account for the existing packed gravel surfaces on-site, the TIMP value
* was calibrated (see design calcs)
--------------------------
| CALIB STANDHYD         |   Area    (ha)=    2.46
| 01:PRE1       DT= 1.00 |   Total Imp(%)=   24.00   Dir. Conn.(%)=    1.00
--------------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .59         1.87
     Dep. Storage     (mm)=       2.00         8.10
     Average Slope     (%)=       2.00        10.00
     Length            (m)=     100.00        80.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      43.00        50.88
                over (min)        3.00        12.00
     Storage Coeff.  (min)=       2.91 (ii)   11.56 (ii)
     Unit Hyd. Tpeak (min)=       3.00        12.00
     Unit Hyd. peak  (cms)=        .39          .10
                                                           *TOTALS*
     PEAK FLOW      (cms)=        .00          .26           .262 (iii)
     TIME TO PEAK    (hrs)=       6.95         7.00          7.000
     RUNOFF VOLUME    (mm)=     191.00       150.04        150.449
     TOTAL RAINFALL   (mm)=     193.00       193.00        193.000
     RUNOFF COEFFICIENT   =        .99          .78           .780

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  81.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------------------
```

```
R0005:C00004-------------------------------------------------------------------------------
* EXTERNAL
--------------------------
| CALIB NASHYD           |   Area    (ha)=   11.710   Curve Number   (CN)= 83.00
| 02:EXT        DT= 1.00 |   Ia      (mm)=    6.800   # of Linear Res.(N)=  3.00
--------------------------   U.H. Tp(hrs)=     .240

     Unit Hyd Qpeak  (cms)=    1.864

     PEAK FLOW       (cms)=    1.215 (i)
     TIME TO PEAK    (hrs)=    7.017
     DURATION        (hrs)=   13.667, (dddd|hh:mm:)=   0|13:40
     AVERAGE FLOW    (cms)=     .346
     RUNOFF VOLUME    (mm)=  145.537
     TOTAL RAINFALL   (mm)=  193.000
     RUNOFF COEFFICIENT   =     .754

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

-------------------------------------------------------------------------------------------
R0005:C00005-------------------------------------------------------------------------------
* TOTAL
------------------------
| ADD HYD              |
| 03:TOTAL             |   ID:NHYD            AREA     QPEAK    TPEAK      R.V.     DWF
------------------------                      (ha)     (cms)    (hrs)      (mm)   (cms)
                      ID 1 01:PRE1           2.460      .262    7.000   150.449    .000
                     +ID 2 02:EXT           11.710     1.215    7.017   145.537    .000
                     ==================================================================
                     SUM   03:TOTAL         14.170     1.477    7.017   146.390    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------------------
R0005:C00006-------------------------------------------------------------------------------
* SITE
* To account for the existing packed gravel surfaces on-site, the TIMP value
* was calibrated (see design calcs)
--------------------------
| CALIB STANDHYD         |   Area    (ha)=    1.40
| 04:PRE2       DT= 1.00 |   Total Imp(%)=   24.00   Dir. Conn.(%)=    1.00
--------------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .34         1.06
     Dep. Storage     (mm)=       2.00         8.00
     Average Slope     (%)=       3.50        13.00
     Length            (m)=      45.00        70.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      43.00        50.96
                over (min)        2.00         9.00
     Storage Coeff.  (min)=       1.52 (ii)    8.90 (ii)
     Unit Hyd. Tpeak (min)=       2.00         9.00
```

```
     Unit Hyd. peak  (cms)=        .66          .13
                                                       *TOTALS*
     PEAK FLOW       (cms)=        .00          .15          .151 (iii)
     TIME TO PEAK    (hrs)=       6.87         7.00         7.000
     RUNOFF VOLUME    (mm)=     191.00       150.11       150.522
     TOTAL RAINFALL   (mm)=     193.00       193.00       193.000
     RUNOFF COEFFICIENT   =        .99          .78          .780

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  81.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------------------
R0005:C00007-------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------
R0005:C00002-------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------
R0005:C00002-------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------
R0005:C00002-------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------
R0005:C00002-------------------------------------------------------------------------------
--------------------
| FINISH           |
--------------------
-------------------------------------------------------------------------------------------
*******************************************************************************************
     WARNINGS / ERRORS / NOTES
     -------------------------
   Simulation ended on 2020-11-16     at 11:20:36
===========================================================================================
```

Pre-Development Condition
4-hour Chicago Storm Distribution

```
2     Metric units
*#******************************************************************************
*#  Project Name: [Mansfield Ski Club]    Project Number: [15-319]
*#  Date        : 07-31-2017
*#  Modeller    : [J. Lightheart]
*#  Company     : WMI & Associates Ltd.
*#  License #   :  2880720
*#******************************************************************************
*
* Pre-Development Condition - Mansfield Ski Club
*
*% 2-year Chicago Storm Dist. based on Mansfield, ON. rainfall (4-hr)
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[1]
*%                   ["2CHI4.stm"] <--storm filename
*%-----------------|-----------------------------------------------------------|
READ STORM          STORM_FILENAME=["STORM.001"]
*%-----------------|-----------------------------------------------------------|
* SITE
* To account for the existing packed gravel surfaces on-site, the TIMP value
* was calibrated (see design calcs)
CALIB STANDHYD      ID=[1], NHYD=["PRE1"], DT=[1](min), AREA=[2.46](ha),
                    XIMP=[0.01], TIMP=[0.24], DWF=[0](cms), LOSS=[2],
                    SCS curve number CN=[81],
                    Pervious   surfaces: IAper=[8.1](mm), SLPP=[10](%),
                                         LGP=[80](m), MNP=[0.25], SCP=[0](min),
                    Impervious surfaces: IAimp=[2.0](mm), SLPI=[2.0](%),
                                         LGI=[100](m), MNI=[0.013], SCI=[0](min),
                    RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
*%-----------------|-----------------------------------------------------------|
* EXTERNAL
CALIB NASHYD        ID=[2], NHYD=["EXT"], DT=[1]min, AREA=[11.71](ha),
                    DWF=[0](cms),  CN/C=[83], IA=[6.8](mm),
                    N=[3], TP=[0.24]hrs,
                    RAINFALL=[ ,  ,  ,  , ](mm/hr),  END=-1
*%-----------------|-----------------------------------------------------------|
* TOTAL
ADD HYD             IDsum=[3], NHYD=["TOTAL"], IDs to add=[1+2]
*%-----------------|-----------------------------------------------------------|
* SITE
* To account for the existing packed gravel surfaces on-site, the TIMP value
* was calibrated (see design calcs)
CALIB STANDHYD      ID=[4], NHYD=["PRE2"], DT=[1](min), AREA=[1.40](ha),
                    XIMP=[0.01], TIMP=[0.24], DWF=[0](cms), LOSS=[2],
                    SCS curve number CN=[81],
                    Pervious   surfaces: IAper=[8.0](mm), SLPP=[13](%),
                                         LGP=[70](m), MNP=[0.25], SCP=[0](min),
                    Impervious surfaces: IAimp=[2.0](mm), SLPI=[3.5](%),
                                         LGI=[45](m), MNI=[0.013], SCI=[0](min),
                    RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
*%-----------------|-----------------------------------------------------------|
*% 5-year Chicago Storm Dist. based on Mansfield, ON. rainfall (4-hr)
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[2]
*%                   ["5CHI4.stm"] <--storm filename
```

```
*%-----------------|-----------------------------------------------------------|
*% 25-year Chicago Storm Dist. based on Mansfield, ON. rainfall (4-hr)
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[3]
*%                   ["25CHI4.stm"] <--storm filename
*%-----------------|-----------------------------------------------------------|
*% 100-year Chicago Storm Dist. based on Mansfield, ON. rainfall (4-hr)
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[4]
*%                   ["100CHI4.stm"] <--storm filename
*%-----------------|-----------------------------------------------------------|
*% Timmins Regional Storm (12-hr)
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[5]
*%                   ["12regtim.o89"] <--storm filename
*%-----------------|-----------------------------------------------------------|
FINISH
```

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

 SSSSS   W   W   M   M   H   H   Y   Y   M   M    OOO          222     000    11   77777 ==
 S       W W W   MM MM   H   H    Y Y    MM MM   O   O           2    0   0   11   7   7
 SSSSS   W W W   M M M   HHHHH     Y     M M M   O   O           2    0   0   11       7
     S    W W    M   M   H   H     Y     M   M   O   O         222    0   0   11      7
 SSSSS    W W    M   M   H   H     Y     M   M    OOO          2      0   0   11     7   ==
                                                               2      0   0   11    7    #
       StormWater Management HYdrologic Model                   222     000    11    7    ==

 ******************************************************************************************
 ****************************************  SWMHYMO Ver4.05.0  ******************************
 ******************  A single event and continuous hydrologic simulation model  ***********
 ******************     based on the principles of HYMO and its successors      ***********
 ******************                 OTTHYMO-83 and OTTHYMO-89.                  ***********
 ******************************************************************************************
 ****************** Distributed by:  J.F. Sabourin and Associates Inc.          ***********
 ******************                  Ottawa,  Ontario: (613) 836-3884           ***********
 ******************                  Gatineau, Quebec: (819) 243-6858           ***********
 ******************                  E-Mail: swmhymo@jfsa.com                   ***********
 ******************************************************************************************

 ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
 ++++++++++++++++++ Licensed user: WMI & Associates Ltd.                       +++++++++++
 ++++++++++++++++++               Barrie                SERIAL#:2880720        +++++++++++
 ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

 ******************************************************************************************
 ******************           ++++++ PROGRAM ARRAY DIMENSIONS ++++++           ***********
 ******************           Maximum value for ID numbers  :     11           ***********
 ******************           Max. number of rainfall points: 105408           ***********
 ******************           Max. number of flow points    : 105408           ***********
 ******************************************************************************************


 *******************************   D E T A I L E D   O U T P U T   ***********************
 ******************************************************************************************
 *                 RUN DATE: 2020-11-16     TIME: 11:21:02     RUN COUNTER: 000006
 ******************************************************************************************
 * Input   file: C:\Temp\15-319\EX\4-hour_Chic\2-CYRCHI.dat
 * Output  file: C:\Temp\15-319\EX\4-hour_Chic\2-CYRCHI.out
 * Summary file: C:\Temp\15-319\EX\4-hour_Chic\2-CYRCHI.sum
 * User comments:
 * 1:_______________________________________________________________________________________
 * 2:_______________________________________________________________________________________
 * 3:_______________________________________________________________________________________
 ******************************************************************************************

-------------------------------------------------------------------------------------------
R0001:C00001-------------------------------------------------------------------------------
*#******************************************************************************
*#  Project Name: [Mansfield Ski Club]    Project Number: [15-319]
*#  Date        : 07-31-2017
```

```
*#  Modeller    : [J. Lightheart]
*#  Company     : WMI & Associates Ltd.
*#  License #   :  2880720
*#******************************************************************************
*
* Pre-Development Condition - Mansfield Ski Club
*
--------------------
| START            | Project  dir.:C:\Temp\15-319\EX\4-hour_Chic\
-------------------- Rainfall dir.:C:\Temp\15-319\EX\4-hour_Chic\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 0001
    NSTORM=   1
           #  1=2CHI4.stm
-------------------------------------------------------------------------------------------
R0001:C00002-------------------------------------------------------------------------------
--------------------
| READ STORM       |  Filename: C:\Temp\15-319\EX\4-hour_Chic\2CHI4.stm
| Ptotal=  32.37 mm|  Comments: 2-Year Chicago Storm Distribution (4-hour) Mansfield, ON.
--------------------
      TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME
     hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm
      0:10   2.552|   0:50   4.945|   1:30  17.908|   2:10   5.281|   2:50   3.431|   3:30
      0:20   2.869|   1:00   6.961|   1:40  10.450|   2:20   4.618|   3:00   3.177|   3:40
      0:30   3.301|   1:10  14.171|   1:50   7.709|   2:30   4.124|   3:10   2.963|   3:50
      0:40   3.928|   1:20  73.380|   2:00   6.227|   2:40   3.740|   3:20   2.781|   4:00

-------------------------------------------------------------------------------------------
R0001:C00003-------------------------------------------------------------------------------
* SITE
* To account for the existing packed gravel surfaces on-site, the TIMP value
* was calibrated (see design calcs)
--------------------------
| CALIB STANDHYD         |   Area    (ha)=    2.46
| 01:PRE1       DT= 1.00 |   Total Imp(%)=   24.00   Dir. Conn.(%)=    1.00
--------------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .59         1.87
     Dep. Storage     (mm)=       2.00         8.10
     Average Slope     (%)=       2.00        10.00
     Length            (m)=     100.00        80.00
     Mannings n          =       .013         .250

     Max.eff.Inten.(mm/hr)=      73.38        17.06
                over (min)       2.00        16.00
     Storage Coeff.  (min)=       2.35 (ii)   15.74 (ii)
     Unit Hyd. Tpeak (min)=       2.00        16.00
     Unit Hyd. peak  (cms)=        .50          .07
                                                           *TOTALS*
     PEAK FLOW       (cms)=        .00          .05          .054 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.58         1.583
     RUNOFF VOLUME    (mm)=      30.37         9.52         9.724
```

```
     TOTAL RAINFALL   (mm)=      32.37        32.37         32.374
     RUNOFF COEFFICIENT   =        .94          .29           .300

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  81.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------------------
R0001:C00004-------------------------------------------------------------------------------
* EXTERNAL
--------------------------
| CALIB NASHYD           |   Area    (ha)=   11.710   Curve Number   (CN)= 83.00
| 02:EXT        DT= 1.00 |   Ia      (mm)=    6.800   # of Linear Res.(N)=  3.00
--------------------------   U.H. Tp(hrs)=     .240

     Unit Hyd Qpeak  (cms)=    1.864

     PEAK FLOW       (cms)=     .224 (i)
     TIME TO PEAK    (hrs)=    1.617
     DURATION        (hrs)=    5.667, (dddd|hh:mm:)=   0|05:40
     AVERAGE FLOW    (cms)=     .048
     RUNOFF VOLUME    (mm)=    8.428
     TOTAL RAINFALL   (mm)=   32.374
     RUNOFF COEFFICIENT   =     .260

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

-------------------------------------------------------------------------------------------
R0001:C00005-------------------------------------------------------------------------------
* TOTAL
------------------------
| ADD HYD              |
| 03:TOTAL             |   ID:NHYD            AREA     QPEAK    TPEAK      R.V.     DWF
------------------------                      (ha)     (cms)    (hrs)      (mm)   (cms)
                      ID 1 01:PRE1           2.460      .054    1.583     9.724    .000
                     +ID 2 02:EXT           11.710      .224    1.617     8.428    .000
                     ==================================================================
                     SUM   03:TOTAL         14.170      .277    1.617     8.653    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------------------
R0001:C00006-------------------------------------------------------------------------------
* SITE
* To account for the existing packed gravel surfaces on-site, the TIMP value
* was calibrated (see design calcs)
--------------------------
| CALIB STANDHYD         |   Area    (ha)=    1.40
| 04:PRE2       DT= 1.00 |   Total Imp(%)=   24.00   Dir. Conn.(%)=    1.00
--------------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .34         1.06
```

```
     Dep. Storage     (mm)=       2.00         8.00
     Average Slope     (%)=       3.50        13.00
     Length            (m)=      45.00        70.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      73.38        19.64
                over (min)        1.00        12.00
     Storage Coeff.  (min)=       1.23 (ii)   12.03 (ii)
     Unit Hyd. Tpeak (min)=       1.00        12.00
     Unit Hyd. peak  (cms)=        .95          .09
                                                            *TOTALS*
     PEAK FLOW       (cms)=        .00          .04           .036 (iii)
     TIME TO PEAK    (hrs)=       1.30         1.52          1.500
     RUNOFF VOLUME    (mm)=      30.33         9.56          9.769
     TOTAL RAINFALL   (mm)=      32.37        32.37         32.374
     RUNOFF COEFFICIENT   =        .94          .30           .302

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  81.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------------------
R0001:C00007-------------------------------------------------------------------------------
  ** END OF RUN :    0

*******************************************************************************************





--------------------
| START            | Project  dir.:C:\Temp\15-319\EX\4-hour_Chic\
-------------------- Rainfall dir.:C:\Temp\15-319\EX\4-hour_Chic\
    TZERO =   .00 hrs on       0
    METOUT=   2 (output = METRIC)
    NRUN  = 0002
    NSTORM=   1
           #  1=5CHI4.stm
-------------------------------------------------------------------------------------------
R0002:C00002-------------------------------------------------------------------------------
*#******************************************************************************
*#  Project Name: [Mansfield Ski Club]    Project Number: [15-319]
*#  Date        : 07-31-2017
*#  Modeller    : [J. Lightheart]
*#  Company     : WMI & Associates Ltd.
*#  License #   :  2880720
*#******************************************************************************
*
* Pre-Development Condition - Mansfield Ski Club
*
-------------------------------------------------------------------------------------------
```

```
R0002:C00002----------------------------------------------------------------------------
--------------------
| READ STORM       |  Filename: C:\Temp\15-319\EX\4-hour_Chic\5CHI4.stm
| Ptotal=  42.60 mm|  Comments: 5-Year Chicago Storm Distribution (4-hour) Mansfield, ON.
--------------------
      TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME
     hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm
      0:10   3.347|   0:50   6.492|   1:30  23.565|   2:10   6.934|   2:50   4.502|   3:30
      0:20   3.764|   1:00   9.144|   1:40  13.736|   2:20   6.062|   3:00   4.168|   3:40
      0:30   4.331|   1:10  18.640|   1:50  10.128|   2:30   5.413|   3:10   3.887|   3:50
      0:40   5.155|   1:20  96.860|   2:00   8.178|   2:40   4.908|   3:20   3.648|   4:00

----------------------------------------------------------------------------------------
R0002:C00003----------------------------------------------------------------------------
* SITE
* To account for the existing packed gravel surfaces on-site, the TIMP value
* was calibrated (see design calcs)
--------------------------
| CALIB STANDHYD         |   Area    (ha)=    2.46
| 01:PRE1       DT= 1.00 |   Total Imp(%)=   24.00   Dir. Conn.(%)=    1.00
--------------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .59         1.87
     Dep. Storage     (mm)=       2.00         8.10
     Average Slope     (%)=       2.00        10.00
     Length            (m)=     100.00        80.00
     Mannings n          =        .013         .250

     Max.eff.Inten.(mm/hr)=      96.86        36.26
                over (min)        2.00        12.00
     Storage Coeff.  (min)=       2.10 (ii)   12.01 (ii)
     Unit Hyd. Tpeak (min)=       2.00        12.00
     Unit Hyd. peak  (cms)=        .54          .09
                                                           *TOTALS*
     PEAK FLOW       (cms)=        .01          .12           .118 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.50          1.500
     RUNOFF VOLUME    (mm)=      40.60        16.12         16.365
     TOTAL RAINFALL   (mm)=      42.60        42.60         42.603
     RUNOFF COEFFICIENT   =        .95          .38           .384

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  81.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

----------------------------------------------------------------------------------------
R0002:C00004----------------------------------------------------------------------------
* EXTERNAL
--------------------------
| CALIB NASHYD           |   Area    (ha)=   11.710   Curve Number   (CN)= 83.00
| 02:EXT        DT= 1.00 |   Ia      (mm)=    6.800   # of Linear Res.(N)=  3.00
--------------------------   U.H. Tp(hrs)=     .240
```

```
     Unit Hyd Qpeak  (cms)=    1.864

     PEAK FLOW       (cms)=     .424 (i)
     TIME TO PEAK    (hrs)=    1.600
     DURATION        (hrs)=    5.667, (dddd|hh:mm:)=   0|05:40
     AVERAGE FLOW    (cms)=     .084
     RUNOFF VOLUME    (mm)=   14.595
     TOTAL RAINFALL   (mm)=   42.603
     RUNOFF COEFFICIENT   =     .343

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

----------------------------------------------------------------------------------------
R0002:C00005----------------------------------------------------------------------------
* TOTAL
------------------------
| ADD HYD               |
| 03:TOTAL              |   ID:NHYD           AREA     QPEAK    TPEAK      R.V.     DWF
------------------------                      (ha)     (cms)    (hrs)      (mm)   (cms)
                      ID 1 01:PRE1           2.460      .118    1.500    16.365    .000
                     +ID 2 02:EXT           11.710      .424    1.600    14.595    .000
                     ==============================================================
                     SUM   03:TOTAL         14.170      .529    1.567    14.903    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

----------------------------------------------------------------------------------------
R0002:C00006----------------------------------------------------------------------------
* SITE
* To account for the existing packed gravel surfaces on-site, the TIMP value
* was calibrated (see design calcs)
--------------------------
| CALIB STANDHYD         |   Area    (ha)=    1.40
| 04:PRE2       DT= 1.00 |   Total Imp(%)=   24.00   Dir. Conn.(%)=    1.00
--------------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .34         1.06
     Dep. Storage     (mm)=       2.00         8.00
     Average Slope     (%)=       3.50        13.00
     Length            (m)=      45.00        70.00
     Mannings n          =        .013         .250

     Max.eff.Inten.(mm/hr)=      96.86        43.46
                over (min)        1.00         9.00
     Storage Coeff.  (min)=       1.10 (ii)    8.96 (ii)
     Unit Hyd. Tpeak (min)=       1.00         9.00
     Unit Hyd. peak  (cms)=       1.01          .13
                                                           *TOTALS*
     PEAK FLOW       (cms)=        .00          .08           .080 (iii)
     TIME TO PEAK    (hrs)=       1.28         1.45          1.450
     RUNOFF VOLUME    (mm)=      40.53        16.17         16.417
     TOTAL RAINFALL   (mm)=      42.60        42.60         42.603
     RUNOFF COEFFICIENT   =        .95          .38           .385
```

```
       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  81.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------------------
R0002:C00007-------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------
R0002:C00002-------------------------------------------------------------------------------
  ** END OF RUN :    1

*******************************************************************************************





--------------------
| START            | Project  dir.:C:\Temp\15-319\EX\4-hour_Chic\
-------------------- Rainfall dir.:C:\Temp\15-319\EX\4-hour_Chic\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 0003
    NSTORM=   1
           #  1=25CHI4.stm
-------------------------------------------------------------------------------------------
R0003:C00002-------------------------------------------------------------------------------
*#******************************************************************************
*#  Project Name: [Mansfield Ski Club]    Project Number: [15-319]
*#  Date        : 07-31-2017
*#  Modeller    : [J. Lightheart]
*#  Company     : WMI & Associates Ltd.
*#  License #   :  2880720
*#******************************************************************************
*
* Pre-Development Condition - Mansfield Ski Club
*
-------------------------------------------------------------------------------------------
R0003:C00002-------------------------------------------------------------------------------
--------------------
| READ STORM       |  Filename: C:\Temp\15-319\EX\4-hour_Chic\25CHI4.stm
| Ptotal=  58.08 mm|  Comments: 25-Year Chicago Storm Distribution (4-hour) Mansfield, ON.
--------------------
      TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME
     hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm
      0:10   4.562|   0:50   8.850|   1:30  32.125|   2:10   9.453|   2:50   6.138|   3:30
      0:20   5.131|   1:00  12.466|   1:40  18.726|   2:20   8.265|   3:00   5.682|   3:40
      0:30   5.904|   1:10  25.411|   1:50  13.807|   2:30   7.379|   3:10   5.299|   3:50
      0:40   7.028|   1:20 132.047|   2:00  11.148|   2:40   6.691|   3:20   4.973|   4:00

-------------------------------------------------------------------------------------------
R0003:C00003-------------------------------------------------------------------------------
```

```
* SITE
* To account for the existing packed gravel surfaces on-site, the TIMP value
* was calibrated (see design calcs)
--------------------------
| CALIB STANDHYD         |   Area    (ha)=    2.46
| 01:PRE1       DT= 1.00 |   Total Imp(%)=   24.00   Dir. Conn.(%)=    1.00
--------------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .59         1.87
     Dep. Storage     (mm)=       2.00         8.10
     Average Slope     (%)=       2.00        10.00
     Length            (m)=     100.00        80.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=     132.05        79.60
                over (min)        2.00         9.00
     Storage Coeff.  (min)=       1.86 (ii)    9.09 (ii)
     Unit Hyd. Tpeak (min)=       2.00         9.00
     Unit Hyd. peak  (cms)=        .59          .12
                                                            *TOTALS*
     PEAK FLOW       (cms)=        .01          .25           .252 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.43          1.433
     RUNOFF VOLUME    (mm)=      56.08        27.56         27.843
     TOTAL RAINFALL   (mm)=      58.08        58.08         58.079
     RUNOFF COEFFICIENT   =        .97          .47           .479

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  81.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------------------
R0003:C00004-------------------------------------------------------------------------------
* EXTERNAL
--------------------------
| CALIB NASHYD           |   Area    (ha)=   11.710   Curve Number   (CN)= 83.00
| 02:EXT        DT= 1.00 |   Ia      (mm)=    6.800   # of Linear Res.(N)=  3.00
--------------------------   U.H. Tp(hrs)=     .240

     Unit Hyd Qpeak  (cms)=    1.864

     PEAK FLOW       (cms)=     .795 (i)
     TIME TO PEAK    (hrs)=    1.583
     DURATION        (hrs)=    5.667, (dddd|hh:mm:)=   0|05:40
     AVERAGE FLOW    (cms)=     .146
     RUNOFF VOLUME    (mm)=   25.455
     TOTAL RAINFALL   (mm)=   58.079
     RUNOFF COEFFICIENT   =     .438

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

-------------------------------------------------------------------------------------------
R0003:C00005-------------------------------------------------------------------------------
```

```
* TOTAL
------------------------
| ADD HYD              |
| 03:TOTAL             |   ID:NHYD            AREA     QPEAK    TPEAK      R.V.     DWF
------------------------                      (ha)     (cms)    (hrs)      (mm)   (cms)
                      ID 1 01:PRE1           2.460      .252    1.433    27.843    .000
                     +ID 2 02:EXT           11.710      .795    1.583    25.455    .000
                     ==================================================================
                     SUM   03:TOTAL         14.170      .988    1.550    25.869    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------------------
R0003:C00006-------------------------------------------------------------------------------
* SITE
* To account for the existing packed gravel surfaces on-site, the TIMP value
* was calibrated (see design calcs)
--------------------------
| CALIB STANDHYD         |   Area    (ha)=    1.40
| 04:PRE2       DT= 1.00 |   Total Imp(%)=   24.00   Dir. Conn.(%)=    1.00
--------------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .34        1.06
     Dep. Storage     (mm)=       2.00        8.00
     Average Slope     (%)=       3.50       13.00
     Length            (m)=      45.00       70.00
     Mannings n           =       .013        .250

     Max.eff.Inten.(mm/hr)=     132.05       86.85
                over (min)       1.00        7.00
     Storage Coeff.  (min)=        .97 (ii)    6.93 (ii)
     Unit Hyd. Tpeak (min)=       1.00        7.00
     Unit Hyd. peak  (cms)=       1.09         .16
                                                           *TOTALS*
     PEAK FLOW       (cms)=        .01         .17           .167 (iii)
     TIME TO PEAK    (hrs)=       1.28        1.40          1.400
     RUNOFF VOLUME    (mm)=      56.04       27.62         27.901
     TOTAL RAINFALL   (mm)=      58.08       58.08         58.079
     RUNOFF COEFFICIENT   =        .96         .48           .480

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  81.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------------------
R0003:C00007-------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------
R0003:C00002-------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------
R0003:C00002-------------------------------------------------------------------------------
  ** END OF RUN :    2
```

```
*******************************************************************************************




--------------------
| START             | Project  dir.:C:\Temp\15-319\EX\4-hour_Chic\
-------------------- Rainfall dir.:C:\Temp\15-319\EX\4-hour_Chic\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 0004
    NSTORM=   1
           #  1=100CHI4.stm
-------------------------------------------------------------------------------------------
R0004:C00002-------------------------------------------------------------------------------
*#******************************************************************************
*#  Project Name: [Mansfield Ski Club]    Project Number: [15-319]
*#  Date        : 07-31-2017
*#  Modeller    : [J. Lightheart]
*#  Company     : WMI & Associates Ltd.
*#  License #   :  2880720
*#******************************************************************************
*
* Pre-Development Condition - Mansfield Ski Club
*
-------------------------------------------------------------------------------------------
R0004:C00002-------------------------------------------------------------------------------
--------------------
| READ STORM        |  Filename: C:\Temp\15-319\EX\4-hour_Chic\100CHI4.stm
| Ptotal=  70.93 mm|  Comments: 100-Year Chicago Storm Distribution (4-hour) Mansfield, ON.
--------------------
      TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME
     hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm
      0:10   5.571|   0:50  10.808|   1:30  39.231|   2:10  11.544|   2:50   7.495|   3:30
      0:20   6.266|   1:00  15.223|   1:40  22.869|   2:20  10.093|   3:00   6.939|   3:40
      0:30   7.210|   1:10  31.032|   1:50  16.861|   2:30   9.012|   3:10   6.472|   3:50
      0:40   8.582|   1:20 161.254|   2:00  13.614|   2:40   8.171|   3:20   6.073|   4:00

-------------------------------------------------------------------------------------------
R0004:C00003-------------------------------------------------------------------------------
* SITE
* To account for the existing packed gravel surfaces on-site, the TIMP value
* was calibrated (see design calcs)
--------------------------
| CALIB STANDHYD         |   Area    (ha)=    2.46
| 01:PRE1       DT= 1.00 |   Total Imp(%)=   24.00   Dir. Conn.(%)=    1.00
--------------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .59        1.87
     Dep. Storage     (mm)=       2.00        8.10
     Average Slope     (%)=       2.00       10.00
     Length            (m)=     100.00       80.00
```

```
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=     161.25       117.56
                over (min)        2.00         8.00
     Storage Coeff.  (min)=       1.71 (ii)    7.90 (ii)
     Unit Hyd. Tpeak (min)=       2.00         8.00
     Unit Hyd. peak  (cms)=        .62          .14
                                                       *TOTALS*
     PEAK FLOW       (cms)=        .01          .38          .387 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.42         1.417
     RUNOFF VOLUME    (mm)=      68.93        37.91        38.221
     TOTAL RAINFALL   (mm)=      70.93        70.93        70.926
     RUNOFF COEFFICIENT   =        .97          .53          .539

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  81.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

---------------------------------------------------------------------------------------------
R0004:C00004---------------------------------------------------------------------------------
* EXTERNAL
-------------------------
| CALIB NASHYD          |   Area    (ha)=   11.710   Curve Number   (CN)= 83.00
| 02:EXT       DT= 1.00 |   Ia      (mm)=    6.800   # of Linear Res.(N)=  3.00
-------------------------   U.H. Tp(hrs)=     .240

     Unit Hyd Qpeak  (cms)=    1.864

     PEAK FLOW       (cms)=    1.146 (i)
     TIME TO PEAK    (hrs)=    1.567
     DURATION        (hrs)=    5.667, (dddd|hh:mm:)=   0|05:40
     AVERAGE FLOW    (cms)=     .203
     RUNOFF VOLUME    (mm)=   35.404
     TOTAL RAINFALL   (mm)=   70.926
     RUNOFF COEFFICIENT   =     .499

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

---------------------------------------------------------------------------------------------
R0004:C00005---------------------------------------------------------------------------------
* TOTAL
-----------------------
| ADD HYD             |
| 03:TOTAL            |   ID:NHYD           AREA     QPEAK    TPEAK      R.V.     DWF
-----------------------                     (ha)     (cms)    (hrs)      (mm)   (cms)
                     ID 1 01:PRE1          2.460      .387    1.417    38.221    .000
                    +ID 2 02:EXT          11.710     1.146    1.567    35.404    .000
                    ==================================================================
                    SUM   03:TOTAL        14.170     1.415    1.533    35.893    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
```

```
---------------------------------------------------------------------------------------------
R0004:C00006---------------------------------------------------------------------------------
* SITE
* To account for the existing packed gravel surfaces on-site, the TIMP value
* was calibrated (see design calcs)
--------------------------
| CALIB STANDHYD         |   Area    (ha)=    1.40
| 04:PRE2       DT= 1.00 |   Total Imp(%)=   24.00   Dir. Conn.(%)=    1.00
--------------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .34         1.06
     Dep. Storage     (mm)=       2.00         8.00
     Average Slope     (%)=       3.50        13.00
     Length            (m)=      45.00        70.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=     161.25       125.47
                over (min)        1.00         6.00
     Storage Coeff.  (min)=        .90 (ii)    6.04 (ii)
     Unit Hyd. Tpeak (min)=       1.00         6.00
     Unit Hyd. peak  (cms)=       1.14          .19
                                                       *TOTALS*
     PEAK FLOW       (cms)=        .01          .25          .255 (iii)
     TIME TO PEAK    (hrs)=       1.28         1.38         1.383
     RUNOFF VOLUME    (mm)=      68.90        37.97        38.284
     TOTAL RAINFALL   (mm)=      70.93        70.93        70.926
     RUNOFF COEFFICIENT   =        .97          .54          .540

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  81.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

---------------------------------------------------------------------------------------------
R0004:C00007---------------------------------------------------------------------------------
---------------------------------------------------------------------------------------------
R0004:C00002---------------------------------------------------------------------------------
---------------------------------------------------------------------------------------------
R0004:C00002---------------------------------------------------------------------------------
---------------------------------------------------------------------------------------------
R0004:C00002---------------------------------------------------------------------------------
  ** END OF RUN :    3

*********************************************************************************************





--------------------
| START            | Project  dir.:C:\Temp\15-319\EX\4-hour_Chic\
-------------------- Rainfall dir.:C:\Temp\15-319\EX\4-hour_Chic\
    TZERO =   .00 hrs on        0
```

```
          METOUT=   2 (output = METRIC)
          NRUN  = 0005
          NSTORM=   1
                 #  1=12regtim.o89
      -------------------------------------------------------------------------------------------
      R0005:C00002-------------------------------------------------------------------------------
      *#*******************************************************************************
      *#  Project Name: [Mansfield Ski Club]    Project Number: [15-319]
      *#  Date        : 07-31-2017
      *#  Modeller    : [J. Lighthe art]
      *#  Company     : WMI & Associates Ltd.
      *#  License #   :  2880720
      *#*******************************************************************************
      *
      * Pre-Development Condition - Mansfield Ski Club
      *
      -------------------------------------------------------------------------------------------
      R0005:C00002-------------------------------------------------------------------------------
      --------------------
      | READ STORM       |  Filename: C:\Temp\15-319\EX\4-hour_Chic\12regtim.o89
      | Ptotal= 193.00 mm|  Comments: TIMMINS REGIONAL STORM (12-hour)
      --------------------
            TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME
           hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm
            1:00  15.000|   3:00  10.000|   5:00   5.000|   7:00  43.000|   9:00  23.000|  11:00
            2:00  20.000|   4:00   3.000|   6:00  20.000|   8:00  20.000|  10:00  13.000|  12:00

      -------------------------------------------------------------------------------------------
      R0005:C00003-------------------------------------------------------------------------------
      * SITE
      * To account for the existing packed gravel surfaces on-site, the TIMP value
      * was calibrated (see design calcs)
      --------------------------
      | CALIB STANDHYD         |   Area    (ha)=    2.46
      | 01:PRE1       DT= 1.00 |   Total Imp(%)=   24.00   Dir. Conn.(%)=    1.00
      --------------------------
                                    IMPERVIOUS    PERVIOUS (i)
           Surface Area     (ha)=        .59         1.87
           Dep. Storage     (mm)=       2.00         8.10
           Average Slope     (%)=       2.00        10.00
           Length            (m)=     100.00        80.00
           Mannings n          =       .013         .250

           Max.eff.Inten.(mm/hr)=      43.00        50.88
                      over (min)       3.00        12.00
           Storage Coeff.  (min)=       2.91 (ii)   11.56 (ii)
           Unit Hyd. Tpeak (min)=       3.00        12.00
           Unit Hyd. peak  (cms)=        .39          .10
                                                                *TOTALS*
           PEAK FLOW       (cms)=        .00          .26           .262 (iii)
           TIME TO PEAK    (hrs)=       6.95         7.00          7.000
           RUNOFF VOLUME    (mm)=     191.00       150.04        150.449
           TOTAL RAINFALL   (mm)=     193.00       193.00        193.000
```

```
           RUNOFF COEFFICIENT   =        .99          .78           .780

             (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
                 CN* =  81.0    Ia = Dep. Storage  (Above)
            (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
           (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

      -------------------------------------------------------------------------------------------
      R0005:C00004-------------------------------------------------------------------------------
      * EXTERNAL
      --------------------------
      | CALIB NASHYD           |   Area    (ha)=   11.710   Curve Number   (CN)= 83.00
      | 02:EXT        DT= 1.00 |   Ia      (mm)=    6.800   # of Linear Res.(N)=  3.00
      --------------------------   U.H. Tp(hrs)=     .240

           Unit Hyd Qpeak  (cms)=    1.864

           PEAK FLOW       (cms)=    1.215 (i)
           TIME TO PEAK    (hrs)=    7.017
           DURATION        (hrs)=   13.667, (dddd|hh:mm:)=   0|13:40
           AVERAGE FLOW    (cms)=     .346
           RUNOFF VOLUME    (mm)=  145.537
           TOTAL RAINFALL   (mm)=  193.000
           RUNOFF COEFFICIENT   =     .754

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

      -------------------------------------------------------------------------------------------
      R0005:C00005-------------------------------------------------------------------------------
      * TOTAL
      ------------------------
      | ADD HYD              |
      | 03:TOTAL             |   ID:NHYD            AREA     QPEAK    TPEAK      R.V.     DWF
      ------------------------                      (ha)     (cms)    (hrs)      (mm)   (cms)
                           ID 1 01:PRE1          2.460      .262    7.000   150.449    .000
                          +ID 2 02:EXT          11.710     1.215    7.017   145.537    .000
                          ==========================================================
                          SUM   03:TOTAL        14.170     1.477    7.017   146.390    .000

         NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

      -------------------------------------------------------------------------------------------
      R0005:C00006-------------------------------------------------------------------------------
      * SITE
      * To account for the existing packed gravel surfaces on-site, the TIMP value
      * was calibrated (see design calcs)
      --------------------------
      | CALIB STANDHYD         |   Area    (ha)=    1.40
      | 04:PRE2       DT= 1.00 |   Total Imp(%)=   24.00   Dir. Conn.(%)=    1.00
      --------------------------
                                    IMPERVIOUS    PERVIOUS (i)
           Surface Area     (ha)=        .34         1.06
           Dep. Storage     (mm)=       2.00         8.00
```

```
     Average Slope     (%)=       3.50        13.00
     Length            (m)=      45.00        70.00
     Mannings n          =       .013         .250

     Max.eff.Inten.(mm/hr)=      43.00        50.96
                over (min)        2.00         9.00
     Storage Coeff.  (min)=       1.52 (ii)    8.90 (ii)
     Unit Hyd. Tpeak (min)=       2.00         9.00
     Unit Hyd. peak  (cms)=        .66          .13
                                                        *TOTALS*
     PEAK FLOW       (cms)=        .00          .15          .151 (iii)
     TIME TO PEAK    (hrs)=       6.87         7.00         7.000
     RUNOFF VOLUME    (mm)=     191.00       150.11       150.522
     TOTAL RAINFALL   (mm)=     193.00       193.00       193.000
     RUNOFF COEFFICIENT   =        .99          .78          .780

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  81.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

------------------------------------------------------------------------------------------
R0005:C00007------------------------------------------------------------------------------
------------------------------------------------------------------------------------------
R0005:C00002------------------------------------------------------------------------------
------------------------------------------------------------------------------------------
R0005:C00002------------------------------------------------------------------------------
------------------------------------------------------------------------------------------
R0005:C00002------------------------------------------------------------------------------
------------------------------------------------------------------------------------------
R0005:C00002------------------------------------------------------------------------------
--------------------
| FINISH           |
--------------------
------------------------------------------------------------------------------------------
******************************************************************************************
     WARNINGS / ERRORS / NOTES
     -------------------------
   Simulation ended on 2020-11-16     at 11:21:02
==========================================================================================
```

Post-Development Condition
24-hour SCS Type-II Storm Distribution

```
2     Metric units
*#******************************************************************************
*#  Project Name: [Mansfield Ski Club]    Project Number: [15-319]
*#  Date        : 07-31-2017
*#  Modeller    : [J. Lightheart]
*#  Company     : WMI & Associates Ltd.
*#  License #   :  2880720
*#******************************************************************************
*
* Post-Development Condition - Mansfield Ski Club
*
*% 25mm Chicago Storm Dist. based on Mansfield, ON. rainfall (4-hr)
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[1]
*%                   ["25mm4hr.stm"] <--storm filename
*%-----------------|-----------------------------------------------------------|
READ STORM          STORM_FILENAME=["STORM.001"]
*%-----------------|-----------------------------------------------------------|
* SITE (POST1 - Controlled Area)
CALIB STANDHYD      ID=[1], NHYD=["POST1"], DT=[1](min), AREA=[2.74](ha),
                    XIMP=[0.59], TIMP=[0.69], DWF=[0](cms), LOSS=[2],
                    SCS curve number CN=[84],
                    Pervious   surfaces: IAper=[5.0](mm), SLPP=[33.3](%),
                                         LGP=[6](m), MNP=[0.25], SCP=[0](min),
                    Impervious surfaces: IAimp=[2.0](mm), SLPI=[3.5](%),
                                         LGI=[300](m), MNI=[0.013], SCI=[0](min),
                    RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
*%-----------------|-----------------------------------------------------------|
* EXTERNAL (Routed through SWM Facility)
CALIB NASHYD        ID=[2], NHYD=["EXT"], DT=[1]min, AREA=[11.94](ha),
                    DWF=[0](cms),  CN/C=[83], IA=[6.8](mm),
                    N=[3], TP=[0.24]hrs,
                    RAINFALL=[ ,  ,  ,  , ](mm/hr),  END=-1
*%-----------------|-----------------------------------------------------------|
* TOTAL FLOW TO SIDEROAD 15 CROSS CULVERT (POST1 CONTROLLED + EXT)
ADD HYD             IDsum=[3], NHYD=["POST1+EXT"], IDs to add=[1+2]
*%-----------------|-----------------------------------------------------------|
* SWM Facility
ROUTE RESERVOIR     IDout=[4], NHYD=["SWM Facility"], IDin=[3], RDT=[1](min),
                         TABLE of ( OUTFLOW-STORAGE ) values
                                   (cms) - (ha-m)
                                 [0.0000 , 0.00000]
                                 [0.0015 , 0.00063]
                                 [0.0031 , 0.00131]
                                 [0.0041 , 0.00205]
                                 [0.0050 , 0.00284]
                                 [0.0057 , 0.00368]
                                 [0.0063 , 0.00459]
                                 [0.0069 , 0.00557]
                                 [0.0074 , 0.00661]
                                 [0.0079 , 0.00772]
                                 [0.0084 , 0.00891]
                                 [0.0088 , 0.01017]
                                 [0.0092 , 0.01150]
```

```
                                 [0.0096 , 0.01292]
                                 [0.0100 , 0.01442]
                                 [0.0104 , 0.01601]
                                 [0.0108 , 0.01769]
                                 [0.0111 , 0.01946]
                                 [0.0114 , 0.02133]
                                 [0.0118 , 0.02329]
                                 [0.0121 , 0.02535]
                                 [0.0124 , 0.02777]
                                 [0.0127 , 0.03027]
                                 [0.0130 , 0.03287]
                                 [0.0133 , 0.03557]
                                 [0.0317 , 0.03837]
                                 [0.0651 , 0.04128]
                                 [0.1082 , 0.04430]
                                 [0.1593 , 0.04743]
                                 [0.2172 , 0.05067]
                                 [0.2811 , 0.05403]
                                 [0.3506 , 0.05751]
                                 [0.4252 , 0.06112]
                                 [0.5047 , 0.06486]
                                 [0.5887 , 0.06872]
                                 [0.6769 , 0.07272]
                                 [0.7693 , 0.07686]
                                 [0.8656 , 0.08113]
                                 [0.9656 , 0.08555]
                                 [1.0706 , 0.09011]
                                 [1.1842 , 0.09483]
                                 [1.3084 , 0.09970]
                                 [1.4447 , 0.10472]
                                 [1.5945 , 0.10990]
                                 [1.7589 , 0.11524]
                                 [2.0195 , 0.12075]
                                 [2.3829 , 0.14300]
                                 [2.8396 , 0.14870]
                                 [3.3911 , 0.15454]
                                 [4.0406 , 0.16053]
                                 [4.7921 , 0.16666]
                                 [5.6495 , 0.17293]
                                 [   -1  ,   -1  ]  (maximum one hundred pairs of points)
                                 IDovf=[   ], NHYDovf=["      "],
*%-----------------|-----------------------------------------------------------------------
* SITE (POST2 - Uncontrolled Area)
CALIB STANDHYD      ID=[5], NHYD=["POST2"], DT=[1](min), AREA=[0.89](ha),
                    XIMP=[0.105], TIMP=[0.21], DWF=[0](cms), LOSS=[2],
                    SCS curve number CN=[84],
                    Pervious   surfaces: IAper=[5.0](mm), SLPP=[11.1](%),
                                         LGP=[50](m), MNP=[0.25], SCP=[0](min),
                    Impervious surfaces: IAimp=[2.0](mm), SLPI=[6.0](%),
                                         LGI=[120](m), MNI=[0.013], SCI=[0](min),
                    RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
*%-----------------|-----------------------------------------------------------|
*% 2-year SCS Type-II Storm Dist. based on Mansfield, ON. rainfall (24-hr)
```

```
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[2]
*%                   ["2SCS24.stm"] <--storm filename
*%-----------------|-----------------------------------------------------------|
*% 5-year SCS Type-II Storm Dist. based on Mansfield, ON. rainfall (24-hr)
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[3]
*%                   ["5SCS24.stm"] <--storm filename
*%-----------------|-----------------------------------------------------------|
*% 25-year SCS Type-II Storm Dist. based on Mansfield, ON. rainfall (24-hr)
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[4]
*%                   ["25SCS24.stm"] <--storm filename
*%-----------------|-----------------------------------------------------------|
*% 100-year SCS Type-II Storm Dist. based on Mansfield, ON. rainfall (24-hr)
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[5]
*%                   ["100SCS24.stm"] <--storm filename
*%-----------------|-----------------------------------------------------------|
*% Timmins Regional Storm (12-hr)
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[6]
*%                   ["12regtim.o89"] <--storm filename
*%-----------------|-----------------------------------------------------------|
FINISH
```

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

 SSSSS   W   W   M   M   H   H   Y   Y   M   M    OOO         222     000    11   77777 ==
 S       W W W   MM MM   H   H    Y Y    MM MM   O   O          2    0   0   11   7   7
 SSSSS   W W W   M M M   HHHHH     Y     M M M   O   O          2    0   0   11       7
     S    W W    M   M   H   H     Y     M   M   O   O        222    0   0   11      7
 SSSSS    W W    M   M   H   H     Y     M   M    OOO         2      0   0   11     7   ==
                                                              2      0   0   11    7    #
       StormWater Management HYdrologic Model                  222     000    11    7    ==

 ******************************************************************************************
 **************************************  SWMHYMO Ver4.05.0  ******************************
 ******************  A single event and continuous hydrologic simulation model  ***********
 ******************    based on the principles of HYMO and its successors      ***********
 ******************                OTTHYMO-83 and OTTHYMO-89.                  ***********
 ******************************************************************************************
 ****************** Distributed by:  J.F. Sabourin and Associates Inc.         ***********
 ******************                 Ottawa,  Ontario: (613) 836-3884           ***********
 ******************                 Gatineau, Quebec: (819) 243-6858           ***********
 ******************                 E-Mail: swmhymo@jfsa.com                   ***********
 ******************************************************************************************

 ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
 ++++++++++++++++++ Licensed user: WMI & Associates Ltd.                       +++++++++++
 ++++++++++++++++++              Barrie               SERIAL#:2880720          +++++++++++
 ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

 ******************************************************************************************
 ******************           ++++++ PROGRAM ARRAY DIMENSIONS ++++++           ***********
 ******************           Maximum value for ID numbers  :     11           ***********
 ******************           Max. number of rainfall points: 105408           ***********
 ******************           Max. number of flow points    : 105408           ***********
 ******************************************************************************************


 *******************************   D E T A I L E D   O U T P U T   ***********************
 ******************************************************************************************
 *                RUN DATE: 2020-12-09     TIME: 16:07:39     RUN COUNTER: 000004
 ******************************************************************************************
 * Input   file: C:\Temp\15-319\PR\24-hour_SCS\2-CYRSCS.dat
 * Output  file: C:\Temp\15-319\PR\24-hour_SCS\2-CYRSCS.out
 * Summary file: C:\Temp\15-319\PR\24-hour_SCS\2-CYRSCS.sum
 * User comments:
 * 1:_______________________________________________________________________________________
 * 2:_______________________________________________________________________________________
 * 3:_______________________________________________________________________________________
 ******************************************************************************************

-------------------------------------------------------------------------------------------
R0001:C00001-------------------------------------------------------------------------------
*#*****************************************************************************
*#  Project Name: [Mansfield Ski Club]    Project Number: [15-319]
*#  Date        : 07-31-2017
```

```
*#  Modeller    : [J. Lightheart]
*#  Company     : WMI & Associates Ltd.
*#  License #   :  2880720
*#*****************************************************************************
*
* Post-Development Condition - Mansfield Ski Club
*
--------------------
| START            | Project  dir.:C:\Temp\15-319\PR\24-hour_SCS\
-------------------- Rainfall dir.:C:\Temp\15-319\PR\24-hour_SCS\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 0001
    NSTORM=   1
           #  1=25mm4hr.stm
-------------------------------------------------------------------------------------------
R0001:C00002-------------------------------------------------------------------------------
--------------------
| READ STORM       |  Filename: C:\Temp\15-319\PR\24-hour_SCS\25mm4hr.stm
| Ptotal=  25.00 mm|  Comments: 25mm Chicago Storm Distribution (4-hour) Mansfield, ON.
--------------------
      TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME
     hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm
      0:10   1.970|   0:50   3.820|   1:30  13.830|   2:10   4.080|   2:50   2.650|   3:30
      0:20   2.220|   1:00   5.380|   1:40   8.070|   2:20   3.570|   3:00   2.450|   3:40
      0:30   2.550|   1:10  10.940|   1:50   5.950|   2:30   3.190|   3:10   2.290|   3:50
      0:40   3.030|   1:20  56.670|   2:00   4.810|   2:40   2.890|   3:20   2.150|   4:00

-------------------------------------------------------------------------------------------
R0001:C00003-------------------------------------------------------------------------------
* SITE (POST1 - Controlled Area)
--------------------------
| CALIB STANDHYD         |   Area    (ha)=    2.74
| 01:POST1      DT= 1.00 |   Total Imp(%)=   69.00   Dir. Conn.(%)=   59.00
--------------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.89          .85
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       3.50        33.30
     Length            (m)=     300.00         6.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      56.67        23.86
               over (min)        4.00         6.00
     Storage Coeff.  (min)=       4.26 (ii)    5.98 (ii)
     Unit Hyd. Tpeak (min)=       4.00         6.00
     Unit Hyd. peak  (cms)=        .27          .19
                                                           *TOTALS*
     PEAK FLOW       (cms)=        .22          .04           .255 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.40          1.350
     RUNOFF VOLUME    (mm)=      23.01         7.79         16.768
     TOTAL RAINFALL   (mm)=      25.01        25.01         25.005
     RUNOFF COEFFICIENT   =        .92          .31           .671
```

```
             (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
                 CN* =  84.0    Ia = Dep. Storage  (Above)
            (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
           (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

      -------------------------------------------------------------------------------------------
      R0001:C00004-------------------------------------------------------------------------------
      * EXTERNAL (Routed through SWM Facility)
      --------------------------
      | CALIB NASHYD           |   Area    (ha)=   11.940   Curve Number   (CN)= 83.00
      | 02:EXT        DT= 1.00 |   Ia      (mm)=    6.800   # of Linear Res.(N)=  3.00
      --------------------------   U.H. Tp(hrs)=     .240

           Unit Hyd Qpeak  (cms)=    1.900

           PEAK FLOW       (cms)=     .115 (i)
           TIME TO PEAK    (hrs)=    1.650
           DURATION        (hrs)=    5.667, (dddd|hh:mm:)=   0|05:40
           AVERAGE FLOW    (cms)=     .028
           RUNOFF VOLUME    (mm)=    4.719
           TOTAL RAINFALL   (mm)=   25.005
           RUNOFF COEFFICIENT   =     .189

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

      -------------------------------------------------------------------------------------------
      R0001:C00005-------------------------------------------------------------------------------
      * TOTAL FLOW TO SIDEROAD 15 CROSS CULVERT (POST1 CONTROLLED + EXT)
      ------------------------
      | ADD HYD                |
      | 03:POST1+EXT           |   ID:NHYD           AREA     QPEAK    TPEAK      R.V.     DWF
      ------------------------                       (ha)     (cms)    (hrs)      (mm)   (cms)
                            ID 1 01:POST1          2.740      .255    1.350    16.768    .000
                           +ID 2 02:EXT           11.940      .115    1.650     4.719    .000
                           ==============================================================
                           SUM   03:POST1+EXT     14.680      .282    1.367     6.968    .000

         NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

      -------------------------------------------------------------------------------------------
      R0001:C00006-------------------------------------------------------------------------------
      * SWM Facility
      ----------------------
      |  ROUTE RESERVOIR -> |    Requested routing time step =  1.0 min.
      |  IN>03:POST1+EXT    |
      | OUT<04:SWM Facili   | =========================  OUTLFOW STORAGE TABLE  =================
      ---------------------- OUTFLOW   STORAGE| OUTFLOW   STORAGE| OUTFLOW   STORAGE| OUTFLOW
                               (cms)   (ha.m.)|   (cms)   (ha.m.)|   (cms)   (ha.m.)|   (cms)
                                .000 .0000E+00|    .010 .1292E-01|    .065 .4128E-01|   1.071 .
                                .002 .6300E-03|    .010 .1442E-01|    .108 .4430E-01|   1.184 .
                                .003 .1310E-02|    .010 .1601E-01|    .159 .4743E-01|   1.308 .
                                .004 .2050E-02|    .011 .1769E-01|    .217 .5067E-01|   1.445 .
```

```
                                .005 .2840E-02|    .011 .1946E-01|    .281 .5403E-01|   1.594 .
                                .006 .3680E-02|    .011 .2133E-01|    .351 .5751E-01|   1.759 .
                                .006 .4590E-02|    .012 .2329E-01|    .425 .6112E-01|   2.020 .
                                .007 .5570E-02|    .012 .2535E-01|    .505 .6486E-01|   2.383 .
                                .007 .6610E-02|    .012 .2777E-01|    .589 .6872E-01|   2.840 .
                                .008 .7720E-02|    .013 .3027E-01|    .677 .7272E-01|   3.391 .
                                .008 .8910E-02|    .013 .3287E-01|    .769 .7686E-01|   4.041 .
                                .009 .1017E-01|    .013 .3557E-01|    .866 .8113E-01|   4.792 .
                                .009 .1150E-01|    .032 .3837E-01|    .966 .8555E-01|   5.649 .

           ROUTING RESULTS             AREA     QPEAK     TPEAK       R.V.
           ----------------------      (ha)     (cms)     (hrs)       (mm)
           INFLOW > 03:POST1+EXT     14.680      .282     1.367      6.968
          OUTFLOW < 04:SWM Facili    14.680      .108     2.033      6.968

                         PEAK   FLOW   REDUCTION [Qout/Qin](%)=   38.291
                         TIME SHIFT OF PEAK FLOW         (min)=    40.00
                         MAXIMUM  STORAGE   USED       (ha.m.)=.4429E-01

      -------------------------------------------------------------------------------------------
      R0001:C00007-------------------------------------------------------------------------------
      * SITE (POST2 - Uncontrolled Area)
      --------------------------
      | CALIB STANDHYD         |   Area    (ha)=     .89
      | 05:POST2      DT= 1.00 |   Total Imp(%)=   21.00   Dir. Conn.(%)=   10.50
      --------------------------
                                    IMPERVIOUS    PERVIOUS (i)
           Surface Area     (ha)=        .19          .70
           Dep. Storage     (mm)=       2.00         5.00
           Average Slope     (%)=       6.00        11.10
           Length            (m)=     120.00        50.00
           Mannings n          =        .013         .250

           Max.eff.Inten.(mm/hr)=      56.67        11.01
                      over (min)       2.00        14.00
           Storage Coeff.  (min)=       2.09 (ii)   13.75 (ii)
           Unit Hyd. Tpeak (min)=       2.00        14.00
           Unit Hyd. peak  (cms)=        .54          .08
                                                                 *TOTALS*
           PEAK FLOW       (cms)=        .01          .01           .018 (iii)
           TIME TO PEAK    (hrs)=       1.33         1.55          1.333
           RUNOFF VOLUME    (mm)=      23.00         6.70          8.411
           TOTAL RAINFALL   (mm)=      25.01        25.01         25.005
           RUNOFF COEFFICIENT   =        .92          .27           .336

             (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
                 CN* =  84.0    Ia = Dep. Storage  (Above)
            (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
           (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

      -------------------------------------------------------------------------------------------
      R0001:C00008-------------------------------------------------------------------------------
        ** END OF RUN :    0
```

```
*******************************************************************************************




--------------------
| START            | Project  dir.:C:\Temp\15-319\PR\24-hour_SCS\
-------------------- Rainfall dir.:C:\Temp\15-319\PR\24-hour_SCS\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 0002
    NSTORM=   1
           #  1=2SCS24.stm
-------------------------------------------------------------------------------------------
R0002:C00002-------------------------------------------------------------------------------
*#*****************************************************************************
*#  Project Name: [Mansfield Ski Club]    Project Number: [15-319]
*#  Date        : 07-31-2017
*#  Modeller    : [J. Lightheart]
*#  Company     : WMI & Associates Ltd.
*#  License #   :  2880720
*#*****************************************************************************
*
* Post-Development Condition - Mansfield Ski Club
*
-------------------------------------------------------------------------------------------
R0002:C00002-------------------------------------------------------------------------------
--------------------
| READ STORM       |  Filename: C:\Temp\15-319\PR\24-hour_SCS\2SCS24.stm
| Ptotal=  54.70 mm|  Comments: 2-Year SCS Type-II Storm Distribution (24-hour) Mansfield,
--------------------
      TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME
     hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm
      0:12    .547|   4:12   1.094|   8:12   1.641|  12:12  10.940|  16:12   1.368|  20:12
      0:24    .547|   4:24   1.094|   8:24   1.641|  12:24   6.838|  16:24   1.367|  20:24
      0:36    .547|   4:36   1.094|   8:36   1.641|  12:36   4.923|  16:36   1.367|  20:36
      0:48    .547|   4:48   1.094|   8:48   1.641|  12:48   4.650|  16:48   1.367|  20:48
      1:00    .547|   5:00   1.094|   9:00   1.641|  13:00   3.282|  17:00    .820|  21:00
      1:12    .547|   5:12   1.094|   9:12   1.641|  13:12   2.735|  17:12    .821|  21:12
      1:24    .547|   5:24   1.094|   9:24   1.641|  13:24   2.735|  17:24   1.094|  21:24
      1:36    .547|   5:36   1.094|   9:36   1.641|  13:36   2.735|  17:36    .821|  21:36
      1:48    .547|   5:48   1.094|   9:48   1.641|  13:48   2.735|  17:48   1.094|  21:48
      2:00    .547|   6:00   1.094|  10:00   1.641|  14:00   2.735|  18:00    .821|  22:00
      2:12    .547|   6:12   1.094|  10:12   3.008|  14:12   1.641|  18:12    .821|  22:12
      2:24    .547|   6:24   1.094|  10:24   3.009|  14:24   1.641|  18:24    .820|  22:24
      2:36    .547|   6:36   1.094|  10:36   3.008|  14:36   1.641|  18:36   1.094|  22:36
      2:48    .547|   6:48   1.094|  10:48   3.009|  14:48   1.641|  18:48    .821|  22:48
      3:00    .547|   7:00   1.094|  11:00   3.008|  15:00   1.641|  19:00    .821|  23:00
      3:12    .547|   7:12   1.094|  11:12   4.102|  15:12   1.367|  19:12   1.094|  23:12
      3:24    .547|   7:24   1.094|  11:24   6.017|  15:24   1.367|  19:24    .821|  23:24
      3:36    .547|   7:36   1.094|  11:36  14.495|  15:36   1.367|  19:36   1.094|  23:36
```

```
      3:48    .547|   7:48   1.094|  11:48  30.085|  15:48   1.367|  19:48    .821|  23:48
      4:00    .547|   8:00   1.094|  12:00  61.538|  16:00   1.367|  20:00   1.094|  24:00

-------------------------------------------------------------------------------------------
R0002:C00003-------------------------------------------------------------------------------
* SITE (POST1 - Controlled Area)
--------------------------
| CALIB STANDHYD         |   Area    (ha)=    2.74
| 01:POST1      DT= 1.00 |   Total Imp(%)=   69.00   Dir. Conn.(%)=   59.00
--------------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.89          .85
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       3.50        33.30
     Length            (m)=     300.00         6.00
     Mannings n          =        .013         .250

     Max.eff.Inten.(mm/hr)=      61.54        56.60
                over (min)        4.00         5.00
     Storage Coeff.  (min)=       4.12 (ii)    5.34 (ii)
     Unit Hyd. Tpeak (min)=       4.00         5.00
     Unit Hyd. peak  (cms)=        .28          .22
                                                            *TOTALS*
     PEAK FLOW       (cms)=        .26          .11           .378 (iii)
     TIME TO PEAK    (hrs)=      12.00        12.02         12.000
     RUNOFF VOLUME    (mm)=      52.70        29.63         43.242
     TOTAL RAINFALL   (mm)=      54.70        54.70         54.700
     RUNOFF COEFFICIENT   =        .96          .54           .791

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  84.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------------------
R0002:C00004-------------------------------------------------------------------------------
* EXTERNAL (Routed through SWM Facility)
--------------------------
| CALIB NASHYD           |   Area    (ha)=   11.940   Curve Number   (CN)= 83.00
| 02:EXT        DT= 1.00 |   Ia      (mm)=    6.800   # of Linear Res.(N)=  3.00
--------------------------   U.H. Tp(hrs)=     .240

     Unit Hyd Qpeak  (cms)=    1.900

     PEAK FLOW       (cms)=     .604 (i)
     TIME TO PEAK    (hrs)=   12.150
     DURATION        (hrs)=   25.667, (dddd|hh:mm:)=   1|01:40
     AVERAGE FLOW    (cms)=     .030
     RUNOFF VOLUME    (mm)=   22.962
     TOTAL RAINFALL   (mm)=   54.700
     RUNOFF COEFFICIENT   =     .420

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

```
-------------------------------------------------------------------------------------------
R0002:C00005-------------------------------------------------------------------------------
* TOTAL FLOW TO SIDEROAD 15 CROSS CULVERT (POST1 CONTROLLED + EXT)
------------------------
| ADD HYD              |
| 03:POST1+EXT         |   ID:NHYD            AREA     QPEAK    TPEAK      R.V.     DWF
------------------------                      (ha)     (cms)    (hrs)      (mm)   (cms)
                      ID 1 01:POST1          2.740      .378   12.000    43.242    .000
                     +ID 2 02:EXT           11.940      .604   12.150    22.962    .000
                     ==================================================================
                     SUM   03:POST1+EXT     14.680      .861   12.033    26.747    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------------------
R0002:C00006-------------------------------------------------------------------------------
* SWM Facility
-----------------------
|  ROUTE RESERVOIR -> |    Requested routing time step =  1.0 min.
|  IN>03:POST1+EXT    |
| OUT<04:SWM Facili   | =========================  OUTLFOW STORAGE TABLE  =================
----------------------- OUTFLOW   STORAGE| OUTFLOW   STORAGE| OUTFLOW   STORAGE| OUTFLOW
                          (cms)   (ha.m.)|   (cms)   (ha.m.)|   (cms)   (ha.m.)|   (cms)
                           .000 .0000E+00|    .010 .1292E-01|    .065 .4128E-01|   1.071 .
                           .002 .6300E-03|    .010 .1442E-01|    .108 .4430E-01|   1.184 .
                           .003 .1310E-02|    .010 .1601E-01|    .159 .4743E-01|   1.308 .
                           .004 .2050E-02|    .011 .1769E-01|    .217 .5067E-01|   1.445 .
                           .005 .2840E-02|    .011 .1946E-01|    .281 .5403E-01|   1.594 .
                           .006 .3680E-02|    .011 .2133E-01|    .351 .5751E-01|   1.759 .
                           .006 .4590E-02|    .012 .2329E-01|    .425 .6112E-01|   2.020 .
                           .007 .5570E-02|    .012 .2535E-01|    .505 .6486E-01|   2.383 .
                           .007 .6610E-02|    .012 .2777E-01|    .589 .6872E-01|   2.840 .
                           .008 .7720E-02|    .013 .3027E-01|    .677 .7272E-01|   3.391 .
                           .008 .8910E-02|    .013 .3287E-01|    .769 .7686E-01|   4.041 .
                           .009 .1017E-01|    .013 .3557E-01|    .866 .8113E-01|   4.792 .
                           .009 .1150E-01|    .032 .3837E-01|    .966 .8555E-01|   5.649 .

     ROUTING RESULTS             AREA     QPEAK     TPEAK       R.V.
     ----------------------      (ha)     (cms)     (hrs)       (mm)
     INFLOW > 03:POST1+EXT     14.680      .861    12.033     26.747
    OUTFLOW < 04:SWM Facili    14.680      .709    12.183     26.747

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=   82.385
                   TIME SHIFT OF PEAK FLOW         (min)=     9.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=.7419E-01

-------------------------------------------------------------------------------------------
R0002:C00007-------------------------------------------------------------------------------
* SITE (POST2 - Uncontrolled Area)
-------------------------
| CALIB STANDHYD         |   Area    (ha)=     .89
| 05:POST2      DT= 1.00 |   Total Imp(%)=   21.00   Dir. Conn.(%)=   10.50
```

```
-------------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .19         .70
     Dep. Storage     (mm)=       2.00        5.00
     Average Slope     (%)=       6.00       11.10
     Length            (m)=     120.00       50.00
     Mannings n           =       .013        .250

     Max.eff.Inten.(mm/hr)=      61.54       43.49
                over (min)        2.00        9.00
     Storage Coeff.  (min)=       2.02 (ii)    8.75 (ii)
     Unit Hyd. Tpeak (min)=       2.00        9.00
     Unit Hyd. peak  (cms)=        .56         .13
                                                           *TOTALS*
     PEAK FLOW       (cms)=        .02         .06           .073 (iii)
     TIME TO PEAK    (hrs)=      12.00       12.07         12.017
     RUNOFF VOLUME    (mm)=      52.70       27.19         29.872
     TOTAL RAINFALL   (mm)=      54.70       54.70         54.700
     RUNOFF COEFFICIENT   =        .96         .50           .546

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  84.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------------------
R0002:C00008-------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------
R0002:C00002-------------------------------------------------------------------------------
  ** END OF RUN :    1

*******************************************************************************************




--------------------
| START            | Project  dir.:C:\Temp\15-319\PR\24-hour_SCS\
-------------------- Rainfall dir.:C:\Temp\15-319\PR\24-hour_SCS\
    TZERO =   .00 hrs on       0
    METOUT=   2 (output = METRIC)
    NRUN  = 0003
    NSTORM=   1
           #  1=5SCS24.stm
-------------------------------------------------------------------------------------------
R0003:C00002-------------------------------------------------------------------------------
*#*************************************************************************
*#  Project Name: [Mansfield Ski Club]    Project Number: [15-319]
*#  Date        : 07-31-2017
*#  Modeller    : [J. Lightheart]
*#  Company     : WMI & Associates Ltd.
*#  License #   :  2880720
```

```
*#******************************************************************************
*
* Post-Development Condition - Mansfield Ski Club
*
-------------------------------------------------------------------------------------------
R0003:C00002-------------------------------------------------------------------------------
--------------------
| READ STORM       |  Filename: C:\Temp\15-319\PR\24-hour_SCS\5SCS24.stm
| Ptotal=  72.10 mm|  Comments: 5-Year SCS Type-II Storm Distribution (24-hour) Mansfield,
--------------------
      TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME
     hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm
      0:12    .721|   4:12   1.442|   8:12   2.163|  12:12  14.420|  16:12   1.803|  20:12
      0:24    .721|   4:24   1.442|   8:24   2.163|  12:24   9.013|  16:24   1.802|  20:24
      0:36    .721|   4:36   1.442|   8:36   2.163|  12:36   6.489|  16:36   1.802|  20:36
      0:48    .721|   4:48   1.442|   8:48   2.163|  12:48   6.129|  16:48   1.802|  20:48
      1:00    .721|   5:00   1.442|   9:00   2.163|  13:00   4.326|  17:00   1.081|  21:00
      1:12    .721|   5:12   1.442|   9:12   2.163|  13:12   3.605|  17:12   1.082|  21:12
      1:24    .721|   5:24   1.442|   9:24   2.163|  13:24   3.605|  17:24   1.442|  21:24
      1:36    .721|   5:36   1.442|   9:36   2.163|  13:36   3.605|  17:36   1.082|  21:36
      1:48    .721|   5:48   1.442|   9:48   2.163|  13:48   3.605|  17:48   1.442|  21:48
      2:00    .721|   6:00   1.442|  10:00   2.163|  14:00   3.605|  18:00   1.082|  22:00
      2:12    .721|   6:12   1.442|  10:12   3.965|  14:12   2.163|  18:12   1.082|  22:12
      2:24    .721|   6:24   1.442|  10:24   3.966|  14:24   2.163|  18:24   1.081|  22:24
      2:36    .721|   6:36   1.442|  10:36   3.965|  14:36   2.163|  18:36   1.442|  22:36
      2:48    .721|   6:48   1.442|  10:48   3.966|  14:48   2.163|  18:48   1.082|  22:48
      3:00    .721|   7:00   1.442|  11:00   3.965|  15:00   2.163|  19:00   1.082|  23:00
      3:12    .721|   7:12   1.442|  11:12   5.408|  15:12   1.802|  19:12   1.442|  23:12
      3:24    .721|   7:24   1.442|  11:24   7.931|  15:24   1.802|  19:24   1.082|  23:24
      3:36    .721|   7:36   1.442|  11:36  19.106|  15:36   1.802|  19:36   1.442|  23:36
      3:48    .721|   7:48   1.442|  11:48  39.655|  15:48   1.802|  19:48   1.082|  23:48
      4:00    .721|   8:00   1.442|  12:00  81.113|  16:00   1.802|  20:00   1.442|  24:00

-------------------------------------------------------------------------------------------
R0003:C00003-------------------------------------------------------------------------------
* SITE (POST1 - Controlled Area)
--------------------------
| CALIB STANDHYD         |   Area    (ha)=    2.74
| 01:POST1      DT= 1.00 |   Total Imp(%)=   69.00   Dir. Conn.(%)=   59.00
--------------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.89          .85
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       3.50        33.30
     Length            (m)=     300.00         6.00
     Mannings n          =        .013         .250

     Max.eff.Inten.(mm/hr)=      81.11        83.02
                over (min)        4.00         5.00
     Storage Coeff.  (min)=       3.69 (ii)    4.74 (ii)
     Unit Hyd. Tpeak (min)=       4.00         5.00
     Unit Hyd. peak  (cms)=        .30          .23
                                                           *TOTALS*
```

```
     PEAK FLOW       (cms)=        .35          .17           .526 (iii)
     TIME TO PEAK    (hrs)=      12.00        12.00         12.000
     RUNOFF VOLUME    (mm)=      70.09        44.49         59.602
     TOTAL RAINFALL   (mm)=      72.10        72.10         72.101
     RUNOFF COEFFICIENT   =        .97          .62           .827

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  84.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------------------
R0003:C00004-------------------------------------------------------------------------------
* EXTERNAL (Routed through SWM Facility)
--------------------------
| CALIB NASHYD           |   Area    (ha)=   11.940   Curve Number   (CN)= 83.00
| 02:EXT        DT= 1.00 |   Ia      (mm)=    6.800   # of Linear Res.(N)=  3.00
--------------------------   U.H. Tp(hrs)=     .240

     Unit Hyd Qpeak  (cms)=    1.900

     PEAK FLOW       (cms)=     .966 (i)
     TIME TO PEAK    (hrs)=   12.133
     DURATION        (hrs)=   25.667, (dddd|hh:mm:)=   1|01:40
     AVERAGE FLOW    (cms)=     .047
     RUNOFF VOLUME    (mm)=   36.345
     TOTAL RAINFALL   (mm)=   72.101
     RUNOFF COEFFICIENT   =     .504

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

-------------------------------------------------------------------------------------------
R0003:C00005-------------------------------------------------------------------------------
* TOTAL FLOW TO SIDEROAD 15 CROSS CULVERT (POST1 CONTROLLED + EXT)
------------------------
| ADD HYD               |
| 03:POST1+EXT          |   ID:NHYD            AREA     QPEAK    TPEAK      R.V.     DWF
------------------------                       (ha)     (cms)    (hrs)      (mm)   (cms)
                     ID 1 01:POST1         2.740      .526   12.000    59.602    .000
                    +ID 2 02:EXT          11.940      .966   12.133    36.345    .000
                    ===============================================================
                     SUM   03:POST1+EXT     14.680     1.315   12.033    40.686    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------------------
R0003:C00006-------------------------------------------------------------------------------
* SWM Facility
-----------------------
|  ROUTE RESERVOIR -> |    Requested routing time step =  1.0 min.
|  IN>03:POST1+EXT    |
| OUT<04:SWM Facili   | =========================  OUTFLOW STORAGE TABLE  ================
----------------------- OUTFLOW   STORAGE| OUTFLOW   STORAGE| OUTFLOW   STORAGE| OUTFLOW
```

```
                                (cms)   (ha.m.)|   (cms)   (ha.m.)|   (cms)   (ha.m.)|   (cms)
                                 .000 .0000E+00|    .010 .1292E-01|    .065 .4128E-01|   1.071 .
                                 .002 .6300E-03|    .010 .1442E-01|    .108 .4430E-01|   1.184 .
                                 .003 .1310E-02|    .010 .1601E-01|    .159 .4743E-01|   1.308 .
                                 .004 .2050E-02|    .011 .1769E-01|    .217 .5067E-01|   1.445 .
                                 .005 .2840E-02|    .011 .1946E-01|    .281 .5403E-01|   1.594 .
                                 .006 .3680E-02|    .011 .2133E-01|    .351 .5751E-01|   1.759 .
                                 .006 .4590E-02|    .012 .2329E-01|    .425 .6112E-01|   2.020 .
                                 .007 .5570E-02|    .012 .2535E-01|    .505 .6486E-01|   2.383 .
                                 .007 .6610E-02|    .012 .2777E-01|    .589 .6872E-01|   2.840 .
                                 .008 .7720E-02|    .013 .3027E-01|    .677 .7272E-01|   3.391 .
                                 .008 .8910E-02|    .013 .3287E-01|    .769 .7686E-01|   4.041 .
                                 .009 .1017E-01|    .013 .3557E-01|    .866 .8113E-01|   4.792 .
                                 .009 .1150E-01|    .032 .3837E-01|    .966 .8555E-01|   5.649 .

     ROUTING RESULTS             AREA     QPEAK     TPEAK       R.V.
     ----------------------      (ha)     (cms)     (hrs)       (mm)
     INFLOW > 03:POST1+EXT     14.680     1.315    12.033     40.686
    OUTFLOW < 04:SWM Facili    14.680     1.120    12.167     40.686

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=   85.197
                   TIME SHIFT OF PEAK FLOW         (min)=     8.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=.9218E-01

------------------------------------------------------------------------------------------
R0003:C00007------------------------------------------------------------------------------
* SITE (POST2 - Uncontrolled Area)
--------------------------
| CALIB STANDHYD         |   Area    (ha)=     .89
| 05:POST2      DT= 1.00 |   Total Imp(%)=   21.00   Dir. Conn.(%)=   10.50
--------------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .19          .70
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       6.00        11.10
     Length            (m)=     120.00        50.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      81.11        65.90
                over (min)        2.00         8.00
     Storage Coeff.  (min)=       1.81 (ii)    7.51 (ii)
     Unit Hyd. Tpeak (min)=       2.00         8.00
     Unit Hyd. peak  (cms)=        .60          .15
                                                          *TOTALS*
     PEAK FLOW       (cms)=        .02          .10           .116 (iii)
     TIME TO PEAK    (hrs)=      12.00        12.03         12.017
     RUNOFF VOLUME    (mm)=      70.10        41.50         44.506
     TOTAL RAINFALL   (mm)=      72.10        72.10         72.101
     RUNOFF COEFFICIENT   =        .97          .58           .617

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  84.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
```

```
      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

------------------------------------------------------------------------------------------
R0003:C00008------------------------------------------------------------------------------
------------------------------------------------------------------------------------------
R0003:C00002------------------------------------------------------------------------------
------------------------------------------------------------------------------------------
R0003:C00002------------------------------------------------------------------------------
  ** END OF RUN :    2

******************************************************************************************






--------------------
| START            | Project  dir.:C:\Temp\15-319\PR\24-hour_SCS\
-------------------- Rainfall dir.:C:\Temp\15-319\PR\24-hour_SCS\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 0004
    NSTORM=   1
           #  1=25SCS24.stm
------------------------------------------------------------------------------------------
R0004:C00002------------------------------------------------------------------------------
*#************************************************************************
*#  Project Name: [Mansfield Ski Club]    Project Number: [15-319]
*#  Date        : 07-31-2017
*#  Modeller    : [J. Lightheart]
*#  Company     : WMI & Associates Ltd.
*#  License #   :  2880720
*#************************************************************************
*
* Post-Development Condition - Mansfield Ski Club
*
------------------------------------------------------------------------------------------
R0004:C00002------------------------------------------------------------------------------
--------------------
| READ STORM       |  Filename: C:\Temp\15-319\PR\24-hour_SCS\25SCS24.stm
| Ptotal=  98.40 mm|  Comments: 25-Year SCS Type-II Storm Distribution (24-hour) Mansfield,
--------------------
      TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME
     hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm
      0:12    .984|   4:12   1.968|   8:12   2.952|  12:12  19.680|  16:12   2.460|  20:12
      0:24    .984|   4:24   1.968|   8:24   2.952|  12:24  12.300|  16:24   2.460|  20:24
      0:36    .984|   4:36   1.968|   8:36   2.952|  12:36   8.856|  16:36   2.460|  20:36
      0:48    .984|   4:48   1.968|   8:48   2.952|  12:48   8.364|  16:48   2.460|  20:48
      1:00    .984|   5:00   1.968|   9:00   2.952|  13:00   5.904|  17:00   1.476|  21:00
      1:12    .984|   5:12   1.968|   9:12   2.952|  13:12   4.920|  17:12   1.476|  21:12
      1:24    .984|   5:24   1.968|   9:24   2.952|  13:24   4.920|  17:24   1.968|  21:24
      1:36    .984|   5:36   1.968|   9:36   2.952|  13:36   4.920|  17:36   1.476|  21:36
      1:48    .984|   5:48   1.968|   9:48   2.952|  13:48   4.920|  17:48   1.968|  21:48
```

```
        2:00    .984|   6:00   1.968|  10:00   2.952|  14:00   4.920|  18:00   1.476|  22:00
        2:12    .984|   6:12   1.968|  10:12   5.412|  14:12   2.952|  18:12   1.476|  22:12
        2:24    .984|   6:24   1.968|  10:24   5.412|  14:24   2.952|  18:24   1.476|  22:24
        2:36    .984|   6:36   1.968|  10:36   5.412|  14:36   2.952|  18:36   1.968|  22:36
        2:48    .984|   6:48   1.968|  10:48   5.412|  14:48   2.952|  18:48   1.476|  22:48
        3:00    .984|   7:00   1.968|  11:00   5.412|  15:00   2.952|  19:00   1.476|  23:00
        3:12    .984|   7:12   1.968|  11:12   7.380|  15:12   2.460|  19:12   1.968|  23:12
        3:24    .984|   7:24   1.968|  11:24  10.824|  15:24   2.460|  19:24   1.476|  23:24
        3:36    .984|   7:36   1.968|  11:36  26.076|  15:36   2.460|  19:36   1.968|  23:36
        3:48    .984|   7:48   1.968|  11:48  54.120|  15:48   2.460|  19:48   1.476|  23:48
        4:00    .984|   8:00   1.968|  12:00 110.700|  16:00   2.460|  20:00   1.968|  24:00

 ------------------------------------------------------------------------------------------
 R0004:C00003------------------------------------------------------------------------------
 * SITE (POST1 - Controlled Area)
 --------------------------
 | CALIB STANDHYD         |   Area    (ha)=    2.74
 | 01:POST1      DT= 1.00 |   Total Imp(%)=   69.00   Dir. Conn.(%)=   59.00
 --------------------------
                              IMPERVIOUS    PERVIOUS (i)
      Surface Area     (ha)=       1.89          .85
      Dep. Storage     (mm)=       2.00         5.00
      Average Slope     (%)=       3.50        33.30
      Length            (m)=     300.00         6.00
      Mannings n          =       .013         .250

      Max.eff.Inten.(mm/hr)=     110.70       124.23
                 over (min)        3.00         4.00
      Storage Coeff.  (min)=       3.26 (ii)    4.15 (ii)
      Unit Hyd. Tpeak (min)=       3.00         4.00
      Unit Hyd. peak  (cms)=        .36          .28
                                                            *TOTALS*
      PEAK FLOW       (cms)=        .49          .27           .760 (iii)
      TIME TO PEAK    (hrs)=      12.00        12.00         12.000
      RUNOFF VOLUME    (mm)=      96.40        68.23         84.853
      TOTAL RAINFALL   (mm)=      98.40        98.40         98.399
      RUNOFF COEFFICIENT   =        .98          .69           .862

        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
              CN* =  84.0    Ia = Dep. Storage  (Above)
       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

 ------------------------------------------------------------------------------------------
 R0004:C00004------------------------------------------------------------------------------
 * EXTERNAL (Routed through SWM Facility)
 --------------------------
 | CALIB NASHYD           |   Area    (ha)=   11.940   Curve Number   (CN)= 83.00
 | 02:EXT        DT= 1.00 |   Ia      (mm)=    6.800   # of Linear Res.(N)=  3.00
 --------------------------   U.H. Tp(hrs)=     .240

      Unit Hyd Qpeak  (cms)=    1.900
```

```
      PEAK FLOW       (cms)=    1.559 (i)
      TIME TO PEAK    (hrs)=   12.133
      DURATION        (hrs)=   25.667, (dddd|hh:mm:)=   1|01:40
      AVERAGE FLOW    (cms)=     .075
      RUNOFF VOLUME    (mm)=   58.420
      TOTAL RAINFALL   (mm)=   98.399
      RUNOFF COEFFICIENT   =     .594

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

 ------------------------------------------------------------------------------------------
 R0004:C00005------------------------------------------------------------------------------
 * TOTAL FLOW TO SIDEROAD 15 CROSS CULVERT (POST1 CONTROLLED + EXT)
 ------------------------
 | ADD HYD               |
 | 03:POST1+EXT          |   ID:NHYD            AREA     QPEAK    TPEAK      R.V.     DWF
 ------------------------                       (ha)     (cms)    (hrs)      (mm)   (cms)
                      ID 1 01:POST1          2.740      .760   12.000    84.853    .000
                     +ID 2 02:EXT           11.940     1.559   12.133    58.420    .000
                     ==============================================================
                     SUM   03:POST1+EXT     14.680     2.015   12.033    63.353    .000

    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

 ------------------------------------------------------------------------------------------
 R0004:C00006------------------------------------------------------------------------------
 * SWM Facility
 -----------------------
 |  ROUTE RESERVOIR -> |    Requested routing time step =  1.0 min.
 |  IN>03:POST1+EXT    |
 | OUT<04:SWM Facili   | =========================  OUTFLOW STORAGE TABLE  =================
 ----------------------- OUTFLOW   STORAGE| OUTFLOW   STORAGE| OUTFLOW   STORAGE| OUTFLOW
                           (cms)   (ha.m.)|   (cms)   (ha.m.)|   (cms)   (ha.m.)|   (cms)
                            .000 .0000E+00|    .010 .1292E-01|    .065 .4128E-01|   1.071 .
                            .002 .6300E-03|    .010 .1442E-01|    .108 .4430E-01|   1.184 .
                            .003 .1310E-02|    .010 .1601E-01|    .159 .4743E-01|   1.308 .
                            .004 .2050E-02|    .011 .1769E-01|    .217 .5067E-01|   1.445 .
                            .005 .2840E-02|    .011 .1946E-01|    .281 .5403E-01|   1.594 .
                            .006 .3680E-02|    .011 .2133E-01|    .351 .5751E-01|   1.759 .
                            .006 .4590E-02|    .012 .2329E-01|    .425 .6112E-01|   2.020 .
                            .007 .5570E-02|    .012 .2535E-01|    .505 .6486E-01|   2.383 .
                            .007 .6610E-02|    .012 .2777E-01|    .589 .6872E-01|   2.840 .
                            .008 .7720E-02|    .013 .3027E-01|    .677 .7272E-01|   3.391 .
                            .008 .8910E-02|    .013 .3287E-01|    .769 .7686E-01|   4.041 .
                            .009 .1017E-01|    .013 .3557E-01|    .866 .8113E-01|   4.792 .
                            .009 .1150E-01|    .032 .3837E-01|    .966 .8555E-01|   5.649 .

      ROUTING RESULTS             AREA     QPEAK     TPEAK       R.V.
      ----------------------      (ha)     (cms)     (hrs)       (mm)
      INFLOW > 03:POST1+EXT     14.680     2.015    12.033     63.353
     OUTFLOW < 04:SWM Facili    14.680     1.784    12.150     63.353

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=   88.516
```

```
                         TIME SHIFT OF PEAK FLOW         (min)=     7.00
                         MAXIMUM  STORAGE   USED       (ha.m.)=.1158E+00

      ------------------------------------------------------------------------------------------
      R0004:C00007------------------------------------------------------------------------------
      * SITE (POST2 - Uncontrolled Area)
      --------------------------
      | CALIB STANDHYD         |   Area    (ha)=     .89
      | 05:POST2      DT= 1.00 |   Total Imp(%)=   21.00   Dir. Conn.(%)=   10.50
      --------------------------
                                    IMPERVIOUS    PERVIOUS (i)
           Surface Area     (ha)=        .19          .70
           Dep. Storage     (mm)=       2.00         5.00
           Average Slope     (%)=       6.00        11.10
           Length            (m)=     120.00        50.00
           Mannings n          =        .013         .250

           Max.eff.Inten.(mm/hr)=     110.70       101.37
                      over (min)        2.00         6.00
           Storage Coeff.  (min)=       1.60 (ii)    6.40 (ii)
           Unit Hyd. Tpeak (min)=       2.00         6.00
           Unit Hyd. peak  (cms)=        .64          .18
                                                                  *TOTALS*
           PEAK FLOW       (cms)=        .03          .17           .192 (iii)
           TIME TO PEAK    (hrs)=      12.00        12.02         12.000
           RUNOFF VOLUME    (mm)=      96.40        64.62         67.960
           TOTAL RAINFALL   (mm)=      98.40        98.40         98.399
           RUNOFF COEFFICIENT   =        .98          .66           .691

             (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
                 CN* =  84.0    Ia = Dep. Storage  (Above)
            (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
           (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

      ------------------------------------------------------------------------------------------
      R0004:C00008------------------------------------------------------------------------------
      ------------------------------------------------------------------------------------------
      R0004:C00002------------------------------------------------------------------------------
      ------------------------------------------------------------------------------------------
      R0004:C00002------------------------------------------------------------------------------
      ------------------------------------------------------------------------------------------
      R0004:C00002------------------------------------------------------------------------------
        ** END OF RUN :    3

      ******************************************************************************************




      --------------------
      | START            | Project  dir.:C:\Temp\15-319\PR\24-hour_SCS\
      -------------------- Rainfall dir.:C:\Temp\15-319\PR\24-hour_SCS\
```

```
          TZERO =   .00 hrs on        0
          METOUT=   2 (output = METRIC)
          NRUN  = 0005
          NSTORM=   1
                 #  1=100SCS24.stm
      ------------------------------------------------------------------------------------------
      R0005:C00002------------------------------------------------------------------------------
      *#****************************************************************************************
      *#  Project Name: [Mansfield Ski Club]    Project Number: [15-319]
      *#  Date        : 07-31-2017
      *#  Modeller    : [J. Lightheart]
      *#  Company     : WMI & Associates Ltd.
      *#  License #   :  2880720
      *#****************************************************************************************
      *
      * Post-Development Condition - Mansfield Ski Club
      *
      ------------------------------------------------------------------------------------------
      R0005:C00002------------------------------------------------------------------------------
      --------------------
      | READ STORM       |  Filename: C:\Temp\15-319\PR\24-hour_SCS\100SCS24.stm
      | Ptotal= 120.00 mm|  Comments: 100-Year SCS Type-II Storm Distribution (24-hour)
      --------------------
            TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME
           hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm
            0:12   1.200|   4:12   2.400|   8:12   3.600|  12:12  24.000|  16:12   3.000|  20:12
            0:24   1.200|   4:24   2.400|   8:24   3.600|  12:24  15.000|  16:24   3.000|  20:24
            0:36   1.200|   4:36   2.400|   8:36   3.600|  12:36  10.800|  16:36   3.000|  20:36
            0:48   1.200|   4:48   2.400|   8:48   3.600|  12:48  10.200|  16:48   3.000|  20:48
            1:00   1.200|   5:00   2.400|   9:00   3.600|  13:00   7.200|  17:00   1.800|  21:00
            1:12   1.200|   5:12   2.400|   9:12   3.600|  13:12   6.000|  17:12   1.800|  21:12
            1:24   1.200|   5:24   2.400|   9:24   3.600|  13:24   6.000|  17:24   2.400|  21:24
            1:36   1.200|   5:36   2.400|   9:36   3.600|  13:36   6.000|  17:36   1.800|  21:36
            1:48   1.200|   5:48   2.400|   9:48   3.600|  13:48   6.000|  17:48   2.400|  21:48
            2:00   1.200|   6:00   2.400|  10:00   3.600|  14:00   6.000|  18:00   1.800|  22:00
            2:12   1.200|   6:12   2.400|  10:12   6.600|  14:12   3.600|  18:12   1.800|  22:12
            2:24   1.200|   6:24   2.400|  10:24   6.600|  14:24   3.600|  18:24   1.800|  22:24
            2:36   1.200|   6:36   2.400|  10:36   6.600|  14:36   3.600|  18:36   2.400|  22:36
            2:48   1.200|   6:48   2.400|  10:48   6.600|  14:48   3.600|  18:48   1.800|  22:48
            3:00   1.200|   7:00   2.400|  11:00   6.600|  15:00   3.600|  19:00   1.800|  23:00
            3:12   1.200|   7:12   2.400|  11:12   9.000|  15:12   3.000|  19:12   2.400|  23:12
            3:24   1.200|   7:24   2.400|  11:24  13.200|  15:24   3.000|  19:24   1.800|  23:24
            3:36   1.200|   7:36   2.400|  11:36  31.800|  15:36   3.000|  19:36   2.400|  23:36
            3:48   1.200|   7:48   2.400|  11:48  66.000|  15:48   3.000|  19:48   1.800|  23:48
            4:00   1.200|   8:00   2.400|  12:00 135.000|  16:00   3.000|  20:00   2.400|  24:00

      ------------------------------------------------------------------------------------------
      R0005:C00003------------------------------------------------------------------------------
      * SITE (POST1 - Controlled Area)
      --------------------------
      | CALIB STANDHYD         |   Area    (ha)=    2.74
      | 01:POST1      DT= 1.00 |   Total Imp(%)=   69.00   Dir. Conn.(%)=   59.00
      --------------------------
```

```
                                    IMPERVIOUS    PERVIOUS (i)
           Surface Area     (ha)=       1.89         .85
           Dep. Storage     (mm)=       2.00        5.00
           Average Slope     (%)=       3.50       33.30
           Length            (m)=     300.00        6.00
           Mannings n           =       .013        .250

           Max.eff.Inten.(mm/hr)=     135.00      157.84
                      over (min)        3.00        4.00
           Storage Coeff.  (min)=       3.01 (ii)    3.82 (ii)
           Unit Hyd. Tpeak (min)=       3.00        4.00
           Unit Hyd. peak  (cms)=        .37         .29
                                                                 *TOTALS*
           PEAK FLOW       (cms)=        .60         .35           .949 (iii)
           TIME TO PEAK    (hrs)=      12.00       12.00         12.000
           RUNOFF VOLUME    (mm)=     118.00       88.39        105.863
           TOTAL RAINFALL   (mm)=     120.00      120.00        120.000
           RUNOFF COEFFICIENT   =        .98         .74           .882

             (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
                 CN* =  84.0    Ia = Dep. Storage  (Above)
            (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
           (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

      -------------------------------------------------------------------------------------------
      R0005:C00004-------------------------------------------------------------------------------
      * EXTERNAL (Routed through SWM Facility)
      --------------------------
      | CALIB NASHYD           |   Area    (ha)=   11.940   Curve Number   (CN)= 83.00
      | 02:EXT       DT= 1.00 |   Ia      (mm)=    6.800   # of Linear Res.(N)=  3.00
      --------------------------   U.H. Tp(hrs)=     .240

           Unit Hyd Qpeak  (cms)=    1.900

           PEAK FLOW       (cms)=    2.065 (i)
           TIME TO PEAK    (hrs)=   12.133
           DURATION        (hrs)=   25.667, (dddd|hh:mm:)=   1|01:40
           AVERAGE FLOW    (cms)=     .100
           RUNOFF VOLUME    (mm)=   77.557
           TOTAL RAINFALL   (mm)=  120.000
           RUNOFF COEFFICIENT   =     .646

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

      -------------------------------------------------------------------------------------------
      R0005:C00005-------------------------------------------------------------------------------
      * TOTAL FLOW TO SIDEROAD 15 CROSS CULVERT (POST1 CONTROLLED + EXT)
      ------------------------
      | ADD HYD               |
      | 03:POST1+EXT          |   ID:NHYD            AREA     QPEAK    TPEAK      R.V.     DWF
      ------------------------                      (ha)     (cms)    (hrs)      (mm)   (cms)
                            ID 1 01:POST1          2.740      .949   12.000   105.863    .000
                           +ID 2 02:EXT           11.940     2.065   12.133    77.557    .000
```

```
                           ==================================================================
                           SUM   03:POST1+EXT     14.680     2.628   12.017    82.840    .000

         NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

      -------------------------------------------------------------------------------------------
      R0005:C00006-------------------------------------------------------------------------------
      * SWM Facility
      -----------------------
      |  ROUTE RESERVOIR -> |    Requested routing time step =  1.0 min.
      |  IN>03:POST1+EXT    |
      | OUT<04:SWM Facili   | =========================  OUTLFOW STORAGE TABLE  =================
      ----------------------- OUTFLOW   STORAGE| OUTFLOW   STORAGE| OUTFLOW   STORAGE| OUTFLOW
                                (cms)   (ha.m.)|   (cms)   (ha.m.)|   (cms)   (ha.m.)|   (cms)
                                 .000 .0000E+00|    .010 .1292E-01|    .065 .4128E-01|   1.071 .
                                 .002 .6300E-03|    .010 .1442E-01|    .108 .4430E-01|   1.184 .
                                 .003 .1310E-02|    .010 .1601E-01|    .159 .4743E-01|   1.308 .
                                 .004 .2050E-02|    .011 .1769E-01|    .217 .5067E-01|   1.445 .
                                 .005 .2840E-02|    .011 .1946E-01|    .281 .5403E-01|   1.594 .
                                 .006 .3680E-02|    .011 .2133E-01|    .351 .5751E-01|   1.759 .
                                 .006 .4590E-02|    .012 .2329E-01|    .425 .6112E-01|   2.020 .
                                 .007 .5570E-02|    .012 .2535E-01|    .505 .6486E-01|   2.383 .
                                 .007 .6610E-02|    .012 .2777E-01|    .589 .6872E-01|   2.840 .
                                 .008 .7720E-02|    .013 .3027E-01|    .677 .7272E-01|   3.391 .
                                 .008 .8910E-02|    .013 .3287E-01|    .769 .7686E-01|   4.041 .
                                 .009 .1017E-01|    .013 .3557E-01|    .866 .8113E-01|   4.792 .
                                 .009 .1150E-01|    .032 .3837E-01|    .966 .8555E-01|   5.649 .

           ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
           ----------------------     (ha)     (cms)     (hrs)       (mm)
           INFLOW > 03:POST1+EXT     14.680     2.628    12.017     82.840
          OUTFLOW < 04:SWM Facili    14.680     2.275    12.167     82.840

                         PEAK   FLOW   REDUCTION [Qout/Qin](%)=   86.558
                         TIME SHIFT OF PEAK FLOW         (min)=     9.00
                         MAXIMUM  STORAGE   USED       (ha.m.)=.1364E+00

      -------------------------------------------------------------------------------------------
      R0005:C00007-------------------------------------------------------------------------------
      * SITE (POST2 - Uncontrolled Area)
      --------------------------
      | CALIB STANDHYD         |   Area    (ha)=     .89
      | 05:POST2      DT= 1.00 |   Total Imp(%)=   21.00   Dir. Conn.(%)=   10.50
      --------------------------
                                    IMPERVIOUS    PERVIOUS (i)
           Surface Area     (ha)=        .19         .70
           Dep. Storage     (mm)=       2.00        5.00
           Average Slope     (%)=       6.00       11.10
           Length            (m)=     120.00       50.00
           Mannings n           =       .013        .250

           Max.eff.Inten.(mm/hr)=     135.00      130.11
                      over (min)        1.00        6.00
```

```
     Storage Coeff.  (min)=       1.48 (ii)    5.82 (ii)
     Unit Hyd. Tpeak (min)=       1.00         6.00
     Unit Hyd. peak  (cms)=        .84          .19
                                                           *TOTALS*
     PEAK FLOW       (cms)=        .04          .22          .251 (iii)
     TIME TO PEAK    (hrs)=      12.00        12.02        12.000
     RUNOFF VOLUME    (mm)=     117.98        84.40        87.928
     TOTAL RAINFALL   (mm)=     120.00       120.00       120.000
     RUNOFF COEFFICIENT   =        .98          .70          .733

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  84.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------------------
R0005:C00008-------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------
R0005:C00002-------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------
R0005:C00002-------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------
R0005:C00002-------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------
R0005:C00002-------------------------------------------------------------------------------
  ** END OF RUN :    4

*******************************************************************************************





--------------------
| START            | Project  dir.:C:\Temp\15-319\PR\24-hour_SCS\
-------------------- Rainfall dir.:C:\Temp\15-319\PR\24-hour_SCS\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 0006
    NSTORM=   1
           #  1=12regtim.o89
-------------------------------------------------------------------------------------------
R0006:C00002-------------------------------------------------------------------------------
*#******************************************************************************
*#  Project Name: [Mansfield Ski Club]    Project Number: [15-319]
*#  Date        : 07-31-2017
*#  Modeller    : [J. Lightheart]
*#  Company     : WMI & Associates Ltd.
*#  License #   :  2880720
*#******************************************************************************
*
* Post-Development Condition - Mansfield Ski Club
*
```

```
-------------------------------------------------------------------------------------------
R0006:C00002-------------------------------------------------------------------------------
--------------------
| READ STORM       |  Filename: C:\Temp\15-319\PR\24-hour_SCS\12regtim.o89
| Ptotal= 193.00 mm|  Comments: TIMMINS REGIONAL STORM (12-hour)
--------------------
      TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME
     hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm
      1:00  15.000|   3:00  10.000|   5:00   5.000|   7:00  43.000|   9:00  23.000|  11:00
      2:00  20.000|   4:00   3.000|   6:00  20.000|   8:00  20.000|  10:00  13.000|  12:00

-------------------------------------------------------------------------------------------
R0006:C00003-------------------------------------------------------------------------------
* SITE (POST1 - Controlled Area)
--------------------------
| CALIB STANDHYD         |   Area    (ha)=    2.74
| 01:POST1      DT= 1.00 |   Total Imp(%)=   69.00   Dir. Conn.(%)=   59.00
--------------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.89          .85
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       3.50        33.30
     Length            (m)=     300.00         6.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      43.00        53.33
                over (min)       5.00         6.00
     Storage Coeff.  (min)=       4.75 (ii)    6.00 (ii)
     Unit Hyd. Tpeak (min)=       5.00         6.00
     Unit Hyd. peak  (cms)=        .23          .19
                                                           *TOTALS*
     PEAK FLOW       (cms)=        .19          .13          .318 (iii)
     TIME TO PEAK    (hrs)=       7.00         7.00         7.000
     RUNOFF VOLUME    (mm)=     190.99       158.56       177.702
     TOTAL RAINFALL   (mm)=     193.00       193.00       193.000
     RUNOFF COEFFICIENT   =        .99          .82          .921

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  84.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------------------
R0006:C00004-------------------------------------------------------------------------------
* EXTERNAL (Routed through SWM Facility)
--------------------------
| CALIB NASHYD           |   Area    (ha)=   11.940   Curve Number   (CN)= 83.00
| 02:EXT        DT= 1.00 |   Ia      (mm)=    6.800   # of Linear Res.(N)=  3.00
-------------------------   U.H. Tp(hrs)=     .240

     Unit Hyd Qpeak  (cms)=    1.900

     PEAK FLOW       (cms)=    1.239 (i)
```

```
           TIME TO PEAK    (hrs)=    7.017
           DURATION        (hrs)=   13.667, (dddd|hh:mm:)=   0|13:40
           AVERAGE FLOW    (cms)=     .353
           RUNOFF VOLUME    (mm)=  145.537
           TOTAL RAINFALL   (mm)=  193.000
           RUNOFF COEFFICIENT   =     .754

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

      -------------------------------------------------------------------------------------------
      R0006:C00005-------------------------------------------------------------------------------
      * TOTAL FLOW TO SIDEROAD 15 CROSS CULVERT (POST1 CONTROLLED + EXT)
      ------------------------
      | ADD HYD               |
      | 03:POST1+EXT          |   ID:NHYD           AREA     QPEAK    TPEAK      R.V.     DWF
      ------------------------                      (ha)     (cms)    (hrs)      (mm)   (cms)
                             ID 1 01:POST1          2.740      .318    7.000   177.702    .000
                            +ID 2 02:EXT           11.940     1.239    7.017   145.537    .000
                            ==================================================================
                            SUM   03:POST1+EXT     14.680     1.556    7.000   151.541    .000

         NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

      -------------------------------------------------------------------------------------------
      R0006:C00006-------------------------------------------------------------------------------
      * SWM Facility
      ----------------------
      |  ROUTE RESERVOIR -> |    Requested routing time step =  1.0 min.
      |  IN>03:POST1+EXT    |
      | OUT<04:SWM Facili   | =========================  OUTLFOW STORAGE TABLE  =================
      ---------------------- OUTFLOW   STORAGE| OUTFLOW   STORAGE| OUTFLOW   STORAGE| OUTFLOW
                               (cms)   (ha.m.)|   (cms)   (ha.m.)|   (cms)   (ha.m.)|   (cms)
                                .000 .0000E+00|    .010 .1292E-01|    .065 .4128E-01|   1.071 .
                                .002 .6300E-03|    .010 .1442E-01|    .108 .4430E-01|   1.184 .
                                .003 .1310E-02|    .010 .1601E-01|    .159 .4743E-01|   1.308 .
                                .004 .2050E-02|    .011 .1769E-01|    .217 .5067E-01|   1.445 .
                                .005 .2840E-02|    .011 .1946E-01|    .281 .5403E-01|   1.594 .
                                .006 .3680E-02|    .011 .2133E-01|    .351 .5751E-01|   1.759 .
                                .006 .4590E-02|    .012 .2329E-01|    .425 .6112E-01|   2.020 .
                                .007 .5570E-02|    .012 .2535E-01|    .505 .6486E-01|   2.383 .
                                .007 .6610E-02|    .012 .2777E-01|    .589 .6872E-01|   2.840 .
                                .008 .7720E-02|    .013 .3027E-01|    .677 .7272E-01|   3.391 .
                                .008 .8910E-02|    .013 .3287E-01|    .769 .7686E-01|   4.041 .
                                .009 .1017E-01|    .013 .3557E-01|    .866 .8113E-01|   4.792 .
                                .009 .1150E-01|    .032 .3837E-01|    .966 .8555E-01|   5.649 .

           ROUTING RESULTS             AREA     QPEAK     TPEAK       R.V.
           ----------------------      (ha)     (cms)     (hrs)       (mm)
           INFLOW > 03:POST1+EXT     14.680     1.556     7.000    151.541
          OUTFLOW < 04:SWM Facili    14.680     1.540     7.033    151.540

                         PEAK   FLOW   REDUCTION [Qout/Qin](%)=   98.975
                         TIME SHIFT OF PEAK FLOW         (min)=     2.00
```

```
                        MAXIMUM  STORAGE   USED       (ha.m.)=.1080E+00

      -------------------------------------------------------------------------------------------
      R0006:C00007-------------------------------------------------------------------------------
      * SITE (POST2 - Uncontrolled Area)
      --------------------------
      | CALIB STANDHYD          |   Area    (ha)=     .89
      | 05:POST2      DT= 1.00  |   Total Imp(%)=   21.00   Dir. Conn.(%)=   10.50
      --------------------------
                                      IMPERVIOUS    PERVIOUS (i)
           Surface Area     (ha)=        .19          .70
           Dep. Storage     (mm)=       2.00         5.00
           Average Slope     (%)=       6.00        11.10
           Length            (m)=     120.00        50.00
           Mannings n           =       .013         .250

           Max.eff.Inten.(mm/hr)=      43.00        44.82
                      over (min)        2.00         9.00
           Storage Coeff.  (min)=       2.33 (ii)    8.99 (ii)
           Unit Hyd. Tpeak (min)=       2.00         9.00
           Unit Hyd. peak  (cms)=        .50          .13
                                                                 *TOTALS*
           PEAK FLOW       (cms)=        .01          .09          .098 (iii)
           TIME TO PEAK    (hrs)=       6.98         7.00         7.000
           RUNOFF VOLUME    (mm)=     191.00       153.77       157.677
           TOTAL RAINFALL   (mm)=     193.00       193.00       193.000
           RUNOFF COEFFICIENT   =        .99          .80          .817

             (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
                   CN* =  84.0    Ia = Dep. Storage  (Above)
            (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
           (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

      -------------------------------------------------------------------------------------------
      R0006:C00008-------------------------------------------------------------------------------
      -------------------------------------------------------------------------------------------
      R0006:C00002-------------------------------------------------------------------------------
      -------------------------------------------------------------------------------------------
      R0006:C00002-------------------------------------------------------------------------------
      -------------------------------------------------------------------------------------------
      R0006:C00002-------------------------------------------------------------------------------
      -------------------------------------------------------------------------------------------
      R0006:C00002-------------------------------------------------------------------------------
      -------------------------------------------------------------------------------------------
      R0006:C00002-------------------------------------------------------------------------------
      --------------------
      | FINISH           |
      --------------------
      -------------------------------------------------------------------------------------------
      *******************************************************************************************
           WARNINGS / ERRORS / NOTES
           -------------------------
         Simulation ended on 2020-12-09     at 16:07:39
```

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

Post-Development Condition
12-hour SCS Type-II Storm Distribution

```
2     Metric units
*#******************************************************************************
*#  Project Name: [Mansfield Ski Club]    Project Number: [15-319]
*#  Date        : 07-31-2017
*#  Modeller    : [J. Lightheart]
*#  Company     : WMI & Associates Ltd.
*#  License #   :  2880720
*#******************************************************************************
*
* Post-Development Condition - Mansfield Ski Club
*
*% 25mm Chicago Storm Dist. based on Mansfield, ON. rainfall (4-hr)
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[1]
*%                   ["25mm4hr.stm"] <--storm filename
*%-----------------|-----------------------------------------------------------|
READ STORM          STORM_FILENAME=["STORM.001"]
*%-----------------|-----------------------------------------------------------|
* SITE (POST1 - Controlled Area)
CALIB STANDHYD      ID=[1], NHYD=["POST1"], DT=[1](min), AREA=[2.74](ha),
                    XIMP=[0.59], TIMP=[0.69], DWF=[0](cms), LOSS=[2],
                    SCS curve number CN=[84],
                    Pervious   surfaces: IAper=[5.0](mm), SLPP=[33.3](%),
                                         LGP=[6](m), MNP=[0.25], SCP=[0](min),
                    Impervious surfaces: IAimp=[2.0](mm), SLPI=[3.5](%),
                                         LGI=[300](m), MNI=[0.013], SCI=[0](min),
                    RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
*%-----------------|-----------------------------------------------------------|
* EXTERNAL (Routed through SWM Facility)
CALIB NASHYD        ID=[2], NHYD=["EXT"], DT=[1]min, AREA=[11.94](ha),
                    DWF=[0](cms),  CN/C=[83], IA=[6.8](mm),
                    N=[3], TP=[0.24]hrs,
                    RAINFALL=[ ,  ,  ,  , ](mm/hr),  END=-1
*%-----------------|-----------------------------------------------------------|
* TOTAL FLOW TO SIDEROAD 15 CROSS CULVERT (POST1 CONTROLLED + EXT)
ADD HYD             IDsum=[3], NHYD=["POST1+EXT"], IDs to add=[1+2]
*%-----------------|-----------------------------------------------------------|
* SWM Facility
ROUTE RESERVOIR     IDout=[4], NHYD=["SWM Facility"], IDin=[3], RDT=[1](min),
                         TABLE of ( OUTFLOW-STORAGE ) values
                                   (cms) - (ha-m)
                                 [0.0000 , 0.00000]
                                 [0.0015 , 0.00063]
                                 [0.0031 , 0.00131]
                                 [0.0041 , 0.00205]
                                 [0.0050 , 0.00284]
                                 [0.0057 , 0.00368]
                                 [0.0063 , 0.00459]
                                 [0.0069 , 0.00557]
                                 [0.0074 , 0.00661]
                                 [0.0079 , 0.00772]
                                 [0.0084 , 0.00891]
                                 [0.0088 , 0.01017]
                                 [0.0092 , 0.01150]
```

```
                                 [0.0096 , 0.01292]
                                 [0.0100 , 0.01442]
                                 [0.0104 , 0.01601]
                                 [0.0108 , 0.01769]
                                 [0.0111 , 0.01946]
                                 [0.0114 , 0.02133]
                                 [0.0118 , 0.02329]
                                 [0.0121 , 0.02535]
                                 [0.0124 , 0.02777]
                                 [0.0127 , 0.03027]
                                 [0.0130 , 0.03287]
                                 [0.0133 , 0.03557]
                                 [0.0317 , 0.03837]
                                 [0.0651 , 0.04128]
                                 [0.1082 , 0.04430]
                                 [0.1593 , 0.04743]
                                 [0.2172 , 0.05067]
                                 [0.2811 , 0.05403]
                                 [0.3506 , 0.05751]
                                 [0.4252 , 0.06112]
                                 [0.5047 , 0.06486]
                                 [0.5887 , 0.06872]
                                 [0.6769 , 0.07272]
                                 [0.7693 , 0.07686]
                                 [0.8656 , 0.08113]
                                 [0.9656 , 0.08555]
                                 [1.0706 , 0.09011]
                                 [1.1842 , 0.09483]
                                 [1.3084 , 0.09970]
                                 [1.4447 , 0.10472]
                                 [1.5945 , 0.10990]
                                 [1.7589 , 0.11524]
                                 [2.0195 , 0.12075]
                                 [2.3829 , 0.14300]
                                 [2.8396 , 0.14870]
                                 [3.3911 , 0.15454]
                                 [4.0406 , 0.16053]
                                 [4.7921 , 0.16666]
                                 [5.6495 , 0.17293]
                                 [   -1  ,  -1  ]  (maximum one hundred pairs of points)
                                 IDovf=[   ], NHYDovf=["      "],
*%-----------------|-----------------------------------------------------------------------
* SITE (POST2 - Uncontrolled Area)
CALIB STANDHYD      ID=[5], NHYD=["POST2"], DT=[1](min), AREA=[0.89](ha),
                    XIMP=[0.105], TIMP=[0.21], DWF=[0](cms), LOSS=[2],
                    SCS curve number CN=[84],
                    Pervious   surfaces: IAper=[5.0](mm), SLPP=[11.1](%),
                                         LGP=[50](m), MNP=[0.25], SCP=[0](min),
                    Impervious surfaces: IAimp=[2.0](mm), SLPI=[6.0](%),
                                         LGI=[120](m), MNI=[0.013], SCI=[0](min),
                    RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
*%-----------------|-----------------------------------------------------------|
*% 2-year SCS Type-II Storm Dist. based on Mansfield, ON. rainfall (12-hr)
```

```
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[2]
*%                   ["2SCS12.stm"] <--storm filename
*%-----------------|-----------------------------------------------------------|
*% 5-year SCS Type-II Storm Dist. based on Mansfield, ON. rainfall (12-hr)
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[3]
*%                   ["5SCS12.stm"] <--storm filename
*%-----------------|-----------------------------------------------------------|
*% 25-year SCS Type-II Storm Dist. based on Mansfield, ON. rainfall (12-hr)
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[4]
*%                   ["25SCS12.stm"] <--storm filename
*%-----------------|-----------------------------------------------------------|
*% 100-year SCS Type-II Storm Dist. based on Mansfield, ON. rainfall (12-hr)
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[5]
*%                   ["100SCS12.stm"] <--storm filename
*%-----------------|-----------------------------------------------------------|
*% Timmins Regional Storm (12-hr)
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[6]
*%                   ["12regtim.o89"] <--storm filename
*%-----------------|-----------------------------------------------------------|
FINISH
```

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

 SSSSS   W   W   M   M   H   H   Y   Y   M   M    OOO          222     000    11   77777 ==
 S       W W W   MM MM   H   H    Y Y    MM MM   O   O           2    0   0   11   7   7
 SSSSS   W W W   M M M   HHHHH     Y     M M M   O   O           2    0   0   11       7
     S    W W    M   M   H   H     Y     M   M   O   O         222    0   0   11      7
 SSSSS    W W    M   M   H   H     Y     M   M    OOO          2      0   0   11     7   ==
                                                               2      0   0   11    7    #
       StormWater Management HYdrologic Model                   222     000    11    7    ==

 ******************************************************************************************
 **************************************  SWMHYMO Ver4.05.0  *******************************
 ******************  A single event and continuous hydrologic simulation model  ***********
 ******************     based on the principles of HYMO and its successors      ***********
 ******************                 OTTHYMO-83 and OTTHYMO-89.                  ***********
 ******************************************************************************************
 ****************** Distributed by:  J.F. Sabourin and Associates Inc.          ***********
 ******************                  Ottawa,  Ontario: (613) 836-3884          ***********
 ******************                  Gatineau, Quebec: (819) 243-6858          ***********
 ******************                  E-Mail: swmhymo@jfsa.com                  ***********
 ******************************************************************************************

 ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
 ++++++++++++++++++ Licensed user: WMI & Associates Ltd.                       +++++++++++
 ++++++++++++++++++               Barrie                SERIAL#:2880720        +++++++++++
 ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

 ******************************************************************************************
 ******************           ++++++ PROGRAM ARRAY DIMENSIONS ++++++           ***********
 ******************           Maximum value for ID numbers  :     11           ***********
 ******************           Max. number of rainfall points: 105408           ***********
 ******************           Max. number of flow points    : 105408           ***********
 ******************************************************************************************


 *******************************   D E T A I L E D   O U T P U T   ***********************
 ******************************************************************************************
 *                RUN DATE: 2020-12-09     TIME: 16:07:01     RUN COUNTER: 000003
 ******************************************************************************************
 * Input   file: C:\Temp\15-319\PR\12-hour_SCS\2-CYRSCS.dat
 * Output  file: C:\Temp\15-319\PR\12-hour_SCS\2-CYRSCS.out
 * Summary file: C:\Temp\15-319\PR\12-hour_SCS\2-CYRSCS.sum
 * User comments:
 * 1:_______________________________________________________________________________________
 * 2:_______________________________________________________________________________________
 * 3:_______________________________________________________________________________________
 ******************************************************************************************

-------------------------------------------------------------------------------------------
R0001:C00001-------------------------------------------------------------------------------
*#*****************************************************************************
*#  Project Name: [Mansfield Ski Club]    Project Number: [15-319]
*#  Date        : 07-31-2017
```

```
*#  Modeller    : [J. Lightheart]
*#  Company     : WMI & Associates Ltd.
*#  License #   :  2880720
*#*******************************************************************************
*
* Post-Development Condition - Mansfield Ski Club
*
--------------------
| START            | Project  dir.:C:\Temp\15-319\PR\12-hour_SCS\
-------------------- Rainfall dir.:C:\Temp\15-319\PR\12-hour_SCS\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 0001
    NSTORM=   1
           #  1=25mm4hr.stm
-------------------------------------------------------------------------------------------
R0001:C00002-------------------------------------------------------------------------------
--------------------
| READ STORM       |  Filename: C:\Temp\15-319\PR\12-hour_SCS\25mm4hr.stm
| Ptotal=  25.00 mm|  Comments: 25mm Chicago Storm Distribution (4-hour) Mansfield, ON.
--------------------
      TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME
     hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm
      0:10   1.970|   0:50   3.820|   1:30  13.830|   2:10   4.080|   2:50   2.650|   3:30
      0:20   2.220|   1:00   5.380|   1:40   8.070|   2:20   3.570|   3:00   2.450|   3:40
      0:30   2.550|   1:10  10.940|   1:50   5.950|   2:30   3.190|   3:10   2.290|   3:50
      0:40   3.030|   1:20  56.670|   2:00   4.810|   2:40   2.890|   3:20   2.150|   4:00

-------------------------------------------------------------------------------------------
R0001:C00003-------------------------------------------------------------------------------
* SITE (POST1 - Controlled Area)
--------------------------
| CALIB STANDHYD         |   Area    (ha)=    2.74
| 01:POST1      DT= 1.00 |   Total Imp(%)=   69.00   Dir. Conn.(%)=   59.00
--------------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.89          .85
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       3.50        33.30
     Length            (m)=     300.00         6.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      56.67        23.86
                over (min)        4.00         6.00
     Storage Coeff.  (min)=       4.26 (ii)    5.98 (ii)
     Unit Hyd. Tpeak (min)=       4.00         6.00
     Unit Hyd. peak  (cms)=        .27          .19
                                                          *TOTALS*
     PEAK FLOW       (cms)=        .22          .04           .255 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.40          1.350
     RUNOFF VOLUME    (mm)=      23.01         7.79         16.768
     TOTAL RAINFALL   (mm)=      25.01        25.01         25.005
     RUNOFF COEFFICIENT   =        .92          .31           .671
```

```
           (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
               CN* =  84.0    Ia = Dep. Storage  (Above)
          (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
         (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

      ---------------------------------------------------------------------------------------------
      R0001:C00004---------------------------------------------------------------------------------
      * EXTERNAL (Routed through SWM Facility)
      -------------------------
      | CALIB NASHYD           |   Area    (ha)=   11.940   Curve Number   (CN)= 83.00
      | 02:EXT        DT= 1.00 |   Ia      (mm)=    6.800   # of Linear Res.(N)=  3.00
      -------------------------    U.H. Tp(hrs)=     .240

           Unit Hyd Qpeak  (cms)=    1.900

           PEAK FLOW       (cms)=     .115 (i)
           TIME TO PEAK    (hrs)=    1.650
           DURATION        (hrs)=    5.667, (dddd|hh:mm:)=   0|05:40
           AVERAGE FLOW    (cms)=     .028
           RUNOFF VOLUME    (mm)=    4.719
           TOTAL RAINFALL   (mm)=   25.005
           RUNOFF COEFFICIENT   =     .189

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

      ---------------------------------------------------------------------------------------------
      R0001:C00005---------------------------------------------------------------------------------
      * TOTAL FLOW TO SIDEROAD 15 CROSS CULVERT (POST1 CONTROLLED + EXT)
      ------------------------
      | ADD HYD                |
      | 03:POST1+EXT           |   ID:NHYD            AREA     QPEAK    TPEAK      R.V.     DWF
      ------------------------                        (ha)     (cms)    (hrs)      (mm)   (cms)
                             ID 1 01:POST1          2.740      .255    1.350    16.768    .000
                            +ID 2 02:EXT           11.940      .115    1.650     4.719    .000
                            ==============================================================
                            SUM   03:POST1+EXT     14.680      .282    1.367     6.968    .000

         NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

      ---------------------------------------------------------------------------------------------
      R0001:C00006---------------------------------------------------------------------------------
      * SWM Facility
      -----------------------
      |  ROUTE RESERVOIR -> |    Requested routing time step =  1.0 min.
      |  IN>03:POST1+EXT    |
      | OUT<04:SWM Facili   | =========================  OUTLFOW STORAGE TABLE  =================
      ----------------------- OUTFLOW   STORAGE| OUTFLOW   STORAGE| OUTFLOW   STORAGE| OUTFLOW
                                (cms)   (ha.m.)|   (cms)   (ha.m.)|   (cms)   (ha.m.)|   (cms)
                                 .000 .0000E+00|    .010 .1292E-01|    .065 .4128E-01|   1.071 .
                                 .002 .6300E-03|    .010 .1442E-01|    .108 .4430E-01|   1.184 .
                                 .003 .1310E-02|    .010 .1601E-01|    .159 .4743E-01|   1.308 .
                                 .004 .2050E-02|    .011 .1769E-01|    .217 .5067E-01|   1.445 .
```

```
                                 .005 .2840E-02|    .011 .1946E-01|    .281 .5403E-01|   1.594 .
                                 .006 .3680E-02|    .011 .2133E-01|    .351 .5751E-01|   1.759 .
                                 .006 .4590E-02|    .012 .2329E-01|    .425 .6112E-01|   2.020 .
                                 .007 .5570E-02|    .012 .2535E-01|    .505 .6486E-01|   2.383 .
                                 .007 .6610E-02|    .012 .2777E-01|    .589 .6872E-01|   2.840 .
                                 .008 .7720E-02|    .013 .3027E-01|    .677 .7272E-01|   3.391 .
                                 .008 .8910E-02|    .013 .3287E-01|    .769 .7686E-01|   4.041 .
                                 .009 .1017E-01|    .013 .3557E-01|    .866 .8113E-01|   4.792 .
                                 .009 .1150E-01|    .032 .3837E-01|    .966 .8555E-01|   5.649 .

           ROUTING RESULTS             AREA     QPEAK     TPEAK       R.V.
           ----------------------      (ha)     (cms)     (hrs)       (mm)
           INFLOW > 03:POST1+EXT     14.680      .282     1.367      6.968
          OUTFLOW < 04:SWM Facili    14.680      .108     2.033      6.968

                          PEAK   FLOW   REDUCTION [Qout/Qin](%)=   38.291
                          TIME SHIFT OF PEAK FLOW         (min)=    40.00
                          MAXIMUM  STORAGE   USED       (ha.m.)=.4429E-01

      ---------------------------------------------------------------------------------------------
      R0001:C00007---------------------------------------------------------------------------------
      * SITE (POST2 - Uncontrolled Area)
      --------------------------
      | CALIB STANDHYD         |   Area    (ha)=     .89
      | 05:POST2      DT= 1.00 |   Total Imp(%)=   21.00   Dir. Conn.(%)=   10.50
      --------------------------
                                     IMPERVIOUS    PERVIOUS (i)
           Surface Area     (ha)=        .19          .70
           Dep. Storage     (mm)=       2.00         5.00
           Average Slope     (%)=       6.00        11.10
           Length            (m)=     120.00        50.00
           Mannings n           =       .013         .250

           Max.eff.Inten.(mm/hr)=      56.67        11.01
                      over (min)        2.00        14.00
           Storage Coeff.  (min)=       2.09 (ii)   13.75 (ii)
           Unit Hyd. Tpeak (min)=       2.00        14.00
           Unit Hyd. peak  (cms)=        .54          .08
                                                                 *TOTALS*
           PEAK FLOW       (cms)=        .01          .01          .018 (iii)
           TIME TO PEAK    (hrs)=       1.33         1.55         1.333
           RUNOFF VOLUME    (mm)=      23.00         6.70         8.411
           TOTAL RAINFALL   (mm)=      25.01        25.01        25.005
           RUNOFF COEFFICIENT   =        .92          .27          .336

             (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
                 CN* =  84.0    Ia = Dep. Storage  (Above)
            (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
           (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

      ---------------------------------------------------------------------------------------------
      R0001:C00008---------------------------------------------------------------------------------
        ** END OF RUN :    0
```

```
 *****************************************************************************************




 --------------------
 | START            | Project  dir.:C:\Temp\15-319\PR\12-hour_SCS\
 -------------------- Rainfall dir.:C:\Temp\15-319\PR\12-hour_SCS\
     TZERO =   .00 hrs on        0
     METOUT=   2 (output = METRIC)
     NRUN  = 0002
     NSTORM=   1
            #  1=2SCS12.stm
 -----------------------------------------------------------------------------------------
 R0002:C00002----------------------------------------------------------------------------
 *#****************************************************************************
 *#  Project Name: [Mansfield Ski Club]    Project Number: [15-319]
 *#  Date        : 07-31-2017
 *#  Modeller    : [J. Lightheart]
 *#  Company     : WMI & Associates Ltd.
 *#  License #   :  2880720
 *#****************************************************************************
 *
 * Post-Development Condition - Mansfield Ski Club
 *
 -----------------------------------------------------------------------------------------
 R0002:C00002----------------------------------------------------------------------------
 --------------------
 | READ STORM       |  Filename: C:\Temp\15-319\PR\12-hour_SCS\2SCS12.stm
 | Ptotal=  44.40 mm|  Comments: 2-Year SCS Type-II Storm Distribution (12-hour) Mansfield,
 --------------------
       TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME
      hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm
       0:30    .888|   2:30   1.776|   4:30   2.664|   6:30   7.992|   8:30   1.776|  10:30
       1:00    .888|   3:00   1.776|   5:00   3.552|   7:00   3.552|   9:00   1.776|  11:00
       1:30    .888|   3:30   1.776|   5:30   5.328|   7:30   2.664|   9:30   1.776|  11:30
       2:00    .888|   4:00   1.776|   6:00  39.960|   8:00   2.664|  10:00    .888|  12:00

 -----------------------------------------------------------------------------------------
 R0002:C00003----------------------------------------------------------------------------
 * SITE (POST1 - Controlled Area)
 --------------------------
 | CALIB STANDHYD         |   Area    (ha)=    2.74
 | 01:POST1      DT= 1.00 |   Total Imp(%)=   69.00   Dir. Conn.(%)=   59.00
 --------------------------
                               IMPERVIOUS    PERVIOUS (i)
      Surface Area     (ha)=       1.89          .85
      Dep. Storage     (mm)=       2.00         5.00
      Average Slope     (%)=       3.50        33.30
      Length            (m)=     300.00         6.00
      Mannings n          =       .013         .250
```

```
      Max.eff.Inten.(mm/hr)=      39.96        34.36
                 over (min)        5.00         6.00
      Storage Coeff.  (min)=       4.89 (ii)    6.39 (ii)
      Unit Hyd. Tpeak (min)=       5.00         6.00
      Unit Hyd. peak  (cms)=        .23          .18
                                                            *TOTALS*
      PEAK FLOW       (cms)=        .18          .07           .252 (iii)
      TIME TO PEAK    (hrs)=       6.00         6.02          6.000
      RUNOFF VOLUME    (mm)=      42.40        21.37         33.779
      TOTAL RAINFALL   (mm)=      44.40        44.40         44.400
      RUNOFF COEFFICIENT   =        .95          .48           .761

        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN* =  84.0    Ia = Dep. Storage  (Above)
       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

 -----------------------------------------------------------------------------------------
 R0002:C00004----------------------------------------------------------------------------
 * EXTERNAL (Routed through SWM Facility)
 --------------------------
 | CALIB NASHYD           |   Area    (ha)=   11.940   Curve Number   (CN)= 83.00
 | 02:EXT        DT= 1.00 |   Ia      (mm)=    6.800   # of Linear Res.(N)=  3.00
 --------------------------   U.H. Tp(hrs)=     .240

      Unit Hyd Qpeak  (cms)=    1.900

      PEAK FLOW       (cms)=     .446 (i)
      TIME TO PEAK    (hrs)=    6.117
      DURATION        (hrs)=   13.667, (dddd|hh:mm:)=   0|13:40
      AVERAGE FLOW    (cms)=     .038
      RUNOFF VOLUME    (mm)=   15.774
      TOTAL RAINFALL   (mm)=   44.400
      RUNOFF COEFFICIENT   =     .355

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

 -----------------------------------------------------------------------------------------
 R0002:C00005----------------------------------------------------------------------------
 * TOTAL FLOW TO SIDEROAD 15 CROSS CULVERT (POST1 CONTROLLED + EXT)
 -----------------------
 | ADD HYD               |
 | 03:POST1+EXT          |   ID:NHYD            AREA     QPEAK    TPEAK      R.V.     DWF
 -----------------------                        (ha)     (cms)    (hrs)      (mm)   (cms)
                       ID 1 01:POST1          2.740      .252    6.000    33.779    .000
                      +ID 2 02:EXT           11.940      .446    6.117    15.774    .000
                      ==================================================================
                      SUM   03:POST1+EXT     14.680      .654    6.033    19.135    .000

    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

 -----------------------------------------------------------------------------------------
```

```
R0002:C00006----------------------------------------------------------------------------
* SWM Facility
----------------------
|  ROUTE RESERVOIR -> |    Requested routing time step =  1.0 min.
|  IN>03:POST1+EXT    |
| OUT<04:SWM Facili   | =========================  OUTLFOW STORAGE TABLE  =================
---------------------- OUTFLOW   STORAGE| OUTFLOW   STORAGE| OUTFLOW   STORAGE| OUTFLOW
                         (cms)   (ha.m.)|   (cms)   (ha.m.)|   (cms)   (ha.m.)|   (cms)
                          .000 .0000E+00|    .010 .1292E-01|    .065 .4128E-01|   1.071 .
                          .002 .6300E-03|    .010 .1442E-01|    .108 .4430E-01|   1.184 .
                          .003 .1310E-02|    .010 .1601E-01|    .159 .4743E-01|   1.308 .
                          .004 .2050E-02|    .011 .1769E-01|    .217 .5067E-01|   1.445 .
                          .005 .2840E-02|    .011 .1946E-01|    .281 .5403E-01|   1.594 .
                          .006 .3680E-02|    .011 .2133E-01|    .351 .5751E-01|   1.759 .
                          .006 .4590E-02|    .012 .2329E-01|    .425 .6112E-01|   2.020 .
                          .007 .5570E-02|    .012 .2535E-01|    .505 .6486E-01|   2.383 .
                          .007 .6610E-02|    .012 .2777E-01|    .589 .6872E-01|   2.840 .
                          .008 .7720E-02|    .013 .3027E-01|    .677 .7272E-01|   3.391 .
                          .008 .8910E-02|    .013 .3287E-01|    .769 .7686E-01|   4.041 .
                          .009 .1017E-01|    .013 .3557E-01|    .866 .8113E-01|   4.792 .
                          .009 .1150E-01|    .032 .3837E-01|    .966 .8555E-01|   5.649 .

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     ----------------------      (ha)     (cms)     (hrs)       (mm)
     INFLOW > 03:POST1+EXT     14.680      .654     6.033     19.135
    OUTFLOW < 04:SWM Facili    14.680      .536     6.167     19.135

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=   81.905
                   TIME SHIFT OF PEAK FLOW         (min)=     8.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=.6630E-01

----------------------------------------------------------------------------------------
R0002:C00007----------------------------------------------------------------------------
* SITE (POST2 - Uncontrolled Area)
--------------------------
| CALIB STANDHYD        |   Area    (ha)=     .89
| 05:POST2      DT= 1.00 |   Total Imp(%)=   21.00   Dir. Conn.(%)=   10.50
--------------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .19          .70
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       6.00        11.10
     Length            (m)=     120.00        50.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      39.96        26.09
                over (min)       2.00        11.00
     Storage Coeff.  (min)=       2.40 (ii)   10.66 (ii)
     Unit Hyd. Tpeak (min)=       2.00        11.00
     Unit Hyd. peak  (cms)=        .50          .11
                                                        *TOTALS*
     PEAK FLOW       (cms)=        .01          .04          .050 (iii)
     TIME TO PEAK    (hrs)=       5.77         6.05         6.000
```

```
     RUNOFF VOLUME    (mm)=      42.40        19.34         21.758
     TOTAL RAINFALL   (mm)=      44.40        44.40         44.400
     RUNOFF COEFFICIENT   =        .95          .44           .490

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  84.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

----------------------------------------------------------------------------------------
R0002:C00008----------------------------------------------------------------------------
----------------------------------------------------------------------------------------
R0002:C00002----------------------------------------------------------------------------
  ** END OF RUN :    1

****************************************************************************************





--------------------
| START            | Project  dir.:C:\Temp\15-319\PR\12-hour_SCS\
-------------------- Rainfall dir.:C:\Temp\15-319\PR\12-hour_SCS\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 0003
    NSTORM=   1
           #  1=5SCS12.stm
----------------------------------------------------------------------------------------
R0003:C00002----------------------------------------------------------------------------
*#****************************************************************************
*#  Project Name: [Mansfield Ski Club]    Project Number: [15-319]
*#  Date        : 07-31-2017
*#  Modeller    : [J. Lightheart]
*#  Company     : WMI & Associates Ltd.
*#  License #   :  2880720
*#****************************************************************************
*
* Post-Development Condition - Mansfield Ski Club
*
----------------------------------------------------------------------------------------
R0003:C00002----------------------------------------------------------------------------
--------------------
| READ STORM       |  Filename: C:\Temp\15-319\PR\12-hour_SCS\5SCS12.stm
| Ptotal=  58.50 mm|  Comments: 5-Year SCS Type-II Storm Distribution (12-hour) Mansfield,
--------------------
      TIME    RAIN|  TIME    RAIN|  TIME    RAIN|  TIME    RAIN|  TIME    RAIN|  TIME
     hh:mm   mm/hr| hh:mm   mm/hr| hh:mm   mm/hr| hh:mm   mm/hr| hh:mm   mm/hr| hh:mm
      0:30   1.170|  2:30   2.340|  4:30   3.510|  6:30  10.530|  8:30   2.340| 10:30
      1:00   1.170|  3:00   2.340|  5:00   4.680|  7:00   4.680|  9:00   2.340| 11:00
      1:30   1.170|  3:30   2.340|  5:30   7.020|  7:30   3.510|  9:30   2.340| 11:30
      2:00   1.170|  4:00   2.340|  6:00  52.650|  8:00   3.510| 10:00   1.170| 12:00
```

```
-------------------------------------------------------------------------------------------
R0003:C00003-------------------------------------------------------------------------------
* SITE (POST1 - Controlled Area)
--------------------------
| CALIB STANDHYD         |   Area    (ha)=    2.74
| 01:POST1      DT= 1.00 |   Total Imp(%)=   69.00   Dir. Conn.(%)=   59.00
--------------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.89          .85
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       3.50        33.30
     Length            (m)=     300.00         6.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      52.65        51.19
                over (min)        4.00         6.00
     Storage Coeff.  (min)=       4.38 (ii)    5.65 (ii)
     Unit Hyd. Tpeak (min)=       4.00         6.00
     Unit Hyd. peak  (cms)=        .27          .20
                                                           *TOTALS*
     PEAK FLOW       (cms)=        .24          .11           .349 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.00          6.000
     RUNOFF VOLUME    (mm)=      56.50        32.80         46.781
     TOTAL RAINFALL   (mm)=      58.50        58.50         58.500
     RUNOFF COEFFICIENT   =        .97          .56           .800

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  84.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------------------
R0003:C00004-------------------------------------------------------------------------------
* EXTERNAL (Routed through SWM Facility)
--------------------------
| CALIB NASHYD           |   Area    (ha)=   11.940   Curve Number   (CN)= 83.00
| 02:EXT        DT= 1.00 |   Ia      (mm)=    6.800   # of Linear Res.(N)=  3.00
--------------------------   U.H. Tp(hrs)=     .240

     Unit Hyd Qpeak  (cms)=    1.900

     PEAK FLOW       (cms)=     .742 (i)
     TIME TO PEAK    (hrs)=    6.100
     DURATION        (hrs)=   13.667, (dddd|hh:mm:)=   0|13:40
     AVERAGE FLOW    (cms)=     .063
     RUNOFF VOLUME    (mm)=   25.769
     TOTAL RAINFALL   (mm)=   58.500
     RUNOFF COEFFICIENT   =     .440

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

-------------------------------------------------------------------------------------------
```

```
R0003:C00005-------------------------------------------------------------------------------
* TOTAL FLOW TO SIDEROAD 15 CROSS CULVERT (POST1 CONTROLLED + EXT)
------------------------
| ADD HYD              |
| 03:POST1+EXT         |   ID:NHYD            AREA     QPEAK    TPEAK      R.V.     DWF
                                              (ha)     (cms)    (hrs)      (mm)   (cms)
------------------------
                      ID 1 01:POST1          2.740      .349    6.000    46.781    .000
                     +ID 2 02:EXT           11.940      .742    6.100    25.769    .000
                     ==================================================================
                     SUM   03:POST1+EXT     14.680     1.026    6.033    29.691    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------------------
R0003:C00006-------------------------------------------------------------------------------
* SWM Facility
-----------------------
|  ROUTE RESERVOIR -> |    Requested routing time step =  1.0 min.
|  IN>03:POST1+EXT    |
| OUT<04:SWM Facili   | =========================  OUTLFOW STORAGE TABLE  =================
----------------------- OUTFLOW   STORAGE| OUTFLOW   STORAGE| OUTFLOW   STORAGE| OUTFLOW
                          (cms)   (ha.m.)|   (cms)   (ha.m.)|   (cms)   (ha.m.)|   (cms)
                           .000 .0000E+00|    .010 .1292E-01|    .065 .4128E-01|   1.071 .
                           .002 .6300E-03|    .010 .1442E-01|    .108 .4430E-01|   1.184 .
                           .003 .1310E-02|    .010 .1601E-01|    .159 .4743E-01|   1.308 .
                           .004 .2050E-02|    .011 .1769E-01|    .217 .5067E-01|   1.445 .
                           .005 .2840E-02|    .011 .1946E-01|    .281 .5403E-01|   1.594 .
                           .006 .3680E-02|    .011 .2133E-01|    .351 .5751E-01|   1.759 .
                           .006 .4590E-02|    .012 .2329E-01|    .425 .6112E-01|   2.020 .
                           .007 .5570E-02|    .012 .2535E-01|    .505 .6486E-01|   2.383 .
                           .007 .6610E-02|    .012 .2777E-01|    .589 .6872E-01|   2.840 .
                           .008 .7720E-02|    .013 .3027E-01|    .677 .7272E-01|   3.391 .
                           .008 .8910E-02|    .013 .3287E-01|    .769 .7686E-01|   4.041 .
                           .009 .1017E-01|    .013 .3557E-01|    .866 .8113E-01|   4.792 .
                           .009 .1150E-01|    .032 .3837E-01|    .966 .8555E-01|   5.649 .

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     ----------------------      (ha)     (cms)     (hrs)       (mm)
     INFLOW > 03:POST1+EXT     14.680     1.026     6.033     29.691
    OUTFLOW < 04:SWM Facili    14.680      .892     6.133     29.691

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=   86.998
                   TIME SHIFT OF PEAK FLOW         (min)=     6.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=.8232E-01

-------------------------------------------------------------------------------------------
R0003:C00007-------------------------------------------------------------------------------
* SITE (POST2 - Uncontrolled Area)
--------------------------
| CALIB STANDHYD         |   Area    (ha)=     .89
| 05:POST2      DT= 1.00 |   Total Imp(%)=   21.00   Dir. Conn.(%)=   10.50
--------------------------
                              IMPERVIOUS    PERVIOUS (i)
```

```
     Surface Area     (ha)=        .19          .70
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       6.00        11.10
     Length            (m)=     120.00        50.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      52.65        40.41
                over (min)       2.00         9.00
     Storage Coeff.  (min)=       2.15 (ii)    9.09 (ii)
     Unit Hyd. Tpeak (min)=       2.00         9.00
     Unit Hyd. peak  (cms)=        .53          .13
                                                           *TOTALS*
     PEAK FLOW       (cms)=        .01          .07           .080 (iii)
     TIME TO PEAK    (hrs)=       5.75         6.03          6.000
     RUNOFF VOLUME    (mm)=      56.50        30.22         32.982
     TOTAL RAINFALL   (mm)=      58.50        58.50         58.500
     RUNOFF COEFFICIENT   =        .97          .52           .564

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  84.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------------------
R0003:C00008-------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------
R0003:C00002-------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------
R0003:C00002-------------------------------------------------------------------------------
  ** END OF RUN :    2

*******************************************************************************************




--------------------
| START            | Project  dir.:C:\Temp\15-319\PR\12-hour_SCS\
-------------------- Rainfall dir.:C:\Temp\15-319\PR\12-hour_SCS\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 0004
    NSTORM=   1
           #  1=25SCS12.stm
-------------------------------------------------------------------------------------------
R0004:C00002-------------------------------------------------------------------------------
*#*****************************************************************************
*#  Project Name: [Mansfield Ski Club]    Project Number: [15-319]
*#  Date        : 07-31-2017
*#  Modeller    : [J. Lightheart]
*#  Company     : WMI & Associates Ltd.
*#  License #   :  2880720
```

```
*#*****************************************************************************
*
* Post-Development Condition - Mansfield Ski Club
*
-------------------------------------------------------------------------------------------
R0004:C00002-------------------------------------------------------------------------------
--------------------
| READ STORM       |  Filename: C:\Temp\15-319\PR\12-hour_SCS\25SCS12.stm
| Ptotal=  79.90 mm|  Comments: 25-Year SCS Type-II Storm Distribution (12-hour) Mansfield,
--------------------
      TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME
     hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm
      0:30   1.598|   2:30   3.196|   4:30   4.794|   6:30  14.382|   8:30   3.196|  10:30
      1:00   1.598|   3:00   3.196|   5:00   6.392|   7:00   6.392|   9:00   3.196|  11:00
      1:30   1.598|   3:30   3.196|   5:30   9.588|   7:30   4.794|   9:30   3.196|  11:30
      2:00   1.598|   4:00   3.196|   6:00  71.910|   8:00   4.794|  10:00   1.598|  12:00

-------------------------------------------------------------------------------------------
R0004:C00003-------------------------------------------------------------------------------
* SITE (POST1 - Controlled Area)
--------------------------
| CALIB STANDHYD         |   Area    (ha)=    2.74
| 01:POST1      DT= 1.00 |   Total Imp(%)=   69.00   Dir. Conn.(%)=   59.00
--------------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.89          .85
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       3.50        33.30
     Length            (m)=     300.00         6.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      71.91        77.77
                over (min)       4.00         5.00
     Storage Coeff.  (min)=       3.87 (ii)    4.95 (ii)
     Unit Hyd. Tpeak (min)=       4.00         5.00
     Unit Hyd. peak  (cms)=        .29          .23
                                                           *TOTALS*
     PEAK FLOW       (cms)=        .32          .18           .499 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.00          6.000
     RUNOFF VOLUME    (mm)=      77.90        51.41         67.040
     TOTAL RAINFALL   (mm)=      79.90        79.90         79.900
     RUNOFF COEFFICIENT   =        .97          .64           .839

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  84.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------------------
R0004:C00004-------------------------------------------------------------------------------
* EXTERNAL (Routed through SWM Facility)
--------------------------
| CALIB NASHYD           |   Area    (ha)=   11.940   Curve Number   (CN)= 83.00
```

```
      | 02:EXT        DT= 1.00 |   Ia      (mm)=    6.800   # of Linear Res.(N)=  3.00
      -------------------------   U.H. Tp(hrs)=     .240

           Unit Hyd Qpeak  (cms)=    1.900

           PEAK FLOW       (cms)=    1.241 (i)
           TIME TO PEAK    (hrs)=    6.100
           DURATION        (hrs)=   13.667, (dddd|hh:mm:)=   0|13:40
           AVERAGE FLOW    (cms)=     .104
           RUNOFF VOLUME    (mm)=   42.707
           TOTAL RAINFALL   (mm)=   79.900
           RUNOFF COEFFICIENT   =     .535

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

      -------------------------------------------------------------------------------------------
      R0004:C00005-------------------------------------------------------------------------------
      * TOTAL FLOW TO SIDEROAD 15 CROSS CULVERT (POST1 CONTROLLED + EXT)
      ------------------------
      | ADD HYD                |
      | 03:POST1+EXT           |   ID:NHYD            AREA     QPEAK    TPEAK      R.V.     DWF
      ------------------------                        (ha)     (cms)    (hrs)      (mm)   (cms)
                           ID 1 01:POST1          2.740      .499    6.000    67.040    .000
                          +ID 2 02:EXT           11.940     1.241    6.100    42.707    .000
                          ==============================================================
                          SUM   03:POST1+EXT     14.680     1.647    6.033    47.248    .000

         NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

      -------------------------------------------------------------------------------------------
      R0004:C00006-------------------------------------------------------------------------------
      * SWM Facility
      ----------------------
      |  ROUTE RESERVOIR -> |    Requested routing time step =  1.0 min.
      |  IN>03:POST1+EXT    |
      | OUT<04:SWM Facili   | ========================  OUTLFOW STORAGE TABLE  =================
      ---------------------- OUTFLOW   STORAGE| OUTFLOW   STORAGE| OUTFLOW   STORAGE| OUTFLOW
                               (cms)   (ha.m.)|   (cms)   (ha.m.)|   (cms)   (ha.m.)|   (cms)
                                .000 .0000E+00|    .010 .1292E-01|    .065 .4128E-01|   1.071 .
                                .002 .6300E-03|    .010 .1442E-01|    .108 .4430E-01|   1.184 .
                                .003 .1310E-02|    .010 .1601E-01|    .159 .4743E-01|   1.308 .
                                .004 .2050E-02|    .011 .1769E-01|    .217 .5067E-01|   1.445 .
                                .005 .2840E-02|    .011 .1946E-01|    .281 .5403E-01|   1.594 .
                                .006 .3680E-02|    .011 .2133E-01|    .351 .5751E-01|   1.759 .
                                .006 .4590E-02|    .012 .2329E-01|    .425 .6112E-01|   2.020 .
                                .007 .5570E-02|    .012 .2535E-01|    .505 .6486E-01|   2.383 .
                                .007 .6610E-02|    .012 .2777E-01|    .589 .6872E-01|   2.840 .
                                .008 .7720E-02|    .013 .3027E-01|    .677 .7272E-01|   3.391 .
                                .008 .8910E-02|    .013 .3287E-01|    .769 .7686E-01|   4.041 .
                                .009 .1017E-01|    .013 .3557E-01|    .866 .8113E-01|   4.792 .
                                .009 .1150E-01|    .032 .3837E-01|    .966 .8555E-01|   5.649 .

           ROUTING RESULTS             AREA     QPEAK     TPEAK       R.V.
```

```
           ----------------------      (ha)     (cms)     (hrs)       (mm)
           INFLOW > 03:POST1+EXT     14.680     1.647     6.033     47.248
          OUTFLOW < 04:SWM Facili    14.680     1.483     6.100     47.248

                         PEAK   FLOW   REDUCTION [Qout/Qin](%)=   90.036
                         TIME SHIFT OF PEAK FLOW         (min)=     4.00
                         MAXIMUM  STORAGE   USED       (ha.m.)=.1061E+00

      -------------------------------------------------------------------------------------------
      R0004:C00007-------------------------------------------------------------------------------
      * SITE (POST2 - Uncontrolled Area)
      --------------------------
      | CALIB STANDHYD         |   Area    (ha)=     .89
      | 05:POST2      DT= 1.00 |   Total Imp(%)=   21.00   Dir. Conn.(%)=   10.50
      --------------------------
                                    IMPERVIOUS    PERVIOUS (i)
           Surface Area     (ha)=        .19          .70
           Dep. Storage     (mm)=       2.00         5.00
           Average Slope     (%)=       6.00        11.10
           Length            (m)=     120.00        50.00
           Mannings n          =       .013         .250

           Max.eff.Inten.(mm/hr)=      71.91        62.84
                      over (min)       2.00         8.00
           Storage Coeff.  (min)=       1.90 (ii)    7.71 (ii)
           Unit Hyd. Tpeak (min)=       2.00         8.00
           Unit Hyd. peak  (cms)=        .58          .15
                                                                *TOTALS*
           PEAK FLOW       (cms)=        .02          .11           .129 (iii)
           TIME TO PEAK    (hrs)=       5.75         6.02          6.000
           RUNOFF VOLUME    (mm)=      77.90        48.21         51.330
           TOTAL RAINFALL   (mm)=      79.90        79.90         79.900
           RUNOFF COEFFICIENT   =        .97          .60           .642

             (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
                 CN* =  84.0    Ia = Dep. Storage  (Above)
            (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
           (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

      -------------------------------------------------------------------------------------------
      R0004:C00008-------------------------------------------------------------------------------
      -------------------------------------------------------------------------------------------
      R0004:C00002-------------------------------------------------------------------------------
      -------------------------------------------------------------------------------------------
      R0004:C00002-------------------------------------------------------------------------------
      -------------------------------------------------------------------------------------------
      R0004:C00002-------------------------------------------------------------------------------
        ** END OF RUN :    3

      *******************************************************************************************
```

```
--------------------
| START            | Project  dir.:C:\Temp\15-319\PR\12-hour_SCS\
-------------------- Rainfall dir.:C:\Temp\15-319\PR\12-hour_SCS\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 0005
    NSTORM=   1
           #  1=100SCS12.stm
-------------------------------------------------------------------------------------------
R0005:C00002-------------------------------------------------------------------------------
*#*************************************************************************************
*#  Project Name: [Mansfield Ski Club]    Project Number: [15-319]
*#  Date        : 07-31-2017
*#  Modeller    : [J. Lightheart]
*#  Company     : WMI & Associates Ltd.
*#  License #   :  2880720
*#*************************************************************************************
*
* Post-Development Condition - Mansfield Ski Club
*
-------------------------------------------------------------------------------------------
R0005:C00002-------------------------------------------------------------------------------
--------------------
| READ STORM       |  Filename: C:\Temp\15-319\PR\12-hour_SCS\100SCS12.stm
| Ptotal=  97.40 mm|  Comments: 100-Year SCS Type-II Storm Distribution (12-hour)
--------------------
      TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME
     hh:mm   mm/hr| hh:mm   mm/hr| hh:mm   mm/hr| hh:mm   mm/hr| hh:mm   mm/hr| hh:mm
      0:30   1.948|   2:30   3.896|   4:30   5.844|   6:30  17.532|   8:30   3.896|  10:30
      1:00   1.948|   3:00   3.896|   5:00   7.792|   7:00   7.792|   9:00   3.896|  11:00
      1:30   1.948|   3:30   3.896|   5:30  11.688|   7:30   5.844|   9:30   3.896|  11:30
      2:00   1.948|   4:00   3.896|   6:00  87.660|   8:00   5.844|  10:00   1.948|  12:00

-------------------------------------------------------------------------------------------
R0005:C00003-------------------------------------------------------------------------------
* SITE (POST1 - Controlled Area)
--------------------------
| CALIB STANDHYD         |   Area    (ha)=    2.74
| 01:POST1      DT= 1.00 |   Total Imp(%)=   69.00   Dir. Conn.(%)=   59.00
--------------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.89          .85
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       3.50        33.30
     Length            (m)=     300.00         6.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      87.66        99.54
                over (min)       4.00         5.00
     Storage Coeff.  (min)=       3.57 (ii)    4.55 (ii)
     Unit Hyd. Tpeak (min)=       4.00         5.00
```

```
     Unit Hyd. peak  (cms)=        .30          .24
                                                             *TOTALS*
     PEAK FLOW       (cms)=        .39          .23           .622 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.00          6.000
     RUNOFF VOLUME    (mm)=      95.40        67.32         83.886
     TOTAL RAINFALL   (mm)=      97.40        97.40         97.400
     RUNOFF COEFFICIENT   =        .98          .69           .861

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  84.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------------------
R0005:C00004-------------------------------------------------------------------------------
* EXTERNAL (Routed through SWM Facility)
--------------------------
| CALIB NASHYD           |   Area    (ha)=   11.940   Curve Number   (CN)= 83.00
| 02:EXT        DT= 1.00 |   Ia      (mm)=    6.800   # of Linear Res.(N)=  3.00
--------------------------   U.H. Tp(hrs)=     .240

     Unit Hyd Qpeak  (cms)=    1.900

     PEAK FLOW       (cms)=    1.674 (i)
     TIME TO PEAK    (hrs)=    6.083
     DURATION        (hrs)=   13.667, (dddd|hh:mm:)=   0|13:40
     AVERAGE FLOW    (cms)=     .140
     RUNOFF VOLUME    (mm)=   57.552
     TOTAL RAINFALL   (mm)=   97.400
     RUNOFF COEFFICIENT   =     .591

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

-------------------------------------------------------------------------------------------
R0005:C00005-------------------------------------------------------------------------------
* TOTAL FLOW TO SIDEROAD 15 CROSS CULVERT (POST1 CONTROLLED + EXT)
------------------------
| ADD HYD               |
| 03:POST1+EXT          |   ID:NHYD           AREA     QPEAK    TPEAK      R.V.     DWF
------------------------                      (ha)     (cms)    (hrs)      (mm)   (cms)
                      ID 1 01:POST1         2.740      .622    6.000    83.886    .000
                     +ID 2 02:EXT          11.940     1.674    6.083    57.552    .000
                     ==================================================================
                     SUM   03:POST1+EXT    14.680     2.184    6.033    62.467    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------------------
R0005:C00006-------------------------------------------------------------------------------
* SWM Facility
-----------------------
|  ROUTE RESERVOIR -> |    Requested routing time step =  1.0 min.
|  IN>03:POST1+EXT    |
```

```
| OUT<04:SWM Facili   | ========================  OUTLFOW STORAGE TABLE  ================
----------------------- OUTFLOW   STORAGE| OUTFLOW   STORAGE| OUTFLOW   STORAGE| OUTFLOW
                          (cms)   (ha.m.)|   (cms)   (ha.m.)|   (cms)   (ha.m.)|   (cms)
                           .000 .0000E+00|    .010 .1292E-01|    .065 .4128E-01|   1.071 .
                           .002 .6300E-03|    .010 .1442E-01|    .108 .4430E-01|   1.184 .
                           .003 .1310E-02|    .010 .1601E-01|    .159 .4743E-01|   1.308 .
                           .004 .2050E-02|    .011 .1769E-01|    .217 .5067E-01|   1.445 .
                           .005 .2840E-02|    .011 .1946E-01|    .281 .5403E-01|   1.594 .
                           .006 .3680E-02|    .011 .2133E-01|    .351 .5751E-01|   1.759 .
                           .006 .4590E-02|    .012 .2329E-01|    .425 .6112E-01|   2.020 .
                           .007 .5570E-02|    .012 .2535E-01|    .505 .6486E-01|   2.383 .
                           .007 .6610E-02|    .012 .2777E-01|    .589 .6872E-01|   2.840 .
                           .008 .7720E-02|    .013 .3027E-01|    .677 .7272E-01|   3.391 .
                           .008 .8910E-02|    .013 .3287E-01|    .769 .7686E-01|   4.041 .
                           .009 .1017E-01|    .013 .3557E-01|    .866 .8113E-01|   4.792 .
                           .009 .1150E-01|    .032 .3837E-01|    .966 .8555E-01|   5.649 .

     ROUTING RESULTS             AREA     QPEAK     TPEAK       R.V.
     ----------------------      (ha)     (cms)     (hrs)       (mm)
     INFLOW > 03:POST1+EXT     14.680     2.184     6.033     62.467
    OUTFLOW < 04:SWM Facili    14.680     2.036     6.083     62.467

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=   93.234
                   TIME SHIFT OF PEAK FLOW         (min)=     3.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=.1218E+00

-------------------------------------------------------------------------------------------
R0005:C00007-------------------------------------------------------------------------------
* SITE (POST2 - Uncontrolled Area)
--------------------------
| CALIB STANDHYD         |   Area    (ha)=     .89
| 05:POST2      DT= 1.00 |   Total Imp(%)=   21.00   Dir. Conn.(%)=   10.50
--------------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .19         .70
     Dep. Storage     (mm)=       2.00        5.00
     Average Slope     (%)=       6.00       11.10
     Length            (m)=     120.00       50.00
     Mannings n           =       .013        .250

     Max.eff.Inten.(mm/hr)=      87.66       81.64
                over (min)        2.00        7.00
     Storage Coeff.  (min)=       1.76 (ii)    6.99 (ii)
     Unit Hyd. Tpeak (min)=       2.00        7.00
     Unit Hyd. peak  (cms)=        .61         .16
                                                          *TOTALS*
     PEAK FLOW       (cms)=        .02         .15          .171 (iii)
     TIME TO PEAK    (hrs)=       5.85        6.00         6.000
     RUNOFF VOLUME    (mm)=      95.40       63.72        67.048
     TOTAL RAINFALL   (mm)=      97.40       97.40        97.400
     RUNOFF COEFFICIENT   =        .98         .65          .688

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
```

```
           CN* =  84.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------------------
R0005:C00008-------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------
R0005:C00002-------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------
R0005:C00002-------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------
R0005:C00002-------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------
R0005:C00002-------------------------------------------------------------------------------
  ** END OF RUN :    4

*******************************************************************************************




--------------------
| START            | Project  dir.:C:\Temp\15-319\PR\12-hour_SCS\
-------------------- Rainfall dir.:C:\Temp\15-319\PR\12-hour_SCS\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 0006
    NSTORM=   1
           #  1=12regtim.o89
-------------------------------------------------------------------------------------------
R0006:C00002-------------------------------------------------------------------------------
*#*****************************************************************************
*#  Project Name: [Mansfield Ski Club]    Project Number: [15-319]
*#  Date        : 07-31-2017
*#  Modeller    : [J. Lightheart]
*#  Company     : WMI & Associates Ltd.
*#  License #   :  2880720
*#*****************************************************************************
*
* Post-Development Condition - Mansfield Ski Club
*
-------------------------------------------------------------------------------------------
R0006:C00002-------------------------------------------------------------------------------
--------------------
| READ STORM       |  Filename: C:\Temp\15-319\PR\12-hour_SCS\12regtim.o89
| Ptotal= 193.00 mm|  Comments: TIMMINS REGIONAL STORM (12-hour)
--------------------
      TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME
     hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm
      1:00  15.000|   3:00  10.000|   5:00   5.000|   7:00  43.000|   9:00  23.000|  11:00
      2:00  20.000|   4:00   3.000|   6:00  20.000|   8:00  20.000|  10:00  13.000|  12:00
```

```
------------------------------------------------------------------------------------------
R0006:C00003------------------------------------------------------------------------------
* SITE (POST1 - Controlled Area)
--------------------------
| CALIB STANDHYD         |   Area    (ha)=    2.74
| 01:POST1      DT= 1.00 |   Total Imp(%)=   69.00   Dir. Conn.(%)=   59.00
--------------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.89          .85
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       3.50        33.30
     Length            (m)=     300.00         6.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      43.00        53.33
                over (min)        5.00         6.00
     Storage Coeff.  (min)=       4.75 (ii)    6.00 (ii)
     Unit Hyd. Tpeak (min)=       5.00         6.00
     Unit Hyd. peak  (cms)=        .23          .19
                                                          *TOTALS*
     PEAK FLOW       (cms)=        .19          .13           .318 (iii)
     TIME TO PEAK    (hrs)=       7.00         7.00          7.000
     RUNOFF VOLUME    (mm)=     190.99       158.56        177.702
     TOTAL RAINFALL   (mm)=     193.00       193.00        193.000
     RUNOFF COEFFICIENT   =        .99          .82           .921

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  84.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

------------------------------------------------------------------------------------------
R0006:C00004------------------------------------------------------------------------------
* EXTERNAL (Routed through SWM Facility)
--------------------------
| CALIB NASHYD           |   Area    (ha)=   11.940   Curve Number   (CN)= 83.00
| 02:EXT        DT= 1.00 |   Ia      (mm)=    6.800   # of Linear Res.(N)=  3.00
--------------------------   U.H. Tp(hrs)=     .240

     Unit Hyd Qpeak  (cms)=    1.900

     PEAK FLOW       (cms)=    1.239 (i)
     TIME TO PEAK    (hrs)=    7.017
     DURATION        (hrs)=   13.667, (dddd|hh:mm:)=   0|13:40
     AVERAGE FLOW    (cms)=     .353
     RUNOFF VOLUME    (mm)=  145.537
     TOTAL RAINFALL   (mm)=  193.000
     RUNOFF COEFFICIENT   =     .754

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

------------------------------------------------------------------------------------------
R0006:C00005------------------------------------------------------------------------------
```

```
* TOTAL FLOW TO SIDEROAD 15 CROSS CULVERT (POST1 CONTROLLED + EXT)
------------------------
| ADD HYD               |
| 03:POST1+EXT          |   ID:NHYD            AREA     QPEAK    TPEAK      R.V.     DWF
------------------------                       (ha)     (cms)    (hrs)      (mm)   (cms)
                      ID 1 01:POST1          2.740      .318    7.000   177.702    .000
                     +ID 2 02:EXT           11.940     1.239    7.017   145.537    .000
                     ===============================================================
                     SUM   03:POST1+EXT     14.680     1.556    7.000   151.541    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

------------------------------------------------------------------------------------------
R0006:C00006------------------------------------------------------------------------------
* SWM Facility
-----------------------
|  ROUTE RESERVOIR -> |    Requested routing time step =  1.0 min.
|  IN>03:POST1+EXT    |
| OUT<04:SWM Facili   | =========================  OUTLFOW STORAGE TABLE  =================
----------------------- OUTFLOW   STORAGE| OUTFLOW   STORAGE| OUTFLOW   STORAGE| OUTFLOW
                          (cms)   (ha.m.)|   (cms)   (ha.m.)|   (cms)   (ha.m.)|   (cms)
                           .000 .0000E+00|    .010 .1292E-01|    .065 .4128E-01|   1.071 .
                           .002 .6300E-03|    .010 .1442E-01|    .108 .4430E-01|   1.184 .
                           .003 .1310E-02|    .010 .1601E-01|    .159 .4743E-01|   1.308 .
                           .004 .2050E-02|    .011 .1769E-01|    .217 .5067E-01|   1.445 .
                           .005 .2840E-02|    .011 .1946E-01|    .281 .5403E-01|   1.594 .
                           .006 .3680E-02|    .011 .2133E-01|    .351 .5751E-01|   1.759 .
                           .006 .4590E-02|    .012 .2329E-01|    .425 .6112E-01|   2.020 .
                           .007 .5570E-02|    .012 .2535E-01|    .505 .6486E-01|   2.383 .
                           .007 .6610E-02|    .012 .2777E-01|    .589 .6872E-01|   2.840 .
                           .008 .7720E-02|    .013 .3027E-01|    .677 .7272E-01|   3.391 .
                           .008 .8910E-02|    .013 .3287E-01|    .769 .7686E-01|   4.041 .
                           .009 .1017E-01|    .013 .3557E-01|    .866 .8113E-01|   4.792 .
                           .009 .1150E-01|    .032 .3837E-01|    .966 .8555E-01|   5.649 .

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     ----------------------     (ha)     (cms)     (hrs)       (mm)
     INFLOW > 03:POST1+EXT     14.680     1.556     7.000    151.541
    OUTFLOW < 04:SWM Facili    14.680     1.540     7.033    151.540

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=   98.975
                   TIME SHIFT OF PEAK FLOW         (min)=     2.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=.1080E+00

------------------------------------------------------------------------------------------
R0006:C00007------------------------------------------------------------------------------
* SITE (POST2 - Uncontrolled Area)
--------------------------
| CALIB STANDHYD         |   Area    (ha)=     .89
| 05:POST2      DT= 1.00 |   Total Imp(%)=   21.00   Dir. Conn.(%)=   10.50
--------------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .19          .70
```

```
          Dep. Storage     (mm)=       2.00         5.00
          Average Slope     (%)=       6.00        11.10
          Length            (m)=     120.00        50.00
          Mannings n           =       .013         .250

          Max.eff.Inten.(mm/hr)=      43.00        44.82
                     over (min)        2.00         9.00
          Storage Coeff.  (min)=       2.33 (ii)    8.99 (ii)
          Unit Hyd. Tpeak (min)=       2.00         9.00
          Unit Hyd. peak  (cms)=        .50          .13
                                                                *TOTALS*
          PEAK FLOW       (cms)=        .01          .09           .098 (iii)
          TIME TO PEAK    (hrs)=       6.98         7.00          7.000
          RUNOFF VOLUME    (mm)=     191.00       153.77        157.677
          TOTAL RAINFALL   (mm)=     193.00       193.00        193.000
          RUNOFF COEFFICIENT   =        .99          .80           .817

            (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
                CN* =  84.0    Ia = Dep. Storage  (Above)
           (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
          (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

     -------------------------------------------------------------------------------------------
     R0006:C00008-------------------------------------------------------------------------------
     -------------------------------------------------------------------------------------------
     R0006:C00002-------------------------------------------------------------------------------
     -------------------------------------------------------------------------------------------
     R0006:C00002-------------------------------------------------------------------------------
     -------------------------------------------------------------------------------------------
     R0006:C00002-------------------------------------------------------------------------------
     -------------------------------------------------------------------------------------------
     R0006:C00002-------------------------------------------------------------------------------
     -------------------------------------------------------------------------------------------
     R0006:C00002-------------------------------------------------------------------------------
     --------------------
     | FINISH           |
     --------------------
     -------------------------------------------------------------------------------------------
     *******************************************************************************************
          WARNINGS / ERRORS / NOTES
          -------------------------
        Simulation ended on 2020-12-09     at 16:07:01
     ===========================================================================================
```

Post-Development Condition
6-hour SCS Type-II Storm Distribution

```
2     Metric units
*#******************************************************************************
*#  Project Name: [Mansfield Ski Club]    Project Number: [15-319]
*#  Date        : 07-31-2017
*#  Modeller    : [J. Lightheart]
*#  Company     : WMI & Associates Ltd.
*#  License #   :  2880720
*#******************************************************************************
*
* Post-Development Condition - Mansfield Ski Club
*
*% 25mm Chicago Storm Dist. based on Mansfield, ON. rainfall (4-hr)
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[1]
*%                   ["25mm4hr.stm"] <--storm filename
*%-----------------|-----------------------------------------------------------|
READ STORM          STORM_FILENAME=["STORM.001"]
*%-----------------|-----------------------------------------------------------|
* SITE (POST1 - Controlled Area)
CALIB STANDHYD      ID=[1], NHYD=["POST1"], DT=[1](min), AREA=[2.74](ha),
                    XIMP=[0.59], TIMP=[0.69], DWF=[0](cms), LOSS=[2],
                    SCS curve number CN=[84],
                    Pervious   surfaces: IAper=[5.0](mm), SLPP=[33.3](%),
                                         LGP=[6](m), MNP=[0.25], SCP=[0](min),
                    Impervious surfaces: IAimp=[2.0](mm), SLPI=[3.5](%),
                                         LGI=[300](m), MNI=[0.013], SCI=[0](min),
                    RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
*%-----------------|-----------------------------------------------------------|
* EXTERNAL (Routed through SWM Facility)
CALIB NASHYD        ID=[2], NHYD=["EXT"], DT=[1]min, AREA=[11.94](ha),
                    DWF=[0](cms),  CN/C=[83], IA=[6.8](mm),
                    N=[3], TP=[0.24]hrs,
                    RAINFALL=[ ,  ,  ,  , ](mm/hr),  END=-1
*%-----------------|-----------------------------------------------------------|
* TOTAL FLOW TO SIDEROAD 15 CROSS CULVERT (POST1 CONTROLLED + EXT)
ADD HYD             IDsum=[3], NHYD=["POST1+EXT"], IDs to add=[1+2]
*%-----------------|-----------------------------------------------------------|
* SWM Facility
ROUTE RESERVOIR     IDout=[4], NHYD=["SWM Facility"], IDin=[3], RDT=[1](min),
                         TABLE of ( OUTFLOW-STORAGE ) values
                                   (cms) - (ha-m)
                                 [0.0000 , 0.00000]
                                 [0.0015 , 0.00063]
                                 [0.0031 , 0.00131]
                                 [0.0041 , 0.00205]
                                 [0.0050 , 0.00284]
                                 [0.0057 , 0.00368]
                                 [0.0063 , 0.00459]
                                 [0.0069 , 0.00557]
                                 [0.0074 , 0.00661]
                                 [0.0079 , 0.00772]
                                 [0.0084 , 0.00891]
                                 [0.0088 , 0.01017]
                                 [0.0092 , 0.01150]
```

```
                                 [0.0096 , 0.01292]
                                 [0.0100 , 0.01442]
                                 [0.0104 , 0.01601]
                                 [0.0108 , 0.01769]
                                 [0.0111 , 0.01946]
                                 [0.0114 , 0.02133]
                                 [0.0118 , 0.02329]
                                 [0.0121 , 0.02535]
                                 [0.0124 , 0.02777]
                                 [0.0127 , 0.03027]
                                 [0.0130 , 0.03287]
                                 [0.0133 , 0.03557]
                                 [0.0317 , 0.03837]
                                 [0.0651 , 0.04128]
                                 [0.1082 , 0.04430]
                                 [0.1593 , 0.04743]
                                 [0.2172 , 0.05067]
                                 [0.2811 , 0.05403]
                                 [0.3506 , 0.05751]
                                 [0.4252 , 0.06112]
                                 [0.5047 , 0.06486]
                                 [0.5887 , 0.06872]
                                 [0.6769 , 0.07272]
                                 [0.7693 , 0.07686]
                                 [0.8656 , 0.08113]
                                 [0.9656 , 0.08555]
                                 [1.0706 , 0.09011]
                                 [1.1842 , 0.09483]
                                 [1.3084 , 0.09970]
                                 [1.4447 , 0.10472]
                                 [1.5945 , 0.10990]
                                 [1.7589 , 0.11524]
                                 [2.0195 , 0.12075]
                                 [2.3829 , 0.14300]
                                 [2.8396 , 0.14870]
                                 [3.3911 , 0.15454]
                                 [4.0406 , 0.16053]
                                 [4.7921 , 0.16666]
                                 [5.6495 , 0.17293]
                                 [   -1  ,   -1  ]  (maximum one hundred pairs of points)
                                 IDovf=[   ], NHYDovf=["      "],
*%-----------------|-----------------------------------------------------------------------
* SITE (POST2 - Uncontrolled Area)
CALIB STANDHYD      ID=[5], NHYD=["POST2"], DT=[1](min), AREA=[0.89](ha),
                    XIMP=[0.105], TIMP=[0.21], DWF=[0](cms), LOSS=[2],
                    SCS curve number CN=[84],
                    Pervious   surfaces: IAper=[5.0](mm), SLPP=[11.1](%),
                                         LGP=[50](m), MNP=[0.25], SCP=[0](min),
                    Impervious surfaces: IAimp=[2.0](mm), SLPI=[6.0](%),
                                         LGI=[120](m), MNI=[0.013], SCI=[0](min),
                    RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
*%-----------------|-----------------------------------------------------------|
*% 2-year SCS Type-II Storm Dist. based on Mansfield, ON. rainfall (6-hr)
```

```
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[2]
*%                   ["2SCS6.stm"] <--storm filename
*%-----------------|-----------------------------------------------------------|
*% 5-year SCS Type-II Storm Dist. based on Mansfield, ON. rainfall (6-hr)
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[3]
*%                   ["5SCS6.stm"] <--storm filename
*%-----------------|-----------------------------------------------------------|
*% 25-year SCS Type-II Storm Dist. based on Mansfield, ON. rainfall (6-hr)
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[4]
*%                   ["25SCS6.stm"] <--storm filename
*%-----------------|-----------------------------------------------------------|
*% 100-year SCS Type-II Storm Dist. based on Mansfield, ON. rainfall (6-hr)
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[5]
*%                   ["100SCS6.stm"] <--storm filename
*%-----------------|-----------------------------------------------------------|
*% Timmins Regional Storm (12-hr)
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[6]
*%                   ["12regtim.o89"] <--storm filename
*%-----------------|-----------------------------------------------------------|
FINISH
```

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

 SSSSS   W   W   M   M   H   H   Y   Y   M   M    OOO          222     000    11   77777 ==
 S       W W W   MM MM   H   H    Y Y    MM MM   O   O           2    0   0   11   7   7
 SSSSS   W W W   M M M   HHHHH     Y     M M M   O   O           2    0   0   11       7
     S    W W    M   M   H   H     Y     M   M   O   O        222     0   0   11      7
 SSSSS    W W    M   M   H   H     Y     M   M    OOO         2       0   0   11     7   ==
                                                              2       0   0   11    7    #
       StormWater Management HYdrologic Model                  222     000    11    7    ==

 ******************************************************************************************
 **************************************  SWMHYMO Ver4.05.0  *******************************
 ******************  A single event and continuous hydrologic simulation model  ***********
 ******************     based on the principles of HYMO and its successors      ***********
 ******************                 OTTHYMO-83 and OTTHYMO-89.                  ***********
 ******************************************************************************************
 ****************** Distributed by:  J.F. Sabourin and Associates Inc.          ***********
 ******************                 Ottawa,  Ontario: (613) 836-3884           ***********
 ******************                 Gatineau, Quebec: (819) 243-6858           ***********
 ******************                 E-Mail: swmhymo@jfsa.com                   ***********
 ******************************************************************************************

 ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
 ++++++++++++++++++ Licensed user: WMI & Associates Ltd.                        +++++++++++
 ++++++++++++++++++                Barrie                SERIAL#:2880720        +++++++++++
 ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

 ******************************************************************************************
 ******************           ++++++ PROGRAM ARRAY DIMENSIONS ++++++            ***********
 ******************           Maximum value for ID numbers  :     11            ***********
 ******************           Max. number of rainfall points: 105408            ***********
 ******************           Max. number of flow points    : 105408            ***********
 ******************************************************************************************


 *******************************   D E T A I L E D   O U T P U T   ************************
 ******************************************************************************************
 *                 RUN DATE: 2020-12-09     TIME: 16:06:26     RUN COUNTER: 000002
 ******************************************************************************************
 * Input   file: C:\Temp\15-319\PR\6-hour_SCS\2-CYRSCS.dat
 * Output  file: C:\Temp\15-319\PR\6-hour_SCS\2-CYRSCS.out
 * Summary file: C:\Temp\15-319\PR\6-hour_SCS\2-CYRSCS.sum
 * User comments:
 * 1:______________________________________________________________________________________
 * 2:______________________________________________________________________________________
 * 3:______________________________________________________________________________________
 ******************************************************************************************

-------------------------------------------------------------------------------------------
R0001:C00001-------------------------------------------------------------------------------
*#******************************************************************************
*#  Project Name: [Mansfield Ski Club]    Project Number: [15-319]
*#  Date        : 07-31-2017
```

```
*#  Modeller    : [J. Lightheart]
*#  Company     : WMI & Associates Ltd.
*#  License #   :  2880720
*#******************************************************************************
*
* Post-Development Condition - Mansfield Ski Club
*
--------------------
| START            | Project  dir.:C:\Temp\15-319\PR\6-hour_SCS\
-------------------- Rainfall dir.:C:\Temp\15-319\PR\6-hour_SCS\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 0001
    NSTORM=   1
           #  1=25mm4hr.stm
-------------------------------------------------------------------------------------------
R0001:C00002-------------------------------------------------------------------------------
--------------------
| READ STORM       |  Filename: C:\Temp\15-319\PR\6-hour_SCS\25mm4hr.stm
| Ptotal=  25.00 mm|  Comments: 25mm Chicago Storm Distribution (4-hour) Mansfield, ON.
--------------------
      TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME
     hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm
      0:10   1.970|   0:50   3.820|   1:30  13.830|   2:10   4.080|   2:50   2.650|   3:30
      0:20   2.220|   1:00   5.380|   1:40   8.070|   2:20   3.570|   3:00   2.450|   3:40
      0:30   2.550|   1:10  10.940|   1:50   5.950|   2:30   3.190|   3:10   2.290|   3:50
      0:40   3.030|   1:20  56.670|   2:00   4.810|   2:40   2.890|   3:20   2.150|   4:00

-------------------------------------------------------------------------------------------
R0001:C00003-------------------------------------------------------------------------------
* SITE (POST1 - Controlled Area)
--------------------------
| CALIB STANDHYD         |   Area    (ha)=    2.74
| 01:POST1      DT= 1.00 |   Total Imp(%)=   69.00   Dir. Conn.(%)=   59.00
--------------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.89          .85
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       3.50        33.30
     Length            (m)=     300.00         6.00
     Mannings n          =       .013         .250

     Max.eff.Inten.(mm/hr)=      56.67        23.86
                over (min)        4.00         6.00
     Storage Coeff.  (min)=       4.26 (ii)    5.98 (ii)
     Unit Hyd. Tpeak (min)=       4.00         6.00
     Unit Hyd. peak  (cms)=        .27          .19
                                                           *TOTALS*
     PEAK FLOW       (cms)=        .22          .04           .255 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.40          1.350
     RUNOFF VOLUME    (mm)=      23.01         7.79         16.768
     TOTAL RAINFALL   (mm)=      25.01        25.01         25.005
     RUNOFF COEFFICIENT   =        .92          .31           .671
```

```
       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  84.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

 -----------------------------------------------------------------------------------------
 R0001:C00004-----------------------------------------------------------------------------
 * EXTERNAL (Routed through SWM Facility)
 -------------------------
 | CALIB NASHYD           |   Area    (ha)=   11.940   Curve Number   (CN)= 83.00
 | 02:EXT        DT= 1.00 |   Ia      (mm)=    6.800   # of Linear Res.(N)=  3.00
 -------------------------   U.H. Tp(hrs)=     .240

      Unit Hyd Qpeak  (cms)=    1.900

      PEAK FLOW       (cms)=     .115 (i)
      TIME TO PEAK    (hrs)=    1.650
      DURATION        (hrs)=    5.667, (dddd|hh:mm:)=   0|05:40
      AVERAGE FLOW    (cms)=     .028
      RUNOFF VOLUME    (mm)=    4.719
      TOTAL RAINFALL   (mm)=   25.005
      RUNOFF COEFFICIENT   =     .189

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

 -----------------------------------------------------------------------------------------
 R0001:C00005-----------------------------------------------------------------------------
 * TOTAL FLOW TO SIDEROAD 15 CROSS CULVERT (POST1 CONTROLLED + EXT)
 ------------------------
 | ADD HYD                |
 | 03:POST1+EXT           |   ID:NHYD           AREA     QPEAK    TPEAK      R.V.     DWF
 ------------------------                       (ha)     (cms)    (hrs)      (mm)   (cms)
                        ID 1 01:POST1          2.740      .255    1.350    16.768    .000
                       +ID 2 02:EXT           11.940      .115    1.650     4.719    .000
                       ==============================================================
                       SUM   03:POST1+EXT     14.680      .282    1.367     6.968    .000

    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

 -----------------------------------------------------------------------------------------
 R0001:C00006-----------------------------------------------------------------------------
 * SWM Facility
 ----------------------
 |  ROUTE RESERVOIR -> |    Requested routing time step =  1.0 min.
 |  IN>03:POST1+EXT    |
 | OUT<04:SWM Facili   | =========================  OUTLFOW STORAGE TABLE  =================
 ---------------------- OUTFLOW   STORAGE| OUTFLOW   STORAGE| OUTFLOW   STORAGE| OUTFLOW
                          (cms)   (ha.m.)|   (cms)   (ha.m.)|   (cms)   (ha.m.)|   (cms)
                           .000 .0000E+00|    .010 .1292E-01|    .065 .4128E-01|   1.071 .
                           .002 .6300E-03|    .010 .1442E-01|    .108 .4430E-01|   1.184 .
                           .003 .1310E-02|    .010 .1601E-01|    .159 .4743E-01|   1.308 .
                           .004 .2050E-02|    .011 .1769E-01|    .217 .5067E-01|   1.445 .
```

```
                           .005 .2840E-02|    .011 .1946E-01|    .281 .5403E-01|   1.594 .
                           .006 .3680E-02|    .011 .2133E-01|    .351 .5751E-01|   1.759 .
                           .006 .4590E-02|    .012 .2329E-01|    .425 .6112E-01|   2.020 .
                           .007 .5570E-02|    .012 .2535E-01|    .505 .6486E-01|   2.383 .
                           .007 .6610E-02|    .012 .2777E-01|    .589 .6872E-01|   2.840 .
                           .008 .7720E-02|    .013 .3027E-01|    .677 .7272E-01|   3.391 .
                           .008 .8910E-02|    .013 .3287E-01|    .769 .7686E-01|   4.041 .
                           .009 .1017E-01|    .013 .3557E-01|    .866 .8113E-01|   4.792 .
                           .009 .1150E-01|    .032 .3837E-01|    .966 .8555E-01|   5.649 .

      ROUTING RESULTS             AREA     QPEAK     TPEAK       R.V.
      ----------------------      (ha)     (cms)     (hrs)       (mm)
      INFLOW > 03:POST1+EXT     14.680      .282     1.367      6.968
     OUTFLOW < 04:SWM Facili    14.680      .108     2.033      6.968

                    PEAK   FLOW   REDUCTION [Qout/Qin](%)=   38.291
                    TIME SHIFT OF PEAK FLOW         (min)=    40.00
                    MAXIMUM  STORAGE   USED       (ha.m.)=.4429E-01

 -----------------------------------------------------------------------------------------
 R0001:C00007-----------------------------------------------------------------------------
 * SITE (POST2 - Uncontrolled Area)
 -------------------------
 | CALIB STANDHYD         |   Area    (ha)=     .89
 | 05:POST2      DT= 1.00 |   Total Imp(%)=   21.00   Dir. Conn.(%)=   10.50
 -------------------------
                               IMPERVIOUS    PERVIOUS (i)
      Surface Area     (ha)=        .19          .70
      Dep. Storage     (mm)=       2.00         5.00
      Average Slope     (%)=       6.00        11.10
      Length            (m)=     120.00        50.00
      Mannings n          =       .013         .250

      Max.eff.Inten.(mm/hr)=      56.67        11.01
                 over (min)       2.00        14.00
      Storage Coeff.  (min)=       2.09 (ii)   13.75 (ii)
      Unit Hyd. Tpeak (min)=       2.00        14.00
      Unit Hyd. peak  (cms)=        .54          .08
                                                               *TOTALS*
      PEAK FLOW       (cms)=        .01          .01           .018 (iii)
      TIME TO PEAK    (hrs)=       1.33         1.55          1.333
      RUNOFF VOLUME    (mm)=      23.00         6.70          8.411
      TOTAL RAINFALL   (mm)=      25.01        25.01         25.005
      RUNOFF COEFFICIENT   =        .92          .27           .336

        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN* =  84.0    Ia = Dep. Storage  (Above)
       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

 -----------------------------------------------------------------------------------------
 R0001:C00008-----------------------------------------------------------------------------
   ** END OF RUN :    0
```

```
*******************************************************************************************





--------------------
| START            | Project  dir.:C:\Temp\15-319\PR\6-hour_SCS\
-------------------- Rainfall dir.:C:\Temp\15-319\PR\6-hour_SCS\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 0002
    NSTORM=   1
           #  1=2SCS6.stm
-------------------------------------------------------------------------------------------
R0002:C00002-------------------------------------------------------------------------------
*#******************************************************************************
*#  Project Name: [Mansfield Ski Club]    Project Number: [15-319]
*#  Date        : 07-31-2017
*#  Modeller    : [J. Lightheart]
*#  Company     : WMI & Associates Ltd.
*#  License #   :  2880720
*#******************************************************************************
*
* Post-Development Condition - Mansfield Ski Club
*
-------------------------------------------------------------------------------------------
R0002:C00002-------------------------------------------------------------------------------
--------------------
| READ STORM       |  Filename: C:\Temp\15-319\PR\6-hour_SCS\2SCS6.stm
| Ptotal=  36.00 mm|  Comments: 2-Year SCS Type-II Storm Distribution (6-hour) Mansfield,
--------------------
      TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME
     hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm
      0:30   1.440|   1:30   2.880|   2:30   5.040|   3:30   9.360|   4:30   2.880|   5:30
      1:00   1.440|   2:00   2.880|   3:00  36.720|   4:00   4.320|   5:00   2.160|   6:00

-------------------------------------------------------------------------------------------
R0002:C00003-------------------------------------------------------------------------------
* SITE (POST1 - Controlled Area)
--------------------------
| CALIB STANDHYD         |   Area    (ha)=    2.74
| 01:POST1      DT= 1.00 |   Total Imp(%)=   69.00   Dir. Conn.(%)=   59.00
--------------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.89          .85
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       3.50        33.30
     Length            (m)=     300.00         6.00
     Mannings n          =       .013         .250

     Max.eff.Inten.(mm/hr)=      36.72        27.71
```

```
                over (min)        5.00         7.00
     Storage Coeff.  (min)=       5.06 (ii)    6.69 (ii)
     Unit Hyd. Tpeak (min)=       5.00         7.00
     Unit Hyd. peak  (cms)=        .22          .17
                                                          *TOTALS*
     PEAK FLOW       (cms)=        .16          .06          .221 (iii)
     TIME TO PEAK    (hrs)=       3.00         3.02         3.000
     RUNOFF VOLUME    (mm)=      34.00        15.09        26.246
     TOTAL RAINFALL   (mm)=      36.00        36.00        36.000
     RUNOFF COEFFICIENT   =        .94          .42          .729

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  84.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------------------
R0002:C00004-------------------------------------------------------------------------------
* EXTERNAL (Routed through SWM Facility)
--------------------------
| CALIB NASHYD           |   Area    (ha)=   11.940   Curve Number   (CN)= 83.00
| 02:EXT       DT= 1.00 |   Ia      (mm)=    6.800   # of Linear Res.(N)=  3.00
--------------------------   U.H. Tp(hrs)=     .240

     Unit Hyd Qpeak  (cms)=    1.900

     PEAK FLOW       (cms)=     .310 (i)
     TIME TO PEAK    (hrs)=    3.150
     DURATION        (hrs)=    7.667, (dddd|hh:mm:)=   0|07:40
     AVERAGE FLOW    (cms)=     .045
     RUNOFF VOLUME    (mm)=   10.497
     TOTAL RAINFALL   (mm)=   36.000
     RUNOFF COEFFICIENT   =     .292

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

-------------------------------------------------------------------------------------------
R0002:C00005-------------------------------------------------------------------------------
* TOTAL FLOW TO SIDEROAD 15 CROSS CULVERT (POST1 CONTROLLED + EXT)
------------------------
| ADD HYD              |
| 03:POST1+EXT         |   ID:NHYD           AREA     QPEAK    TPEAK      R.V.     DWF
------------------------                     (ha)     (cms)    (hrs)      (mm)   (cms)
                      ID 1 01:POST1         2.740      .221    3.000    26.246    .000
                     +ID 2 02:EXT          11.940      .310    3.150    10.497    .000
                     ==============================================================
                     SUM   03:POST1+EXT    14.680      .483    3.050    13.437    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------------------
R0002:C00006-------------------------------------------------------------------------------
* SWM Facility
```

```
      ----------------------
      |  ROUTE RESERVOIR -> |    Requested routing time step =  1.0 min.
      |  IN>03:POST1+EXT    |
      | OUT<04:SWM Facili   | ========================  OUTLFOW STORAGE TABLE  ================
      ---------------------- OUTFLOW   STORAGE| OUTFLOW   STORAGE| OUTFLOW   STORAGE| OUTFLOW
                              (cms)   (ha.m.)|   (cms)   (ha.m.)|   (cms)   (ha.m.)|   (cms)
                               .000 .0000E+00|    .010 .1292E-01|    .065 .4128E-01|   1.071 .
                               .002 .6300E-03|    .010 .1442E-01|    .108 .4430E-01|   1.184 .
                               .003 .1310E-02|    .010 .1601E-01|    .159 .4743E-01|   1.308 .
                               .004 .2050E-02|    .011 .1769E-01|    .217 .5067E-01|   1.445 .
                               .005 .2840E-02|    .011 .1946E-01|    .281 .5403E-01|   1.594 .
                               .006 .3680E-02|    .011 .2133E-01|    .351 .5751E-01|   1.759 .
                               .006 .4590E-02|    .012 .2329E-01|    .425 .6112E-01|   2.020 .
                               .007 .5570E-02|    .012 .2535E-01|    .505 .6486E-01|   2.383 .
                               .007 .6610E-02|    .012 .2777E-01|    .589 .6872E-01|   2.840 .
                               .008 .7720E-02|    .013 .3027E-01|    .677 .7272E-01|   3.391 .
                               .008 .8910E-02|    .013 .3287E-01|    .769 .7686E-01|   4.041 .
                               .009 .1017E-01|    .013 .3557E-01|    .866 .8113E-01|   4.792 .
                               .009 .1150E-01|    .032 .3837E-01|    .966 .8555E-01|   5.649 .

           ROUTING RESULTS             AREA     QPEAK     TPEAK       R.V.
           ----------------------      (ha)     (cms)     (hrs)       (mm)
           INFLOW > 03:POST1+EXT     14.680      .483     3.050     13.437
          OUTFLOW < 04:SWM Facili    14.680      .362     3.250     13.437

                         PEAK   FLOW   REDUCTION [Qout/Qin](%)=   74.996
                         TIME SHIFT OF PEAK FLOW         (min)=    12.00
                         MAXIMUM  STORAGE   USED       (ha.m.)=.5807E-01

      -------------------------------------------------------------------------------------------
      R0002:C00007-------------------------------------------------------------------------------
      * SITE (POST2 - Uncontrolled Area)
      -------------------------
      | CALIB STANDHYD         |   Area    (ha)=     .89
      | 05:POST2      DT= 1.00 |   Total Imp(%)=   21.00   Dir. Conn.(%)=   10.50
      -------------------------
                                 IMPERVIOUS    PERVIOUS (i)
           Surface Area     (ha)=       .19          .70
           Dep. Storage     (mm)=      2.00         5.00
           Average Slope     (%)=      6.00        11.10
           Length            (m)=    120.00        50.00
           Mannings n          =      .013         .250

           Max.eff.Inten.(mm/hr)=     36.72        20.32
                      over (min)       2.00        12.00
           Storage Coeff.  (min)=      2.49 (ii)   11.61 (ii)
           Unit Hyd. Tpeak (min)=      2.00        12.00
           Unit Hyd. peak  (cms)=       .48          .10
                                                               *TOTALS*
           PEAK FLOW       (cms)=       .01          .03          .037 (iii)
           TIME TO PEAK    (hrs)=      2.77         3.08         3.000
           RUNOFF VOLUME    (mm)=     34.00        13.43        15.590
           TOTAL RAINFALL   (mm)=     36.00        36.00        36.000
```

```
           RUNOFF COEFFICIENT   =        .94          .37           .433

             (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
                 CN* =  84.0    Ia = Dep. Storage  (Above)
            (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
           (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

      -------------------------------------------------------------------------------------------
      R0002:C00008-------------------------------------------------------------------------------
      -------------------------------------------------------------------------------------------
      R0002:C00002-------------------------------------------------------------------------------
        ** END OF RUN :    1

      *******************************************************************************************





      --------------------
      | START            | Project  dir.:C:\Temp\15-319\PR\6-hour_SCS\
      -------------------- Rainfall dir.:C:\Temp\15-319\PR\6-hour_SCS\
          TZERO =   .00 hrs on        0
          METOUT=   2 (output = METRIC)
          NRUN  = 0003
          NSTORM=   1
                 #  1=5SCS6.stm
      -------------------------------------------------------------------------------------------
      R0003:C00002-------------------------------------------------------------------------------
      *#*****************************************************************************
      *#  Project Name: [Mansfield Ski Club]    Project Number: [15-319]
      *#  Date        : 07-31-2017
      *#  Modeller    : [J. Lightheart]
      *#  Company     : WMI & Associates Ltd.
      *#  License #   : 2880720
      *#*****************************************************************************
      *
      * Post-Development Condition - Mansfield Ski Club
      *
      -------------------------------------------------------------------------------------------
      R0003:C00002-------------------------------------------------------------------------------
      --------------------
      | READ STORM       |  Filename: C:\Temp\15-319\PR\6-hour_SCS\5SCS6.stm
      | Ptotal=  47.50 mm|  Comments: 5-Year SCS Type-II Storm Distribution (6-hour) Mansfield,
      --------------------
            TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME
           hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm
            0:30   1.900|   1:30   3.800|   2:30   6.650|   3:30  12.350|   4:30   3.800|   5:30
            1:00   1.900|   2:00   3.800|   3:00  48.450|   4:00   5.700|   5:00   2.850|   6:00

      -------------------------------------------------------------------------------------------
      R0003:C00003-------------------------------------------------------------------------------
      * SITE (POST1 - Controlled Area)
```

```
--------------------------
| CALIB STANDHYD         |   Area    (ha)=    2.74
| 01:POST1      DT= 1.00 |   Total Imp(%)=   69.00   Dir. Conn.(%)=   59.00
--------------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.89          .85
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       3.50        33.30
     Length            (m)=     300.00         6.00
     Mannings n          =        .013         .250

     Max.eff.Inten.(mm/hr)=      48.45        42.87
                over (min)        5.00         6.00
     Storage Coeff.  (min)=       4.53 (ii)    5.90 (ii)
     Unit Hyd. Tpeak (min)=       5.00         6.00
     Unit Hyd. peak  (cms)=        .24          .19
                                                           *TOTALS*
     PEAK FLOW       (cms)=        .22          .09           .309 (iii)
     TIME TO PEAK    (hrs)=       3.00         3.02          3.000
     RUNOFF VOLUME    (mm)=      45.50        23.80         36.604
     TOTAL RAINFALL   (mm)=      47.50        47.50         47.500
     RUNOFF COEFFICIENT   =        .96          .50           .771

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  84.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------------------
R0003:C00004-------------------------------------------------------------------------------
* EXTERNAL (Routed through SWM Facility)
--------------------------
| CALIB NASHYD           |   Area    (ha)=   11.940   Curve Number   (CN)= 83.00
| 02:EXT        DT= 1.00 |   Ia      (mm)=    6.800   # of Linear Res.(N)=  3.00
--------------------------   U.H. Tp(hrs)=     .240

     Unit Hyd Qpeak  (cms)=    1.900

     PEAK FLOW       (cms)=     .547 (i)
     TIME TO PEAK    (hrs)=    3.133
     DURATION        (hrs)=    7.667, (dddd|hh:mm:)=   0|07:40
     AVERAGE FLOW    (cms)=     .077
     RUNOFF VOLUME    (mm)=   17.865
     TOTAL RAINFALL   (mm)=   47.500
     RUNOFF COEFFICIENT   =     .376

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

-------------------------------------------------------------------------------------------
R0003:C00005-------------------------------------------------------------------------------
* TOTAL FLOW TO SIDEROAD 15 CROSS CULVERT (POST1 CONTROLLED + EXT)
------------------------
| ADD HYD              |
```

```
| 03:POST1+EXT         |   ID:NHYD            AREA     QPEAK    TPEAK      R.V.     DWF
------------------------                      (ha)     (cms)    (hrs)      (mm)   (cms)
                      ID 1 01:POST1          2.740      .309    3.000    36.604    .000
                     +ID 2 02:EXT           11.940      .547    3.133    17.865    .000
                     ==================================================================
                     SUM   03:POST1+EXT     14.680      .789    3.050    21.362    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------------------
R0003:C00006-------------------------------------------------------------------------------
* SWM Facility
-----------------------
|  ROUTE RESERVOIR -> |    Requested routing time step =  1.0 min.
|  IN>03:POST1+EXT    |
| OUT<04:SWM Facili   | =========================  OUTLFOW STORAGE TABLE  =================
----------------------- OUTFLOW   STORAGE| OUTFLOW   STORAGE| OUTFLOW   STORAGE| OUTFLOW
                          (cms)   (ha.m.)|   (cms)   (ha.m.)|   (cms)   (ha.m.)|   (cms)
                           .000 .0000E+00|    .010 .1292E-01|    .065 .4128E-01|   1.071 .
                           .002 .6300E-03|    .010 .1442E-01|    .108 .4430E-01|   1.184 .
                           .003 .1310E-02|    .010 .1601E-01|    .159 .4743E-01|   1.308 .
                           .004 .2050E-02|    .011 .1769E-01|    .217 .5067E-01|   1.445 .
                           .005 .2840E-02|    .011 .1946E-01|    .281 .5403E-01|   1.594 .
                           .006 .3680E-02|    .011 .2133E-01|    .351 .5751E-01|   1.759 .
                           .006 .4590E-02|    .012 .2329E-01|    .425 .6112E-01|   2.020 .
                           .007 .5570E-02|    .012 .2535E-01|    .505 .6486E-01|   2.383 .
                           .007 .6610E-02|    .012 .2777E-01|    .589 .6872E-01|   2.840 .
                           .008 .7720E-02|    .013 .3027E-01|    .677 .7272E-01|   3.391 .
                           .008 .8910E-02|    .013 .3287E-01|    .769 .7686E-01|   4.041 .
                           .009 .1017E-01|    .013 .3557E-01|    .866 .8113E-01|   4.792 .
                           .009 .1150E-01|    .032 .3837E-01|    .966 .8555E-01|   5.649 .

     ROUTING RESULTS             AREA     QPEAK     TPEAK       R.V.
     ----------------------      (ha)     (cms)     (hrs)       (mm)
     INFLOW > 03:POST1+EXT     14.680      .789     3.050     21.362
    OUTFLOW < 04:SWM Facili    14.680      .660     3.183     21.362

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=   83.641
                   TIME SHIFT OF PEAK FLOW         (min)=     8.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=.7197E-01

-------------------------------------------------------------------------------------------
R0003:C00007-------------------------------------------------------------------------------
* SITE (POST2 - Uncontrolled Area)
--------------------------
| CALIB STANDHYD         |   Area    (ha)=     .89
| 05:POST2      DT= 1.00 |   Total Imp(%)=   21.00   Dir. Conn.(%)=   10.50
--------------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .19          .70
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       6.00        11.10
     Length            (m)=     120.00        50.00
```

```
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      48.45        32.84
                over (min)        2.00        10.00
     Storage Coeff.  (min)=       2.22 (ii)    9.76 (ii)
     Unit Hyd. Tpeak (min)=       2.00        10.00
     Unit Hyd. peak  (cms)=        .52          .12
                                                           *TOTALS*
     PEAK FLOW       (cms)=        .01          .05           .062 (iii)
     TIME TO PEAK    (hrs)=       2.90         3.05          3.000
     RUNOFF VOLUME    (mm)=      45.50        21.64         24.145
     TOTAL RAINFALL   (mm)=      47.50        47.50         47.500
     RUNOFF COEFFICIENT   =        .96          .46           .508

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  84.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------------------
R0003:C00008-------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------
R0003:C00002-------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------
R0003:C00002-------------------------------------------------------------------------------
  ** END OF RUN :    2

*******************************************************************************************




--------------------
| START            | Project  dir.:C:\Temp\15-319\PR\6-hour_SCS\
-------------------- Rainfall dir.:C:\Temp\15-319\PR\6-hour_SCS\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 0004
    NSTORM=   1
           #  1=25SCS6.stm
-------------------------------------------------------------------------------------------
R0004:C00002-------------------------------------------------------------------------------
*#******************************************************************************
*#  Project Name: [Mansfield Ski Club]    Project Number: [15-319]
*#  Date        : 07-31-2017
*#  Modeller    : [J. Lightheart]
*#  Company     : WMI & Associates Ltd.
*#  License #   :  2880720
*#******************************************************************************
*
* Post-Development Condition - Mansfield Ski Club
*
```

```
-------------------------------------------------------------------------------------------
R0004:C00002-------------------------------------------------------------------------------
--------------------
| READ STORM       |  Filename: C:\Temp\15-319\PR\6-hour_SCS\25SCS6.stm
| Ptotal=  64.80 mm|  Comments: 25-Year SCS Type-II Storm Distribution (6-hour) Mansfield,
--------------------
      TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME
     hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm
      0:30   2.592|   1:30   5.184|   2:30   9.072|   3:30  16.848|   4:30   5.184|   5:30
      1:00   2.592|   2:00   5.184|   3:00  66.096|   4:00   7.776|   5:00   3.888|   6:00

-------------------------------------------------------------------------------------------
R0004:C00003-------------------------------------------------------------------------------
* SITE (POST1 - Controlled Area)
-------------------------
| CALIB STANDHYD         |   Area    (ha)=    2.74
| 01:POST1      DT= 1.00 |   Total Imp(%)=   69.00   Dir. Conn.(%)=   59.00
-------------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.89          .85
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       3.50        33.30
     Length            (m)=     300.00         6.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      66.10        66.82
                over (min)        4.00         5.00
     Storage Coeff.  (min)=       4.00 (ii)    5.15 (ii)
     Unit Hyd. Tpeak (min)=       4.00         5.00
     Unit Hyd. peak  (cms)=        .28          .22
                                                           *TOTALS*
     PEAK FLOW       (cms)=        .30          .15           .445 (iii)
     TIME TO PEAK    (hrs)=       3.00         3.00          3.000
     RUNOFF VOLUME    (mm)=      62.80        38.15         52.693
     TOTAL RAINFALL   (mm)=      64.80        64.80         64.800
     RUNOFF COEFFICIENT   =        .97          .59           .813

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  84.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------------------
R0004:C00004-------------------------------------------------------------------------------
* EXTERNAL (Routed through SWM Facility)
-------------------------
| CALIB NASHYD           |   Area    (ha)=   11.940   Curve Number   (CN)= 83.00
| 02:EXT        DT= 1.00 |   Ia      (mm)=    6.800   # of Linear Res.(N)=  3.00
-------------------------   U.H. Tp(hrs)=     .240

     Unit Hyd Qpeak  (cms)=    1.900

     PEAK FLOW       (cms)=     .960 (i)
```

```
     TIME TO PEAK    (hrs)=    3.117
     DURATION        (hrs)=    7.667, (dddd|hh:mm:)=   0|07:40
     AVERAGE FLOW    (cms)=     .132
     RUNOFF VOLUME    (mm)=   30.575
     TOTAL RAINFALL   (mm)=   64.800
     RUNOFF COEFFICIENT   =     .472

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

---------------------------------------------------------------------------------------------
R0004:C00005---------------------------------------------------------------------------------
* TOTAL FLOW TO SIDEROAD 15 CROSS CULVERT (POST1 CONTROLLED + EXT)
------------------------
| ADD HYD               |
| 03:POST1+EXT          |   ID:NHYD            AREA     QPEAK    TPEAK      R.V.     DWF
------------------------                       (ha)     (cms)    (hrs)      (mm)   (cms)
                     ID 1 01:POST1          2.740      .445    3.000    52.693    .000
                    +ID 2 02:EXT           11.940      .960    3.117    30.575    .000
                    ==========================================================================
                    SUM   03:POST1+EXT     14.680     1.304    3.033    34.703    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

---------------------------------------------------------------------------------------------
R0004:C00006---------------------------------------------------------------------------------
* SWM Facility
-----------------------
|  ROUTE RESERVOIR -> |    Requested routing time step =  1.0 min.
|  IN>03:POST1+EXT    |
| OUT<04:SWM Facili   | =========================  OUTLFOW STORAGE TABLE  =================
----------------------- OUTFLOW   STORAGE| OUTFLOW   STORAGE| OUTFLOW   STORAGE| OUTFLOW
                          (cms)   (ha.m.)|   (cms)   (ha.m.)|   (cms)   (ha.m.)|   (cms)
                           .000 .0000E+00|    .010 .1292E-01|    .065 .4128E-01|   1.071 .
                           .002 .6300E-03|    .010 .1442E-01|    .108 .4430E-01|   1.184 .
                           .003 .1310E-02|    .010 .1601E-01|    .159 .4743E-01|   1.308 .
                           .004 .2050E-02|    .011 .1769E-01|    .217 .5067E-01|   1.445 .
                           .005 .2840E-02|    .011 .1946E-01|    .281 .5403E-01|   1.594 .
                           .006 .3680E-02|    .011 .2133E-01|    .351 .5751E-01|   1.759 .
                           .006 .4590E-02|    .012 .2329E-01|    .425 .6112E-01|   2.020 .
                           .007 .5570E-02|    .012 .2535E-01|    .505 .6486E-01|   2.383 .
                           .007 .6610E-02|    .012 .2777E-01|    .589 .6872E-01|   2.840 .
                           .008 .7720E-02|    .013 .3027E-01|    .677 .7272E-01|   3.391 .
                           .008 .8910E-02|    .013 .3287E-01|    .769 .7686E-01|   4.041 .
                           .009 .1017E-01|    .013 .3557E-01|    .866 .8113E-01|   4.792 .
                           .009 .1150E-01|    .032 .3837E-01|    .966 .8555E-01|   5.649 .

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     ----------------------      (ha)     (cms)     (hrs)       (mm)
     INFLOW > 03:POST1+EXT     14.680     1.304     3.033     34.703
    OUTFLOW < 04:SWM Facili    14.680     1.140     3.150     34.703

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=   87.431
                   TIME SHIFT OF PEAK FLOW         (min)=     7.00
```

```
                   MAXIMUM  STORAGE   USED       (ha.m.)=.9302E-01

---------------------------------------------------------------------------------------------
R0004:C00007---------------------------------------------------------------------------------
* SITE (POST2 - Uncontrolled Area)
--------------------------
| CALIB STANDHYD         |   Area    (ha)=     .89
| 05:POST2      DT= 1.00 |   Total Imp(%)=   21.00   Dir. Conn.(%)=   10.50
--------------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .19          .70
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       6.00        11.10
     Length            (m)=     120.00        50.00
     Mannings n          =       .013         .250

     Max.eff.Inten.(mm/hr)=      66.10        53.07
                over (min)       2.00         8.00
     Storage Coeff.  (min)=       1.96 (ii)    8.18 (ii)
     Unit Hyd. Tpeak (min)=       2.00         8.00
     Unit Hyd. peak  (cms)=        .57          .14
                                                               *TOTALS*
     PEAK FLOW       (cms)=        .02          .09           .106 (iii)
     TIME TO PEAK    (hrs)=       2.85         3.03          3.000
     RUNOFF VOLUME    (mm)=      62.80        35.37         38.252
     TOTAL RAINFALL   (mm)=      64.80        64.80         64.800
     RUNOFF COEFFICIENT   =        .97          .55           .590

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  84.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

---------------------------------------------------------------------------------------------
R0004:C00008---------------------------------------------------------------------------------
---------------------------------------------------------------------------------------------
R0004:C00002---------------------------------------------------------------------------------
---------------------------------------------------------------------------------------------
R0004:C00002---------------------------------------------------------------------------------
---------------------------------------------------------------------------------------------
R0004:C00002---------------------------------------------------------------------------------
  ** END OF RUN :    3

*********************************************************************************************





--------------------
| START            | Project  dir.:C:\Temp\15-319\PR\6-hour_SCS\
-------------------- Rainfall dir.:C:\Temp\15-319\PR\6-hour_SCS\
    TZERO =   .00 hrs on       0
```

```
    METOUT=   2 (output = METRIC)
    NRUN  = 0005
    NSTORM=   1
           #  1=100SCS6.stm
-------------------------------------------------------------------------------------------
R0005:C00002-------------------------------------------------------------------------------
*#*****************************************************************************
*#  Project Name: [Mansfield Ski Club]    Project Number: [15-319]
*#  Date        : 07-31-2017
*#  Modeller    : [J. Lightheart]
*#  Company     : WMI & Associates Ltd.
*#  License #   :  2880720
*#*****************************************************************************
*
* Post-Development Condition - Mansfield Ski Club
*
-------------------------------------------------------------------------------------------
R0005:C00002-------------------------------------------------------------------------------
--------------------
| READ STORM       |  Filename: C:\Temp\15-319\PR\6-hour_SCS\100SCS6.stm
| Ptotal=  79.10 mm|  Comments: 100-Year SCS Type-II Storm Distribution (6-hour) Mansfield,
--------------------
      TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME
     hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm
      0:30   3.164|   1:30   6.328|   2:30  11.074|   3:30  20.566|   4:30   6.328|   5:30
      1:00   3.164|   2:00   6.328|   3:00  80.682|   4:00   9.492|   5:00   4.746|   6:00

-------------------------------------------------------------------------------------------
R0005:C00003-------------------------------------------------------------------------------
* SITE (POST1 - Controlled Area)
--------------------------
| CALIB STANDHYD         |   Area    (ha)=    2.74
| 01:POST1      DT= 1.00 |   Total Imp(%)=   69.00   Dir. Conn.(%)=   59.00
--------------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.89          .85
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       3.50        33.30
     Length            (m)=     300.00         6.00
     Mannings n          =       .013         .250

     Max.eff.Inten.(mm/hr)=      80.68        86.82
                over (min)        4.00         5.00
     Storage Coeff.  (min)=       3.70 (ii)    4.72 (ii)
     Unit Hyd. Tpeak (min)=       4.00         5.00
     Unit Hyd. peak  (cms)=        .30          .23
                                                           *TOTALS*
     PEAK FLOW       (cms)=        .36          .20           .558 (iii)
     TIME TO PEAK    (hrs)=       3.00         3.00          3.000
     RUNOFF VOLUME    (mm)=      77.10        50.70         66.275
     TOTAL RAINFALL   (mm)=      79.10        79.10         79.100
     RUNOFF COEFFICIENT   =        .97          .64           .838
```

```
       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  84.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------------------
R0005:C00004-------------------------------------------------------------------------------
* EXTERNAL (Routed through SWM Facility)
--------------------------
| CALIB NASHYD           |   Area    (ha)=   11.940   Curve Number   (CN)= 83.00
| 02:EXT        DT= 1.00 |   Ia      (mm)=    6.800   # of Linear Res.(N)=  3.00
--------------------------   U.H. Tp(hrs)=     .240

     Unit Hyd Qpeak  (cms)=    1.900

     PEAK FLOW       (cms)=    1.333 (i)
     TIME TO PEAK    (hrs)=    3.117
     DURATION        (hrs)=    7.667, (dddd|hh:mm:)=   0|07:40
     AVERAGE FLOW    (cms)=     .182
     RUNOFF VOLUME    (mm)=   42.046
     TOTAL RAINFALL   (mm)=   79.100
     RUNOFF COEFFICIENT   =     .532

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

-------------------------------------------------------------------------------------------
R0005:C00005-------------------------------------------------------------------------------
* TOTAL FLOW TO SIDEROAD 15 CROSS CULVERT (POST1 CONTROLLED + EXT)
------------------------
| ADD HYD               |
| 03:POST1+EXT          |   ID:NHYD            AREA     QPEAK    TPEAK      R.V.     DWF
------------------------                       (ha)     (cms)    (hrs)      (mm)   (cms)
                      ID 1 01:POST1          2.740      .558    3.000    66.275    .000
                     +ID 2 02:EXT           11.940     1.333    3.117    42.046    .000
                     ===============================================================
                     SUM   03:POST1+EXT     14.680     1.769    3.033    46.568    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------------------
R0005:C00006-------------------------------------------------------------------------------
* SWM Facility
----------------------
|  ROUTE RESERVOIR -> |    Requested routing time step =  1.0 min.
|  IN>03:POST1+EXT    |
| OUT<04:SWM Facili   | =========================  OUTLFOW STORAGE TABLE  =================
---------------------- OUTFLOW   STORAGE| OUTFLOW   STORAGE| OUTFLOW   STORAGE| OUTFLOW
                         (cms)   (ha.m.)|   (cms)   (ha.m.)|   (cms)   (ha.m.)|   (cms)
                          .000 .0000E+00|    .010 .1292E-01|    .065 .4128E-01|   1.071 .
                          .002 .6300E-03|    .010 .1442E-01|    .108 .4430E-01|   1.184 .
                          .003 .1310E-02|    .010 .1601E-01|    .159 .4743E-01|   1.308 .
                          .004 .2050E-02|    .011 .1769E-01|    .217 .5067E-01|   1.445 .
                          .005 .2840E-02|    .011 .1946E-01|    .281 .5403E-01|   1.594 .
```

```
                              .006 .3680E-02|    .011 .2133E-01|    .351 .5751E-01|   1.759 .
                              .006 .4590E-02|    .012 .2329E-01|    .425 .6112E-01|   2.020 .
                              .007 .5570E-02|    .012 .2535E-01|    .505 .6486E-01|   2.383 .
                              .007 .6610E-02|    .012 .2777E-01|    .589 .6872E-01|   2.840 .
                              .008 .7720E-02|    .013 .3027E-01|    .677 .7272E-01|   3.391 .
                              .008 .8910E-02|    .013 .3287E-01|    .769 .7686E-01|   4.041 .
                              .009 .1017E-01|    .013 .3557E-01|    .866 .8113E-01|   4.792 .
                              .009 .1150E-01|    .032 .3837E-01|    .966 .8555E-01|   5.649 .

          ROUTING RESULTS             AREA     QPEAK     TPEAK       R.V.
          ----------------------      (ha)     (cms)     (hrs)       (mm)
          INFLOW > 03:POST1+EXT     14.680     1.769     3.033     46.568
         OUTFLOW < 04:SWM Facili    14.680     1.590     3.117     46.568

                     PEAK   FLOW   REDUCTION [Qout/Qin](%)=   89.864
                     TIME SHIFT OF PEAK FLOW         (min)=     5.00
                     MAXIMUM  STORAGE   USED       (ha.m.)=.1098E+00

     ------------------------------------------------------------------------------------------
     R0005:C00007--------------------------------------------------------------------------------
     * SITE (POST2 - Uncontrolled Area)
     --------------------------
     | CALIB STANDHYD         |   Area    (ha)=     .89
     | 05:POST2      DT= 1.00 |   Total Imp(%)=   21.00   Dir. Conn.(%)=   10.50
     --------------------------
                                  IMPERVIOUS    PERVIOUS (i)
          Surface Area     (ha)=        .19          .70
          Dep. Storage     (mm)=       2.00         5.00
          Average Slope     (%)=       6.00        11.10
          Length            (m)=     120.00        50.00
          Mannings n          =        .013         .250

          Max.eff.Inten.(mm/hr)=      80.68        70.28
                     over (min)       2.00         7.00
          Storage Coeff.  (min)=       1.81 (ii)    7.37 (ii)
          Unit Hyd. Tpeak (min)=       2.00         7.00
          Unit Hyd. peak  (cms)=        .59          .16
                                                              *TOTALS*
          PEAK FLOW       (cms)=        .02          .12           .144 (iii)
          TIME TO PEAK    (hrs)=       2.73         3.02          3.000
          RUNOFF VOLUME    (mm)=      77.10        47.52         50.623
          TOTAL RAINFALL   (mm)=      79.10        79.10         79.100
          RUNOFF COEFFICIENT   =        .97          .60           .640

            (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
                CN* =  84.0    Ia = Dep. Storage  (Above)
           (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
          (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

     ------------------------------------------------------------------------------------------
     R0005:C00008--------------------------------------------------------------------------------
     ------------------------------------------------------------------------------------------
     R0005:C00002--------------------------------------------------------------------------------
```

```
     ------------------------------------------------------------------------------------------
     R0005:C00002--------------------------------------------------------------------------------
     ------------------------------------------------------------------------------------------
     R0005:C00002--------------------------------------------------------------------------------
     ------------------------------------------------------------------------------------------
     R0005:C00002--------------------------------------------------------------------------------
       ** END OF RUN :    4

     ******************************************************************************************




     --------------------
     | START            | Project  dir.:C:\Temp\15-319\PR\6-hour_SCS\
     -------------------- Rainfall dir.:C:\Temp\15-319\PR\6-hour_SCS\
         TZERO =   .00 hrs on        0
         METOUT=   2 (output = METRIC)
         NRUN  = 0006
         NSTORM=   1
                #  1=12regtim.o89
     ------------------------------------------------------------------------------------------
     R0006:C00002--------------------------------------------------------------------------------
     *#*****************************************************************************
     *#  Project Name: [Mansfield Ski Club]    Project Number: [15-319]
     *#  Date        : 07-31-2017
     *#  Modeller    : [J. Lightheart]
     *#  Company     : WMI & Associates Ltd.
     *#  License #   :  2880720
     *#*****************************************************************************
     *
     * Post-Development Condition - Mansfield Ski Club
     *
     ------------------------------------------------------------------------------------------
     R0006:C00002--------------------------------------------------------------------------------
     --------------------
     | READ STORM       |  Filename: C:\Temp\15-319\PR\6-hour_SCS\12regtim.o89
     | Ptotal= 193.00 mm|  Comments: TIMMINS REGIONAL STORM (12-hour)
     --------------------
           TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME
          hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm
           1:00  15.000|   3:00  10.000|   5:00   5.000|   7:00  43.000|   9:00  23.000|  11:00
           2:00  20.000|   4:00   3.000|   6:00  20.000|   8:00  20.000|  10:00  13.000|  12:00

     ------------------------------------------------------------------------------------------
     R0006:C00003--------------------------------------------------------------------------------
     * SITE (POST1 - Controlled Area)
     --------------------------
     | CALIB STANDHYD         |   Area    (ha)=    2.74
     | 01:POST1      DT= 1.00 |   Total Imp(%)=   69.00   Dir. Conn.(%)=   59.00
     --------------------------
                                  IMPERVIOUS    PERVIOUS (i)
```

```
          Surface Area     (ha)=       1.89          .85
          Dep. Storage     (mm)=       2.00         5.00
          Average Slope     (%)=       3.50        33.30
          Length            (m)=     300.00         6.00
          Mannings n           =       .013         .250

          Max.eff.Inten.(mm/hr)=      43.00        53.33
                     over (min)        5.00         6.00
          Storage Coeff.  (min)=       4.75 (ii)    6.00 (ii)
          Unit Hyd. Tpeak (min)=       5.00         6.00
          Unit Hyd. peak  (cms)=        .23          .19
                                                                *TOTALS*
          PEAK FLOW       (cms)=        .19          .13           .318 (iii)
          TIME TO PEAK    (hrs)=       7.00         7.00          7.000
          RUNOFF VOLUME    (mm)=     190.99       158.56        177.702
          TOTAL RAINFALL   (mm)=     193.00       193.00        193.000
          RUNOFF COEFFICIENT   =        .99          .82           .921

            (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
                CN* =  84.0    Ia = Dep. Storage  (Above)
           (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
          (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

     ------------------------------------------------------------------------------------------
     R0006:C00004------------------------------------------------------------------------------
     * EXTERNAL (Routed through SWM Facility)
     --------------------------
     | CALIB NASHYD           |   Area    (ha)=   11.940   Curve Number   (CN)= 83.00
     | 02:EXT        DT= 1.00 |   Ia      (mm)=    6.800   # of Linear Res.(N)=  3.00
     --------------------------   U.H. Tp(hrs)=     .240

          Unit Hyd Qpeak  (cms)=    1.900

          PEAK FLOW       (cms)=    1.239 (i)
          TIME TO PEAK    (hrs)=    7.017
          DURATION        (hrs)=   13.667, (dddd|hh:mm:)=   0|13:40
          AVERAGE FLOW    (cms)=     .353
          RUNOFF VOLUME    (mm)=  145.537
          TOTAL RAINFALL   (mm)=  193.000
          RUNOFF COEFFICIENT   =     .754

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

     ------------------------------------------------------------------------------------------
     R0006:C00005------------------------------------------------------------------------------
     * TOTAL FLOW TO SIDEROAD 15 CROSS CULVERT (POST1 CONTROLLED + EXT)
     ------------------------
     | ADD HYD              |
     | 03:POST1+EXT         |   ID:NHYD            AREA     QPEAK    TPEAK      R.V.     DWF
     ------------------------                      (ha)     (cms)    (hrs)      (mm)   (cms)
                           ID 1 01:POST1          2.740      .318    7.000   177.702    .000
                          +ID 2 02:EXT           11.940     1.239    7.017   145.537    .000
                          ==================================================================
```

```
                          SUM   03:POST1+EXT     14.680     1.556    7.000   151.541    .000

        NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

     ------------------------------------------------------------------------------------------
     R0006:C00006------------------------------------------------------------------------------
     * SWM Facility
     -----------------------
     |  ROUTE RESERVOIR -> |    Requested routing time step =  1.0 min.
     |  IN>03:POST1+EXT    |
     | OUT<04:SWM Facili   | ========================  OUTLFOW STORAGE TABLE  =================
     ----------------------- OUTFLOW   STORAGE| OUTFLOW   STORAGE| OUTFLOW   STORAGE| OUTFLOW
                               (cms)   (ha.m.)|   (cms)   (ha.m.)|   (cms)   (ha.m.)|   (cms)
                                .000 .0000E+00|    .010 .1292E-01|    .065 .4128E-01|   1.071 .
                                .002 .6300E-03|    .010 .1442E-01|    .108 .4430E-01|   1.184 .
                                .003 .1310E-02|    .010 .1601E-01|    .159 .4743E-01|   1.308 .
                                .004 .2050E-02|    .011 .1769E-01|    .217 .5067E-01|   1.445 .
                                .005 .2840E-02|    .011 .1946E-01|    .281 .5403E-01|   1.594 .
                                .006 .3680E-02|    .011 .2133E-01|    .351 .5751E-01|   1.759 .
                                .006 .4590E-02|    .012 .2329E-01|    .425 .6112E-01|   2.020 .
                                .007 .5570E-02|    .012 .2535E-01|    .505 .6486E-01|   2.383 .
                                .007 .6610E-02|    .012 .2777E-01|    .589 .6872E-01|   2.840 .
                                .008 .7720E-02|    .013 .3027E-01|    .677 .7272E-01|   3.391 .
                                .008 .8910E-02|    .013 .3287E-01|    .769 .7686E-01|   4.041 .
                                .009 .1017E-01|    .013 .3557E-01|    .866 .8113E-01|   4.792 .
                                .009 .1150E-01|    .032 .3837E-01|    .966 .8555E-01|   5.649 .

          ROUTING RESULTS             AREA     QPEAK     TPEAK       R.V.
          ----------------------      (ha)     (cms)     (hrs)       (mm)
          INFLOW > 03:POST1+EXT     14.680     1.556     7.000    151.541
         OUTFLOW < 04:SWM Facili    14.680     1.540     7.033    151.540

                        PEAK   FLOW   REDUCTION [Qout/Qin](%)=   98.975
                        TIME SHIFT OF PEAK FLOW         (min)=     2.00
                        MAXIMUM  STORAGE   USED       (ha.m.)=.1080E+00

     ------------------------------------------------------------------------------------------
     R0006:C00007------------------------------------------------------------------------------
     * SITE (POST2 - Uncontrolled Area)
     --------------------------
     | CALIB STANDHYD         |   Area    (ha)=     .89
     | 05:POST2      DT= 1.00 |   Total Imp(%)=   21.00   Dir. Conn.(%)=   10.50
     --------------------------
                                   IMPERVIOUS    PERVIOUS (i)
          Surface Area     (ha)=        .19          .70
          Dep. Storage     (mm)=       2.00         5.00
          Average Slope     (%)=       6.00        11.10
          Length            (m)=     120.00        50.00
          Mannings n           =       .013         .250

          Max.eff.Inten.(mm/hr)=      43.00        44.82
                     over (min)        2.00         9.00
          Storage Coeff.  (min)=       2.33 (ii)    8.99 (ii)
```

```
     Unit Hyd. Tpeak (min)=       2.00         9.00
     Unit Hyd. peak  (cms)=        .50          .13
                                                        *TOTALS*
     PEAK FLOW       (cms)=        .01          .09           .098 (iii)
     TIME TO PEAK    (hrs)=       6.98         7.00          7.000
     RUNOFF VOLUME    (mm)=     191.00       153.77        157.677
     TOTAL RAINFALL   (mm)=     193.00       193.00        193.000
     RUNOFF COEFFICIENT   =        .99          .80           .817

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  84.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------------------
R0006:C00008-------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------
R0006:C00002-------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------
R0006:C00002-------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------
R0006:C00002-------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------
R0006:C00002-------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------
R0006:C00002-------------------------------------------------------------------------------
--------------------
| FINISH           |
--------------------
-------------------------------------------------------------------------------------------
*******************************************************************************************
     WARNINGS / ERRORS / NOTES
     -------------------------
   Simulation ended on 2020-12-09     at 16:06:26
===========================================================================================
```

Post-Development Condition
4-hour Chicago Storm Distribution

```
2     Metric units
*#******************************************************************************
*#  Project Name: [Mansfield Ski Club]    Project Number: [15-319]
*#  Date        : 07-31-2017
*#  Modeller    : [J. Lightheart]
*#  Company     : WMI & Associates Ltd.
*#  License #   :  2880720
*#******************************************************************************
*
* Post-Development Condition - Mansfield Ski Club
*
*% 25mm Chicago Storm Dist. based on Mansfield, ON. rainfall (4-hr)
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[1]
*%                   ["25mm4hr.stm"] <--storm filename
*%-----------------|-----------------------------------------------------------|
READ STORM          STORM_FILENAME=["STORM.001"]
*%-----------------|-----------------------------------------------------------|
* SITE (POST1 - Controlled Area)
CALIB STANDHYD      ID=[1], NHYD=["POST1"], DT=[1](min), AREA=[2.74](ha),
                    XIMP=[0.59], TIMP=[0.69], DWF=[0](cms), LOSS=[2],
                    SCS curve number CN=[84],
                    Pervious   surfaces: IAper=[5.0](mm), SLPP=[33.3](%),
                                         LGP=[6](m), MNP=[0.25], SCP=[0](min),
                    Impervious surfaces: IAimp=[2.0](mm), SLPI=[3.5](%),
                                         LGI=[300](m), MNI=[0.013], SCI=[0](min),
                    RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
*%-----------------|-----------------------------------------------------------|
* EXTERNAL (Routed through SWM Facility)
CALIB NASHYD        ID=[2], NHYD=["EXT"], DT=[1]min, AREA=[11.94](ha),
                    DWF=[0](cms),  CN/C=[83], IA=[6.8](mm),
                    N=[3], TP=[0.24]hrs,
                    RAINFALL=[ ,  ,  ,  , ](mm/hr),  END=-1
*%-----------------|-----------------------------------------------------------|
* TOTAL FLOW TO SIDEROAD 15 CROSS CULVERT (POST1 CONTROLLED + EXT)
ADD HYD             IDsum=[3], NHYD=["POST1+EXT"], IDs to add=[1+2]
*%-----------------|-----------------------------------------------------------|
* SWM Facility
ROUTE RESERVOIR     IDout=[4], NHYD=["SWM Facility"], IDin=[3], RDT=[1](min),
                         TABLE of ( OUTFLOW-STORAGE ) values
                                   (cms) - (ha-m)
                                 [0.0000 , 0.00000]
                                 [0.0015 , 0.00063]
                                 [0.0031 , 0.00131]
                                 [0.0041 , 0.00205]
                                 [0.0050 , 0.00284]
                                 [0.0057 , 0.00368]
                                 [0.0063 , 0.00459]
                                 [0.0069 , 0.00557]
                                 [0.0074 , 0.00661]
                                 [0.0079 , 0.00772]
                                 [0.0084 , 0.00891]
                                 [0.0088 , 0.01017]
                                 [0.0092 , 0.01150]
                                 [0.0096 , 0.01292]
                                 [0.0100 , 0.01442]
                                 [0.0104 , 0.01601]
                                 [0.0108 , 0.01769]
                                 [0.0111 , 0.01946]
                                 [0.0114 , 0.02133]
                                 [0.0118 , 0.02329]
```

```
                                 [0.0121 , 0.02535]
                                 [0.0124 , 0.02777]
                                 [0.0127 , 0.03027]
                                 [0.0130 , 0.03287]
                                 [0.0133 , 0.03557]
                                 [0.0317 , 0.03837]
                                 [0.0651 , 0.04128]
                                 [0.1082 , 0.04430]
                                 [0.1593 , 0.04743]
                                 [0.2172 , 0.05067]
                                 [0.2811 , 0.05403]
                                 [0.3506 , 0.05751]
                                 [0.4252 , 0.06112]
                                 [0.5047 , 0.06486]
                                 [0.5887 , 0.06872]
                                 [0.6769 , 0.07272]
                                 [0.7693 , 0.07686]
                                 [0.8656 , 0.08113]
                                 [0.9656 , 0.08555]
                                 [1.0706 , 0.09011]
                                 [1.1842 , 0.09483]
                                 [1.3084 , 0.09970]
                                 [1.4447 , 0.10472]
                                 [1.5945 , 0.10990]
                                 [1.7589 , 0.11524]
                                 [2.0195 , 0.12075]
                                 [2.3829 , 0.14300]
                                 [2.8396 , 0.14870]
                                 [3.3911 , 0.15454]
                                 [4.0406 , 0.16053]
                                 [4.7921 , 0.16666]
                                 [5.6495 , 0.17293]
                                 [   -1  ,  -1  ]  (maximum one hundred pairs of points)
                                 IDovf=[   ], NHYDovf=["      "],
*%-----------------|-----------------------------------------------------------------------
* SITE (POST2 - Uncontrolled Area)
CALIB STANDHYD      ID=[5], NHYD=["POST2"], DT=[1](min), AREA=[0.89](ha),
                    XIMP=[0.105], TIMP=[0.21], DWF=[0](cms), LOSS=[2],
                    SCS curve number CN=[84],
                    Pervious   surfaces: IAper=[5.0](mm), SLPP=[11.1](%),
                                         LGP=[50](m), MNP=[0.25], SCP=[0](min),
                    Impervious surfaces: IAimp=[2.0](mm), SLPI=[6.0](%),
                                         LGI=[120](m), MNI=[0.013], SCI=[0](min),
                    RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
*%-----------------|-----------------------------------------------------------|
*% 2-year Chicago Storm Dist. based on Mansfield, ON. rainfall (4-hr)
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[2]
*%                   ["2CHI4.stm"] <--storm filename
*%-----------------|-----------------------------------------------------------|
*% 5-year Chicago Storm Dist. based on Mansfield, ON. rainfall (4-hr)
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[3]
*%                   ["5CHI4.stm"] <--storm filename
*%-----------------|-----------------------------------------------------------|
*% 25-year Chicago Storm Dist. based on Mansfield, ON. rainfall (4-hr)
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[4]
*%                   ["25CHI4.stm"] <--storm filename
*%-----------------|-----------------------------------------------------------|
*% 100-year Chicago Storm Dist. based on Mansfield, ON. rainfall (4-hr)
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[5]
*%                   ["100CHI4.stm"] <--storm filename
```

```
*%-----------------|-----------------------------------------------------------|
*% Timmins Regional Storm (12-hr)
START              TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[6]
*%                  ["12regtim.o89"] <--storm filename
*%-----------------|-----------------------------------------------------------|
FINISH
```

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

 SSSSS   W   W   M   M   H   H   Y   Y   M   M    OOO         222     000    11   77777 ==
 S       W W W   MM MM   H   H    Y Y    MM MM   O   O          2    0   0   11   7   7
 SSSSS   W W W   M M M   HHHHH     Y     M M M   O   O          2    0   0   11       7
     S    W W    M   M   H   H     Y     M   M   O   O        222    0   0   11      7
 SSSSS    W W    M   M   H   H     Y     M   M    OOO         2      0   0   11     7   ==
                                                              2      0   0   11    7    #
       StormWater Management HYdrologic Model                  222     000    11    7    ==

 ******************************************************************************************
 **************************************  SWMHYMO Ver4.05.0  ******************************
 ******************  A single event and continuous hydrologic simulation model  ***********
 ******************     based on the principles of HYMO and its successors      ***********
 ******************                 OTTHYMO-83 and OTTHYMO-89.                  ***********
 ******************************************************************************************
 ****************** Distributed by:  J.F. Sabourin and Associates Inc.          ***********
 ******************                  Ottawa,  Ontario: (613) 836-3884           ***********
 ******************                  Gatineau, Quebec: (819) 243-6858           ***********
 ******************                  E-Mail: swmhymo@jfsa.com                   ***********
 ******************************************************************************************

 ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
 ++++++++++++++++++ Licensed user: WMI & Associates Ltd.                        +++++++++++
 ++++++++++++++++++               Barrie               SERIAL#:2880720          +++++++++++
 ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

 ******************************************************************************************
 ******************           ++++++ PROGRAM ARRAY DIMENSIONS ++++++            ***********
 ******************           Maximum value for ID numbers  :     11            ***********
 ******************           Max. number of rainfall points: 105408            ***********
 ******************           Max. number of flow points    : 105408            ***********
 ******************************************************************************************


 *******************************   D E T A I L E D   O U T P U T   ***********************
 ******************************************************************************************
 *                 RUN DATE: 2020-12-09     TIME: 16:05:29     RUN COUNTER: 000001
 ******************************************************************************************
 * Input   file: C:\Temp\15-319\PR\4-hour_Chic\2-CYRCHI.dat
 * Output  file: C:\Temp\15-319\PR\4-hour_Chic\2-CYRCHI.out
 * Summary file: C:\Temp\15-319\PR\4-hour_Chic\2-CYRCHI.sum
 * User comments:
 * 1:_____________________________________________________________________________________
 * 2:_____________________________________________________________________________________
 * 3:_____________________________________________________________________________________
 ******************************************************************************************

-------------------------------------------------------------------------------------------
R0001:C00001-------------------------------------------------------------------------------
*#*******************************************************************************
*#  Project Name: [Mansfield Ski Club]    Project Number: [15-319]
*#  Date        : 07-31-2017
```

```
*#  Modeller    : [J. Lightheart]
*#  Company     : WMI & Associates Ltd.
*#  License #   :  2880720
*#*******************************************************************************
*
* Post-Development Condition - Mansfield Ski Club
*
--------------------
| START            | Project  dir.:C:\Temp\15-319\PR\4-hour_Chic\
-------------------- Rainfall dir.:C:\Temp\15-319\PR\4-hour_Chic\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 0001
    NSTORM=   1
           #  1=25mm4hr.stm
-------------------------------------------------------------------------------------------
R0001:C00002-------------------------------------------------------------------------------
--------------------
| READ STORM       |  Filename: C:\Temp\15-319\PR\4-hour_Chic\25mm4hr.stm
| Ptotal=  25.00 mm|  Comments: 25mm Chicago Storm Distribution (4-hour) Mansfield, ON.
--------------------
      TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME
     hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm
      0:10   1.970|   0:50   3.820|   1:30  13.830|   2:10   4.080|   2:50   2.650|   3:30
      0:20   2.220|   1:00   5.380|   1:40   8.070|   2:20   3.570|   3:00   2.450|   3:40
      0:30   2.550|   1:10  10.940|   1:50   5.950|   2:30   3.190|   3:10   2.290|   3:50
      0:40   3.030|   1:20  56.670|   2:00   4.810|   2:40   2.890|   3:20   2.150|   4:00

-------------------------------------------------------------------------------------------
R0001:C00003-------------------------------------------------------------------------------
* SITE (POST1 - Controlled Area)
--------------------------
| CALIB STANDHYD         |   Area    (ha)=    2.74
| 01:POST1      DT= 1.00 |   Total Imp(%)=   69.00   Dir. Conn.(%)=   59.00
--------------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.89          .85
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       3.50        33.30
     Length            (m)=     300.00         6.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      56.67        23.86
                over (min)        4.00         6.00
     Storage Coeff.  (min)=       4.26 (ii)    5.98 (ii)
     Unit Hyd. Tpeak (min)=       4.00         6.00
     Unit Hyd. peak  (cms)=        .27          .19
                                                            *TOTALS*
     PEAK FLOW       (cms)=        .22          .04           .255 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.40          1.350
     RUNOFF VOLUME    (mm)=      23.01         7.79         16.768
     TOTAL RAINFALL   (mm)=      25.01        25.01         25.005
     RUNOFF COEFFICIENT   =        .92          .31           .671
```

```
       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  84.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

 ---------------------------------------------------------------------------------------------
 R0001:C00004---------------------------------------------------------------------------------
 * EXTERNAL (Routed through SWM Facility)
 --------------------------
 | CALIB NASHYD           |   Area    (ha)=   11.940   Curve Number   (CN)= 83.00
 | 02:EXT        DT= 1.00 |   Ia      (mm)=    6.800   # of Linear Res.(N)=  3.00
 --------------------------   U.H. Tp(hrs)=     .240

      Unit Hyd Qpeak  (cms)=    1.900

      PEAK FLOW       (cms)=     .115 (i)
      TIME TO PEAK    (hrs)=    1.650
      DURATION        (hrs)=    5.667, (dddd|hh:mm:)=   0|05:40
      AVERAGE FLOW    (cms)=     .028
      RUNOFF VOLUME    (mm)=    4.719
      TOTAL RAINFALL   (mm)=   25.005
      RUNOFF COEFFICIENT   =     .189

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

 ---------------------------------------------------------------------------------------------
 R0001:C00005---------------------------------------------------------------------------------
 * TOTAL FLOW TO SIDEROAD 15 CROSS CULVERT (POST1 CONTROLLED + EXT)
 ------------------------
 | ADD HYD                |
 | 03:POST1+EXT           |   ID:NHYD           AREA     QPEAK    TPEAK      R.V.     DWF
 ------------------------                       (ha)     (cms)    (hrs)      (mm)   (cms)
                        ID 1 01:POST1          2.740      .255    1.350    16.768    .000
                       +ID 2 02:EXT           11.940      .115    1.650     4.719    .000
                       ==============================================================
                       SUM   03:POST1+EXT     14.680      .282    1.367     6.968    .000

    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

 ---------------------------------------------------------------------------------------------
 R0001:C00006---------------------------------------------------------------------------------
 * SWM Facility
 ----------------------
 |  ROUTE RESERVOIR -> |    Requested routing time step =  1.0 min.
 |  IN>03:POST1+EXT    |
 | OUT<04:SWM Facili   | =========================  OUTLFOW STORAGE TABLE  =================
 ---------------------- OUTFLOW   STORAGE| OUTFLOW   STORAGE| OUTFLOW   STORAGE| OUTFLOW
                          (cms)   (ha.m.)|   (cms)   (ha.m.)|   (cms)   (ha.m.)|   (cms)
                           .000 .0000E+00|    .010 .1292E-01|    .065 .4128E-01|   1.071 .
                           .002 .6300E-03|    .010 .1442E-01|    .108 .4430E-01|   1.184 .
                           .003 .1310E-02|    .010 .1601E-01|    .159 .4743E-01|   1.308 .
                           .004 .2050E-02|    .011 .1769E-01|    .217 .5067E-01|   1.445 .
```

```
                           .005 .2840E-02|    .011 .1946E-01|    .281 .5403E-01|   1.594 .
                           .006 .3680E-02|    .011 .2133E-01|    .351 .5751E-01|   1.759 .
                           .006 .4590E-02|    .012 .2329E-01|    .425 .6112E-01|   2.020 .
                           .007 .5570E-02|    .012 .2535E-01|    .505 .6486E-01|   2.383 .
                           .007 .6610E-02|    .012 .2777E-01|    .589 .6872E-01|   2.840 .
                           .008 .7720E-02|    .013 .3027E-01|    .677 .7272E-01|   3.391 .
                           .008 .8910E-02|    .013 .3287E-01|    .769 .7686E-01|   4.041 .
                           .009 .1017E-01|    .013 .3557E-01|    .866 .8113E-01|   4.792 .
                           .009 .1150E-01|    .032 .3837E-01|    .966 .8555E-01|   5.649 .

      ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
      ----------------------     (ha)     (cms)     (hrs)       (mm)
      INFLOW > 03:POST1+EXT     14.680      .282     1.367      6.968
     OUTFLOW < 04:SWM Facili    14.680      .108     2.033      6.968

                    PEAK   FLOW   REDUCTION [Qout/Qin](%)=   38.291
                    TIME SHIFT OF PEAK FLOW         (min)=    40.00
                    MAXIMUM  STORAGE   USED       (ha.m.)=.4429E-01

 ---------------------------------------------------------------------------------------------
 R0001:C00007---------------------------------------------------------------------------------
 * SITE (POST2 - Uncontrolled Area)
 --------------------------
 | CALIB STANDHYD         |   Area    (ha)=     .89
 | 05:POST2      DT= 1.00 |   Total Imp(%)=   21.00   Dir. Conn.(%)=   10.50
 --------------------------
                              IMPERVIOUS    PERVIOUS (i)
      Surface Area     (ha)=        .19          .70
      Dep. Storage     (mm)=       2.00         5.00
      Average Slope     (%)=       6.00        11.10
      Length            (m)=     120.00        50.00
      Mannings n          =       .013         .250

      Max.eff.Inten.(mm/hr)=      56.67        11.01
                 over (min)       2.00        14.00
      Storage Coeff.  (min)=       2.09 (ii)   13.75 (ii)
      Unit Hyd. Tpeak (min)=       2.00        14.00
      Unit Hyd. peak  (cms)=        .54          .08
                                                             *TOTALS*
      PEAK FLOW       (cms)=        .01          .01           .018 (iii)
      TIME TO PEAK    (hrs)=       1.33         1.55          1.333
      RUNOFF VOLUME    (mm)=      23.00         6.70          8.411
      TOTAL RAINFALL   (mm)=      25.01        25.01         25.005
      RUNOFF COEFFICIENT   =        .92          .27           .336

        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN* =  84.0    Ia = Dep. Storage  (Above)
       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

 ---------------------------------------------------------------------------------------------
 R0001:C00008---------------------------------------------------------------------------------
   ** END OF RUN :    0
```

```
 ******************************************************************************************





 --------------------
 | START            | Project  dir.:C:\Temp\15-319\PR\4-hour_Chic\
 -------------------- Rainfall dir.:C:\Temp\15-319\PR\4-hour_Chic\
     TZERO =   .00 hrs on        0
     METOUT=   2 (output = METRIC)
     NRUN  = 0002
     NSTORM=   1
            #  1=2CHI4.stm
 ------------------------------------------------------------------------------------------
 R0002:C00002------------------------------------------------------------------------------
 *#*****************************************************************************
 *#  Project Name: [Mansfield Ski Club]    Project Number: [15-319]
 *#  Date        : 07-31-2017
 *#  Modeller    : [J. Lightheart]
 *#  Company     : WMI & Associates Ltd.
 *#  License #   :  2880720
 *#*****************************************************************************
 *
 * Post-Development Condition - Mansfield Ski Club
 *
 ------------------------------------------------------------------------------------------
 R0002:C00002------------------------------------------------------------------------------
 --------------------
 | READ STORM       |  Filename: C:\Temp\15-319\PR\4-hour_Chic\2CHI4.stm
 | Ptotal=  32.37 mm|  Comments: 2-Year Chicago Storm Distribution (4-hour) Mansfield, ON.
 --------------------
       TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME
      hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm
       0:10   2.552|   0:50   4.945|   1:30  17.908|   2:10   5.281|   2:50   3.431|   3:30
       0:20   2.869|   1:00   6.961|   1:40  10.450|   2:20   4.618|   3:00   3.177|   3:40
       0:30   3.301|   1:10  14.171|   1:50   7.709|   2:30   4.124|   3:10   2.963|   3:50
       0:40   3.928|   1:20  73.380|   2:00   6.227|   2:40   3.740|   3:20   2.781|   4:00

 ------------------------------------------------------------------------------------------
 R0002:C00003------------------------------------------------------------------------------
 * SITE (POST1 - Controlled Area)
 --------------------------
 | CALIB STANDHYD         |   Area    (ha)=    2.74
 | 01:POST1      DT= 1.00 |   Total Imp(%)=   69.00   Dir. Conn.(%)=   59.00
 --------------------------
                               IMPERVIOUS    PERVIOUS (i)
      Surface Area     (ha)=       1.89          .85
      Dep. Storage     (mm)=       2.00         5.00
      Average Slope     (%)=       3.50        33.30
      Length            (m)=     300.00         6.00
      Mannings n          =        .013         .250
```

```
      Max.eff.Inten.(mm/hr)=      73.38        41.45
                 over (min)        4.00         5.00
      Storage Coeff.  (min)=       3.84 (ii)    5.22 (ii)
      Unit Hyd. Tpeak (min)=       4.00         5.00
      Unit Hyd. peak  (cms)=        .29          .22
                                                               *TOTALS*
      PEAK FLOW       (cms)=        .30          .07            .359 (iii)
      TIME TO PEAK    (hrs)=       1.33         1.37           1.350
      RUNOFF VOLUME    (mm)=      30.37        12.54          23.064
      TOTAL RAINFALL   (mm)=      32.37        32.37          32.374
      RUNOFF COEFFICIENT   =        .94          .39            .712

        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN* =  84.0    Ia = Dep. Storage  (Above)
       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

 ------------------------------------------------------------------------------------------
 R0002:C00004------------------------------------------------------------------------------
 * EXTERNAL (Routed through SWM Facility)
 --------------------------
 | CALIB NASHYD           |   Area    (ha)=   11.940   Curve Number   (CN)= 83.00
 | 02:EXT       DT= 1.00 |   Ia      (mm)=    6.800   # of Linear Res.(N)=  3.00
 --------------------------   U.H. Tp(hrs)=     .240

      Unit Hyd Qpeak  (cms)=    1.900

      PEAK FLOW       (cms)=     .229 (i)
      TIME TO PEAK    (hrs)=    1.617
      DURATION        (hrs)=    5.667, (dddd|hh:mm:)=   0|05:40
      AVERAGE FLOW    (cms)=     .049
      RUNOFF VOLUME    (mm)=    8.428
      TOTAL RAINFALL   (mm)=   32.374
      RUNOFF COEFFICIENT   =     .260

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

 ------------------------------------------------------------------------------------------
 R0002:C00005------------------------------------------------------------------------------
 * TOTAL FLOW TO SIDEROAD 15 CROSS CULVERT (POST1 CONTROLLED + EXT)
 -----------------------
 | ADD HYD               |
 | 03:POST1+EXT          |   ID:NHYD           AREA     QPEAK    TPEAK      R.V.     DWF
 -----------------------                       (ha)     (cms)    (hrs)      (mm)   (cms)
                      ID 1 01:POST1          2.740      .359    1.350    23.064    .000
                     +ID 2 02:EXT           11.940      .229    1.617     8.428    .000
                     ==========================================================
                     SUM   03:POST1+EXT     14.680      .434    1.367    11.160    .000

    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

 ------------------------------------------------------------------------------------------
```

```
R0002:C00006----------------------------------------------------------------------------
* SWM Facility
----------------------
|  ROUTE RESERVOIR -> |    Requested routing time step =  1.0 min.
|  IN>03:POST1+EXT    |
| OUT<04:SWM Facili   | =========================  OUTLFOW STORAGE TABLE  =================
---------------------- OUTFLOW   STORAGE| OUTFLOW   STORAGE| OUTFLOW   STORAGE| OUTFLOW
                         (cms)   (ha.m.)|   (cms)   (ha.m.)|   (cms)   (ha.m.)|   (cms)
                          .000 .0000E+00|    .010 .1292E-01|    .065 .4128E-01|   1.071 .
                          .002 .6300E-03|    .010 .1442E-01|    .108 .4430E-01|   1.184 .
                          .003 .1310E-02|    .010 .1601E-01|    .159 .4743E-01|   1.308 .
                          .004 .2050E-02|    .011 .1769E-01|    .217 .5067E-01|   1.445 .
                          .005 .2840E-02|    .011 .1946E-01|    .281 .5403E-01|   1.594 .
                          .006 .3680E-02|    .011 .2133E-01|    .351 .5751E-01|   1.759 .
                          .006 .4590E-02|    .012 .2329E-01|    .425 .6112E-01|   2.020 .
                          .007 .5570E-02|    .012 .2535E-01|    .505 .6486E-01|   2.383 .
                          .007 .6610E-02|    .012 .2777E-01|    .589 .6872E-01|   2.840 .
                          .008 .7720E-02|    .013 .3027E-01|    .677 .7272E-01|   3.391 .
                          .008 .8910E-02|    .013 .3287E-01|    .769 .7686E-01|   4.041 .
                          .009 .1017E-01|    .013 .3557E-01|    .866 .8113E-01|   4.792 .
                          .009 .1150E-01|    .032 .3837E-01|    .966 .8555E-01|   5.649 .

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     ----------------------      (ha)     (cms)     (hrs)       (mm)
     INFLOW > 03:POST1+EXT     14.680      .434     1.367     11.160
    OUTFLOW < 04:SWM Facili    14.680      .252     1.800     11.160

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=   58.087
                   TIME SHIFT OF PEAK FLOW         (min)=    26.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=.5250E-01

------------------------------------------------------------------------------------------
R0002:C00007------------------------------------------------------------------------------
* SITE (POST2 - Uncontrolled Area)
--------------------------
| CALIB STANDHYD         |   Area    (ha)=     .89
| 05:POST2      DT= 1.00 |   Total Imp(%)=   21.00   Dir. Conn.(%)=   10.50
--------------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .19          .70
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       6.00        11.10
     Length            (m)=     120.00        50.00
     Mannings n          =       .013         .250

     Max.eff.Inten.(mm/hr)=      73.38        22.33
                over (min)       2.00        11.00
     Storage Coeff.  (min)=       1.88 (ii)   10.67 (ii)
     Unit Hyd. Tpeak (min)=       2.00        11.00
     Unit Hyd. peak  (cms)=        .58          .11
                                                           *TOTALS*
     PEAK FLOW       (cms)=        .02          .03           .032 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.48          1.483
```

```
     RUNOFF VOLUME    (mm)=      30.37        11.06         13.091
     TOTAL RAINFALL   (mm)=      32.37        32.37         32.374
     RUNOFF COEFFICIENT   =        .94          .34           .404

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  84.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

------------------------------------------------------------------------------------------
R0002:C00008------------------------------------------------------------------------------
------------------------------------------------------------------------------------------
R0002:C00002------------------------------------------------------------------------------
  ** END OF RUN :    1

******************************************************************************************




--------------------
| START            | Project  dir.:C:\Temp\15-319\PR\4-hour_Chic\
-------------------- Rainfall dir.:C:\Temp\15-319\PR\4-hour_Chic\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 0003
    NSTORM=   1
           #  1=5CHI4.stm
------------------------------------------------------------------------------------------
R0003:C00002------------------------------------------------------------------------------
*#*****************************************************************************
*#  Project Name: [Mansfield Ski Club]    Project Number: [15-319]
*#  Date        : 07-31-2017
*#  Modeller    : [J. Lightheart]
*#  Company     : WMI & Associates Ltd.
*#  License #   :  2880720
*#*****************************************************************************
*
* Post-Development Condition - Mansfield Ski Club
*
------------------------------------------------------------------------------------------
R0003:C00002------------------------------------------------------------------------------
--------------------
| READ STORM       |  Filename: C:\Temp\15-319\PR\4-hour_Chic\5CHI4.stm
| Ptotal=  42.60 mm|  Comments: 5-Year Chicago Storm Distribution (4-hour) Mansfield, ON.
--------------------
      TIME    RAIN|  TIME    RAIN|  TIME    RAIN|  TIME    RAIN|  TIME    RAIN|  TIME
     hh:mm   mm/hr| hh:mm   mm/hr| hh:mm   mm/hr| hh:mm   mm/hr| hh:mm   mm/hr| hh:mm
      0:10   3.347|  0:50   6.492|  1:30  23.565|  2:10   6.934|  2:50   4.502|  3:30
      0:20   3.764|  1:00   9.144|  1:40  13.736|  2:20   6.062|  3:00   4.168|  3:40
      0:30   4.331|  1:10  18.640|  1:50  10.128|  2:30   5.413|  3:10   3.887|  3:50
      0:40   5.155|  1:20  96.860|  2:00   8.178|  2:40   4.908|  3:20   3.648|  4:00
```

```
-------------------------------------------------------------------------------------------
R0003:C00003-------------------------------------------------------------------------------
* SITE (POST1 - Controlled Area)
--------------------------
| CALIB STANDHYD         |   Area    (ha)=    2.74
| 01:POST1      DT= 1.00 |   Total Imp(%)=   69.00   Dir. Conn.(%)=   59.00
--------------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.89         .85
     Dep. Storage     (mm)=       2.00        5.00
     Average Slope     (%)=       3.50       33.30
     Length            (m)=     300.00        6.00
     Mannings n           =       .013        .250

     Max.eff.Inten.(mm/hr)=      96.86       67.61
                over (min)        3.00        5.00
     Storage Coeff.  (min)=       3.44 (ii)    4.57 (ii)
     Unit Hyd. Tpeak (min)=       3.00        5.00
     Unit Hyd. peak  (cms)=        .34         .24
                                                           *TOTALS*
     PEAK FLOW       (cms)=        .41         .12           .516 (iii)
     TIME TO PEAK    (hrs)=       1.33        1.37          1.333
     RUNOFF VOLUME    (mm)=      40.60       19.99         32.151
     TOTAL RAINFALL   (mm)=      42.60       42.60         42.603
     RUNOFF COEFFICIENT   =        .95         .47           .755

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  84.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------------------
R0003:C00004-------------------------------------------------------------------------------
* EXTERNAL (Routed through SWM Facility)
--------------------------
| CALIB NASHYD           |   Area    (ha)=   11.940   Curve Number   (CN)= 83.00
| 02:EXT        DT= 1.00 |   Ia      (mm)=    6.800   # of Linear Res.(N)=  3.00
--------------------------   U.H. Tp(hrs)=     .240

     Unit Hyd Qpeak  (cms)=    1.900

     PEAK FLOW       (cms)=     .433 (i)
     TIME TO PEAK    (hrs)=    1.600
     DURATION        (hrs)=    5.667, (dddd|hh:mm:)=   0|05:40
     AVERAGE FLOW    (cms)=     .085
     RUNOFF VOLUME    (mm)=   14.595
     TOTAL RAINFALL   (mm)=   42.603
     RUNOFF COEFFICIENT   =     .343

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

-------------------------------------------------------------------------------------------
```

```
R0003:C00005-------------------------------------------------------------------------------
* TOTAL FLOW TO SIDEROAD 15 CROSS CULVERT (POST1 CONTROLLED + EXT)
------------------------
| ADD HYD               |
| 03:POST1+EXT          |   ID:NHYD           AREA     QPEAK    TPEAK      R.V.     DWF
------------------------                      (ha)     (cms)    (hrs)      (mm)   (cms)
                      ID 1 01:POST1          2.740      .516    1.333    32.151    .000
                     +ID 2 02:EXT           11.940      .433    1.600    14.595    .000
                     ==============================================================
                     SUM   03:POST1+EXT     14.680      .669    1.350    17.872    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------------------
R0003:C00006-------------------------------------------------------------------------------
* SWM Facility
-----------------------
|  ROUTE RESERVOIR -> |    Requested routing time step =  1.0 min.
|  IN>03:POST1+EXT    |
| OUT<04:SWM Facili   | =========================  OUTLFOW STORAGE TABLE  =================
----------------------- OUTFLOW   STORAGE| OUTFLOW   STORAGE| OUTFLOW   STORAGE| OUTFLOW
                          (cms)   (ha.m.)|   (cms)   (ha.m.)|   (cms)   (ha.m.)|   (cms)
                           .000 .0000E+00|    .010 .1292E-01|    .065 .4128E-01|   1.071 .
                           .002 .6300E-03|    .010 .1442E-01|    .108 .4430E-01|   1.184 .
                           .003 .1310E-02|    .010 .1601E-01|    .159 .4743E-01|   1.308 .
                           .004 .2050E-02|    .011 .1769E-01|    .217 .5067E-01|   1.445 .
                           .005 .2840E-02|    .011 .1946E-01|    .281 .5403E-01|   1.594 .
                           .006 .3680E-02|    .011 .2133E-01|    .351 .5751E-01|   1.759 .
                           .006 .4590E-02|    .012 .2329E-01|    .425 .6112E-01|   2.020 .
                           .007 .5570E-02|    .012 .2535E-01|    .505 .6486E-01|   2.383 .
                           .007 .6610E-02|    .012 .2777E-01|    .589 .6872E-01|   2.840 .
                           .008 .7720E-02|    .013 .3027E-01|    .677 .7272E-01|   3.391 .
                           .008 .8910E-02|    .013 .3287E-01|    .769 .7686E-01|   4.041 .
                           .009 .1017E-01|    .013 .3557E-01|    .866 .8113E-01|   4.792 .
                           .009 .1150E-01|    .032 .3837E-01|    .966 .8555E-01|   5.649 .

     ROUTING RESULTS             AREA     QPEAK     TPEAK       R.V.
     ----------------------      (ha)     (cms)     (hrs)       (mm)
     INFLOW > 03:POST1+EXT     14.680      .669     1.350     17.872
    OUTFLOW < 04:SWM Facili    14.680      .494     1.700     17.872

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=   73.761
                   TIME SHIFT OF PEAK FLOW         (min)=    21.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=.6436E-01

-------------------------------------------------------------------------------------------
R0003:C00007-------------------------------------------------------------------------------
* SITE (POST2 - Uncontrolled Area)
--------------------------
| CALIB STANDHYD         |   Area    (ha)=     .89
| 05:POST2      DT= 1.00 |   Total Imp(%)=   21.00   Dir. Conn.(%)=   10.50
--------------------------
                              IMPERVIOUS    PERVIOUS (i)
```

```
     Surface Area     (ha)=        .19         .70
     Dep. Storage     (mm)=       2.00        5.00
     Average Slope     (%)=       6.00       11.10
     Length            (m)=     120.00       50.00
     Mannings n           =       .013        .250

     Max.eff.Inten.(mm/hr)=      96.86       46.11
                over (min)       2.00        8.00
     Storage Coeff.  (min)=       1.69 (ii)    8.26 (ii)
     Unit Hyd. Tpeak (min)=       2.00        8.00
     Unit Hyd. peak  (cms)=        .62         .14
                                                           *TOTALS*
     PEAK FLOW       (cms)=        .03         .06           .065 (iii)
     TIME TO PEAK    (hrs)=       1.33        1.42          1.350
     RUNOFF VOLUME    (mm)=      40.60       18.03         20.399
     TOTAL RAINFALL   (mm)=      42.60       42.60         42.603
     RUNOFF COEFFICIENT   =        .95         .42           .479

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  84.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------------------
R0003:C00008---------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------
R0003:C00002---------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------
R0003:C00002---------------------------------------------------------------------------------
  ** END OF RUN :    2

*******************************************************************************************





--------------------
| START            | Project  dir.:C:\Temp\15-319\PR\4-hour_Chic\
-------------------- Rainfall dir.:C:\Temp\15-319\PR\4-hour_Chic\
    TZERO =   .00 hrs on       0
    METOUT=   2 (output = METRIC)
    NRUN  = 0004
    NSTORM=   1
           #  1=25CHI4.stm
-------------------------------------------------------------------------------------------
R0004:C00002---------------------------------------------------------------------------------
*#******************************************************************************
*#  Project Name: [Mansfield Ski Club]    Project Number: [15-319]
*#  Date        : 07-31-2017
*#  Modeller    : [J. Lightheart]
*#  Company     : WMI & Associates Ltd.
*#  License #   :  2880720
```

```
*#******************************************************************************
*
* Post-Development Condition - Mansfield Ski Club
*
-------------------------------------------------------------------------------------------
R0004:C00002---------------------------------------------------------------------------------
--------------------
| READ STORM       |  Filename: C:\Temp\15-319\PR\4-hour_Chic\25CHI4.stm
| Ptotal=  58.08 mm|  Comments: 25-Year Chicago Storm Distribution (4-hour) Mansfield, ON.
--------------------
      TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME
     hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm
      0:10   4.562|   0:50   8.850|   1:30  32.125|   2:10   9.453|   2:50   6.138|   3:30
      0:20   5.131|   1:00  12.466|   1:40  18.726|   2:20   8.265|   3:00   5.682|   3:40
      0:30   5.904|   1:10  25.411|   1:50  13.807|   2:30   7.379|   3:10   5.299|   3:50
      0:40   7.028|   1:20 132.047|   2:00  11.148|   2:40   6.691|   3:20   4.973|   4:00

-------------------------------------------------------------------------------------------
R0004:C00003---------------------------------------------------------------------------------
* SITE (POST1 - Controlled Area)
--------------------------
| CALIB STANDHYD         |   Area    (ha)=    2.74
| 01:POST1      DT= 1.00 |   Total Imp(%)=   69.00   Dir. Conn.(%)=   59.00
--------------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.89         .85
     Dep. Storage     (mm)=       2.00        5.00
     Average Slope     (%)=       3.50       33.30
     Length            (m)=     300.00        6.00
     Mannings n           =       .013        .250

     Max.eff.Inten.(mm/hr)=     132.05      113.47
                over (min)       3.00        4.00
     Storage Coeff.  (min)=       3.03 (ii)    3.96 (ii)
     Unit Hyd. Tpeak (min)=       3.00        4.00
     Unit Hyd. peak  (cms)=        .37         .28
                                                           *TOTALS*
     PEAK FLOW       (cms)=        .57         .21           .773 (iii)
     TIME TO PEAK    (hrs)=       1.33        1.35          1.333
     RUNOFF VOLUME    (mm)=      56.08       32.44         46.388
     TOTAL RAINFALL   (mm)=      58.08       58.08         58.079
     RUNOFF COEFFICIENT   =        .97         .56           .799

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  84.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------------------
R0004:C00004---------------------------------------------------------------------------------
* EXTERNAL (Routed through SWM Facility)
--------------------------
| CALIB NASHYD           |   Area    (ha)=   11.940   Curve Number   (CN)= 83.00
```

```
 | 02:EXT        DT= 1.00 |   Ia      (mm)=    6.800   # of Linear Res.(N)=  3.00
 -------------------------   U.H. Tp(hrs)=     .240

      Unit Hyd Qpeak  (cms)=    1.900

      PEAK FLOW       (cms)=     .810 (i)
      TIME TO PEAK    (hrs)=    1.583
      DURATION        (hrs)=    5.667, (dddd|hh:mm:)=   0|05:40
      AVERAGE FLOW    (cms)=     .149
      RUNOFF VOLUME    (mm)=   25.455
      TOTAL RAINFALL   (mm)=   58.079
      RUNOFF COEFFICIENT   =     .438

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

 ---------------------------------------------------------------------------------------------
 R0004:C00005---------------------------------------------------------------------------------
 * TOTAL FLOW TO SIDEROAD 15 CROSS CULVERT (POST1 CONTROLLED + EXT)
 ------------------------
 | ADD HYD               |
 | 03:POST1+EXT          |   ID:NHYD            AREA     QPEAK    TPEAK      R.V.     DWF
 ------------------------                       (ha)     (cms)    (hrs)      (mm)   (cms)
                       ID 1 01:POST1           2.740      .773    1.333    46.388    .000
                      +ID 2 02:EXT            11.940      .810    1.583    25.455    .000
                      ===============================================================
                      SUM   03:POST1+EXT      14.680     1.105    1.350    29.362    .000

    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

 ---------------------------------------------------------------------------------------------
 R0004:C00006---------------------------------------------------------------------------------
 * SWM Facility
 ----------------------
 |  ROUTE RESERVOIR -> |    Requested routing time step =  1.0 min.
 |  IN>03:POST1+EXT    |
 | OUT<04:SWM Facili   | =========================  OUTLFOW STORAGE TABLE  =================
 ---------------------- OUTFLOW   STORAGE| OUTFLOW   STORAGE| OUTFLOW   STORAGE| OUTFLOW
                          (cms)   (ha.m.)|   (cms)   (ha.m.)|   (cms)   (ha.m.)|   (cms)
                           .000 .0000E+00|    .010 .1292E-01|    .065 .4128E-01|   1.071 .
                           .002 .6300E-03|    .010 .1442E-01|    .108 .4430E-01|   1.184 .
                           .003 .1310E-02|    .010 .1601E-01|    .159 .4743E-01|   1.308 .
                           .004 .2050E-02|    .011 .1769E-01|    .217 .5067E-01|   1.445 .
                           .005 .2840E-02|    .011 .1946E-01|    .281 .5403E-01|   1.594 .
                           .006 .3680E-02|    .011 .2133E-01|    .351 .5751E-01|   1.759 .
                           .006 .4590E-02|    .012 .2329E-01|    .425 .6112E-01|   2.020 .
                           .007 .5570E-02|    .012 .2535E-01|    .505 .6486E-01|   2.383 .
                           .007 .6610E-02|    .012 .2777E-01|    .589 .6872E-01|   2.840 .
                           .008 .7720E-02|    .013 .3027E-01|    .677 .7272E-01|   3.391 .
                           .008 .8910E-02|    .013 .3287E-01|    .769 .7686E-01|   4.041 .
                           .009 .1017E-01|    .013 .3557E-01|    .866 .8113E-01|   4.792 .
                           .009 .1150E-01|    .032 .3837E-01|    .966 .8555E-01|   5.649 .

      ROUTING RESULTS             AREA     QPEAK     TPEAK       R.V.
```

```
      ----------------------      (ha)     (cms)     (hrs)       (mm)
      INFLOW > 03:POST1+EXT     14.680     1.105     1.350     29.362
     OUTFLOW < 04:SWM Facili    14.680      .915     1.650     29.362

                    PEAK   FLOW   REDUCTION [Qout/Qin](%)=   82.841
                    TIME SHIFT OF PEAK FLOW         (min)=    18.00
                    MAXIMUM  STORAGE   USED       (ha.m.)=.8335E-01

 ---------------------------------------------------------------------------------------------
 R0004:C00007---------------------------------------------------------------------------------
 * SITE (POST2 - Uncontrolled Area)
 --------------------------
 | CALIB STANDHYD         |   Area    (ha)=     .89
 | 05:POST2      DT= 1.00 |   Total Imp(%)=   21.00   Dir. Conn.(%)=   10.50
 --------------------------
                               IMPERVIOUS    PERVIOUS (i)
      Surface Area     (ha)=        .19          .70
      Dep. Storage     (mm)=       2.00         5.00
      Average Slope     (%)=       6.00        11.10
      Length            (m)=     120.00        50.00
      Mannings n           =       .013         .250

      Max.eff.Inten.(mm/hr)=     132.05        82.34
                 over (min)       1.00         7.00
      Storage Coeff.  (min)=       1.49 (ii)    6.70 (ii)
      Unit Hyd. Tpeak (min)=       1.00         7.00
      Unit Hyd. peak  (cms)=        .83          .17
                                                                *TOTALS*
      PEAK FLOW       (cms)=        .03          .11           .120 (iii)
      TIME TO PEAK    (hrs)=       1.33         1.40          1.333
      RUNOFF VOLUME    (mm)=      56.07        29.88         32.634
      TOTAL RAINFALL   (mm)=      58.08        58.08         58.079
      RUNOFF COEFFICIENT   =        .97          .51           .562

        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN* =  84.0    Ia = Dep. Storage  (Above)
       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

 ---------------------------------------------------------------------------------------------
 R0004:C00008---------------------------------------------------------------------------------
 ---------------------------------------------------------------------------------------------
 R0004:C00002---------------------------------------------------------------------------------
 ---------------------------------------------------------------------------------------------
 R0004:C00002---------------------------------------------------------------------------------
 ---------------------------------------------------------------------------------------------
 R0004:C00002---------------------------------------------------------------------------------
   ** END OF RUN :    3

 *********************************************************************************************
```

```
 --------------------
 | START            | Project  dir.:C:\Temp\15-319\PR\4-hour_Chic\
 -------------------- Rainfall dir.:C:\Temp\15-319\PR\4-hour_Chic\
     TZERO =   .00 hrs on        0
     METOUT=   2 (output = METRIC)
     NRUN  = 0005
     NSTORM=   1
            #  1=100CHI4.stm
 -------------------------------------------------------------------------------------------
 R0005:C00002-------------------------------------------------------------------------------
 *#*************************************************************************
 *#  Project Name: [Mansfield Ski Club]    Project Number: [15-319]
 *#  Date        : 07-31-2017
 *#  Modeller    : [J. Lightheart]
 *#  Company     : WMI & Associates Ltd.
 *#  License #   :  2880720
 *#*************************************************************************
 *
 * Post-Development Condition - Mansfield Ski Club
 *
 -------------------------------------------------------------------------------------------
 R0005:C00002-------------------------------------------------------------------------------
 --------------------
 | READ STORM       |  Filename: C:\Temp\15-319\PR\4-hour_Chic\100CHI4.stm
 | Ptotal=  70.93 mm|  Comments: 100-Year Chicago Storm Distribution (4-hour) Mansfield, ON.
 --------------------
       TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME
      hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm
       0:10   5.571|   0:50  10.808|   1:30  39.231|   2:10  11.544|   2:50   7.495|   3:30
       0:20   6.266|   1:00  15.223|   1:40  22.869|   2:20  10.093|   3:00   6.939|   3:40
       0:30   7.210|   1:10  31.032|   1:50  16.861|   2:30   9.012|   3:10   6.472|   3:50
       0:40   8.582|   1:20 161.254|   2:00  13.614|   2:40   8.171|   3:20   6.073|   4:00

 -------------------------------------------------------------------------------------------
 R0005:C00003-------------------------------------------------------------------------------
 * SITE (POST1 - Controlled Area)
 --------------------------
 | CALIB STANDHYD         |   Area    (ha)=    2.74
 | 01:POST1      DT= 1.00 |   Total Imp(%)=   69.00   Dir. Conn.(%)=   59.00
 --------------------------
                               IMPERVIOUS    PERVIOUS (i)
      Surface Area     (ha)=       1.89          .85
      Dep. Storage     (mm)=       2.00         5.00
      Average Slope     (%)=       3.50        33.30
      Length            (m)=     300.00         6.00
      Mannings n           =       .013         .250

      Max.eff.Inten.(mm/hr)=     161.25       151.92
                 over (min)        3.00         4.00
      Storage Coeff.  (min)=       2.80 (ii)    3.62 (ii)
      Unit Hyd. Tpeak (min)=       3.00         4.00
```

```
      Unit Hyd. peak  (cms)=        .39          .30
                                                              *TOTALS*
      PEAK FLOW       (cms)=        .70          .30           .990 (iii)
      TIME TO PEAK    (hrs)=       1.33         1.35          1.333
      RUNOFF VOLUME    (mm)=      68.93        43.47         58.488
      TOTAL RAINFALL   (mm)=      70.93        70.93         70.926
      RUNOFF COEFFICIENT   =        .97          .61           .825

        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN* =  84.0    Ia = Dep. Storage  (Above)
       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

 -------------------------------------------------------------------------------------------
 R0005:C00004-------------------------------------------------------------------------------
 * EXTERNAL (Routed through SWM Facility)
 --------------------------
 | CALIB NASHYD           |   Area    (ha)=   11.940   Curve Number   (CN)= 83.00
 | 02:EXT        DT= 1.00 |   Ia      (mm)=    6.800   # of Linear Res.(N)=  3.00
 --------------------------   U.H. Tp(hrs)=     .240

      Unit Hyd Qpeak  (cms)=    1.900

      PEAK FLOW       (cms)=    1.168 (i)
      TIME TO PEAK    (hrs)=    1.567
      DURATION        (hrs)=    5.667, (dddd|hh:mm:)=   0|05:40
      AVERAGE FLOW    (cms)=     .207
      RUNOFF VOLUME    (mm)=   35.404
      TOTAL RAINFALL   (mm)=   70.926
      RUNOFF COEFFICIENT   =     .499

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

 -------------------------------------------------------------------------------------------
 R0005:C00005-------------------------------------------------------------------------------
 * TOTAL FLOW TO SIDEROAD 15 CROSS CULVERT (POST1 CONTROLLED + EXT)
 -----------------------
 | ADD HYD              |
 | 03:POST1+EXT         |   ID:NHYD            AREA     QPEAK    TPEAK      R.V.     DWF
 -----------------------                       (ha)     (cms)    (hrs)      (mm)   (cms)
                       ID 1 01:POST1          2.740      .990    1.333    58.488    .000
                      +ID 2 02:EXT           11.940     1.168    1.567    35.404    .000
                      ==============================================================
                      SUM   03:POST1+EXT     14.680     1.506    1.367    39.713    .000

    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

 -------------------------------------------------------------------------------------------
 R0005:C00006-------------------------------------------------------------------------------
 * SWM Facility
 -----------------------
 |  ROUTE RESERVOIR -> |    Requested routing time step =  1.0 min.
 |  IN>03:POST1+EXT    |
```

```
| OUT<04:SWM Facili   | =========================  OUTLFOW STORAGE TABLE  =================
----------------------- OUTFLOW   STORAGE| OUTFLOW   STORAGE| OUTFLOW   STORAGE| OUTFLOW
                          (cms)   (ha.m.)|   (cms)   (ha.m.)|   (cms)   (ha.m.)|   (cms)
                           .000 .0000E+00|    .010 .1292E-01|    .065 .4128E-01|   1.071 .
                           .002 .6300E-03|    .010 .1442E-01|    .108 .4430E-01|   1.184 .
                           .003 .1310E-02|    .010 .1601E-01|    .159 .4743E-01|   1.308 .
                           .004 .2050E-02|    .011 .1769E-01|    .217 .5067E-01|   1.445 .
                           .005 .2840E-02|    .011 .1946E-01|    .281 .5403E-01|   1.594 .
                           .006 .3680E-02|    .011 .2133E-01|    .351 .5751E-01|   1.759 .
                           .006 .4590E-02|    .012 .2329E-01|    .425 .6112E-01|   2.020 .
                           .007 .5570E-02|    .012 .2535E-01|    .505 .6486E-01|   2.383 .
                           .007 .6610E-02|    .012 .2777E-01|    .589 .6872E-01|   2.840 .
                           .008 .7720E-02|    .013 .3027E-01|    .677 .7272E-01|   3.391 .
                           .008 .8910E-02|    .013 .3287E-01|    .769 .7686E-01|   4.041 .
                           .009 .1017E-01|    .013 .3557E-01|    .866 .8113E-01|   4.792 .
                           .009 .1150E-01|    .032 .3837E-01|    .966 .8555E-01|   5.649 .

     ROUTING RESULTS             AREA     QPEAK     TPEAK       R.V.
     ----------------------      (ha)     (cms)     (hrs)       (mm)
     INFLOW > 03:POST1+EXT     14.680     1.506     1.367     39.713
    OUTFLOW < 04:SWM Facili    14.680     1.312     1.633     39.712

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=   87.069
                   TIME SHIFT OF PEAK FLOW         (min)=    16.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=.9983E-01

-------------------------------------------------------------------------------------------
R0005:C00007-------------------------------------------------------------------------------
* SITE (POST2 - Uncontrolled Area)
--------------------------
| CALIB STANDHYD         |   Area    (ha)=     .89
| 05:POST2      DT= 1.00 |   Total Imp(%)=   21.00   Dir. Conn.(%)=   10.50
--------------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .19          .70
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       6.00        11.10
     Length            (m)=     120.00        50.00
     Mannings n          =        .013         .250

     Max.eff.Inten.(mm/hr)=     161.25       116.15
                over (min)        1.00         6.00
     Storage Coeff.  (min)=       1.38 (ii)    5.92 (ii)
     Unit Hyd. Tpeak (min)=       1.00         6.00
     Unit Hyd. peak  (cms)=        .88          .19
                                                          *TOTALS*
     PEAK FLOW       (cms)=        .04          .16           .182 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.38          1.333
     RUNOFF VOLUME    (mm)=      68.92        40.51         43.489
     TOTAL RAINFALL   (mm)=      70.93        70.93         70.926
     RUNOFF COEFFICIENT   =        .97          .57           .613

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
```

```
           CN* =  84.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------------------
R0005:C00008-------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------
R0005:C00002-------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------
R0005:C00002-------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------
R0005:C00002-------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------
R0005:C00002-------------------------------------------------------------------------------
  ** END OF RUN :    4

*******************************************************************************************




--------------------
| START            | Project  dir.:C:\Temp\15-319\PR\4-hour_Chic\
-------------------- Rainfall dir.:C:\Temp\15-319\PR\4-hour_Chic\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 0006
    NSTORM=   1
           #  1=12regtim.o89
-------------------------------------------------------------------------------------------
R0006:C00002-------------------------------------------------------------------------------
*#*****************************************************************************
*#  Project Name: [Mansfield Ski Club]    Project Number: [15-319]
*#  Date        : 07-31-2017
*#  Modeller    : [J. Lightheart]
*#  Company     : WMI & Associates Ltd.
*#  License #   :  2880720
*#*****************************************************************************
*
* Post-Development Condition - Mansfield Ski Club
*
-------------------------------------------------------------------------------------------
R0006:C00002-------------------------------------------------------------------------------
--------------------
| READ STORM       |  Filename: C:\Temp\15-319\PR\4-hour_Chic\12regtim.o89
| Ptotal= 193.00 mm|  Comments: TIMMINS REGIONAL STORM (12-hour)
--------------------
      TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME
     hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm
      1:00  15.000|   3:00  10.000|   5:00   5.000|   7:00  43.000|   9:00  23.000|  11:00
      2:00  20.000|   4:00   3.000|   6:00  20.000|   8:00  20.000|  10:00  13.000|  12:00
```

```
-------------------------------------------------------------------------------------------
R0006:C00003-------------------------------------------------------------------------------
* SITE (POST1 - Controlled Area)
--------------------------
| CALIB STANDHYD         |   Area    (ha)=    2.74
| 01:POST1      DT= 1.00 |   Total Imp(%)=   69.00   Dir. Conn.(%)=   59.00
--------------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.89         .85
     Dep. Storage     (mm)=       2.00        5.00
     Average Slope     (%)=       3.50       33.30
     Length            (m)=     300.00        6.00
     Mannings n           =       .013        .250

     Max.eff.Inten.(mm/hr)=      43.00       53.33
                over (min)        5.00        6.00
     Storage Coeff.  (min)=       4.75 (ii)    6.00 (ii)
     Unit Hyd. Tpeak (min)=       5.00        6.00
     Unit Hyd. peak  (cms)=        .23         .19
                                                           *TOTALS*
     PEAK FLOW       (cms)=        .19         .13           .318 (iii)
     TIME TO PEAK    (hrs)=       7.00        7.00          7.000
     RUNOFF VOLUME    (mm)=     190.99      158.56        177.702
     TOTAL RAINFALL   (mm)=     193.00      193.00        193.000
     RUNOFF COEFFICIENT   =        .99         .82           .921

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  84.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------------------
R0006:C00004-------------------------------------------------------------------------------
* EXTERNAL (Routed through SWM Facility)
--------------------------
| CALIB NASHYD           |   Area    (ha)=   11.940   Curve Number   (CN)= 83.00
| 02:EXT        DT= 1.00 |   Ia      (mm)=    6.800   # of Linear Res.(N)=  3.00
--------------------------   U.H. Tp(hrs)=     .240

     Unit Hyd Qpeak  (cms)=    1.900

     PEAK FLOW       (cms)=    1.239 (i)
     TIME TO PEAK    (hrs)=    7.017
     DURATION        (hrs)=   13.667, (dddd|hh:mm:)=   0|13:40
     AVERAGE FLOW    (cms)=     .353
     RUNOFF VOLUME    (mm)=  145.537
     TOTAL RAINFALL   (mm)=  193.000
     RUNOFF COEFFICIENT   =     .754

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

-------------------------------------------------------------------------------------------
R0006:C00005-------------------------------------------------------------------------------
```

```
* TOTAL FLOW TO SIDEROAD 15 CROSS CULVERT (POST1 CONTROLLED + EXT)
------------------------
| ADD HYD               |
| 03:POST1+EXT          |   ID:NHYD           AREA     QPEAK    TPEAK      R.V.     DWF
------------------------                      (ha)     (cms)    (hrs)      (mm)   (cms)
                      ID 1 01:POST1          2.740      .318    7.000   177.702    .000
                     +ID 2 02:EXT           11.940     1.239    7.017   145.537    .000
                     ===============================================================
                     SUM   03:POST1+EXT     14.680     1.556    7.000   151.541    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------------------
R0006:C00006-------------------------------------------------------------------------------
* SWM Facility
-----------------------
|  ROUTE RESERVOIR -> |    Requested routing time step =  1.0 min.
|  IN>03:POST1+EXT    |
| OUT<04:SWM Facili   | =========================  OUTLFOW STORAGE TABLE  =================
----------------------- OUTFLOW   STORAGE| OUTFLOW   STORAGE| OUTFLOW   STORAGE| OUTFLOW
                          (cms)   (ha.m.)|   (cms)   (ha.m.)|   (cms)   (ha.m.)|   (cms)
                           .000 .0000E+00|    .010 .1292E-01|    .065 .4128E-01|   1.071 .
                           .002 .6300E-03|    .010 .1442E-01|    .108 .4430E-01|   1.184 .
                           .003 .1310E-02|    .010 .1601E-01|    .159 .4743E-01|   1.308 .
                           .004 .2050E-02|    .011 .1769E-01|    .217 .5067E-01|   1.445 .
                           .005 .2840E-02|    .011 .1946E-01|    .281 .5403E-01|   1.594 .
                           .006 .3680E-02|    .011 .2133E-01|    .351 .5751E-01|   1.759 .
                           .006 .4590E-02|    .012 .2329E-01|    .425 .6112E-01|   2.020 .
                           .007 .5570E-02|    .012 .2535E-01|    .505 .6486E-01|   2.383 .
                           .007 .6610E-02|    .012 .2777E-01|    .589 .6872E-01|   2.840 .
                           .008 .7720E-02|    .013 .3027E-01|    .677 .7272E-01|   3.391 .
                           .008 .8910E-02|    .013 .3287E-01|    .769 .7686E-01|   4.041 .
                           .009 .1017E-01|    .013 .3557E-01|    .866 .8113E-01|   4.792 .
                           .009 .1150E-01|    .032 .3837E-01|    .966 .8555E-01|   5.649 .

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     ----------------------     (ha)     (cms)     (hrs)       (mm)
     INFLOW > 03:POST1+EXT     14.680     1.556     7.000    151.541
    OUTFLOW < 04:SWM Facili    14.680     1.540     7.033    151.540

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=   98.975
                   TIME SHIFT OF PEAK FLOW         (min)=     2.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=.1080E+00

-------------------------------------------------------------------------------------------
R0006:C00007-------------------------------------------------------------------------------
* SITE (POST2 - Uncontrolled Area)
--------------------------
| CALIB STANDHYD         |   Area    (ha)=     .89
| 05:POST2      DT= 1.00 |   Total Imp(%)=   21.00   Dir. Conn.(%)=   10.50
--------------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .19         .70
```

```
           Dep. Storage     (mm)=       2.00         5.00
           Average Slope     (%)=       6.00        11.10
           Length            (m)=     120.00        50.00
           Mannings n           =       .013         .250

           Max.eff.Inten.(mm/hr)=      43.00        44.82
                      over (min)        2.00         9.00
           Storage Coeff.  (min)=       2.33 (ii)    8.99 (ii)
           Unit Hyd. Tpeak (min)=       2.00         9.00
           Unit Hyd. peak  (cms)=        .50          .13
                                                                 *TOTALS*
           PEAK FLOW       (cms)=        .01          .09           .098 (iii)
           TIME TO PEAK    (hrs)=       6.98         7.00          7.000
           RUNOFF VOLUME    (mm)=     191.00       153.77        157.677
           TOTAL RAINFALL   (mm)=     193.00       193.00        193.000
           RUNOFF COEFFICIENT   =        .99          .80           .817

             (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
                 CN* =  84.0    Ia = Dep. Storage  (Above)
            (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
           (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

      -------------------------------------------------------------------------------------------
      R0006:C00008-------------------------------------------------------------------------------
      -------------------------------------------------------------------------------------------
      R0006:C00002-------------------------------------------------------------------------------
      -------------------------------------------------------------------------------------------
      R0006:C00002-------------------------------------------------------------------------------
      -------------------------------------------------------------------------------------------
      R0006:C00002-------------------------------------------------------------------------------
      -------------------------------------------------------------------------------------------
      R0006:C00002-------------------------------------------------------------------------------
      -------------------------------------------------------------------------------------------
      R0006:C00002-------------------------------------------------------------------------------
      --------------------
      | FINISH           |
      --------------------
      -------------------------------------------------------------------------------------------
      *******************************************************************************************
           WARNINGS / ERRORS / NOTES
           -------------------------
         Simulation ended on 2020-12-09     at 16:05:29
      ===========================================================================================
```

APPENDIX E

TRAFFIC IMPACT OPINION LETTER

WMI & Associates Limited
119 Collier Street, Barrie, Ontario, L4M 1H5
P (705) 797-2027 F (705)797-2028

August 9, 2017
Revised December 10, 2020

Via: Email

Township of Mulmur
758070 2nd Line East
Mulmur, Ontario
L9V 0G8

Attention: **Tracey Atkinson**
CAO/Deputy Clerk/Planner

Re: **Mansfield Ski Club**
Community of Mansfield, Township of Mulmur
Traffic Impact Opinion
WMI File No.: 15-319

Dear Tracey,

The following provides our opinion of the traffic impact associated with the proposed development within the existing Mansfield Ski Club (MSC) that is located in the Township of Mulmur, Ontario.

Overview

The area of MSC that is proposed to be re-developed is accessed from the Ski Club's existing main entrance on the 15th Sideroad, approximately 0.7km west of the Airport Road and 15th Sideroad intersection.

The development is to comprise 91 residential units, as well as office and personal business spaces and an expanded parking lot; all of which is to reside within existing site boundaries. It is understood that the purpose of the proposed development is to provide additional amenities and offer on-site accommodation for the existing members.

Existing Conditions:

Access to MSC's main complex is off of 15th Sideroad, at the south end of the Club. The existing complex currently contains a main chalet building, an administration building, general manager office building, ski house, and a large gravel parking lot. From previous planning studies prepared for MSC, it has been identified that the observed parking capacity is approximately 356 vehicles as referenced from the Mansfield Ski Club Functional Assessment and Recommendations, Winter 2008/09 report, prepared by Stempski Kelly Associates Inc. This report further concludes that the main parking lot is adequate to support the demand during the peak ski season.

More recent data obtained from MSC reveals that their membership levels have remained within a consistent range over the past 15 years, and that these membership levels are constrained by hill capacity- as determined by lifts and hill space.

It is further noted that there are local members who reside adjacent to MSC's main complex and do not drive to the facility, and that not all of the Club's members and their families visit the facility at any given time.

Overall, it has been observed that the existing parking lot has always been sufficient in accommodating the demands during peak ski season.

Refer to the **Figure 1** for an illustration of the main complex's site layout.

Proposed Conditions:

The proposed development within the main complex is to be comprised of 91 residential units in the form of lofts and stacked townhomes, as well as ground floor office and personal business space. The existing parking lot is proposed to be re-developed and additional parking will be situated to the south and east of the existing parking lot. In total, the proposed parking lot will accommodate 371 vehicles. In addition to a marginal increase in capacity (from the observed 356 spaces under existing conditions), the new parking lot will also provide formalized vehicular circulation and improved parking space efficiency by delineating the internal laneways and parking stalls.

It should be noted that the existing site access onto 15th Sideroad is proposed to be maintained.

Refer to the **Figure 2** for an illustration of the proposed development within the main complex of MSC.

Vehicular Trip Impact

It is understood that other factors that could otherwise increase membership and associated vehicular trips such as lift capacity and hill space are not proposed to be altered, but rather the primary intent of the project is to provide additional amenities for the existing members.

The residential units are intended to offer on-site accommodation for members, which will inherently reduce the amount of vehicular trips in to and out of the facility. The remaining building space is intended to serve as accessory amenities to MSC's members. Any additional vehicular trips made by employees to these facilities are expected to be negligible, and furthermore they would be more than offset by the anticipated reduction in trips due to the onsite residential accommodations as noted previously.

It is expected that travel demand patterns and the timing of peak hourly trips may evolve from current peak ski season conditions as a result of the proposed amenities and onsite accommodations, however any changes in this regard will be negligible. As a result, and since the overall volume of vehicular trips is not anticipated to increase from existing conditions, it is our opinion that the proposed re-development of The Mansfield Ski Club can be accommodated by the existing road network without adverse impacts.

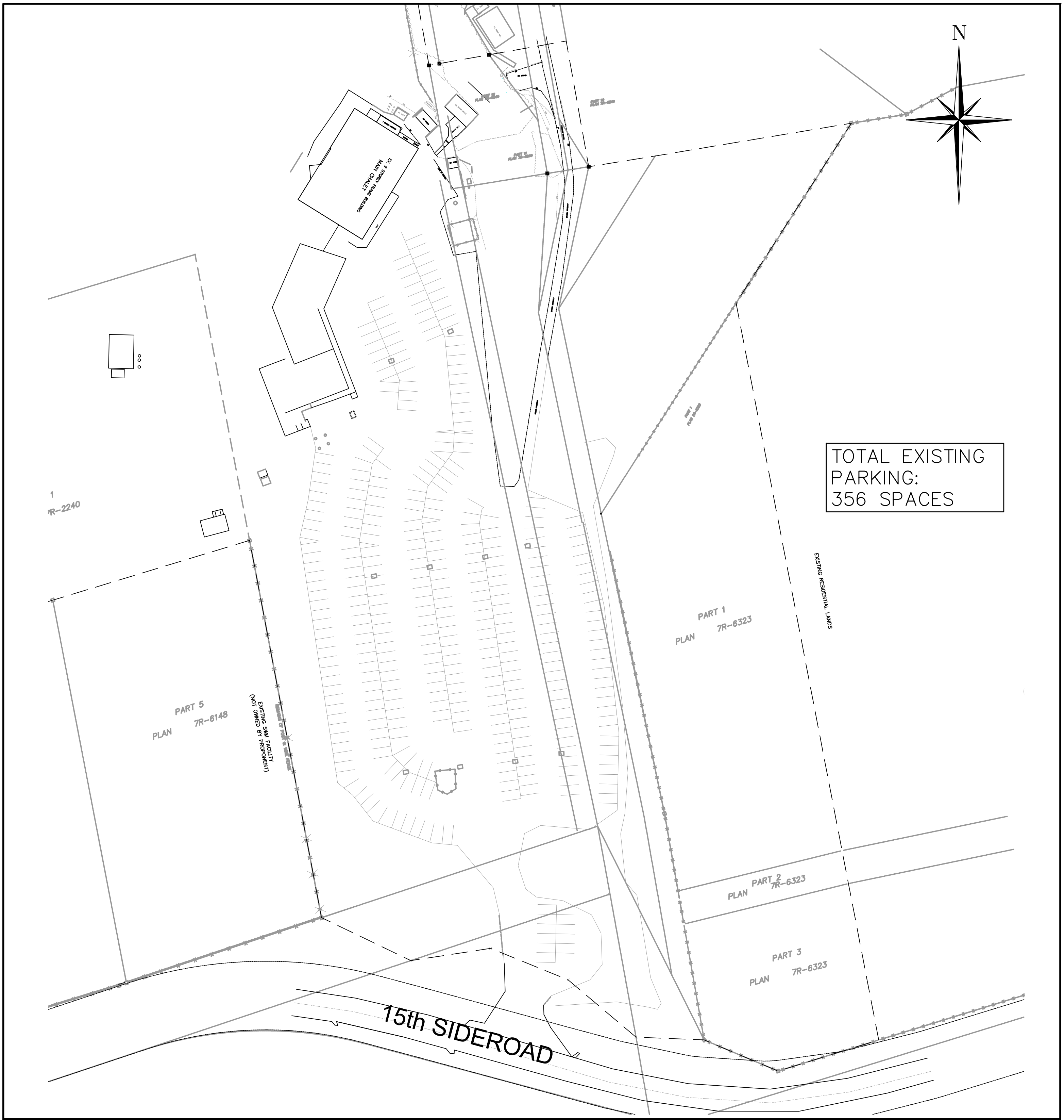
Should you have any questions or require additional information, please contact the undersigned.

Yours truly,

WMI & Associates Limited

Jonathan Reimer, P. Eng.

\\WMI-SERVER\wmi-server\Data\Projects\2015\15-319\Design\Reports\TIS\201120_Traffic_Impact.docx



Drawing Title

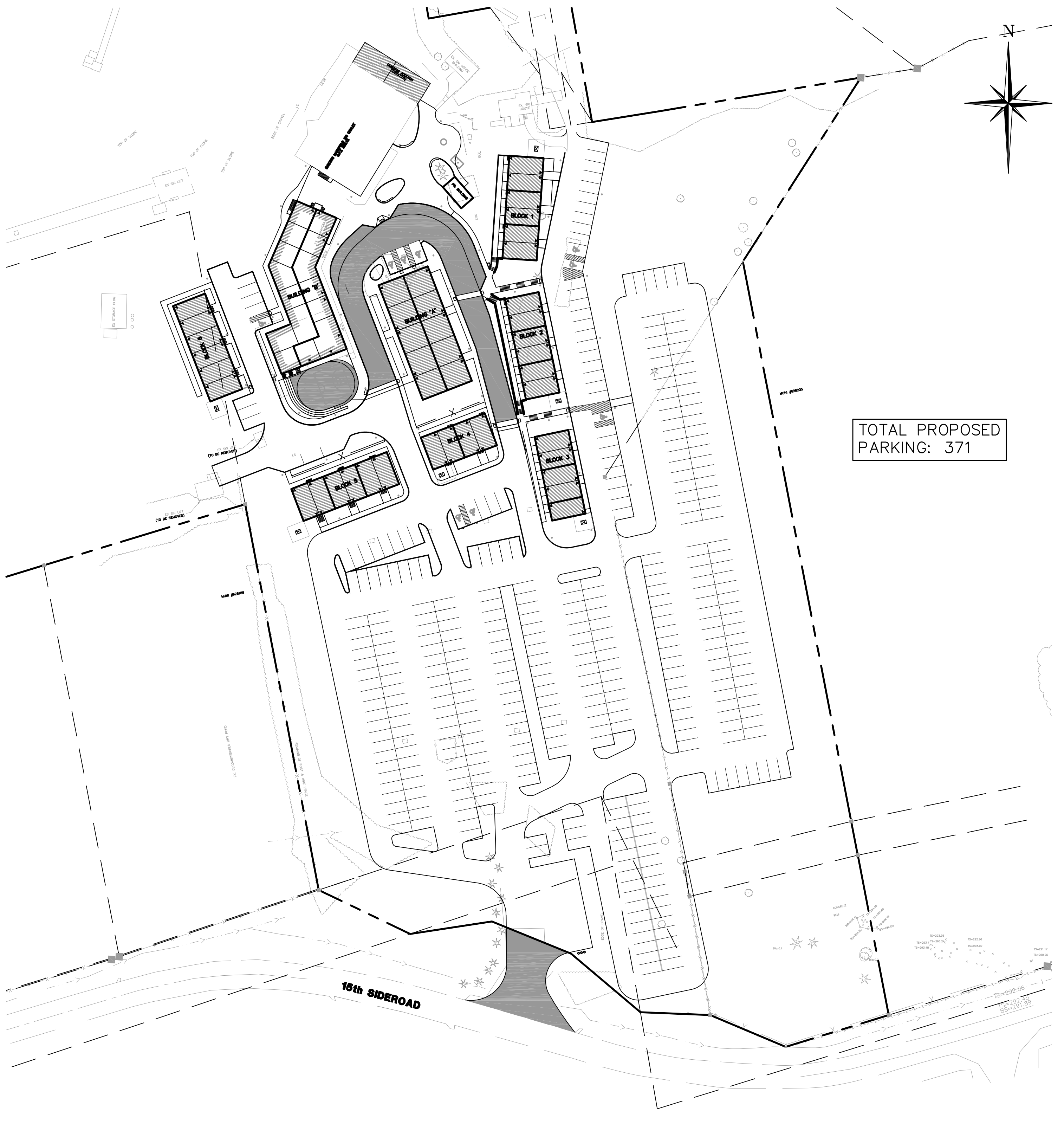
EXISTING SKI CLUB SITE PLAN

Project Title

MANSFIELD SKI CLUB

WMI & Associates Limited
119 Collier Street
Barrie, Ontario
L4M 1H5
705-797-2027
www.wmiengineering.ca

Drawn By	Checked By	Figure No.
JR	JWL	FIG1
Scale 1:1500	Project No. 15–319	



Drawing Title

PROPOSED SKI CLUB SITE PLAN

Project Title

MANSFIELD SKI CLUB

WMI & Associates Limited
119 Collier Street
Barrie, Ontario
L4M 1H5
705-797-2027
www.wmiengineering.ca

Drawn By	Checked By	Figure No.
JR	JWL	FIG2
Scale N.T.S.	Project No. 15–319	

\\WMI–SERVER\wmi–server\Data\Projects\2015\15–319\CAD\WMI\Issue_No2\201118_Baseplan_15–319.dwg, TIS–FIG2, 1:25.4

APPENDIX F

EXISTING SEWAGE TREATMENT SYSTEM ANALYSIS

WMI & Associates Limited
119 Collier Street, Barrie, Ontario, L4M 1H5
P (705) 797-2027 F (705)797-2028

January 20, 2016

Via: Email

County of Dufferin
55 Zina Street,
Orangeville, Ontario
L9W 1E5

Attention: **Rita Geurts, M.A.A.T.O., C.B.C.O.**
Building Inspector/Plans Examiner

Re: **Ski House Development at the Mansfield Ski Club**
Sewage Treatment System Analysis
WMI File No. 15-319

Dear Rita,

Based on our recent emailed correspondence, please find enclosed documentation supporting the use of the existing sewage treatment system for the proposed Ski House development at the Mansfield Ski Club (MSC) in Mansfield, Ontario.

Based on the background information provided to us and our correspondence with staff at the MSC, it is our understanding that the current on-site sewage treatment system consists of a 150mm diameter gravity sanitary sewer which collects the on-site sewage from both the existing 2-storey service/operations building and the 2-storey main chalet building. The 150mm diameter sanitary sewer drains from the main chalet building, southeast to an existing sewage pump chamber. The existing pump chamber is located approximately 20m east of the main chalet at the east limit of the gravel parking area and just west of the top of bank of the existing slope located between the gravel parking area and the existing gravel driveway which provides access to existing chalets located northeast of the MSC's main chalet building. From the existing pump chamber, the sewage is lifted and pumped into a Northern Purification System (NPS), model GC-2. Lastly from the GC-2 unit, the sewage is pumped southeast approximately 40m to an existing leaching bed located immediately east of the existing gravel driveway which provides access to the existing chalets located northeast of the MSC's main chalet building.

To determine the total daily sewage flow delivered to the sewage treatment system at the above mentioned site, the daily recorded water consumption records as well as the previously analyzed NPS systems batch meter records were analyzed. In addition to the review and analysis of the above mentioned data provided by the MSC, a site visit by WMI & Associates Limited on November 26, 2015 with Dave Morrison of the MSC present, was completed to confirm the existing layout and equipment is consistent with the background information provided by the client.

The MSC operates seasonally, typically between late December and early April. The MSC monitors and records daily during times of operation, the water consumption for each of its sources of water. The MSC primary domestic water supply is provided via a drilled well located just north of the convergence between the east limit of the existing gravel parking area and the existing driveway which services the chalets located northeast of the MSC's main chalet building. One other source of potable water which is rarely used, is an existing bored well located north of the MSC's main chalet building. Lastly, the remaining water source which is only used in the existing water closets and urinals, is provided by the Pine River located immediately northeast of the MSC. Each water source is metered and recorded by the MSC. This information was provided to WMI & Associates Limited for the months of December 2014 to March 2015 and was analyzed to determine the total daily sewage flows experienced at the MSC during the most recent ski season in order to confirm actual sewage flow values experienced by the sewage treatment system. It was determined based on the above mentioned water consumption records for December 2014 to March 2015, that the average total daily sewage flow produced at the MSC over this period of operation was 6.6m^3/day (6,600L/day). Refer to the attached Water Consumption Records Analysis spreadsheet provided herein for additional details.

In addition to the more recent water consumption records analysis provided above, please find attached supporting documentation from NPS which reports that based on the systems batch meter reading, during the ski season from December 2004 to April 2005, the average total daily sewage flow was approximately 7,350L/day.

Based on a design flow of 1,600L/day for a 3 bedroom dwelling as per the Ontario Building Code (OBC), Section 8.2.1.3. Sewage System Design Flows, Table 8.2.1.3.A, Residential Occupancy, and the most recent water consumption log records as noted above, the anticipated total daily sewage flow experienced by the existing sewage treatment system at the MSC including the development of the proposed Ski House is 8,200L/day. Considering the 24-hour rated capacity of the existing sewage treatment system which is 22,700L/day as well as its reserve volume of 9,100L and the additional surge tank located immediately east of the NPS system of 18,000L, the existing sewage treatment system is considered more than capable of providing the necessary treatment for all sewage flows generated in the post-development condition.

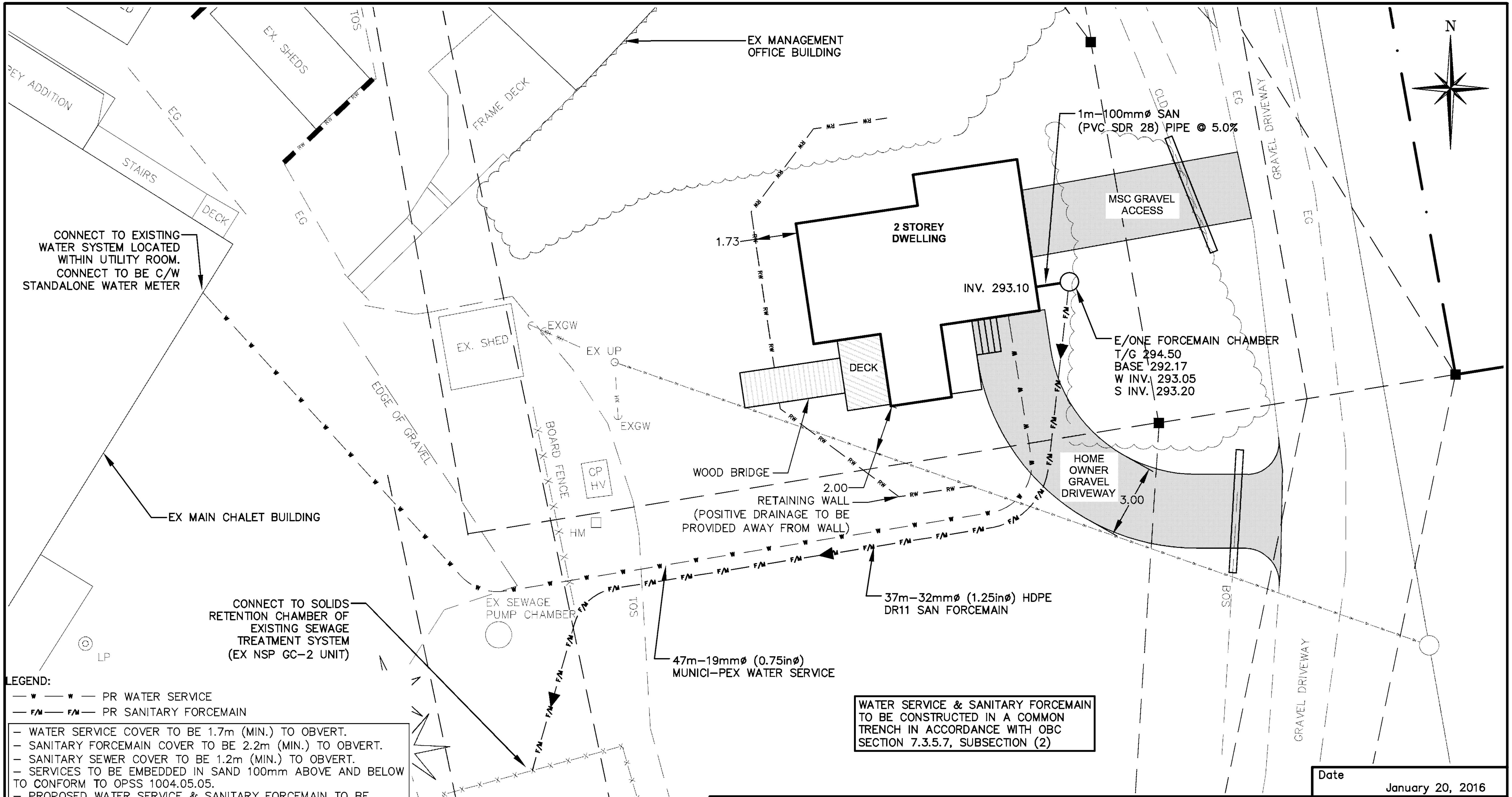
We trust the written confirmation provided above sufficiently addresses your requests outlined within our emailed correspondence dated January 7, 2016, but should you have any questions or require additional information please do not hesitate to contact the undersigned.

Yours truly,

WMI & Associates Limited

Jeremy W. Lightheart, P. Eng.

\\Wmi-server\wmi-server\Data\Projects\2015\15-319\Design\Reports\160120-Sewage_Treatment_Analysis-Ski_House.docx



WATER SERVICE & SANITARY FORCEMAIN TO BE CONSTRUCTED IN A COMMON TRENCH IN ACCORDANCE WITH OBC SECTION 7.3.5.7, SUBSECTION (2)

LEGEND:

— W — W — PR WATER SERVICE

— F/M — F/M — PR SANITARY FORCEMAIN

- WATER SERVICE COVER TO BE 1.7m (MIN.) TO OBVERT.
- SANITARY FORCEMAIN COVER TO BE 2.2m (MIN.) TO OBVERT.
- SANITARY SEWER COVER TO BE 1.2m (MIN.) TO OBVERT.
- SERVICES TO BE EMBEDDED IN SAND 100mm ABOVE AND BELOW TO CONFORM TO OPSS 1004.05.05.
- PROPOSED WATER SERVICE & SANITARY FORCEMAIN TO BE PRESSURE TESTED AS PER CITY STANDARDS PRIOR TO COMMISSIONING.
- WATER SERVICE & SANITARY FORCEMAIN TO BE PLACED WITH A STEADY GRADIENT (i.e. NO UP/DOWN BENDS) TO REDUCE THE POSSIBILITY OF AIR–LOCKING THE SYSTEMS.
- CAUTION TAPE TO BE PLACED 300mm ABOVE THE FORCEMAIN TO IDENTIFY IT AS A SEWAGE LINE.
- CONTRACTOR IS TO CONFIRM THE LOCATION OF ALL EXISTING UTILITIES PRIOR TO CONSTRUCTION. ANY DISCREPANCIES FOUND ARE TO BE REVIEWED WITH THE ENGINEER PRIOR TO CONSTRUCTION.
- REFER TO ARCHITECTURAL PLANS PREPARED BY KRA ARCHITECTS FOR INTERNAL BUILDING ELEVATIONS

Date January 20, 2016

Drawing Title

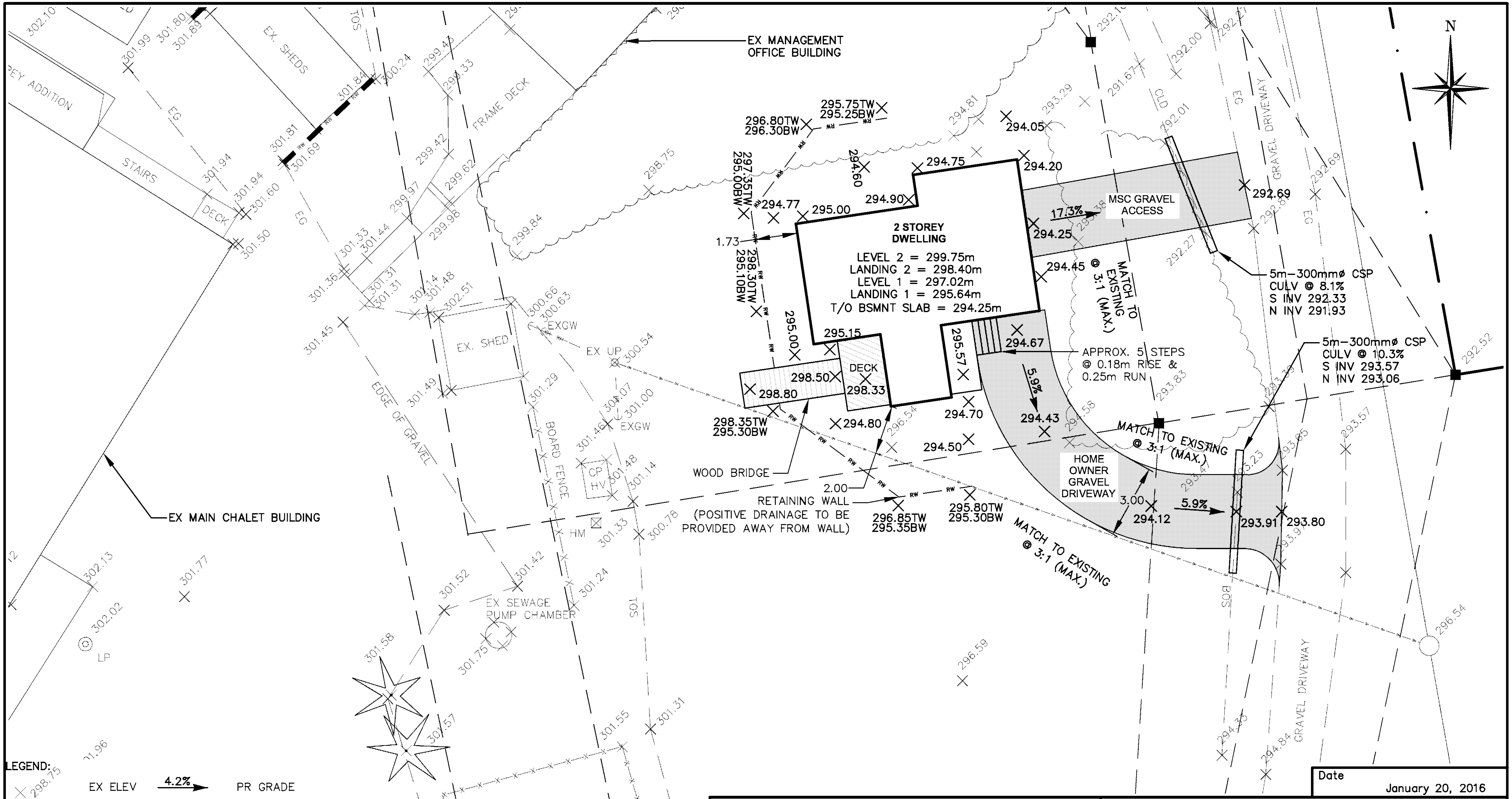
SKI HOUSE
SERVICING PLAN

Project Title

MANSFIELD SKI CLUB

WMI & Associates Limited
119 Collier Street
Barrie, Ontario
L4M 1H5
705-797-2027
www.wmiengineering.ca

Drawn By	Checked By	Figure No.
MM	JWL	SH-GEN
Scale 1:150	Project No. 15–319	



LEGEND:

× 298.75	EX ELEV	4.2% →	PR GRADE
×296.00	PR ELEV	—·—>—·—>	PR SWALE
×296.00TW	PR TOP OF RETAINING WALL ELEV		
×296.00BW	PR BOTTOM OF RETAINING WALL ELEV		

- ALL ROOF DRAINAGE TO BE DIRECTED TO THE EAST SIDE OF THE BUILDING
- ENSURE 1.2m FROST COVER OVER ALL FOOTINGS
- ENSURE 0.15m FREEBOARD BETWEEN TOP OF FOUNDATION WALL AND ADJACENT GROUND GRADE
- ENSURE POSITIVE GRADE IS PROVIDED AWAY FROM THE BUILDING FOUNDATION
- REFER TO ARCHITECTURAL PLANS PREPARED BY KRA ARCHITECTS FOR INTERNAL BUILDING ELEVATIONS

Date January 20, 2016

Drawing Title

SKI HOUSE
LOT GRADING PLAN

Project Title

MANSFIELD SKI CLUB

WMI & Associates Limited
119 Collier Street
Barrie, Ontario
L4M 1H5
705-797-2027
www.wmiengineering.ca

Drawn By	Checked By	Figure No.
MM	JWL	SH-LGR
Scale 1:150	Project No. 15-319	

WATER CONSUMPTION LOG RECORDS - MANSFIELD SKI CLUB

	DEC 2014				JAN 2015				FEB 2015				MARCH 2015			
Days of the Month	DRILLED WELL Flow Meter Reading (m^3)	BORED WELL Flow Meter Reading (m^3)	RIVER Flow Meter Reading (m^3)	Daily Flow (m^3/day)	DRILLED WELL Flow Meter Reading (m^3)	BORED WELL Flow Meter Reading (m^3)	RIVER Flow Meter Reading (m^3)	Daily Flow (m^3/day)	DRILLED WELL Flow Meter Reading (m^3)	BORED WELL Flow Meter Reading (m^3)	RIVER Flow Meter Reading (m^3)	Daily Flow (m^3/day)	DRILLED WELL Flow Meter Reading (m^3)	BORED WELL Flow Meter Reading (m^3)	RIVER Flow Meter Reading (m^3)	Daily Flow (m^3/day)
1								6.35				6.32	1695.1	1749.5	4018.7	13.50
2					1527.3	1746.5	3759	6.35				6.32				4.50
3					1529.7	1746.5	3765.5	8.90				6.32				4.50
4								4.73				6.32	1699.6	1749.5	4027.7	4.50
5								4.73	1616.5	1747.8	3909.7	6.32	1701.5	1750	4030.3	5.00
6								4.73	1621.2	1748.3	3913	8.50	1703.3	1750	4033.2	4.70
7								4.73	1625.9	1748.3	3917.5	9.20	1706.7	1750	4038.1	8.30
8								4.73	1630.9	1748.3	3928.5	16.00	1709.3	1750	4045.7	10.20
9					1540.2	1747	3782.9	4.73				4.50				5.23
10								6.16				4.50				5.23
11								6.16	1635.8	1748.3	3937.1	4.50	1712	1755.6	4053.1	5.23
12								6.16	1638.7	1748.3	3938.8	4.60	1712.9	1756.6	4055.5	4.30
13								6.16	1640.1	1748.3	3941.6	4.20	1713.7	1757.5	4058.7	4.90
14								6.16	1642.7	1748.3	3944.8	5.80	1715.4	1758.5	4061.1	5.10
15								6.16	1648.2	1748.3	3955.5	16.20	1716.9	1760.3	4064.4	6.60
16					1555.1	1747.3	3810.8	6.16	1652.1	1748.3	3960.7	9.10				7.05
17								12.10				6.20	1719.7	1763.6	4072.4	7.05
18					1564.4	1747.3	3825.7	12.10				6.20	1720.8	1764.7	4075.5	5.30
19								4.63	1661.2	1748.3	3970.2	6.20	1722.1	1766.2	4079.2	6.50
20	1500	1745	3720	-				4.63	1664	1748.3	3971.9	4.50	1723.6	1767.5	4083.5	7.10
21	1502	1745	3723.2	5.20	1568.9	1747.8	3834.6	4.63	1667.9	1748.3	3975.2	7.20	1725.1	1768.8	4087	6.30
22	1505.1	1745.6	3725.3	5.80	1571.3	1747.8	3839.9	7.70	1673.5	1748.3	3986	16.40	1726.2	1773.3	4093.3	11.90
23	1507.3	1746.2	3726.6	4.10	1573.7	1747.8	3842.4	4.90				5.07				1.90
24				1.17	1576.1	1747.8	3846.8	6.80				5.07				1.90
25				1.17	1582.3	1747.8	3858.4	17.80	1678.8	1748.3	3995.9	5.07				1.90
26	1509.9	1746.2	3727.5	1.17				4.97	1681.4	1749.5	3999.7	7.60				1.90
27	1511.2	1746.2	3728.7	2.50				4.97	1683.7	1749.5	4003.1	5.70	1730.5	1775.3	4096.5	1.90
28	1513.9	1746.2	3733.7	7.70	1587.8	1747.8	3867.8	4.97				13.50				
29	1517.2	1746.5	3738.7	8.60				16.35								
30	1519.8	1746.5	3745.6	9.50	1600.2	1747.8	3888.1	16.35								
31	1522.1	1746.5	3751.5	8.20				6.32								
Monthly MAX				9.50				17.80				16.40				13.50
Monthly MEAN				5.01				7.17				7.41				5.65
Monthly MIN				1.17				4.63				4.20				1.90

2014/2015 DAYS IN OPERATION **97**

MAX	**17.80**	**m^3/day**
MEAN	**6.57**	**m^3/day**
MIN	**1.17**	**m^3/day**

NOTES: - For days with no daily flow meter reading, the following flow meter reading has been assumed to be averaged over the previous unrecorded days.

8.2.1.3. Sewage System Design Flows

(1) For *residential occupancies*, the total daily design *sanitary sewage* flow shall be at least the value in Column 2 as determined from Table 8.2.1.3.A. (See Appendix A.)

(2) For all other *occupancies*, the total daily design *sanitary sewage* flow shall be at least the value in Column 2 as determined from Table 8.2.1.3.B. (See Appendix A.)

(3) Where a *building* contains more than one establishment, the total daily design *sanitary sewage* flow shall be the sum of the total daily design *sanitary sewage* flow for each establishment.

(4) Where an *occupancy* is not listed in Table 8.2.1.3.B., the highest of metered flow data from at least 3 similar establishments shall be acceptable for determining the total daily design *sanitary sewage* flow.

Table 8.2.1.3.A.
Residential Occupancy
Forming Part of Sentence 8.2.1.3.(1)

Residential Occupancy	Volume, litres
Apartments, Condominiums, Other Multi-family Dwellings - per person(1)	275
Boarding Houses	
(a) Per person,	
(i) with meals and laundry facilities, or,	200
(ii) without meal or laundry facilities, and	150
(b) Per non-resident staff per 8 hour shift	40
Boarding School - per person	300
Dwellings	
(a) 1 bedroom dwelling	750
(b) 2 bedroom dwelling	1 100
(c) 3 bedroom dwelling	1 600
(d) 4 bedroom dwelling	2 000
(e) 5 bedroom dwelling	2 500
(f) Additional flow for(2)	
(i) each bedroom over 5,	500
(ii) (A) each 10 m^2 (or part of it) over 200 m^2 up to 400 m^2 (3),	100
(B) each 10 m^2 (or part of it) over 400 m^2 up to 600 m^2 (3), and	75
(C) each 10 m^2 (or part of it) over 600 m^2 (3), or	50
(iii) each fixture unit over 20 fixture units	50
Hotels and Motels (excluding bars and restaurants)	
(a) Regular, per room	250
(b) Resort hotel, cottage, per person	500
(c) Self service laundry, add per machine	2 500
Work Camp/Construction Camp, semi-permanent per worker	250
Column 1	2

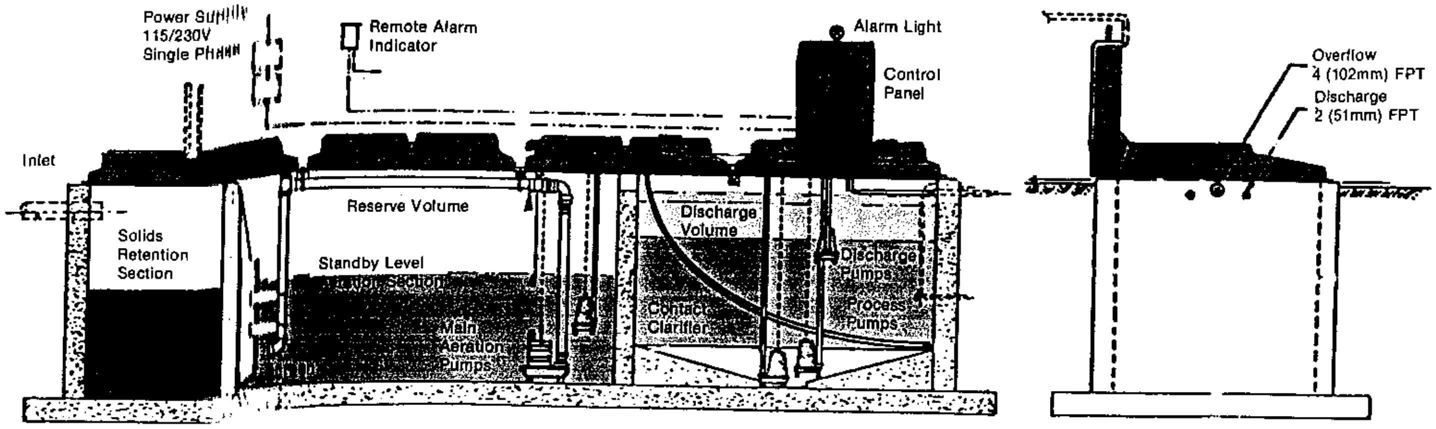
Notes to Table 8.2.1.3.A.:

(1) The *occupant load* shall be calculated using Subsection 3.1.17.
(2) Where multiple calculations of *sanitary sewage* volume is permitted, the calculation resulting in the highest flow shall be used in determining the design daily *sanitary sewage* flow.
(3) Total finished area, excluding the area of the finished *basement*.

Larger capacity Systems

GC SERIES

CONCRETE TANK



STANDARD EQUIPMENT: NPS systems have modular assembled components that are interchangeable and easily serviced. Plants are totally enclosed with low maintenance, non-corroding fibreglass covers and hatches. Plastic pipe and fittings are used in all module assemblies. The only moving parts are oil-filled submersible pumps. The control system is modular automatic digital computer system. Fibreglass covers and hatches containing all piping and wiring hydraulic fragmentation and submersible aeration system. Submersible process pumps. Duplex alternator discharge pumps. Automatic control panel. Flow discharge recorder. Remote alarm indicator. Accessory equipment programmer.

POWER SUPPLY: All systems require 115/240v - single phase - 60hz - 3 wire supply See Table below for supply amperage requirements. All systems are CSA approved.

DISCHARGE SYSTEM: Two discharge pumps alternate automatically, or can be preset to operate in single or tandem. If one pump malfunctions, the control activates the main alarm and alternates to the second pump.

INSTALLATION DRAWINGS: Detailed drawings for tank slabs and concrete tank construction are supplied to the purchaser by NPS. Material and work must conform to building code regulations and specifications.

Plant Model	IMPERIAL GALLONS			METRIC m³			PLANT LENGTH C		Shipping Weight	Power Supply AMPS
	24 Hr. Rated Capacity	Discharge Volume	Reserve Volume	24 Hr. Rated Capacity	Discharge Volume	Reserve Volume	Ft.	mm	lbs.	
GC-2	[illegible]	455	2,000	22.7	2.1	9.1	17	5,182	1,800 MODULES ONLY	60
-3	[illegible]	773	3,000	38.6	3.5	13.6	25	7,620	2,100	60
-4	[illegible]	1,136	4,000	56.8	5.2	18.2	33	10,058	2,200	60
-5	[illegible]	1,364	5,000	68.2	6.2	22.7	41	12,497	2,600	100
-6	[illegible]	1,590	5,500	79.6	7.2	25.0	49	14,935	3,000	100
-7	[illegible]	1,910	7,000	95.5	8.7	31.8	57	17,374	3,500	100
-7S	[illegible]	2,272	8,700	113.7	10.3	39.6	57	17,374	3,600	100
-8S	[illegible]	2,727	10,200	136.4	12.4	46.4	65	19,812	4,400	150

(a) Based on 16 hour raw sewage inflow.
(b) Sized for 11 batches per 24 hours at full loading.
(c) Reserve/surge volume capacity based on standby liquid level.

Northern Purification Systems
2614 Conc 4, R.R. #1
Loretto Ontario
L0G-1L0

August 16/06

Re; **MANSFIELD SKI CLUB**

To Whom it May Concern

The sewage system located at Mansfield Ski Club is a Northern Purification System model GC-2 with a 24 hour rated capacity of 22,700 litres per day.

The system was installed in the summer of 1997 by Northern Purification Systems and has been serviced and maintained by same till present.

The batch count since installation is 3607 as of June 6/06. Each batch is 2100 litres. Being approx 8 years since start up this would be 2920 days.
3607 X 2100 = 7,574,700 litres Divided by 2920 days =2,594 litres per day.
Average over the total time

Reports for the period from Dec 17/04 to Apr 28/05 being a time of peek flows show a total of 462 batches for 132 days.
462 X 2100 = 970,200 litres Divided by 132 days = 7,350 litres per day.

The above shows that the system is running at about one third of capacity.

I hope that this will be of help.

Any questions please call

Yours Truly

Tom Musgrove. Principal
TM/mt

APPENDIX G

MECP PRE-CONSULTATION CORRESPONDENCE

Hutchinson
Environmental Sciences Ltd.

Suite 202 – 501 Krug Street, Kitchener, ON N2B 1L3 │ 519-576-1711

September 20, 2016 HESL Job #: J160071

Finley McEwen
20 Queen Street West, 5th Floor
Toronto, Ontario
M5H 3R4

Dear Mr. McEwen:

Re: Work Plan – Mansfield Ski Club – Receiving Water Assessment for Surface Discharge of Treated Wastewater Effluent to the Pine River

Hutchinson Environmental Sciences Ltd. (HESL) is pleased to submit this work plan to complete a receiving water assessment for a surface discharge of treated domestic wastewater effluent to the Pine River from a proposed redevelopment/expansion of the Mansfield Ski Club (MSC), located at 628213 Side Rd 15, Mansfield, Ontario, in the Township of Mulmur.

The existing MSC operates seasonally from late December to early April. Sanitary servicing for the site (an existing Chalet Building and an Operations Building) is by a private on-site sewage treatment system (Northern Purification System) with subsurface disposal to a leaching bed. The proposed redevelopment of the site is to include the existing Chalet Building, and renovation of the Operations Building and new development providing a total of 1,595 m^2 of commercial retail space and 93 residential units.

The Site Servicing and Stormwater Management Report[1] (WMI 2016) for the redevelopment reported that sewage flows from the site will increase from 14,740 L/day to 116,765 L/day with the proposed redevelopment, which will necessitate a new sanitary sewage treatment system to accommodate the expanded flows. A package plant was proposed consisting of a Waterloo Biofilter System with UV disinfection and sodium aluminate dosing with disposal of the effluent to a new onsite wetland stormwater management facility. The effluent would then be conveyed off site a distance of 1,050 m via a series of grass-covered roadside ditches, swales and two existing dry ponds/basins for surface discharge to the Pine River as the ultimate receiver. The proposed effluent treatment objectives were 10.0 mg/L for carbonaceous oxygen demand (CBOD5) and total suspended solids (TSS), 0.5 mg/L for total phosphorus (TP), 3.0 mg/L for total ammonia nitrogen (TAN) and a geometric annual mean concentration of 100 organisms/100 mL for *Escherichia coli*. The proposed effluent treatment limits were 15 mg/L for CBOD5 and TSS, 1.0 mg/L for TP, 5.0 mg/L for TAN and a geometric annual mean concentration of 200 organisms/100 mL for *E. coli*.

As previously discussed, the proposed effluent conveyance route (i.e., roadside ditches, swales, dry ponds) would provide minimal dilution of the effluent and would thereby represent a ‘dry ditch’ discharge. The conveyance route passes through residential lands which could be of concern to local residents and the Ministry of Environment and Climate Change (MOECC). Moreover, the Pine River near the subject property

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[1] *WMI & Associates Limited, 2016. Site servicing & stormwater management report. Mansfield Ski Club, Township of Mulmur. Report WMI 15-319. June 2016.*

is a high quality receiver that supports a sensitive trout fishery and is used by local residents for recreation (swimming and fishing). Better treatment objectives are therefore likely warranted to protect the beneficial uses of the river. These concerns were also expressed by MOECC at the pre-consultation meeting at the Guelph District Office on August 9th, 2016, and further supported by the results of a site reconnaissance visit by HESL on August 10th, 2016.

Alternate methods of effluent disposal may be feasible including direct discharge to the Pine River to the northwest of the subject property at the existing pump house, or discharge to an onsite 3-5 acre pond that is located in the northeast corner of the subject property and draining to the Pine River through a conduit. These options would avoid issues associated with an open, dry ditch discharge, and be more amenable to the MOECC.

During our site visit, we observed five large trout in the Pine River upstream of the rock weir adjacent to the pump house on the subject property, confirming the presence of trout habitat. We collected water samples from the centre of the river immediately downstream of the weir, which were analysed for total phosphorus (TP), orthophosphate (PO4), total ammonia nitrogen (TAN), nitrate (NO3), nitrite (NO2) and total suspended solids (TSS). Results indicated that the river at this location had very low concentrations of phosphorus (TP = 0.0053 mg/L, PO4 = <0.003 mg/L), TAN (<0.02 mg/L) and TSS (<2.0 mg/L). NO3 was elevated at 2.1 mg-N/L but was below the Canadian Environmental Quality Guideline (CEQG) of 3.0 mg-N/L. A farm with cattle was located across the river just upstream of the sampling location that is likely a source of nitrate at this sampling location, in addition to other rural land uses upstream. Based on these results, the Pine River adjacent to the subject property likely has capacity to receive effluent from the MSC, however, additional data are required to confirm the status of the river, in particular for the period of operation of the MSC from December to April.

A surface discharge of treated effluent to the Pine River requires a receiving water assessment to determine the impacts of that effluent on water quality in the river. Key to this assessment is the determination of suitable effluent quality and a discharge location so that the size and quality of the effluent plume in the river meets the guidelines of the MOECC to protect water quality and beneficial uses. Based on our project understanding and input from the MOECC at the Pre-consultation Meeting, we have developed a comprehensive work plan to complete this assessment with the objectives to:

1. Characterize the existing water quality and flows of the Pine River at the proposed discharge location and determine its assimilative capacity to receive treated effluent,
2. Identify environmental and beneficial usage constraints for the discharge,
3. Recommend alternative discharge options (e.g., direct to river or via an existing man-made pond) and locations based on identified constraints,
4. Complete a mixing zone analysis at the point of effluent discharge to the Pine River to determine the size of the mixing zone and provide recommendations for a discharge configuration to minimize the size of the mixing zone,
5. Recommend appropriate treatment objectives and limits based on the assimilative capacity of the river and results of the mixing zone analysis, and
6. Develop a water quality monitoring program to confirm the results of the assessment and to monitor the effects of the discharge on water quality of the Pine River.

Work Plan

We propose the following work plan tasks to complete the assessment:

Task 1. Compilation of Data and Background Information

We will work with WMI & Associates Limited to confirm and document details of the preferred servicing approach including expected effluent volumes, treatment objectives and the specific discharge location.

We will compile relevant water quality and flow data for the Pine River from the following sources:

- Water Survey of Canada Station Pine River near Everett (02ED014) located approximately 10 km downstream of the study site. Continuous flow data are available for this station from 1967 to present;
- Provincial Water Quality Monitoring Network (PWQMN) Station 03005701002 located upstream of the Nottawasaga River at Mill Street, Angus, ON. Long-term data are available for this site from 1972 to 2015, which is typically monitored monthly from April to November by the Nottawasaga Valley Conservation Authority (NVCA).

We will also contact the MOECC and the NVCA to request any additional water quality monitoring data or information that may be relevant to the assessment including fish inventories, fish habitat and benthic invertebrate assessments.

Task 2. Field Work

While the above water quality and flow data exist for the Pine River, site-specific data closer to the proposed discharge location and for the full period of discharge are required for the assimilative capacity assessment and the mixing zone analysis (Task 6). We therefore propose to sample water quality and stream flows monthly from September 2016 until April 2017 at two locations in the river (immediately downstream of the rock weir near the MSC pump house and at the crossing of the river at Airport Road (Regional Road 18). Water quality monitoring parameters will include:

- Field parameters (pH, temperature, dissolved oxygen, conductivity);
- TP;
- Nitrogen species (TAN, NO3, NO2, and total Kjeldahl nitrogen (TKN));
- Total suspended solids (TSS);
- Carbonaceous biochemical oxygen demand (CBOD5); and
- *E. coli*.

Water samples will be shipped to ALS Laboratories in Waterloo, Ontario, for analysis of all chemical parameters. River discharge will be measured at both sampling locations using the transect method and a Flo Mate or equivalent meter.

It is our understanding that the NVCA has conducted fish habitat and benthic invertebrate assessments in the Pine River that are likely suitable to document these biological characteristics for the purposes of the receiving water assessment. If additional information is required, we will submit a revised work plan to collect this information.

Task 3. Low Flow Analysis

Effluent discharge to any receiver requires the determination that the receiver can effectively assimilate or dilute the effluent. In Ontario streams and rivers, the 7Q20 low-flow statistic is used as a basic design flow to determine the assimilative capacity of a stream or river. The 7Q20 flow represents the minimum 7-day average flow with a recurrence period of 20 years. This value determines the 5% chance of there not being adequate streamflow to properly dilute the point discharge.

We will calculate the 7Q20 flows in the Pine River at the proposed discharge site using the most recent 20-year data record from WSC Station, pro-rated and for the watershed area upstream of the proposed discharge location and verified with the measured flows from Task 2. We will also use this dataset to calculate the mean, minimum, maximum, and lower quartile (25th percentile) flows to fully describe flow and dilution potential of the river.

Task 4. Water Quality Summary

We will summarize water quality data from the PWQMN Station and results of the Task 2 monitoring. Data will be assessed against applicable Provincial Water Quality Objectives (PWQO) to determine the policy status of the Pine River to receive treated effluent at the proposed discharge location in accordance with MOECC policies and guidelines[2]:

- Policy 1 - In areas which have water quality better than the PWQO, water quality shall be maintained at or above the objectives;
- Policy 2 - Water quality which presently does not meet the PWQO shall not be degraded further and all practical measures shall be taken to upgrade the water quality to the objectives.

Task 5. Documentation of Natural Heritage and Beneficial Use Constraints

We will perform a desk-top search to document natural heritage features and beneficial uses of the Pine River in the vicinity of the proposed discharge that may pose constraints to siting the discharge location and configuration of the effluent plume, to include:

- Water takings for drinking water,
- Recreation (swimming and fishing) areas,
- Sensitive fish habitat,
- Natural heritage features, and
- Aquatic Species at Risk (SAR) and critical habitat

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[2] *Ontario Ministry of Environment and Energy (MOEE), 1994. Water Management, Policies, Guidelines, Provincial Water Quality Objectives. Queen's Printer for Ontario. 32 pp.*

Task 6. Assimilative Capacity Assessment

The assimilative capacity assessment will be completed using a mass balance modeling approach to determine water quality in the Pine River at the point of complete mixing of the effluent and a CORMIX model to determine the size and shape of the mixing zone. CORMIX is a software system developed by Cornell University for the analysis, prediction, and design of aqueous toxic or conventional pollutant discharges into diverse water bodies[3]. CORMIX requires a small number of inputs in order to generate meaningful simulation data, which will be gathered from our background review and field work (Tasks 1 to 3).

Modeling will be conducted for low flow conditions over the proposed operational period of the package plant (to be determined) to inform recommendations for effluent limits and the discharge configuration under different flow, water quality and temperature regimes of the river. A preferred discharge location and configuration (i.e., single port discharge versus multi-port discharge) will be recommended that provides the most rapid assimilation but that also considers any identified constraints from Task 4. Factors including temperature (water density) of the water, the number of ports, and the location of the discharge in relation to banks and the river bottom all affect the resulting discharge mixing zone.

Recommendations for effluent limits will be based on the above modeling and MOECC's requirements in *Deriving Receiving Water Based, Point-Source Effluent Requirements for Ontario Waters*[4], which provides requirements for point-source discharges and the procedures for determining effluent requirements for an Environmental Compliance Approval (ECA). This assessment will also consider the need to meet the condition of "no acute lethality" at the discharge point to the creek based on unionized ammonia concentration.

Task 7. Reporting and Meetings

Completion of the full receiving water assessment will not be possible until early summer of 2017 once the field work in Task 2 is completed. To permit design planning to move forward, we will prepare a technical memorandum that documents the preliminary results of Tasks 1 to 5 (to include results of two Task 2 field events) in October 2016. We anticipate that this technical memorandum will provide sufficient information for pre-consultation with MOECC to further discuss the design concept, to be refined and finalized once all data have been collected. This will allow MOECC to comment on a) the proposed field study in advance of the critical operation period of the MSC from December to April, and b) the approach to the assimilative capacity assessment and mixing zone modelling (Task 6). At this meeting, we will also discuss the potential for extending the operating season of the MSC, and hence the effluent discharge period. We will prepare meeting minutes from the pre-consultation meeting and revise our work plan if necessary to address MOECC concerns.

We will complete a technical report for submission to the MOECC Guelph District Office for review and concurrence by the Technical Support Unit, which is required for the Environmental Compliance Approval application. The report will summarize the field investigations, constraints, assimilation assessment,

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[3] *Doneker, R. L. and G. H. Jirka, 2007. CORMIX User Manual, USEPA: EPA-823-K-07-001.*

[4] *Ontario Ministry of the Environment (MOE). 1994. Deriving receiving water based point source effluent requirements for Ontario waters. PIBS#3302 Procedure B-1-5.*

recommendations for effluent limits and for continued water quality monitoring to track the influence of the discharge in the future.

Over the course of the project, we will provide monthly updates on the progress of the study.

Schedule

The following schedule is proposed to complete the ACS:

Technical Memorandum of preliminary results – October 28, 2016
MOECC Pre-consultation Meeting – Week of October 31, 2016
Field Work – September, 2016 to April, 2017 (monthly)
Final Report – May 31, 2017

We thank MSC for inviting Hutchinson Environmental Sciences Ltd. to submit this work plan. Please do not hesitate to contact us if you have any questions.

Sincerely,
Hutchinson Environmental Sciences Ltd.

T. KR

Tammy Karst-Riddoch, Ph.D.
Senior Aquatic Scientist
tammy@environmentalsciences.ca

Jeremy Lightheart

From:	Spencer, Michael (MOECC) <Michael.Spencer@ontario.ca>
Sent:	April 4, 2017 2:56 PM
To:	Tomlinson, Gary (MOECC); Jeremy Lightheart
Cc:	'Finley McEwen'; 'Finley McEwen'; 'Tammy Karst-Riddoch'
Subject:	RE: 15-319 Mansfield Ski Club (Pre-Consultation Update)

Hi Jeremy,

I have been in field sampling and only received the emails today. Any discussion on the Receiving Water Assessment and options would be best after I've reviewed the report, and I won't be getting to it this month. Please schedule in May. Thanks.

Michael Spencer
Surface Water Group Leader
Ministry of Environment and Climate Change
119 King Street West, 12th Flr
Hamilton, ON L8P 4Y7
Ph (905) 521-7734

-----Original Message-----
From: Tomlinson, Gary (MOECC)
Sent: April 04, 2017 9:42 AM
To: Jeremy Lightheart; Spencer, Michael (MOECC)
Cc: 'Finley McEwen'; 'Finley McEwen'; 'Tammy Karst-Riddoch'
Subject: Re: 15-319 Mansfield Ski Club (Pre-Consultation Update)

Jeremy:

Sorry for the short notice but at this point it looks to me as if Mike is not available to participate in a telecon this morning. I understand he will be passing you some available dates and times a bit later in the month to make this happen.

G.W. Tomlinson
Provincial Officer
Senior Environmental Officer
Guelph District Office
West Central Region
Ontario Ministry of Environment and Climate Change
Tel: 519 826 4272
Fax: 519 826 4286
Original Message
From: Jeremy Lightheart
Sent: Monday, April 3, 2017 16:00
To: Tomlinson, Gary (MOECC); Spencer, Michael (MOECC)
Cc: 'Finley McEwen'; 'Finley McEwen'; 'Tammy Karst-Riddoch'
Subject: RE: 15-319 Mansfield Ski Club (Pre-Consultation Update)

Gary/Mike,

Please find attached an agenda as well the "Receiving Water Assessment for Surface Discharge of Treated Wastewater Effluent to the Pine River" for your review prior to the conference call tomorrow morning at 10:30am.

Mike, if you could please confirm that you will be available for the call tomorrow it would be greatly appreciated.

Regards,

Jeremy W. Lightheart, P. Eng.
WMI & Associates Limited
119 Collier Street
Barrie, ON. L4M 1H5
Office 705-797-2027 Ext 104
Fax 705-797-2028
wmiengineering.ca

-----Original Message-----
From: Tomlinson, Gary (MOECC) [mailto:gary.tomlinson@ontario.ca]
Sent: April 3, 2017 11:44 AM
To: Jeremy Lightheart <jlightheart@wmiengineering.ca>; Spencer, Michael (MOECC) <Michael.Spencer@ontario.ca>
Subject: Re: 15-319 Mansfield Ski Club (Pre-Consultation Update)

I can call in at 10:30 but will need the phone number and access code again.

G.W. Tomlinson
Provincial Officer
Senior Environmental Officer
Guelph District Office
West Central Region
Ontario Ministry of Environment and Climate Change
Tel: 519 826 4272
Fax: 519 826 4286
Original Message
From: Jeremy Lightheart
Sent: Monday, April 3, 2017 11:41
To: Tomlinson, Gary (MOECC); Spencer, Michael (MOECC)
Subject: RE: 15-319 Mansfield Ski Club (Pre-Consultation Update)

Gary/Mike,

Just following up to confirm that you are both still available for tomorrow mornings conference call at 10:30am? I trust you both have received Finley McEwen's invite via email which outlines the call details/instructions for calling in?

Your earliest response would be much appreciated.

Regards,

Jeremy W. Lightheart, P. Eng.
WMI & Associates Limited
119 Collier Street
Barrie, ON. L4M 1H5
Office 705-797-2027 Ext 104
Fax 705-797-2028
wmiengineering.ca

-----Original Message-----
From: Tomlinson, Gary (MOECC) [mailto:gary.tomlinson@ontario.ca]
Sent: March 20, 2017 10:53 PM
To: Jeremy Lightheart <jlightheart@wmiengineering.ca>
Cc: Spencer, Michael (MOECC) <Michael.Spencer@ontario.ca>
Subject: Re: 15-319 Mansfield Ski Club (Pre-Consultation Update)

Jeremy:

Sorry for being a while getting back to you but things here have been real busy.

I'm afraid I will not be able to do a face to face any time the week of 03 April. I might be able to call into a meeting on the 4th provided it is happening in the middle of the morning or mid pm. I understand that Mike Spencer is available on the 4th so possibly we can make this happen this way.

G.W. Tomlinson
Provincial Officer
Senior Environmental Officer
Guelph District Office
West Central Region
Ontario Ministry of Environment and Climate Change
Tel: 519 826 4272
Fax: 519 826 4286

Original Message
From: Jeremy Lightheart
Sent: Friday, March 10, 2017 10:36
To: Tomlinson, Gary (MOECC)
Cc: Spencer, Michael (MOECC)
Subject: RE: 15-319 Mansfield Ski Club (Pre-Consultation Update)

Gary,

It has been a while since we last spoke but now that we are part way through the Assimilation Capacity Study work for the above mentioned site and have now received some feedback via public meetings, etc., we would like to sit back down with you and your colleagues to have an updated pre-consultation meeting if possible?

Would you be available to meet myself, Finley McEwen (Mansfield Ski Club) and Tammy Karst-Riddoch (Hutchinson Environmental Sciences Ltd.) any time on Tuesday April 4th?

Thanks in advance for your assistance,

Jeremy W. Lightheart, P. Eng.
WMI & Associates Limited

119 Collier Street
Barrie, ON. L4M 1H5
Office 705-797-2027 Ext 104
Fax 705-797-2028
wmiengineering.ca

-----Original Message-----
From: Tomlinson, Gary (MOECC) [mailto:gary.tomlinson@ontario.ca]
Sent: September 21, 2016 10:35 AM
To: Jeremy Lightheart <jlightheart@wmiengineering.ca>
Cc: Spencer, Michael (MOECC) <Michael.Spencer@ontario.ca>
Subject: Re: 15-319 Mansfield Ski Club (Assimilative Capacity Study Work Plan)

Thanks Jeremy.

G.W. Tomlinson
Provincial Officer
Senior Environmental Officer
Guelph District Office
West Central Region
Ontario Ministry of Environment and Climate Change
Tel: 519 826 4272
Fax: 519 826 4286
Original Message
From: Jeremy Lightheart
Sent: Wednesday, September 21, 2016 09:27
To: Tomlinson, Gary (MOECC)
Cc: Spencer, Michael (MOECC)
Subject: RE: 15-319 Mansfield Ski Club (Assimilative Capacity Study Work Plan)

Gary,

As promised, please find attached the revised Assimilative Capacity Study Work Plan for your review. Should you have any questions, please do not hesitate to contact me.

Regards,

Jeremy W. Lightheart, P. Eng.
WMI & Associates Limited
119 Collier Street
Barrie, ON. L4M 1H5
Office 705-797-2027 Ext 104
Fax 705-797-2028
wmiengineering.ca

-----Original Message-----
From: Tomlinson, Gary (MOECC) [mailto:gary.tomlinson@ontario.ca]
Sent: September 16, 2016 12:53 PM
To: Jeremy Lightheart <jlightheart@wmiengineering.ca>

Cc: Spencer, Michael (MOECC) <Michael.Spencer@ontario.ca>
Subject: Re: 15-319 Mansfield Ski Club (Assimilative Capacity Study Work Plan)

Great. Thanks.

G.W. Tomlinson
Provincial Officer
Senior Environmental Officer
Guelph District Office
West Central Region
Ontario Ministry of Environment and Climate Change
Tel: 519 826 4272
Fax: 519 826 4286
From: Jeremy Lightheart
Sent: Friday, September 16, 2016 11:57
To: Tomlinson, Gary (MOECC)
Cc: Spencer, Michael (MOECC)
Subject: RE: 15-319 Mansfield Ski Club (Assimilative Capacity Study Work Plan)

Gary,

Sorry for the delay in getting back to you, I was off yesterday. Based on my discussions with Tammy at Hutchison Environmental, the first round of sampling was completed on Wednesday and they plan to begin with the other tasks next week.

Tammy has promised to get me the revised work plan today. I hope to have the work plan to you either later today or early next week.

Regards,

Jeremy W. Lightheart, P. Eng.
WMI & Associates Limited
119 Collier Street
Barrie, ON. L4M 1H5
Office 705-797-2027 Ext 104
Fax 705-797-2028
wmiengineering.ca

From: Tomlinson, Gary (MOECC) [mailto:gary.tomlinson@ontario.ca]
Sent: September 15, 2016 9:15 AM
To: Jeremy Lightheart <jlightheart@wmiengineering.ca>
Cc: Spencer, Michael (MOECC) <Michael.Spencer@ontario.ca>
Subject: RE: 15-319 Mansfield Ski Club (Assimilative Capacity Study Work Plan)

Jeremy:

Just curious, has the ACS work gone forward and is there a modified work plan floating around somewhere that someone can send us?

G.W. Tomlinson
Provincial Officer
Badge # 132
Senior Environmental Officer
Guelph District Office
West Central Region
Ontario Ministry of the Environment and Climate Change
Tel: 519 826 4272
Fax: 519 826 4286
Gary.Tomlinson@ontario.ca<mailto:Gary.Tomlinson@ontario.ca>
Spills Action Centre 1 800 268 6060
[Peace_Officer_Exemplary_Service_Medal_Ribbon]
[cid:image001.gif@01C70356.E58073E0] [cid:image002.jpg@01C70356.E58073E0]

From: Tomlinson, Gary (MOECC)
Sent: September-01-16 3:07 PM
To: 'Jeremy Lightheart'
Cc: Spencer, Michael (MOECC)
Subject: RE: 15-319 Mansfield Ski Club (Assimilative Capacity Study Work Plan)

Jeremy:

MOECC’s comments on the 29 August, 2016 Mansfield Ski Club Work Plan are as follows:

1.) Overall the Work Plan is acceptable with the following exceptions\comments:

2.) The 29 August, 2016 Work Plan identifies that the operational period of the proposed redevelopment\expansion of the Mansfield Ski Club as from December to April. During the 09 August, 2016 pre-consultation meeting our notes indicate that the discussion was around an expanded operational period, (that being some point in September to some point in April). As such, the proposed sewage discharge period needs to be clarified\identified;

3.) In Task 1, the Work Plan identified that the Water Survey of Canada station Pine River station near Everett, (02ED014), has flow data from 1967 to 1970. This may be a typing error since this station appears to have flow records from 1967 to present;

4.) In Task 7, the Work Plan identified that a technical memorandum will
be submitted in October of this year to document the preliminary results of Tasks 1 through 5 in order to provide information to the Ministry for approval in concept on the design, which will be refined and finalized once all the data has been collected. The Work Plan identified that this will allow the Ministry to comment on the proposed field study in advance of the December to April, (or September to April), period and the approach to the assimilative capacity assessment/mixing zone modelling. It should be noted that this Ministry does not review preliminary results for these type of assessments, especially since the Work Plan already contains the proposed field study and the approach to the assimilative capacity assessment\mixing zone which the Ministry has reviewed and commented on. Having said that, if the proponent requires an additional meeting through the process, Staff from both the District Office and Technical Support Unit can make themselves available to attend, and;

5.) The final report will need to be submitted to the MOECC Guelph
District Office for review and concurrence by the MOECC Technical Support Unit prior before an Environmental Compliance Approval application being submitted.

I would suggest that based on the comments provided above that it would be acceptable for the proponent to commence with the activities identified in the Work Plan at such time as it modifies the Work Plan accordingly, (and provides the modified Work Plan to this Office).

G.W. Tomlinson
Provincial Officer
Badge # 132
Senior Environmental Officer
Guelph District Office
West Central Region
Ontario Ministry of the Environment and Climate Change
Tel: 519 826 4272
Fax: 519 826 4286
Gary.Tomlinson@ontario.ca<mailto:Gary.Tomlinson@ontario.ca>
Spills Action Centre 1 800 268 6060
[Peace_Officer_Exemplary_Service_Medal_Ribbon]
[cid:image001.gif@01C70356.E58073E0] [cid:image002.jpg@01C70356.E58073E0]
P Please consider the environment before printing this email!

From: Jeremy Lightheart [mailto:jlightheart@wmiengineering.ca]
Sent: August-31-16 9:05 AM
To: Tomlinson, Gary (MOECC)
Subject: 15-319 Mansfield Ski Club (Assimilative Capacity Study Work Plan)

Gary,

Please find attached our proposed work plan for the required Assimilative Capacity Study associated with the above mentioned project. If you could please review the work plan and confirm your acceptance it would be greatly appreciated. Please note that there are a few time sensitivity items which require monitoring to start immediately.

Regards,

Jeremy W. Lightheart, P. Eng.
WMI & Associates Limited
119 Collier Street
Barrie, ON. L4M 1H5
Office 705-797-2027 Ext 104
Fax 705-797-2028
wmiengineering.ca

Ministry of the Environment
and Climate Change
West Central Region

119 King Street West
12th Floor
Hamilton, Ontario L8P 4Y7
Tel.: 905 521-7640
Fax: 905 521-7820

Ministère de l'Environnement
et de l'Action en matière de changement climatique
Direction régionale du Centre-Ouest

119 rue King Ouest
12e étage
Hamilton (Ontario) L8P 4Y7
Tél. : 905 521-7640
Téléc. : 905 521-7820

July 14, 2017

MEMORANDUM

To: Gary Tomlinson
Senior Environmental Officer
Guelph District Office

From: Michael Spencer
Surface Water Group Leader
Technical Support Section

RE: Mansfield Ski Club Redevelopment Project
Preliminary Receiving Water Assessment
Township of Mulmur, Pine River

As requested, I have reviewed the following document for surface water issues:

> February 10, 2017 Memo, Re: Mansfield Ski Club, Receiving Water Assessment for Surface Discharge of Treated Wastewater Effluent to the Pine River, Hutchinson Environmental Sciences Ltd.

Background

The Mansfield Ski Club redevelopment project includes renovation of the Operations Building and a new development including commercial retail and residential. A sewage effluent discharge to the Pine River is proposed. The preliminary Receiving Water Assessment (Feb. 10, 2017) contains the results of the monitoring and the study to date and is based on the September 20, 2016 work plan which was previously reviewed by the Ministry.

Comments

Based on my review of the preliminary Receiving Water Assessment (Feb. 10, 2017), I have the following comments:

1. Based on my July 6, 2017 telephone conversation with Deborah Sinclair, Hutchinson Environmental, it is my understanding that the Mansfield Ski Club is now considering a year round sewage effluent discharge and the monthly water quality sampling program is continuing. As such, the final receiving water assessment should incorporate a monthly assessment in regards to the low flow analysis (ie. monthly 7Q20) and the corresponding

assimilative capacity study. The submitted preliminary Receiving Water Assessment was based on a seasonal assessment period since a seasonal discharge was proposed at the time of writing.

2. Table 4 and 5 listed the PWQO (or CWQG) for un-ionized ammonia as 16 ug/L. The PWQO for un-ionized ammonia is 20 ug/L and the CWQG is 19 ug/L.

3. The need for a DO sag assessment should be determined and included in the final receiving water assessment as needed.

4. The preliminary Receiving Water Assessment identified that further study is required in regards to the presence and habitat of snapping turtles and the presence of wetlands which I concur with.

5. The preliminary Receiving Water Assessment identified that a site specific assessment is recommended to characterize sensitive aquatic communities and fish habitat near the proposed effluent outfall which I concur with.

Michael Spencer
Surface Water Group Leader
Technical Support Section

cc: B. Koblik, TSS

IDS Ref. No.
File H-04-PI-32-01

Limitations: The purpose of the preceding review is to provide advice to the Ministry of the Environment and Climate Change regarding surface water impacts based on a review of the information provided in the above referenced documents. The conclusions, opinions and recommendations of the reviewer are based on information provided by others, except where otherwise noted. The Ministry cannot guarantee that the information that is provided by others is accurate or complete. A lack of specific comment by the reviewer is not to be construed as endorsing the content or views expressed in the reviewed material.

Ministry of the Environment, Conservation and Parks
Drinking Water and Environmental Compliance Division
West Central Region

119 King Street West
12th Floor
Hamilton, Ontario L8P 4Y7
Tel.: 905 521-7640
Fax: 905 521-7820

Ministère de l'Environnement de la Protection de la nature et des Parcs
Division de la conformité en matière d'eau potable et d'environnement
Direction régionale du Centre-Ouest

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Hamilton (Ontario) L8P 4Y7
Tél. : 905 521-7640
Téléc. : 905 521-7820

Ontario

January 31, 2019

MEMORANDUM

To: Gary Tomlinson
Environmental Officer
Guelph District Office

From: Michael Spencer
Surface Water Group Leader
Technical Support Section

RE: Mansfield Ski Club
Receiving Water Assessment for New Wastewater Treatment Plant
Township of Mulmur, Pine River

As requested, I have reviewed the following document for surface water issues:

> Pine River Receiving Water Assessment – Final Report, Mansfield Ski Club, Hutchinson Environmental Sciences Ltd., May 17, 2018.

Background

The Mansfield Ski Club is located at 628213 15th Sideroad in the Town of Mansfield, Township of Mulmur. The site currently operates seasonally from late December to early April with sanitary servicing provided by a sewage treatment system with subsurface disposal. The proposed redevelopment includes renovation of existing buildings, a new commercial space and new residential units for year round occupancy. To accommodate redevelopment with expanded sewage flows, a package plant (Waterloo Biofilter with UV disinfection and phosphorus removal) is proposed with continuous discharge to the Pine River.

The Pine River near Mansfield Ski Club has very good water quality with low concentrations of nutrients and total suspended solids. The river water quality was determined to be surface water Policy 1 for total phosphorus and un-ionized ammonia near the site. As well, dissolved oxygen concentrations were better the PWQO. The Pine River provides spawning habitat and supports various fish species including Chinook salmon and rainbow trout. Available dilution in the Pine River (7Q20 = 432 L/s) for the proposed effluent discharge (1.39 L/s) was determined to be

311:1. A mass balance assessment was completed as well as Cormix modelling for a diffuser discharge.

Comments

Based on my review of the Mansfield Ski Club's "Pine River Receiving Water Assessment – Final Report" (Hutchinson, May 2018), I have the following comments:

1. The report assessed the end-of-pipe acute toxicity threshold with an un-ionized ammonia value of 0.27 mg/L based on the US EPA document "Draft 2009 Update Aquatic Life Ambient Water Quality Criteria for Ammonia – Freshwater, Dec. 2009". The assessment used a total ammonia nitrogen concentration of 5 mg/L (proposed effluent limit), temperature of 22°C and pH of 8.0.

   Historically and procedurally West Central Region has used a non-acutely lethal end-of-pipe un-ionized ammonia concentration of 0.1 mg/L. That being said, the report's assessment can be considered very conservative since a pH of 8.0 was used while it identified for comparison purposes that a 75th percentile pH of 7.2 was calculated for the Caledonia and Hagersville Wastewater Treatment Plants. Using an un-ionized ammonia concentration of 0.1 mg/L for a non-acutely lethal discharge, a pH of 7.65 would have to be consistently reached which is higher than the Caledonia and Hagersville Wastewater Treatment Plants. As such, the proposed total ammonia nitrogen effluent limit of 5 mg/L is acceptable.

2. The report recommended that the effluent be discharged directly to the Pine River at the pump house based on the water quality analysis and aquatic habitat requirements which is acceptable.

3. The report's proposed effluent objectives and limits listed below are acceptable and can be incorporated into an ECA.

Parameter	Objective	Limit
cBOD5	10 mg/L	15 mg/L
Total Suspended Solids	10 mg/L	15 mg/L
Total Phosphorus	0.5 mg/L	1 mg/L
Total Ammonia N.	3 mg/L	5 mg/L
E.coli (per 100mL)	100	200

4. The report proposed a pH effluent objective of 8.0 and limit of 8.5. However, I recommend the ECA include the standard pH range effluent objective (6.5 to 8.5) and limit (6.0 to 9.0).

5. The ECA should incorporate effluent loading limits as listed below. The loading for total phosphorus and total ammonia nitrogen is the same as Table 9 in the report. However, I have recommended 1.8 kg/d for cBOD5 and total suspended solids since it seems that Table 9 rounded off the value (2 kg/d).

Parameter	Loading Limit
cBOD5	1.8 kg/d
Total Suspended Solids	1.8 kg/d
Total Phosphorus	0.12 kg/d
Total Ammonia N.	0.6 kg/d

6. The ECA should incorporate standard effluent toxicity testing (ie. rainbow trout and *Daphnia magna*).

7. The report identified that additional information about snapping turtles, wetlands and other natural heritage features will be examined in an Environmental Impact Study during the site plan approval which is acceptable.

Conclusion

In conclusion, the Mansfield Ski Club's "Pine River Receiving Water Assessment – Final Report" (Hutchinson, May 2018) is acceptable with the recommendations discussed above. The proposal can proceed forward to Environmental Approvals and Permissions Branch accordingly.

Original Signed By

Michael Spencer
Surface Water Group Leader
Technical Support Section

cc: B. Koblik, TSS

IDS Ref. No. 2063-AZGRZ7
File H-04-PI-32-01

Limitations: The purpose of the preceding review is to provide advice to the Ministry of the Environment and Climate Change regarding surface water impacts based on a review of the information provided in the above referenced documents. The conclusions, opinions and recommendations of the reviewer are based on information provided by others, except where otherwise noted. The Ministry cannot guarantee that the information that is provided by others is accurate or complete. A lack of specific comment by the reviewer is not to be construed as endorsing the content or views expressed in the reviewed material.

APPENDIX H

Geotechnical Investigations Reports & Addendum

SHAD & ASSOCIATES INC.

June 21, 2018
Ref. No.: T18733

Mansfield Ski Club
628213 Sideroad 15
Mulmur, Ontario
L9V 3M6

Attention: Mr. Finley McEwen

Dear Mr. McEwen,

RE: **FEASIBILITY ASSESSMENT**
PRELIMINARY GEOTECHNICAL INVESTIGATION
PROPOSED DEVELOPMENT
MANSFIELD SKI CLUB
628213 SIDEROAD 15, MULMUR, ONTARIO

Please find enclosed the Feasibility Assessment - Preliminary Geotechnical Investigation Report prepared for the above-mentioned project. Should you have any questions or require any clarifications, please do not hesitate to contact our office.

We thank you for giving us this opportunity to be of service to you.

Sincerely,
Shad & Associates Inc.

H. Shad

Houshang Shad, Ph.D., P. Eng.
Principal

SHAD & ASSOCIATES INC. **GEOTECHNICAL, ENVIRONMENTAL AND MATERIALS CONSULTING ENGINEERS**
83 Citation Drive, Unit 9
Vaughan, Ontario, L4K 2Z6
Tel: (905) 760-5566
Fax: (905) 760-5567
www.shadinc.ca

FEASIBILITY ASSESSMENT
PRELIMINARY GEOTECHNICAL INVESTIGATION
PROPOSED DEVELOPMENT
MANSFIELD SKI CLUB
628213 SIDEROAD 15, MULMUR, ONTARIO

Submitted to:

Mansfield Ski Club
628213 Sideroad 15
Mulmur, Ontario
L9V 3M6

Attention:

Mr. Finley McEwen

Submitted by:

Shad & Associates Inc.
83 Citation Drive, Unit 9
Vaughan, Ontario, L4K 2Z6
Canada
Tel: (905) 760-5566
Fax: (905) 760-5567

June 21, 2018

T18733

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FIGURES

RECORD OF BOREHOLES

ENCLOSURES

APPENDECIES

…/…

1.0 INTRODUCTION

Shad & Associates Inc. was retained by Mansfield Ski Club ('Client') to carry out a preliminary geotechnical investigation for the proposed development being considered at 628213 Sideroad 15 in Mulmur, Ontario. The site location is shown in Figure 1. We understand that the preliminary geotechnical report is required to confirm the general viability of each of the following proposed works:

- Construction of a 6.0 m deep snow making pond on the north end of the property, adjacent to 17 Sideroad;
- Addition of 25 m of fill to be placed on top of the ski hill;
- Construction of six block of chalet type housing units (Blocks 1 to 6), two buildings (Building A and B), a water treatment plant and firefighting tanks to be located on the north end of the main parking lot at Sideroad 15; and
- Construction of a 1.2 to 2.2 m deep Dry Detention Basin to be located at the southeast portion of the site (south of the proposed building structures).

The Client requested the following boreholes to be drilled:

- one borehole in the vicinity of the 6.6 m snow making pond;
- three boreholes for the top of the ski hill where 25 m of fill will be placed;
- three boreholes in the vicinity of proposed buildings, water treatment plant and firefighting tanks; and
- one borehole in the vicinity of the dry detention basin.

Authorization to proceed with this investigation was provided by Mr. Dave Morrison of Mansfield Ski Club on May 18, 2018. The work carried out for this investigation was completed in accordance with Shad Proposal P18666-Revised, dated May 7, 2018.

The purpose of the current preliminary geotechnical feasibility assessment was to obtain some general information about the subsurface conditions at the site by means of a number of boreholes. Based on our interpretation of the data obtained, some preliminary recommendations are provided on the geotechnical aspects of design for the proposed development.

This report contains the findings of our geotechnical investigation, together with our recommendations and comments. These recommendations and comments are based on factual information and are intended only for use by the design engineer.

We recommend on-going liaison with Shad & Associates Inc. during the design and construction phases of the project to ensure that the recommendations provided in this report are applicable and/or correctly interpreted and implemented. Also, any queries concerning the geotechnical aspects of the proposed project should be directed to Shad & Associates Inc. for further elaboration and/or clarification.

2.0 INVESTIGATION PROCEDURES

The fieldwork for the investigation was performed during the period of May 24, 25, 29 and 30, 2018, and it consisted of drilling and sampling altogether eight boreholes down to depths ranging from approximately 4.7 m to 12.3 m below the existing ground surface. The borehole locations were stake-out by the Client and their approximate locations are shown in Figure 2. The Client also provided us with a base plan showing some limited existing topographical information at the development site as well as proposed grading information (un-dated, un-numbered plan 161117-Baseplan-15-319-1 as well as the landscape architectural plan prepared by Stempski Kelly Associates Inc. (Figure 2, dated 2009)). These plans were used to extrapolate the “approximate” existing ground surface elevations at the borehole locations. However, the elevations should only be considered as being approximate and should be confirmed once the actual survey information is received from the Client. We have assumed the elevations to be Geodetic.

The boreholes were advanced using solid and hollow stem continuous flight augers, with a track-mounted drilling rig, under the full-time supervision of geotechnical personnel from our office. Soil samples were taken at 0.76 to 1.5 m intervals for the full depth of the investigation and the Standard Penetration Test (SPT) was performed in accordance with ASTM D1586. This consists of freely dropping a 63.5 kg (140 lbs) hammer a vertical distance of 0.76 m (30 inches) to drive a 51 mm (2 inches) diameter o.d. split-barrel (split spoon) sampler into the ground. The number of blows of the hammer required to drive the sampler into the relatively undisturbed ground by a vertical distance of 0.30 m (12 inches) is recorded as the SPT ‘N’-value of the soil and this gives an indication of the consistency or the relative density of the soil deposit.

Upon completion of boreholes, the soil samples were transported to our Soils Laboratory for further examination and laboratory testing. Soil laboratory testing, consisting of moisture content determination, gradation analysis (Sieve and Hydrometer tests) and Atterberg Limits (Liquid and Plastic Limits), were performed on selected representative soil samples. The results of the in-situ and laboratory tests are presented on the corresponding Record of Borehole Sheets as well as in Enclosure A.

Samples obtained during this investigation will be stored in our Soils Laboratory for three months and will be disposed thereafter.

3.0 SUB-SURFACE CONDITIONS

The stratigraphic units and groundwater conditions are briefly discussed in the following sections for each of the proposed works. For more detailed information, reference should be made to the Record of Borehole Sheets.

3.1 Proposed Snow Making Pond (Borehole 1)

The snow making pond is proposed to be located on the north end of the property, adjacent to 17

Sideroad. As requested, Borehole 1 was drilled at this location. Based on the subsurface conditions encountered at this borehole, the site is underlain by topsoil and fill extending down to a depth of about 0.8 m below existing grade. It should however be noted that the thickness and quality of topsoil and fill can vary significantly beyond the borehole location. Considering this, the extent of fill at the site and the limited size of an auger hole, we recommend that allowance be made for possible variations when making estimates. Alternatively, the depth and quality of topsoil and fill could be further investigated by test pitting.

The fill was then underlain by gravelly sand and layers of sand deposits with occasional gravel, silty sand interbeddings, trace to some silt and clay, extending to the completion of the borehole at approximately 9.0 m below existing ground surface.

Standard Penetration Tests were performed at the site and the recorded 'N'-values within the gravelly sand and sand layers were found to range widely from 8 to more than 50 blows/0.3m, indicating a loose to very dense, but generally compact relative density. Samples from these deposits were also tested for natural moisture content and the results were found to generally range from 8 to 19%. Considering these results as well as visual and tactile examination of the recovered soil samples, the deposits were generally wet.

Representative samples from the sand deposits were tested for gradation analysis. The results are presented on the Record of Boreholes as well as in Enclosure A and they are summarized below:

	BH 1: S5	BH 1: S8	BH 1: S10
Gravel:	1%	0%	11%
Sand:	92%	74%	87%
Silt and Clay:	7%	26%*	2%

* (Silt: 10%, Clay: 16%)

The groundwater condition at this borehole was monitored during and upon the completion of drilling as well as by installing a monitoring well. The results are summarized in below:

Table 1: Measured Groundwater data

Borehole	"Approx." Geodetic Ground Surface Elevation (m)	Measured Groundwater Depth / Elevation (m)		
		Upon Completion	June 6, 2018	June 13, 2018
BH 1	~264	2.0 / 262	+ 0.9 / 264.9	+ 0.8 / 264.8

It should be mentioned that the groundwater condition at the site would fluctuate seasonally and can be expected to be somewhat higher during the spring months and in response to major weather events.

3.2 Heightening the Top of the Existing Ski Hill (Boreholes 2 to 4)

Boreholes 2, 3 and 4 were drilled for this proposed work and they encountered some surficial topsoil that was underlain by fill, generally consisting of silty clay/clayey silt with occasional organic stains, trace to some rootlets and topsoil, that extended down to depths ranging from approximately 0.7 m in Borehole 2 to 5.2 m in Borehole 3. The fill at Borehole 2 was in turn underlain by a 0.3 m thick topsoil (may be the original topsoil layer). The recorded ‘N’-values within the silty clay to clayey silt fill ranged from about 6 to 12 blows/0.3 m. Samples from the fill layer were also tested for moisture content and the results were found to generally range from 12 to 23%. The collected fill samples were generally damp and the higher measured moisture content values could be due to the presence of organic content within the fill deposit. Considering the above results, we are of the opinion that the fill has received some non-systematic compaction and quality control. It should however be noted that the thickness and quality of topsoil and fill can vary significantly between and beyond the boreholes locations. Considering this, the extent of fill at the site and the limited size of an auger hole, we recommend that allowance be made for possible variations when making estimates.

Native silty clay/clayey silt was encountered below the fill layer in Boreholes 2 and 4 and below the lower topsoil layer in Borehole 3 and it extended down to depths ranging from about 0.8 m to 10.0 m below existing grade, where it was in turn underlain by highly weathered to weathered shale.

The measured ‘N’-values within the silty clay/clayey silt ranged from about 14 to more than 30 blows/0.3 m, indicating a stiff to hard, but generally very stiff to hard consistency. Representative samples from this layer were also tested for natural moisture content and the results were found to range from 10 to 17%. Based on these results as well as visual and tactile examination of the recovered soil samples, the silty clay/clayey silt was generally damp. A representative sample from this deposit was analyzed for gradation and Atterberg Limits. The results are presented on the Record of Boreholes as well as in Enclosure A and they are summarized below:

	BH 4: S54
Gravel:	0%
Sand:	4%
Silt:	52%
Clay:	44%
Liquid Limit:	36%
Plastic Limit:	21%
Plasticity Index:	15%

Considering the above results, the silty clay/clayey silt has medium plasticity.

Highly weathered to weathered shale was encountered below the silty clay to clayey silt at all three boreholes. This was further confirmed by drilling additional two shallower boreholes at a 2 m radius around Borehole 4 to ensure that a large cobble or boulder was not being encountered. The recorded 'N'-values within the highly weathered to weathered shale deposit were all well in excess of 50 blows/0.3 m. The natural moisture content test results performed on selected samples ranged from 5 to 9%. It should however be noted that the quality and the surface elevation of the highly weathered to weathered shale as described in the borehole logs should be considered as approximate only, as they were inferred from the observations during drilling rather than proven by rock coring.

The groundwater condition at these boreholes were monitored during and upon the completion of drilling as well as by installing a monitoring well in Borehole 3. The results are summarized in Table 2, below:

Table 2: Measured Groundwater data

Borehole	"Approx." Geodetic Ground Surface Elevation (m)	Measured Groundwater Depth / Elevation (m)		
		Upon Completion	June 6, 2018	June 13, 2018
BH 2	~377	Dry	-	-
BH 3	~385	12.2 / 372.8	11.1 / 373.9	11.1 / 373.9
BH 4	~374	Dry	-	-

It should be mentioned that the groundwater at the site would fluctuate seasonally and can be expected to be somewhat higher during the spring months and in response to major weather events. Furthermore, a perched water condition may also exist within the fill deposit.

3.3 Proposed Housing Units, Buildings, Water Treatment Plant & Firefighting Tanks (Boreholes 5 to 7)

As requested, Boreholes 5 to 7 were drilled to obtain some general information below the proposed six block of chalet type housing units (Blocks 1 to 6), two buildings (Building A and B), a water treatment plant and firefighting tanks to be located on the north end of the main parking lot at Sideroad 15. Based on the subsurface conditions encountered at these boreholes, fill soils generally consisting of silty sand to sandy silt, granular fill and clayey silt were contacted at all boreholes that extended down to depths ranging from approximately 0.7 m (at Boreholes 5 and 7) to 2.2 m (at Borehole 6) below existing ground surface. However, at Borehole 6, a topsoil layer was also contacted interbedded within the fill deposit. It should be noted that the thickness and quality of fill and topsoil can vary significantly in between and beyond the borehole locations. Considering this, the extent of fill at the site and the limited size of an auger hole, we recommend that allowance be made for possible variations when making estimates. Alternatively, the depth and quality of topsoil and fill could be further investigated by test pitting.

The fill layer at all boreholes was then underlain by glacial deposits, generally consisting of silty sand till and/or sandy silt till, that extended down to the completion of the boreholes at 4.9 to 5.0

…/…

m below existing grade. The recorded 'N'-values within the glacial deposits ranged from 16 to more than 50 blows/0.3 m penetration, indicating a compact to very dense, but generally dense to very dense relative density. Samples from these deposits were also tested for natural moisture content determination and the results within the sandy silt till were 12 and 13% and within the silty sand till ranged from 7 to 11%. Considering these results as well as visual and tactile examination of the recovered soil samples, the silty sand till and sandy silt till deposits were generally damp and occasionally damp to moist or moist.

Representative samples from the silty sand till and sandy silt till deposits were tested for gradation analysis. The results are presented on the Record of Boreholes as well as in Enclosure A and they are summarized below:

	BH 5: S2	BH 5: S5	BH 7: S2
Gravel:	13%	5%	2%
Sand:	59%	59%	24%
Silt:	28%	35%	69%
Clay:	0%	1%	5%

It should be noted that the occurrence of cobbles and boulders should always be expected when working in glacial till deposits.

The groundwater condition at these boreholes were monitored during and upon the completion of drilling as well as by installing a monitoring well in Borehole 7. The results are summarized in Table 3 below:

Table 3: Measured Groundwater data

Borehole	"Approx." Geodetic Ground Surface Elevation (m)	Measured Groundwater Depth / Elevation (m)		
		Upon Completion	June 6, 2018	June 13, 2018
BH 5	~307	3.2 / 303.80	-	-
BH 6	~302	4.3 / 297.7	-	-
BH 7	~286	4.5 / 281.5	2.6 / 283.4	2.8 / 283.2

It should be mentioned that the groundwater at the site would fluctuate seasonally and can be expected to be somewhat higher during the spring months and in response to major weather events. Furthermore, a perched water condition may also exist within the fill deposit.

3.4 Proposed Dry Detention Pond Basin (Borehole 8)

The dry basin is proposed to be located south of the proposed building structures, on the southeast portion of the site. Based on the subsurface conditions encountered at Borehole 8 drilled for this structure, the site is underlain by a surficial topsoil layer followed by fill that extended down to approximately 4.4 m below the ground surface. The fill generally consisted of sandy silt with trace clay, organic stains and some topsoil. The fill was found to overlie a layer of deeper topsoil (may be the original topsoil layer) that extended to about 4.8 m below existing grade. It should be noted that the thickness and quality of fill and topsoil can vary significantly beyond the borehole location. Considering this, the extent of fill at the site and the limited size of an auger hole, we recommend that allowance be made for possible variations when making estimates. Alternatively, the depth and quality of topsoil and fill could be further investigated by test pitting.

The fill deposit was then underlain by a relatively thin layer of silty sand to sandy silt that extended to approximately 5.2 m below grade. The recorded ‘N’-value with this deposit was 6 blows/0.4 m with a moisture content of more than 40%, indicating a loose and wet condition.

The silty sand to sandy silt was then underlain by glacial till deposits consisting of silty sand till or silty sand to sandy silt till that extended down to the completion of the borehole. The measured ‘N’-values within these layers ranged widely from 22 to more than 50 blows/0.3 m penetration, indicating a compact to very dense relative density. Samples from these deposits were also tested for natural moisture content determination and the results were found to range from 9 to 13%. Considering these results as well as visual and tactile examination of the recovered soil samples, the silty sand till and/or sandy silt till deposits were wet at higher elevations and became damp to moist with increased depth.

A representative sample from the silty sand to sandy silt till deposit was tested for gradation analysis. The results are presented on the Record of Boreholes as well as in Enclosure A and they are summarized below:

	BH 8: S11
Gravel:	3%
Sand:	50%
Silt:	42%
Clay:	5%

It should be noted that the occurrence of cobbles and boulders should always be expected when working in glacial till deposits.

The groundwater condition at this borehole was monitored during and upon the completion of drilling as well as by installing a monitoring well. The results are summarized in below:

Table 4: Measured Groundwater data

Borehole	“Approx.” Geodetic Ground Surface Elevation (m)	Measured Groundwater Depth / Elevation (m)		
		Upon Completion	June 6, 2018	June 13, 2018
BH 8	~296	4.6 / 291.4	3.7 / 292.3	3.8 / 292.2

It should be mentioned that the groundwater at the site would fluctuate seasonally and can be expected to be somewhat higher during the spring months and in response to major weather events. Furthermore, a perched water condition may also exist within the fill deposit.

4.0 DISCUSSION AND RECOMMENDATIONS

According to the preliminary information provided to us, we understand that the general viability of the following works is being considered at the site:

- Construction of a 6.0 m deep snow making pond on the north end of the property, adjacent to 17 Sideroad;
- Addition of 25 m of fill to be placed on top of the ski hill;
- Construction of six blocks of chalet type housing units (Blocks 1 to 6), two buildings (Building A and B), a water treatment plant and firefighting tanks to be located on the north end of the main parking lot at Sideroad 15. The proposed buildings appear to be slab-on-grade structures; and
- Construction of a 1.2 to 2.2 m deep Dry Detention Basin to be located at the southeast portion of the site (south of the proposed building structures).

Considering the above information and the subsurface conditions encountered at the borehole locations, some discussions and recommendations are provided in this section. However, they should be considered as general in nature and will need to be reviewed and confirmed by supplementary geotechnical investigations once the exact project details are known.

4.1 Construction of a Snow Making Pond

According to the information provided to us, the pond will be located on the north end of the property, adjacent to 17 Sideroad and will be 6.0 m deep with a base elevation of 257.40 m and an approximate side slope of 3H:1V.

Based on the preliminary topographic information provided to us, the existing ground surface elevation within the pond footprint generally varies from about 263 to 264 m and therefore the pond will be generally in cut.

Borehole 1 was drilled at this location. Based on the subsurface conditions encountered at this location, the pond base and walls would generally be within gravelly sand and sand deposits with the exception of the top part of the pond walls, where some engineered fill will be required to replace any existing topsoil and silty sand fill. Furthermore, the short-term groundwater level in the monitoring well installed in this borehole is measured above the existing ground surface, at Elevations 264.8 to 264.9 m and this will fluctuate with time.

Considering the above information, the stability of the pond walls was assessed by assuming a representative Section A, as shown in Figure 3. The section was analysed by assuming conservative soil parameters, as summarized in Table 5 below, based on the borehole information, the field and laboratory tests performed, our experience with similar site conditions as well as published geotechnical data.

Table 5: Assumed Conservative Geotechnical Parameters

Soil Type	**Bulk Unit Weight (kN/m^3)**	**Shear Strength Parameters**			
		C' (kPa)	**Φ' (degree)**	**C_u (kPa)**	**Φ_u (degree)**
Loose Fine Sand, Trace to Some Clay and Silt	16.5	0	20	10	10
Compact Sand, Gravelly Sand	19.0	0	30	0	30
Dense to Very Dense Sand	21.0	0	32	0	32
Engineered Fill (Sandy)	19.0	0	30	0	30

For slope stability analysis, computer program Slope/W 2012 and the Bishop's Simplified method for the calculation of the factor of safety for slip surface were used. For a slope to be assessed as being stable, a minimum Factor of Safety of 1.5 is normally required under a static loading condition.

The assumed cross-section was analysed under the following conditions:
-During Construction (Undrained Analysis); and
-Full Pool (Drained Analysis).

Furthermore, the pond wall was analysed under seismic loading conditions. The site specific seismic hazards as per National Building Code of Canada (2015) were obtained from Earthquakes Canada website (www.EarthquakesCanada.ca) and are provided in Appendix A. The peak ground acceleration (PGA) for 2 percent probability in 50 years (0.000404 per annum or return period of 2,475 years) for the site is 0.062g corresponding to Site Class C. For this study, although a geophysical assessment was not completed in assessing the applicable seismic site classification, considering the subsurface conditions encountered at the boreholes drilled at the site, a site Class D (Stiff Soil) is recommended for the property. Therefore, the peak ground acceleration corresponding to Site Class D at the site will be PGA=1.3×0.062g=0.0806g. According to industry standards, the acceleration used in pseudostatic analysis is equal to 0.5 × PGA. Based on these values and in accordance to the Canadian Foundation Manual (4th Edition), the following parameters were used for seismic stability evaluations:

Horizontal Seismic Coefficient = 0.5 X 0.0806g=0.0403g
Vertical Seismic Coefficient = 0

For a stable slope under seismic loading using pseudostatic analysis, a minimum FOS of 1.1 is normally recommended.

Considering the above details, the stability of the assumed representative cross-section under construction and ponding conditions was analysed and some of the results are shown in

Enclosures B-1 to B-3. The results indicate that the calculated Factors of Safety for static and seismic loading conditions were all above the recommended minimum values. Based on these results, the pond walls are considered to be stable.

It should be noted that as the pond base and the walls will be constructed in sandy deposits with high groundwater levels, they would need proper protection against erosion and washout. Furthermore, if a permanent water level has to be maintained in the pond, a suitable impermeable liner would be required. The liner would need to be designed against uplift hydrostatic pressures due to high groundwater levels measured at the site. We will review and provide additional recommendations once the pond information is finalized.

The pond excavation would require temporary dewatering to lower the groundwater level to below the pond base. This should be provided by the Project Dewatering Consultant.

4.2 Heightening of the Top of the Ski Hill

According to the information provided to us, we understand that the top of the existing ski hill is proposed to be raised by as much as 25 m on the front side and also a retaining wall system, ranging in height from approximately 4 to more than 18 m, is being considered for the backside.

Boreholes 2, 3 and 4 were drilled within the proposed heightening part of the hill. Based on the subsurface conditions encountered at these boreholes, below some surficial topsoil, the existing top of the hill has about 5 m of silty clay/clayey silt fill at Borehole 3 and this reduces to about 0.2 m at Borehole 2 and to about 1.5 m at Borehole 4. The fill at Borehole 3 was in turn underlain by a 0.3 m thick deeper topsoil layer. The field and laboratory test results appear to indicate that the existing fill has received some relatively non-systematic low compaction and quality control. The topsoil and fill layers were in turn underlain by still to hard silty clay/clayey silt that was found to overlie highly weathered to weathered shale.

Based on the provided topographic survey information, two sections were assumed that pass through the front of the ski hill (i.e. Sections B and C). The sections were analysed by assuming conservative soil parameters, as summarized in Table 6 below, based on the borehole information, the field and laboratory tests performed, our experience with similar site conditions as well as published geotechnical data.

Table 6: Assumed Conservative Geotechnical Parameters

Soil Type	Bulk Unit Weight (kN/m³)	Shear Strength Parameters			
		C' (kPa)	Φ' (degree)	C_u (kPa)	Φ_u (degree)
Topsoil	16.5	0	15	20	0
Silty Clay/Clayey Silt Fill	17.0	0	22	35	0
Stiff Silty Clay Clayey Silt	17.5	0	25	40	0
Very Stiff to Hard Silty Clay/Clayey Silt	19.5	5	30	100	0
Highly Weathered to Weathered Shale	-	-	-	-	-
Engineered Fill (Clayey)	19.0	0	30	90	0

The assumed cross-sections were analysed under the following conditions:

-During and Immediately After Construction (Undrained Analysis);
-Long-term after Construction (Drained Analysis); and
-Seismic Loading.

Considering the above details, the stability of the assumed representative cross-sections for during and after construction was analysed and some of the results are shown in Enclosure B-4 to B-9. The results indicate that the calculated Factors of Safety under static and seismic loading conditions were all above the recommended minimum values. Based on these results, the proposed slope heightening would have adequate factor of safety against slope failure for the front slope. However, additional boreholes should be drilled within the proposed filling area as well as at lower elevations down the slope face in order to better define the existing subsurface conditions.

For raising the slope, the following 'preliminary' placement procedure is recommended.

(i) The area to receive the engineered fill should be stripped of any topsoil and other compressible, weak and deleterious materials. After stripping, the entire area should be inspected and approved by the geotechnical engineer. Spongy, wet or soft/loose spots should be sub-excavated to stable subgrade and replaced with compactable approved soil, compatible with subgrade conditions, as directed by the geotechnical engineer.

(ii) The fill material should be placed in thin layers not exceeding approximately 200 mm when loose. Oversize particles (cobbles and boulders) larger than 120 mm should be discarded, and each fill layer should be uniformly compacted with heavy compactors, suitable for the type of fill used, to at least 100% of its Standard Proctor Maximum Dry Density.

The on-site inorganic soils are generally acceptable for use as engineered fill, provided they are not contaminated with the overlying organic rich deposits and any organic inclusions are removed. Depending on the construction season, the on-site soils may require some reconditioning, wetting or drying. It should also be noted that the sandy and silty deposits are sensitive to moisture and they will require a more strict control on their moisture content if they are to be used in the engineered fill operation.

(iii) Full-time geotechnical inspection and quality control (by means of frequent field density and laboratory testing) are necessary for the construction of a certifiable engineered fill. Compaction procedures and efficiency should be controlled by a qualified geotechnical technician.

(iv) The engineered fill should not be frozen and should be placed at a moisture content within 2% of the optimum value for compaction. The engineered fill should not be performed during winter months when freezing ambient temperatures occur persistently or intermittently.

The proposed fill will settle under self-weight and it will also cause settlement of the underlying existing fill and native soils. Assuming the above procedure, the total settlement is estimated to range from approximately 40 to 60 cm. However, depending on the actual organic content within the existing fill, the settlement values could be higher. Also, considering the cohesive nature of the existing fill and assuming that a similar soil type is used for raising the hill, the settlements should occur over several years. We would however recommend that the settlements at the site (within the proposed fill areas as well as down the existing hill) to be instrumented and monitored by surveying. Due to the non-homogeneous nature of the existing fill and the presence of topsoil and organic matters within the fill, some excessive differential settlement should also be expected.

With respect to the proposed retaining walls for the backside of the hill, we would recommend that global slope stability analysis to be performed once the wall designs are available. Additional boreholes would be required along the proposed wall to better identify the subsurface conditions. The wall designer should also confirm the internal stability of the walls (sliding, overturning and bearing capacity). We would recommend the walls to be placed on the native and competent silty clay/clayey silt deposit, properly engineered fill or on the highly weathered to weathered shale. Based on these as well as the wall design, additional geotechnical parameters and recommendations will be provided.

4.3 Proposed Housing Units, Buildings, Water Treatment Plant & Fire Fighting Tanks

According to the Client, six blocks of chalet type housing units, two buildings, a water treatment plant and firefighting tanks are being assessed for construction on the north end of the main parking lot at Sideroad 15. The proposed buildings appear to be slab-on-grade structures. Boreholes 5, 6 and 7 were drilled in this area. Based on the subsurface conditions encountered at these boreholes, below some fill and/or topsoil, the site is predominantly underlain by compact to very dense silty sand till and/or sandy silt till. Furthermore, the groundwater level over our short-term monitoring program was measured below a depth of about 2.6 m below existing ground surface.

4.3.1 Site Grading

The development of the site will require clearing and stripping of all topsoil and fill. Where residential lots or structures are being considered, it is recommended that all fill be placed as engineered fill to provide competent subgrade. Prior to placement of engineered fill, all the surficial topsoil and fill should be stripped from planned fill areas to expose the inorganic subgrade. The exposed subgrade should then be proof-rolled with a suitably heavy roller to identify weak areas. Any weak or excessively wet zones identified during proof-rolling should be sub-excavated and replaced with compacted competent material to establish stable and uniform conditions. Prior to placement of engineered fill, the subgrade should be inspected and approved by a geotechnical engineer. Reference is made to Section 4.3.4 for recommendations regarding engineered fill placement.

Provided the above recommendations are followed, and all topsoil and compressible materials are stripped or sub-excavated, the existing deposits are not considered to be highly compressible and long-term settlements should be minimal.

4.3.2 Foundations

Based on the subsurface conditions encountered at Boreholes 5, 6 and 7 drilled at the site, the footings would need to be extended down to the competent undisturbed native deposits or be placed on properly compacted engineered fill. The recommended spread footing depths and allowable soil bearing pressures are given in the following table.

Table 7: Recommended Soil Bearing Capacity Values

Borehole	**Depth Below Existing Grade (m)**	**Recommended Geotechnical Reaction at SLS * (kPa)**	**Factored Geotechnical Resistance at ULS (with a Geotechnical Resistance Factor of 0.5), (kPa)***
BH 5	± 1.1	150	225
BH 6	± 2.3	150	225
BH 7	± 1.1	150	225

* Higher Allowable Soil Bearing Capacity values are available at lower elevations, if required.

The minimum footing sizes, footing thickness, excavations and other footing requirements should be designed in accordance to the latest edition of the Ontario Building Code.

The footing subgrade should be inspected and evaluated by the Geotechnical Engineer prior to concreting to ensure that the footings are founded on competent subgrade capable of supporting the recommended design pressure.

Design frost penetration depth for the general area is 1.6 m. Therefore, a permanent soil cover of 1.6 m or its thermal equivalent is required for frost protection of foundations. All exterior footings and footings beneath unheated areas should have at least 1.6 m of earth cover or equivalent synthetic insulation for frost protection.

Where necessary, the stepping of the footings at different elevations should be carried out at an angle no steeper than 2 horizontal (clear horizontal distance between footings) to 1 vertical (difference in elevation) and no individual footing step should be greater than 0.6 m and may have to be as low as 0.3 m if weaker soils are encountered.

For footings designed and constructed in accordance with the above criteria, total and differential settlements should be less than 25 mm and 15 mm, respectively. These values are usually within tolerable limits for most types of structures.

4.3.3 Earthquake Considerations

In conformance to the Criteria in Table 4.1.8.4.A, Part 4, Division B of the National Building Code (NBC 2005), for footings designed as recommended in Section 4.3.2, the subject site is classified as Site Class “D-Stiff Soil”. The four values of the Spectral Response Acceleration $S_a(T)$ for the different periods and the peak ground acceleration (PGA) can be obtained from Table C-2 in Appendix C, Division B of the NBC (2005). The design values of F_a and F_v for the project site should be calculated in accordance to Table 4.1.8.4.B and C.

4.3.4 Engineered Fill

Depending on the proposed grades for the site, engineered fill may be required to replace the existing fill and topsoil as well as to raise the site grades for the possible support of footings and floor slabs. Engineered fill could be placed after stripping all topsoil, any soils containing excessive organics and otherwise unsuitable soils, within an area extending at least 2.5 m beyond the perimeter of the footprint of the proposed structures. Engineered fill would then be suitable to support the foundations including the slabs provided that the following criteria are strictly followed. Engineered fill may also be carried out to raise the existing grades below the proposed roads and parking lots.

The following placement procedure is recommended.

(i) The areal extent of engineered fill should be controlled by proper surveying techniques to ensure that the top of the engineered fill extends a minimum of 2.5 m beyond the perimeter of the buildings to be supported. Where the depth of engineered fill exceeds 1.5 m, this horizontal distance of 2.5 m beyond the perimeter of the building should be increased by at least 1.0 m for each 1.0 m depth of fill.

(ii) The area to receive the engineered fill should be stripped of any topsoil, fill and other compressible, weak and deleterious materials. After stripping, the entire area should be inspected and approved by the geotechnical engineer. Spongy, wet or soft/loose spots should be sub-excavated to stable subgrade and replaced with compactable approved soil, compatible with subgrade conditions, as directed by the geotechnical engineer.

(iii) The fill material should be placed in thin layers not exceeding approximately 200 mm when loose. Oversize particles (cobbles and boulders) larger than 120 mm should be discarded, and each fill layer should be uniformly compacted with heavy compactors, suitable for the type of fill used, to at least 98% of its Standard Proctor Maximum Dry Density.

The on-site inorganic soils are generally acceptable for use as engineered fill, provided they are not contaminated with the overlying organic rich deposits and any organic inclusions are removed. Depending on the construction season, the on-site soils may require some reconditioning.

(iv) Full-time geotechnical inspection and quality control (by means of frequent field density and laboratory testing) are necessary for the construction of a certifiable engineered fill. Compaction procedures and efficiency should be controlled by a qualified geotechnical technician.

(v) The engineered fill should not be frozen and should be placed at a moisture content within 2% of the optimum value for compaction. The engineered fill should not be performed during winter months when freezing ambient temperatures occur persistently or intermittently.

The allowable soil bearing pressure is 150 kPa for footings supported by at least 1.0 m of engineered fill constructed in accordance with the above recommendations. We also recommend that the footing subgrade be evaluated by the geotechnical engineer prior to placing the formwork. It is recommended to increase the rigidity of foundations of structures erected over engineered fill, and this is generally achieved by making the footings at least 0.5 m wide, and adding reinforcing rebars to the footings and walls. This measure helps to bridge over eventual weak spots in the fill.

All footings should have at least 1.6 m of earth cover or equivalent artificial insulation for frost protection.

For footings designed and constructed in accordance with the above criteria, total and differential settlements should be less than 25 mm and 15 mm, respectively. These values are usually within tolerable limits.

4.3.5 Excavating and Dewatering

All temporary excavations should be carried out in accordance with the Ontario Health and Safety Regulations. The soils to be excavated can be classified as follows:

-Topsoil / Fill	Type 4
-Compact Silty Sand/Sandy Silt Till	Type 3
-Dense to Very Dense Silty Sand/Sandy Silt Till (above groundwater level or when dewatered)	Type 2

Accordingly, for Type 3 Soils, a side slope of 1H:1V is required for excavations in accordance with the Ontario Health and Safety Regulations. Within Type 4 Soils, the side slope of the excavation would need to be flattened to at least 3H:1V. In Type 2 soils, the bottom 1.2 m of the excavation could be carried out close to vertical.

Stockpiles of excavated materials should be kept at least 5 m away from the edge of the excavation to avoid slope instability. This distance should be increased for any stockpiling along the top of the existing slopes (we should be informed to provide additional recommendations if soil stockpiling on top of slopes is being considered). Care should also be taken to avoid overloading of any underground services/structures by stockpiles.

Based on the subsurface conditions encountered at the boreholes, within the recommended depth for footings provided in Table 7, we anticipate all footing excavations to be above the measured groundwater levels, either in engineered fill or within native deposits. Considering this, we do not anticipate major dewatering problems for footing excavations, although some dewatering may have to be carried out for excavations due to surface runoff, from any perched water within the fill layer or groundwater seepage. We are of the opinion that these should be manageable by pumping from temporary sumps protected against erosion. Such sumps should be dug outside the footprint of the structures to minimize disturbance to the footing grade. We recommend that once the structure footing invert information are known and prior to construction, the groundwater conditions at the site to be further assessed by test pitting.

4.3.6 Building Slab Construction & Drainage

Concrete floor slab may be built on properly prepared subgrade or engineered fill. If the existing topsoil/fill is left underneath the slab, long-term settlement and/or cracks may occur. The existing

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fill and topsoil should be removed and replaced with compacted engineered fill in order to support the floor slab. For engineered fill subgrade, Section 4.3.4 should be followed.

Underneath the building slabs, a 150 mm thick base course consisting of 20 mm size clear stone or OPSS Granular A should be placed to improve the support for the floor slab and function as drainage layer. This base course should be compacted with vibratory equipment to a uniform high density. If the subgrade is wet, the clear stone or OPSS Granular A base should be separated from the subgrade by an approved filter fabric (e.g. non-woven geotextile, with FOS of 75 - 150 µm, Class II).

The site should be graded for drainage away from foundations. A minimum cross fall of three percent (3%) immediately adjacent to foundations is recommended to allow for some settlement and promote good surface drainage.

4.4 Proposed Dry Detention Basin

Based on the information provided to us we understand that a 1.2 to 2.2 m deep dry detention basin is proposed to be constructed on the southeast portion of the site, south of the proposed building structures. The dry pond base will be at Elevation 293.80 m and the top of the pond at Elevation 296.35 m. The pond will have a side slope of 4H:1V.

Based on the preliminary topographic information provided to us, the existing ground surface elevation within the pond footprint generally varies from about 295 to 297 m and therefore the pond will generally in cut.

Borehole 8 was drilled at this location. Based on the subsurface conditions encountered at this location, the pond base and walls would generally be within sandy silt fill with occasional topsoil interbeddings. Furthermore, the short-term highest groundwater level in the monitoring well installed in this borehole was measured at depth of about 3.7 m below existing ground surface and this will fluctuate with time.

Considering the above information, the pond will be placed within a fill deposit which appears to have received little to no compactive effort or quality control and will not provide a long-term stable pond structure. We would therefore recommend the fill to be removed and then the area to be engineered up. For recommendations on the construction of the engineered fill reference should be made to Section 4.3.4. It should be noted that the pond is designed as a dry pond and threfeore by definition it will not be holding a permanent water level. We would however recommend the pond side slopes to be protected against erosion and washout.

Considering the above information, the stability of the pond wall was assessed by assuming a representative section (i.e., Section F), as shown in Figure 5. The section was analysed by assuming conservative soil parameters, as summarized in Table 8 below, based on the borehole information, the field and laboratory tests performed, our experience with similar site conditions as well as published geotechnical data.

Table 8: Assumed Conservative Geotechnical Parameters

Soil Type	**Bulk Unit Weight (kN/m^3)**	**Shear Strength Parameters**			
		C' (kPa)	**Φ' (degree)**	**C_u (kPa)**	**Φ_u (degree)**
Engineered Fill (Sandy)	19.0	0	30	0	30

For slope stability analysis, computer program Slope/W 2012 and the Bishop's Simplified method for the calculation of the factor of safety for slip surface were used.

The assumed cross-section was analysed under the following conditions:

-During Construction (Undrained Analysis);
-Normal Water Level (Drained Analysis); and
-Seismic Loading.

Considering the above details, the stability of the assumed representative cross-section was analysed under construction, normal water level as well as seismic loading conditions. Some of the results are shown in Enclosure B-10 to B-15. The results indicate that the calculated Factors of Safety were all above the recommended minimum values for static and seismic loading conditions. Based on these results, the pond walls are considered to be stable.

The pond excavation would require temporary dewatering to lower the groundwater level down to the native deposit, so that the engineered fill could be constructed. Recommendations on the dewatering methodology should be provided by the Project Dewatering Consultant.

5.0 CLOSURE

As requested, the viability of some proposed works at the ski club was investigated and this preliminary feasibility report was prepared to summarise the subsurface findings at the requested borehole locations together with some preliminary geotechnical comments and recommendations. We would however recommend that once the development details are finalized and a detailed topographic survey map is available, our recommendations should be reviewed for their specific applicability and the recommendations to be finalized. A supplemental geotechnical investigation will be required.

The attached Report Limitations are an integral part of this report.

Sincerely,
Shad & Associates Inc.

S. Chong

LICENSED PROFESSIONAL ENGINEER
H. SHAD
PROVINCE OF ONTARIO

H. Shad

Stephen Chong, P. Eng.
Senior Engineer

Houshang Shad, Ph. D., P. Eng.
Principal

STATEMENT OF LIMITATION

The conclusions and recommendations given in this report are based on information obtained at the testhole locations. Subsurface and groundwater conditions between and beyond the testholes may differ from those encountered at the testhole locations, and conditions may become apparent during construction which could not be detected or foreseen at the time of the site investigation.

The information contained herein in no way reflects on the environmental aspects of the project, unless stated otherwise.

The benchmark and elevations used in this report are primarily to establish relative elevation differences between the testhole locations and should not be used for other purposes, such as planning, grading, excavating, etc.

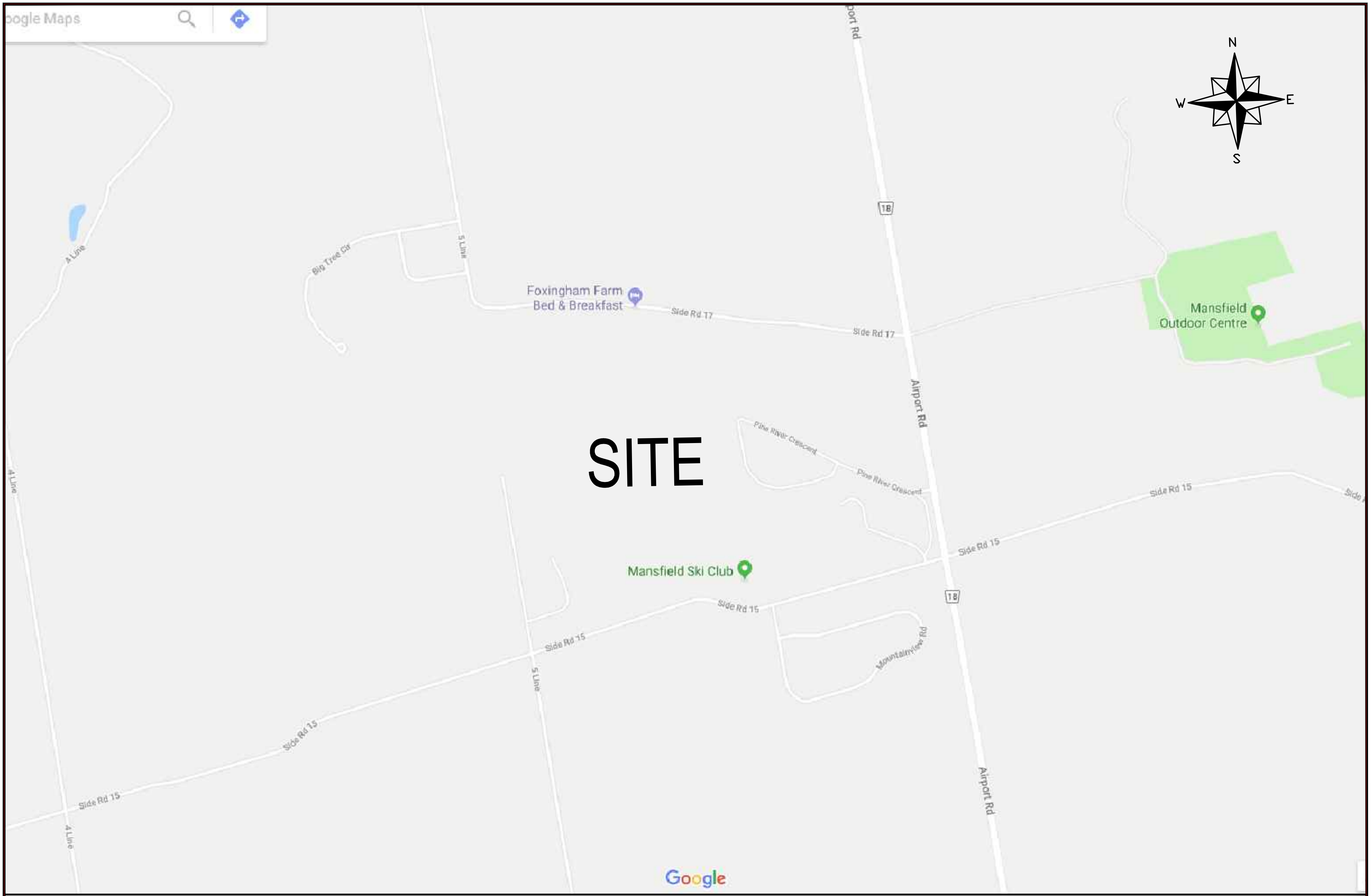
The design recommendations given in this report are project as well as site specific and then only if constructed substantially in accordance with the details stated in this report. We recommend, therefore, that we be retained during the final design stage to review the design drawings and to verify that they are consistent with our recommendations or the assumptions made in our analysis.

The comments given in this report on potential construction problems and possible methods are intended only for the guidance of the designer. The number of the testholes may not be sufficient to determine all the factors that may affect construction methods and costs. The contractors bidding on this project or undertaking construction should, therefore, make their own interpretation of the factual information presented and draw their own conclusions as to how the subsurface conditions may affect their work.

We recommend that we be retained during construction to confirm that the subsurface conditions throughout the site do not deviate materially from those encountered in the testholes.

Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, is the responsibility of such third party. We accept no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

FIGURES



CLIENT:

Mansfield Ski Club

SHAD & ASSOCIATES INC.
GEOTECHNICAL, ENVIRONMENTAL AND MATERIALS CONSULTING ENGINEERS
83 Citation Drive, Unit 9
Vaughan, Ontaruio, L4K 2Z6
Tel: (905) 760-5566
Fax: (905) 760-5567
www.shadinc.ca

SHAD & ASSOCIATES INC.

Drawn By: M.Z.
Checked By: H.S.
Datum: -
Projection: -
Scale: N.T.S.

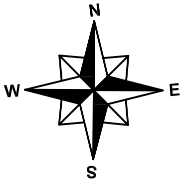
TITLE:

SITE LOCATION PLAN

PROJECT:

Feasibility Assessment
Preliminary Geotechnical Investigation
Proposed Development
628213 Sideroad 15
Mulmur, Ontario

Date: June, 2018
Project No.: T18733
Figure No.:
1



LEGEND:

BH 1
⊕ Borehole Location

NOTES:

1. All Borehole locations are approximate.
2. Drawing not to scale.
3. The base drawing was provided by Client.
4. The drawing should be read in conjunction with the associated report by Shad & Associates Inc., T18733.

CLIENT:
Mansfield Ski Club

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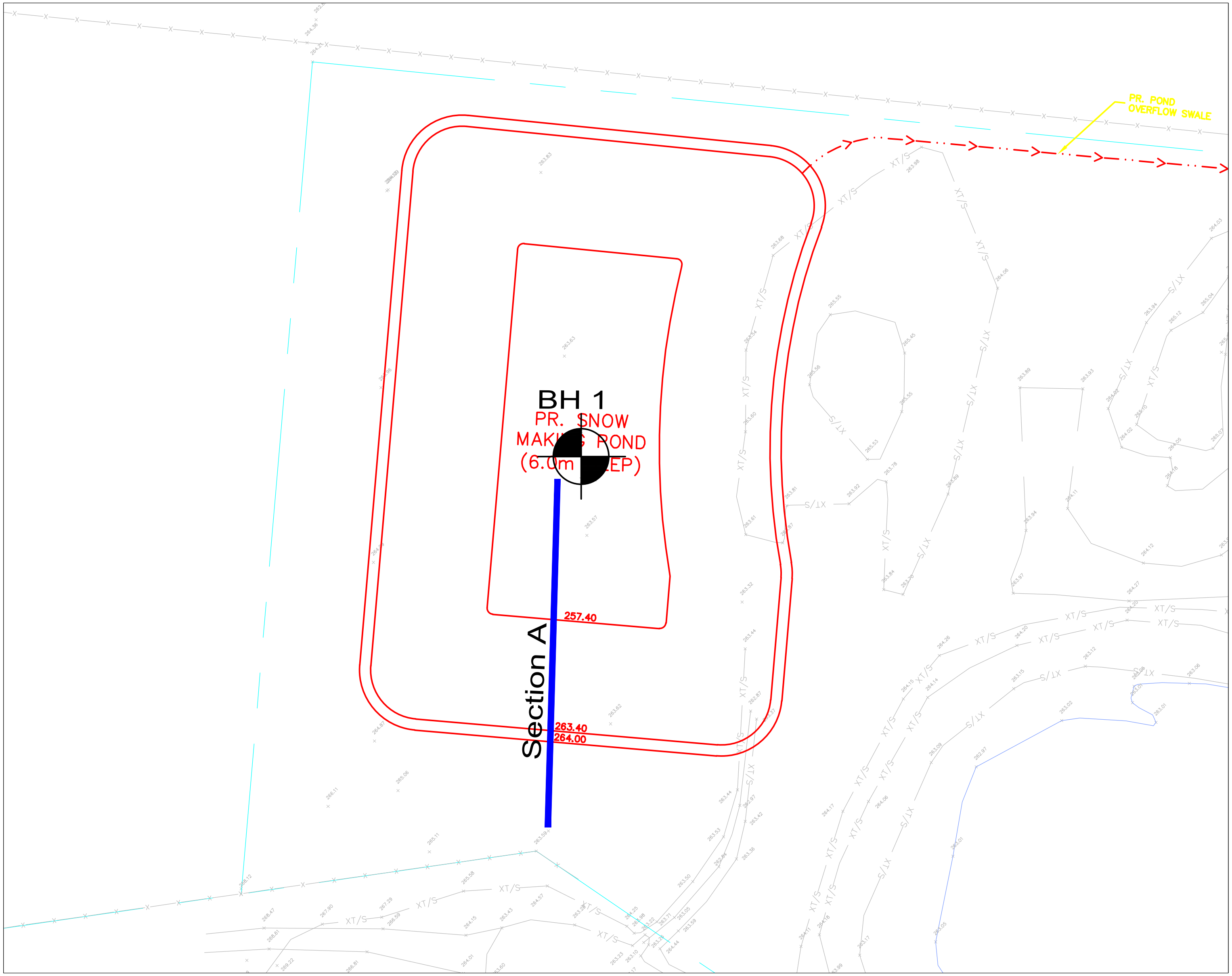
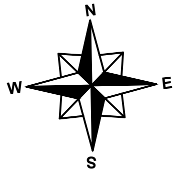
Drawn By: M.Z.
Checked By: H.S.
Datum: -
Projection: -
Scale: N.T.S.

TITLE:
Borehole Location Plan

PROJECT:
Feasibility Assessment
Preliminary Geotechnical Investigation
Proposed Development
628213 Sideroad 15
Mulmur, Ontario

Date: June, 2018
Project No.: **T18733**
Figure No.:
2





LEGEND:

BH 1

⊕ Borehole Location

Section A

▬ Assumed Sections

NOTES:

1. All Borehole locations are approximate.
2. Drawing not to scale.
3. The base drawing was provided by the Client.
4. The drawing should be read in conjunction with the associated report by Shad & Associates Inc., T18733.

CLIENT:
Mansfield Ski Club

Drawn By: M.Z.
Checked By: H.S.

TITLE:
Assumed Section for Snow Making Pond

Date: June, 2018
Project No.: **T18733**

SHAD & ASSOCIATES INC.
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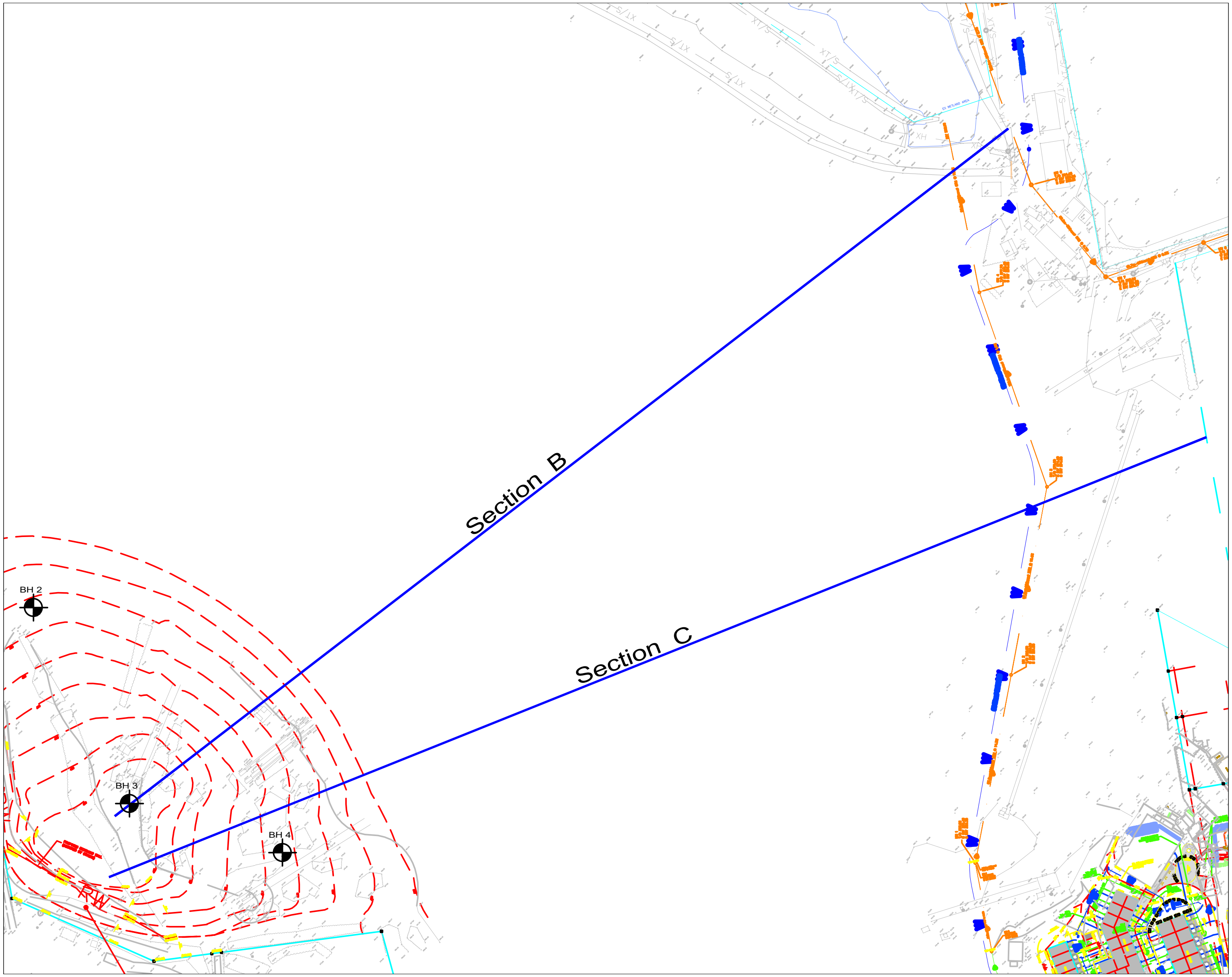
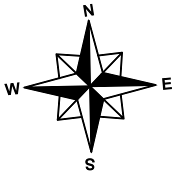
Datum: -
Projection: -
Scale: N.T.S.

PROJECT:
Feasibility Assessment
Preliminary Geotechnical Investigation
Proposed Development
628213 Sideroad 15
Mulmur, Ontario

Figure No.:
3





LEGEND:

BH 1

⊕ Borehole Location

Section B

▬ Assumed Sections

NOTES:

1. All Borehole locations are approximate.
2. Drawing not to scale.
3. The base drawing was provided by the Client.
4. The drawing should be read in conjunction with the associated report by Shad & Associates Inc., T18733.

CLIENT:

Mansfield Ski Club

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Drawn By: M.Z.

Checked By: H.S.

Datum: -

Projection: -

Scale: N.T.S.

TITLE:

Assumed Sections for Ski Hill Heightening

PROJECT:

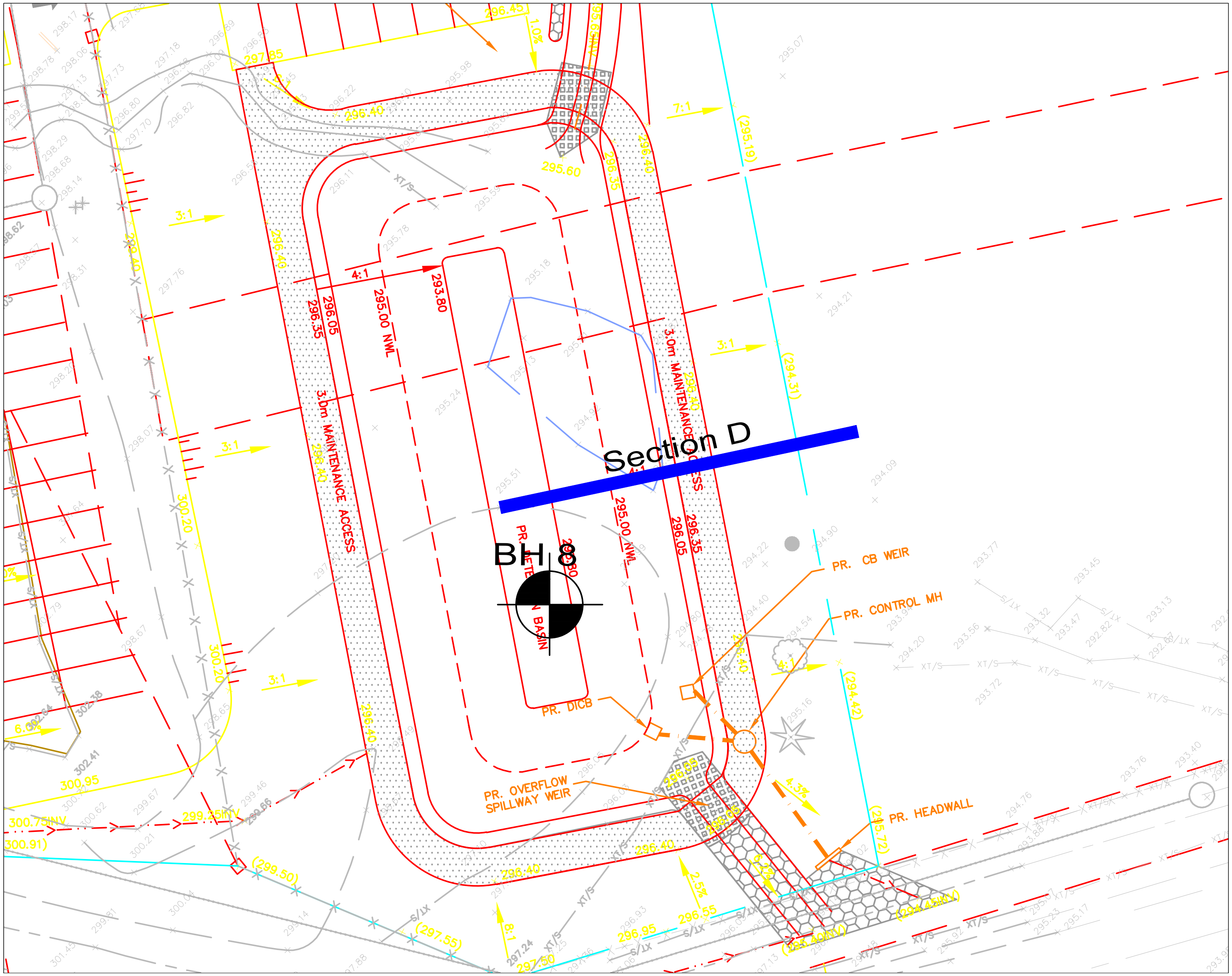
Feasibility Assessment
Preliminary Geotechnical Investigation
Proposed Development
628213 Sideroad 15
Mulmur, Ontario

Date: June, 2018

Project No.: **T18733**

Figure No.:

4



N
W
E
S

LEGEND:

BH 1

⊕ Borehole Location

Section D

▬ Assumed Sections

NOTES:

1. All Borehole locations are approximate.
2. Drawing not to scale.
3. The base drawing was provided by the Client.
4. The drawing should be read in conjunction with the associated report by Shad & Associates Inc., T18733.

CLIENT:

Mansfield Ski Club

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Drawn By: M.Z.

Checked By: H.S.

Datum: -

Projection: -

Scale: N.T.S.

TITLE:

Assumed Section for Dry Detention Pond

PROJECT:
Feasibility Assessment
Preliminary Geotechnical Investigation
Proposed Development
628213 Sideroad 15
Mulmur, Ontario

Date: June, 2018

Project No.: **T18733**

Figure No.:

5

RECORD OF BOREHOLES

RECORD OF BOREHOLES (BH 1 to 8)
EXPANATION OF BOREHOLE LOGS

RECORD OF BOREHOLE 1

Project No.: T18733
CLIENT: Mansfield Ski Club
ORIGINATED BY: M.Z.
DATE: May 24, 2018
LOCATION: Mulmur, Ontario
COMPILED BY: M.Z.
DATUM: Approximate Geodetic
BOREHOLE TYPE: Hollow Stem Augers
CHECKED BY: H.S.

SHAD & ASSOCIATES INC.
83 Citation Dr, Unit 9,
Vaughan, Ontario, L4K 2Z6

SOIL PROFILE

ELEVATION (metres)	DESCRIPTION
264.0	Ground Surface
263.6	**Topsoil**
263.2	dark brown to black **Silty Sand Fill** some rootlets, occ. organic stains some gravel, wet
261.9	occ. organic stains greyish brown **Gravelly Sand** wet, compact grey
258.5	grey **Fine Sand** occ. gravel wet, compact very dense occ. silty sand interbeddings occ. gravel
257.3	grey **Fine Sand** trace to some clay and silt wet, loose
	grey **Sand** some gravel, occ. silty sand/sandy silt seams wet, dense

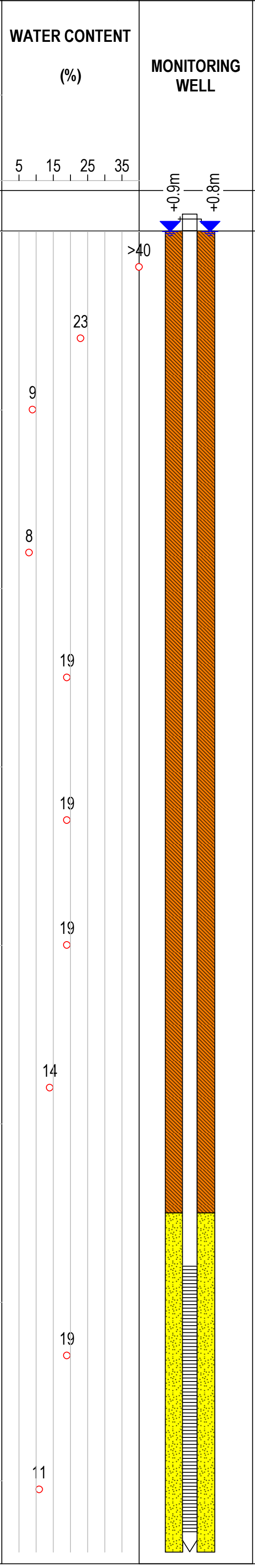
SAMPLES

SAMPLE NUMBER	TYPE	RECOVERY (cm)	" N " VALUES	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
1	SS	60	5	
2	SS	23	21	
3	SS	20	28	
4	SS	10	10	
5	SS	25	11	Gradation Analysis, S(5): 1 92 7
6	SS	41	16	
7	SS	35	100	The high 'N'-Value could be due to the presence of gravel particles within the soil matrix.
8	SS	28	8	Gradation Analysis, S(8): 0 74 10 16
9	SS	35	47	

GROUND WATER CONDITIONS: May 24, 2018

DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100

SHEAR STRENGTH kPa 20 40 60 80 100



RECORD OF BOREHOLE 1

Project No.: T18733
CLIENT: Mansfield Ski Club
ORIGINATED BY: M.Z.
DATE: May 24, 2018
LOCATION: Mulmur, Ontario
COMPILED BY: M.Z.
DATUM: Approximate Geodetic
BOREHOLE TYPE: Hollow Stem Augers
CHECKED BY: H.S.

SHAD & ASSOCIATES INC.
83 Citation Dr, Unit 9,
Vaughan, Ontario, L4K 2Z6

SOIL PROFILE				SAMPLES								
ELEVATION (metres)	DEPTH SCALE (metres)	DESCRIPTION	STRATA PLOT	SAMPLE NUMBER	TYPE	RECOVERY (cm)	" N " VALUES	GROUND WATER CONDITIONS	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH kPa 20 40 60 80 100	WATER CONTENT (%) 5 15 25 35	MONITORING WELL	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	8	occ. gravel, compact		10	SS	30	26			14		Gradation Analysis, S(10): 11 87 2
255.8		grey **Fine to Medium Sand** occ. gravel, wet, very dense		11	SS	30	77			17		
255.0	9	**End of Borehole** Cave-in Depth on Completion: N/A Groundwater Depth on Completion: 2.0m Measured Groundwater in Installed Monitoring Well on: June 6, 2018: 0.9m above ground June 13, 2018: 0.8m above ground										
	10											
	11											
	12											
	13											
	14											

RECORD OF BOREHOLE 2

Project No.: T18733
CLIENT: Mansfield Ski Club
ORIGINATED BY: M.Z.
DATE: May 29, 2018
LOCATION: Mulmur, Ontario
COMPILED BY: M.Z.
DATUM: Approximate Geodetic
BOREHOLE TYPE: Solid Stem Augers
CHECKED BY: H.S.

SHAD & ASSOCIATES INC.
83 Citation Dr, Unit 9,
Vaughan, Ontario, L4K 2Z6

ELEVATION (metres)	DEPTH SCALE (metres)	SOIL PROFILE DESCRIPTION	SAMPLE NUMBER	TYPE	RECOVERY (cm)	" N " VALUES	GROUND WATER CONDITIONS	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH kPa 20 40 60 80 100	WATER CONTENT (%) 5 15 25 35	MONITORING WELL	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
377.0		Ground Surface									
	0	**Topsoil**	1	SS	46	5			28		
376.6		mottled brown **Silty Clay/Clayey Silt Fill** occ. organic stains, damp							21		
376.4											
376.2	1	reddish brown, occ. greyish brown **Silty Clay/Clayey Silt** damp, stiff	2	SS	13	50/8cm			6		
		reddish brown **Highly Weathered Shale** occ. limestone seams/fragments	3	SS	15	50/8cm			7		Hard Augering
	2	**Weathered Shale**									
		occ. limestone seams/interbeddings	4	SS	15	50/8cm			5		
	3		5	SS	13	50/5cm			7		
	4										
372.3			6	SS	8	50/8cm			9		
	5	**End of Borehole** Cave-in Depth on Completion: None Groundwater Depth on Completion: Dry									
	6										
	7										

RECORD OF BOREHOLE 3

Project No.: T18733
CLIENT: Mansfield Ski Club
ORIGINATED BY: M.Z.
DATE: May 29, 2018
LOCATION: Mulmur, Ontario
COMPILED BY: M.Z.
DATUM: Approximate Geodetic
BOREHOLE TYPE: Hollow Stem Augers
CHECKED BY: H.S.

SHAD & ASSOCIATES INC.
83 Citation Dr, Unit 9,
Vaughan, Ontario, L4K 2Z6

SOIL PROFILE

ELEVATION (metres)	DESCRIPTION
385.0	Ground Surface
384.8	**Topsoil**
	some rootlets, occ. organic stains
	reddish brown, occ. greyish brown **Silty Clay/Clayey Silt Fill** occ. gravel, damp
	occ. organic stains
	occ. rootlets
379.8	**Topsoil**
379.5	reddish brown, occ. greyish brown **Silty Clay/Clayey Silt** occ. shale fragments damp, very stiff

DEPTH SCALE (metres): 0, 1, 2, 3, 4, 5, 6, 7

SAMPLES

SAMPLE NUMBER	TYPE	RECOVERY (cm)	" N " VALUES
1	SS	28	7
2	SS	10	6
3	SS	18	7
4	SS	15	12
5	SS	28	12
6	SS	25	10
7	SS	23	9
8	SS	15	17
9	SS	28	21
10	SS	25	18

GROUND WATER CONDITIONS

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

SHEAR STRENGTH kPa: 20 40 60 80 100

WATER CONTENT (%): 5 15 25 35

21
18
21
19
16
16
16
12
18
16
17
17

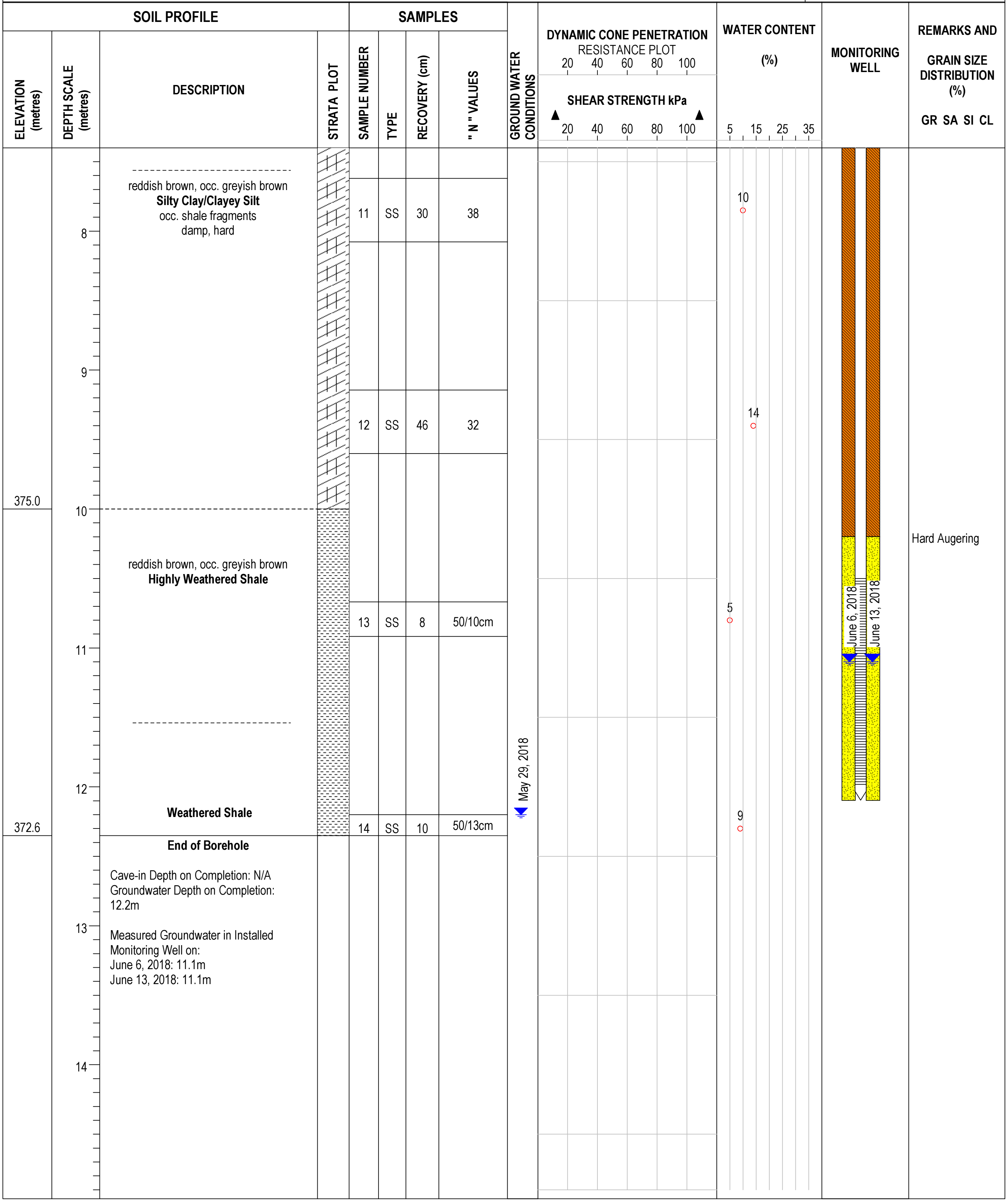
MONITORING WELL

REMARKS AND GRAIN SIZE DISTRIBUTION (%)
GR SA SI CL

RECORD OF BOREHOLE 3

Project No.: T18733
CLIENT: Mansfield Ski Club
ORIGINATED BY: M.Z.
DATE: May 29, 2018
LOCATION: Mulmur, Ontario
COMPILED BY: M.Z.
DATUM: Approximate Geodetic
BOREHOLE TYPE: Hollow Stem Augers
CHECKED BY: H.S.

SHAD & ASSOCIATES INC.
83 Citation Dr, Unit 9,
Vaughan, Ontario, L4K 2Z6



ELEVATION (metres)	DESCRIPTION	REMARKS
	reddish brown, occ. greyish brown **Silty Clay/Clayey Silt** occ. shale fragments damp, hard	
375.0	reddish brown, occ. greyish brown **Highly Weathered Shale**	Hard Augering
	Weathered Shale	
372.6	**End of Borehole**	

SAMPLE NUMBER	TYPE	RECOVERY (cm)	" N " VALUES	WATER CONTENT (%)
11	SS	30	38	10
12	SS	46	32	14
13	SS	8	50/10cm	5
14	SS	10	50/13cm	9

End of Borehole

Cave-in Depth on Completion: N/A
Groundwater Depth on Completion: 12.2m

Measured Groundwater in Installed Monitoring Well on:
June 6, 2018: 11.1m
June 13, 2018: 11.1m

RECORD OF BOREHOLE 4

Project No.: T18733
CLIENT: Mansfield Ski Club
ORIGINATED BY: M.Z.

DATE: May 25, 2018
LOCATION: Mulmur, Ontario
COMPILED BY: M.Z.

DATUM: Approximate Geodetic
BOREHOLE TYPE: Hollow Stem Augers
CHECKED BY: H.S.

SHAD & ASSOCIATES INC.
83 Citation Dr, Unit 9,
Vaughan, Ontario, L4K 2Z6

SOIL PROFILE				SAMPLES								
ELEVATION (metres)	DEPTH SCALE (metres)	DESCRIPTION	STRATA PLOT	SAMPLE NUMBER	TYPE	RECOVERY (cm)	" N " VALUES	GROUND WATER CONDITIONS	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa 20 40 60 80 100	WATER CONTENT (%) 5 15 25 35	MONITORING WELL	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
374.0		Ground Surface										
	0	**Topsoil**		1	SS	41	6			36		
373.7		some topsoil								23		
	1	reddish brown **Silty Clay/Clayey Silt Fill** occ. organic stains, trace rootlets, damp		2	SS	30	11			18		
				3	SS	28	14			20		
372.2	2	reddish brown **Silty Clay/Clayey Silt** occ. silt seams damp, stiff										
		occ. shale fragments, hard		4	SS	30	41			13		
371.1	3	reddish brown **Highly Weathered Shale** occ. limestone fragments		5	SS	18	50/10cm			7		
	4			6	SS	15	50/8cm			7		
		Weathered Shale		7	SS	15	50/3cm			6		
	5											
	6			8	SS	8	50/10cm			7		
	7											

Additionally drilled Boreholes 4A and 4B about 2m west and east of Borehole 4 to confirm the shale deposit.

BH 4A:
Approx. Depth: 4.6m
Highly Weathered Shale @~ 3.0m with a SPT value of 50 blow/2cm and moisture content of 6%.

BH 4B:
Approx. Depth: 4.6m
Highly Weathered Shale @~ 3.0m with a SPT value of 50 blow/10cm and moisture content of 6%.

Gradation Analysis & Atterberg Limits, S(4):
0 4 52 44
LL: 36%
PL: 21%
PI: 15%

RECORD OF BOREHOLE 4

Project No.: T18733
CLIENT: Mansfield Ski Club
ORIGINATED BY: M.Z.
DATE: May 25, 2018
LOCATION: Mulmur, Ontario
COMPILED BY: M.Z.
DATUM: Approximate Geodetic
BOREHOLE TYPE: Hollow Stem Augers
CHECKED BY: H.S.

SHAD & ASSOCIATES INC.
83 Citation Dr, Unit 9,
Vaughan, Ontario, L4K 2Z6

SOIL PROFILE				SAMPLES								
ELEVATION (metres)	DEPTH SCALE (metres)	DESCRIPTION	STRATA PLOT	SAMPLE NUMBER	TYPE	RECOVERY (cm)	" N " VALUES	GROUND WATER CONDITIONS	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH kPa ▲ 20 40 60 80 100 ▲	WATER CONTENT (%) 5 15 25 35	MONITORING WELL	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
		reddish brown **Weathered Shale**	▨	9	SS	10	50/13cm			8		
	8		▨									
	9		▨									
364.7			▨	10	SS	10	50/10cm			6		
		End of Borehole Cave-in Depth on Completion: None Groundwater Depth on Completion: Dry										
	10											
	11											
	12											
	13											
	14											

RECORD OF BOREHOLE 5

Project No.: T18733
CLIENT: Mansfield Ski Club
ORIGINATED BY: M.Z.
DATE: May 30, 2018
LOCATION: Mulmur, Ontario
COMPILED BY: M.Z.
DATUM: Approximate Geodetic
BOREHOLE TYPE: Solid Stem Augers
CHECKED BY: H.S.

SHAD & ASSOCIATES INC.
83 Citation Dr, Unit 9,
Vaughan, Ontario, L4K 2Z6

SOIL PROFILE				SAMPLES								
ELEVATION (metres)	DEPTH SCALE (metres)	DESCRIPTION	STRATA PLOT	SAMPLE NUMBER	TYPE	RECOVERY (cm)	" N " VALUES	GROUND WATER CONDITIONS	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH kPa 20 40 60 80 100	WATER CONTENT (%) 5 15 25 35	MONITORING WELL	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
307.0		Ground Surface										
	0	dark brown **Silty Sand/Sandy Silt Fill** some topsoil, trace clay, moist		1	SS	30	3			15 12		
306.3		occ. organic stains										
	1	**Silty Sand Till** occ. oxidized fissures moist, compact		2	SS	41	16			11		Gradation Analysis, S(2): 13 59 28 0
		damp		3	SS	41	30			8		
	2	very dense		4	SS	30	81			7		
	3			5	SS	30	87	May 30, 2018 ▼		8		Gradation Analysis, S(5): 5 59 35 1
	4	moist										
302.1				6	SS	28	50/13cm			10		
	5	**End of Borehole** Cave-in Depth on Completion: 4.1m Groundwater Depth on Completion: 3.2m										
	6											
	7											

RECORD OF BOREHOLE 6

Project No.: T18733
CLIENT: Mansfield Ski Club
ORIGINATED BY: M.Z.
DATE: May 30, 2018
LOCATION: Mulmur, Ontario
COMPILED BY: M.Z.
DATUM: Approximate Geodetic
BOREHOLE TYPE: Solid Stem Augers
CHECKED BY: H.S.

SHAD & ASSOCIATES INC.
83 Citation Dr, Unit 9,
Vaughan, Ontario, L4K 2Z6

SOIL PROFILE				SAMPLES								
ELEVATION (metres)	DEPTH SCALE (metres)	DESCRIPTION	STRATA PLOT	SAMPLE NUMBER	TYPE	RECOVERY (cm)	" N " VALUES	GROUND WATER CONDITIONS	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH kPa ▲ 20 40 60 80 100 ▲	WATER CONTENT (%) 5 15 25 35	MONITORING WELL	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
302.0		Ground Surface										
	0	**Granular Fill**		1	SS	48	14			3 14		
		some clayey silt fill occ. organic stains		2	SS	41	17			8		
300.9	1	**Topsoil**								19 27		
300.3		brown, occ. dark brown **Sandy Silt Fill** some clay, some organic stains moist to wet		3	SS	35	2			26		
299.8	2	brown **Silty Sand Till** damp, dense		4	SS	35	47			8		
	3	damp, very dense		5	SS	20	50/13cm			7		
	4							May 30, 2018 ▼				
				6	SS	35	93			8		
297.0	5	**End of Borehole** Cave-in Depth on Completion: 4.3m Groundwater Depth on Completion: 4.3m										
	6											
	7											

RECORD OF BOREHOLE 7

Project No.: T18733
CLIENT: Mansfield Ski Club
ORIGINATED BY: M.Z.
DATE: May 30, 2018
LOCATION: Mulmur, Ontario
COMPILED BY: M.Z.
DATUM: Approximate Geodetic
BOREHOLE TYPE: Hollow Stem Augers
CHECKED BY: H.S.

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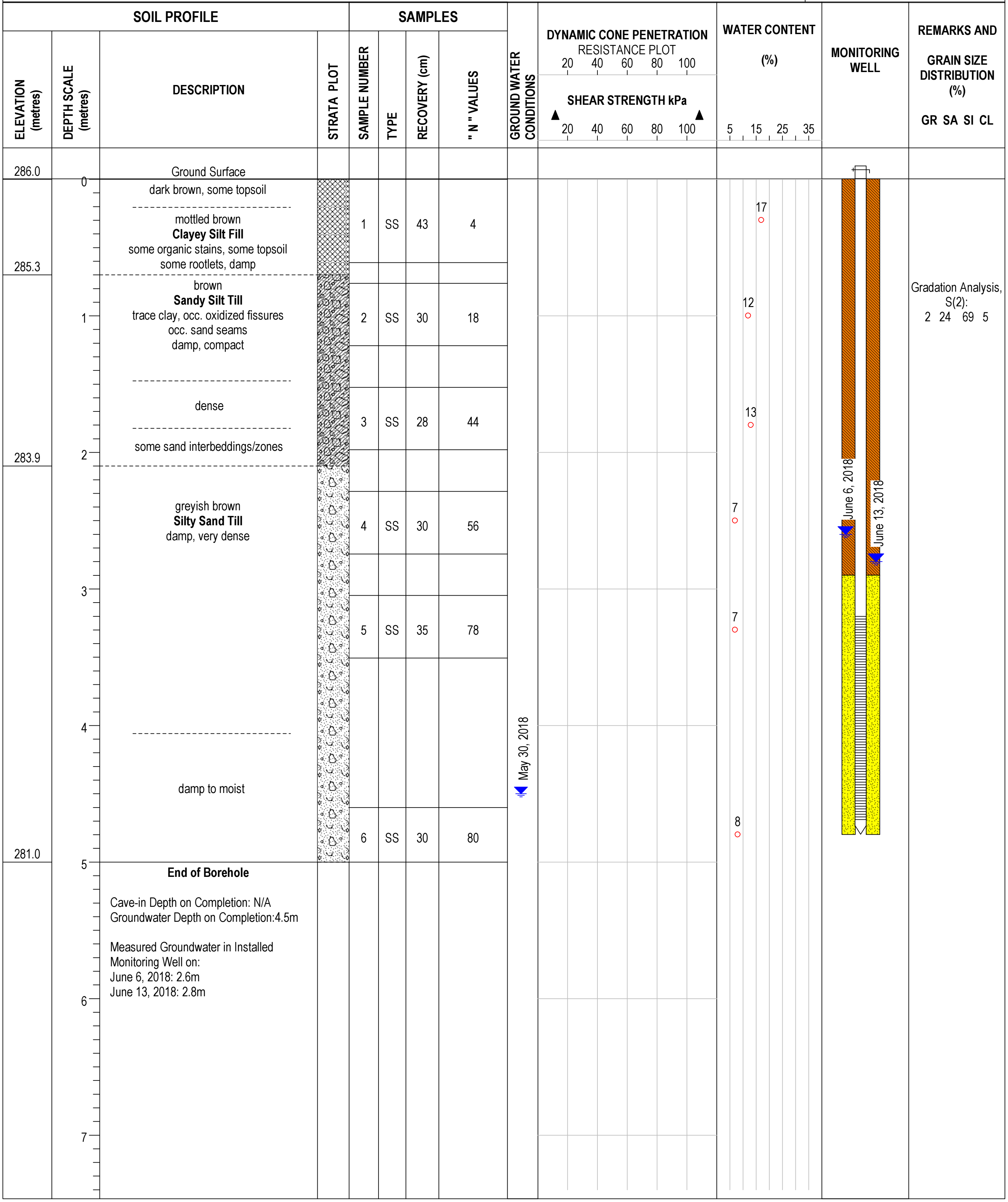

ELEVATION (metres)	DESCRIPTION	SAMPLE NUMBER	TYPE	RECOVERY (cm)	" N " VALUES	WATER CONTENT (%)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
286.0	Ground Surface						
	dark brown, some topsoil mottled brown **Clayey Silt Fill** some organic stains, some topsoil some rootlets, damp	1	SS	43	4	17	
285.3	brown **Sandy Silt Till** trace clay, occ. oxidized fissures occ. sand seams damp, compact	2	SS	30	18	12	Gradation Analysis, S(2): 2 24 69 5
	dense	3	SS	28	44	13	
	some sand interbeddings/zones						
283.9	greyish brown **Silty Sand Till** damp, very dense	4	SS	30	56	7	
		5	SS	35	78	7	
	damp to moist	6	SS	30	80	8	
281.0	**End of Borehole**						

Cave-in Depth on Completion: N/A
Groundwater Depth on Completion:4.5m

Measured Groundwater in Installed Monitoring Well on:
June 6, 2018: 2.6m
June 13, 2018: 2.8m

RECORD OF BOREHOLE 8

Project No.: T18733
CLIENT: Mansfield Ski Club
ORIGINATED BY: M.Z.
DATE: May 30, 2018
LOCATION: Mulmur, Ontario
COMPILED BY: M.Z.
DATUM: Approximate Geodetic
BOREHOLE TYPE: Hollow Stem Augers
CHECKED BY: H.S.

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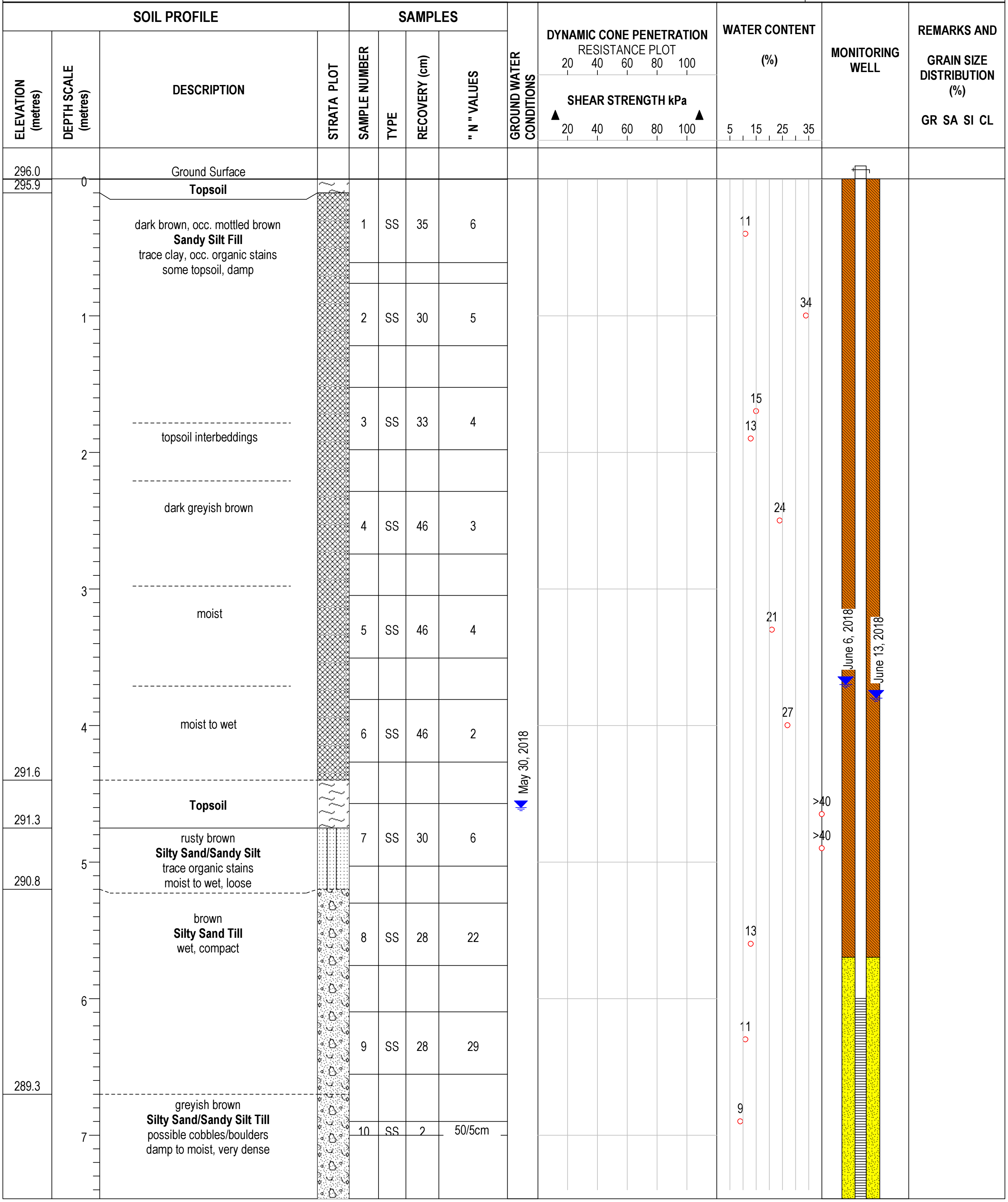

ELEVATION (metres)	DESCRIPTION
296.0	Ground Surface
295.9	**Topsoil**
	dark brown, occ. mottled brown **Sandy Silt Fill** trace clay, occ. organic stains some topsoil, damp
	topsoil interbeddings
	dark greyish brown
	moist
	moist to wet
291.6	**Topsoil**
291.3	rusty brown **Silty Sand/Sandy Silt** trace organic stains moist to wet, loose
290.8	brown **Silty Sand Till** wet, compact
289.3	greyish brown **Silty Sand/Sandy Silt Till** possible cobbles/boulders damp to moist, very dense

SAMPLE NUMBER	TYPE	RECOVERY (cm)	" N " VALUES	WATER CONTENT (%)
1	SS	35	6	11
2	SS	30	5	34
3	SS	33	4	15 13
4	SS	46	3	24
5	SS	46	4	21
6	SS	46	2	27
7	SS	30	6	>40 >40
8	SS	28	22	13
9	SS	28	29	11
10	SS	2	50/5cm	9

RECORD OF BOREHOLE 8

Project No.: T18733
CLIENT: Mansfield Ski Club
ORIGINATED BY: M.Z.
DATE: May 30, 2018
LOCATION: Mulmur, Ontario
COMPILED BY: M.Z.
DATUM: Approximate Geodetic
BOREHOLE TYPE: Hollow Stem Augers
CHECKED BY: H.S.

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Vaughan, Ontario, L4K 2Z6

SOIL PROFILE				SAMPLES								
ELEVATION (metres)	DEPTH SCALE (metres)	DESCRIPTION	STRATA PLOT	SAMPLE NUMBER	TYPE	RECOVERY (cm)	" N " VALUES	GROUND WATER CONDITIONS	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH kPa 20 40 60 80 100	WATER CONTENT (%) 5 15 25 35	MONITORING WELL	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
288.1		greyish brown **Silty Sand/Sandy Silt Till** occ. oxidized fissures damp to moist, very dense		11	SS	20	50/13cm			9		Gradation Analysis, S(11): 3 50 42 5
	8	**End of Borehole** Cave-in Depth on Completion: N/A Groundwater Depth on Completion:4.6m Measured Groundwater Level in Installed Monitoring Well on: June 6, 2018: 3.7m June 13, 2018: 3.8m										
	9											
	10											
	11											
	12											
	13											
	14											

EXPLANATION OF BOREHOLE LOG

This form describes some of the information provided on the borehole logs, which is based primarily on examination of the recovered samples, and the results of the field and laboratory tests. It should be noted that materials, boundaries and conditions have been established only at the borehole locations at the time of investigation and are not necessarily representative of subsurface conditions elsewhere across the site. Additional description of the soil/rock encountered is given in the accompanying geotechnical report.

GENERAL INFORMATION

Project details, borehole number, location coordinates and type of drilling equipment used are given at the top of the borehole log.

SOIL LITHOLOGY

Elevation and depth

This column gives the elevation and depth of inferred geologic layers. The elevation is referred to the datum shown in the Description column.

Lithology Plot

This column presents a graphic depiction of the soil and rock stratigraphy encountered within the borehole.

Description

This column gives a description of the soil stratums, based on visual and tactile examination of the samples augmented with field and laboratory test results. Each stratum is described according to the following classification and terminology (Ref. Unified Soil Classification System):

The compactness condition of cohesionless soils (SPT) and the consistency of cohesive soils (undrained shear strength) are defined as follows (Ref. Canadian Foundation Engineering Manual):

Compactness of Cohesionless Soils	SPT N-Value
Very loose	0 to 4
Loose	4 to 10
Compact	10 to 30
Dense	30 to 50
Very Dense	> 50

Consistency of Cohesive Soils	SPT N-Value	Undrained Shear Strength	
		kPa	psf
Very soft	0 to 2	0 to 12	0 to 250
Soft	2 to 4	12 to 25	250 to 500
Firm	4 to 8	25 to 50	500 to 1000
Stiff	8 to 15	50 to 100	1000 to 2000
Very stiff	15 to 30	100 to 200	2000 to 4000
Hard	> 30	Over 200	Over 4000

Soil Sampling

Sample types are abbreviated as follows:

SS	Split Spoon	TW	Thin Wall Open (Pushed)	RC	Rock Core
AS	Auger Sample	TP	Thin Wall Piston (Pushed)	WS	Washed Sample

Additional information provided in this section includes sample numbering, sample recovery and numerical testing results.

Field and Laboratory Testing

Results of field testing (e.g., SPT, pocket penetrometer, and vane testing) and laboratory testing (e.g., natural moisture content, and limits) executed on the recovered samples are plotted in this section.

Instrumentation Installation

Instrumentation installations (monitoring wells, piezometers, inclinometers, etc.) are plotted in this section. Water levels, if measured during fieldwork, are also plotted. These water levels may or may not be representative of the static groundwater level depending on the nature of soil stratum where the piezometer tips are located, the time elapsed from installation to reading and other applicable factors.

Comments

This column is used to describe non-standard situations or notes of interest.

MODIFIED * UNIFIED CLASSIFICATION SYSTEM FOR SOILS

*The soil of each stratum is described using the Unified Soil Classification System (Technical Memorandum 36-357 prepared by Waterways Experiment Station, Vicksburg, Mississippi, Corps of Engineers, U.S Army. Vol. 1 March 1953.) modified slightly so that an inorganic clay of "medium plasticity" is recognized.

MAJOR DIVISION			GROUP SYMBOL	TYPICAL DESCRIPTION	LABORATORY CLASSIFICATION CRITERIA
COARSE GRAINED SOILS (MORE THAN HALF BY WEIGHT LARGER THAN 75µm)	GRAVELS MORE THAN HALF THE COARSE FRACTION LARGER THAN 4.75mm	CLEAN GRAVELS (TRACE OR NO FINES)	GW	WELL GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES	$C_u = \frac{D_{60}}{D_{10}} > 4;\ C_C = \frac{(D_{30})^2}{D_{10} \text{ x } D_{60}} = 1 \text{ to } 3$
			GP	POORLY GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES	NOT MEETING ABOVE REQUIREMENTS
		DIRTYGRAVELS (WITH SOME OR MORE FINES)	GM	SILTY GRAVELS, GRAVEL-SAND- SILT MIXTURES	ATTERBERG LIMITS BELOW "A" LINE OR P.I. MORE THAN 4
			GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES	ATTERBERG LIMITS BELOW "A" LINE OR P.I. MORE THAN 7
	SANDS MORE THAN HALF THE COARSE FRACTION SMALLER THAN 4.75mm	CLEAN SANDS (TRACE OR NO FINES)	SW	WELL GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES	$C_u = \frac{D_{60}}{D_{10}} > 6;\ C_C = \frac{(D_{30})^2}{D_{10} \text{ x } D_{60}} = 1 \text{ to } 3$
			SP	POORLY GRADED GRAVELS, GRAVEL- SAND MIXTURES, LITTLE OR NO FINES	NOT MEETING ABOVE REQUIREMENTS
		DIRTY SANDS (WITH SOME OR MORE FINES)	SM	SILTY SANDS, SAND-SILT MIXTURES	ATTERBERG LIMITS BELOW "A" LINE OR P.I MORE THAN 4
			SC	CLAYEY SANDS, SAND-CLAY MIXTURES	ATTERBERG LIMITS BELOW "A" LINE OR P.I MORE THAN 7
FINE-GRAINED SOILS (MORE THAN HALF BY WEIGHT SMALLER THAN 75µm)	SILTS BELOW "A" LINE NEGLIGIBLE ORGANIC CONTENT	$W_L < 50\%$	ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY SANDS OF SLIGHT PLASTICITY	CLASSIFICATION IS BASED UPON PLASTICITY CHART (SEE BELOW)
		$W_L < 50\%$	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS, FINE SANDY OR SILTY SOILS	
	CLAY ABOVE "A" LINE NEGLIGIBLE ORGANIC CONTENT	$W_L < 30\%$	CL	INORGANIC CLAYS OF LOW PLASTICITY, GRAVELLY, SANDY OR SILTY CLAYS, LEAN CLAYS	
		$30\% < W_L < 50\%$	CI	INORGANIC CLAYS OF MEDIUM PLASTICITY, SILTY CLAYS	
		$W_L < 50\%$	CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS	
	ORGANIC SILTS & CLAYS BELOW "A" LINE	$W_L < 50\%$	OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY	WHENEVER THE NATURE OF THE FINES CONTENT HAS NOT BEEN DETERMINED, IT IS DESIGNATED BY THE LETTER "F", E.G SF IS A MIXTURE OF SAND WITH SILT OR CLAY
		$W_L < 50\%$	OH	ORGANIC CLAYS OF HIGH PLASTICITY	
HIGH ORGANIC SOILS			Pt	PEAT AND OTHER HIGHLY ORGANIC SOILS	STRONG COLOUR OR ODOUR, AND OFTEN FIBROUS TEXTURE

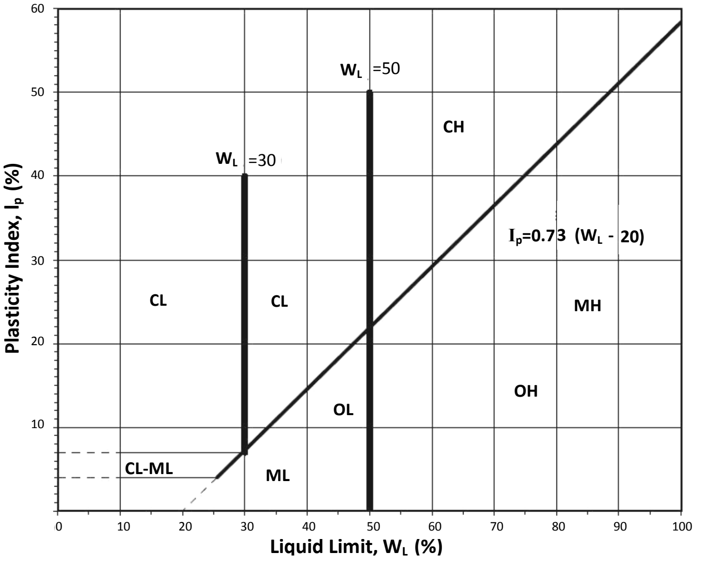
SOIL COMPONENTS

FRACTION	U.S STANDARD SIEVE SIZE			DEFINING RANGES OF PERCENTAGE BY WEIGHT OF MINOR COMPONENTS	
		PASSING	RETAINED	PERCENT	DESCRIPTOR
GRAVEL	COARSE	76 mm	19 mm	35-50 20-35 10-20 1-10	AND Y/EY SOME TRACE
	FINE	19 mm	4.75 mm		
SAND	COARSE	4.75 mm	2.00 mm		
	MEDIUM	2.00 mm	425 µm		
	FINE	425 µm	75 µm		
FINES (SILT OR CLAY BASED ON PLASTICITY)		75 µm			

OVERSIZED MATERIAL

ROUNDED OR SUBROUNDED: COBBLES 76 mm TO 200 mm BOULDERS > 200 mm	NOT ROUNDED: ROCK FRAGMENTS > 76 mm ROCKS> 0.76 CUBIC METRE IN VOLUME

Plasticity Chart for Soil Passing 425 Micron Sieve



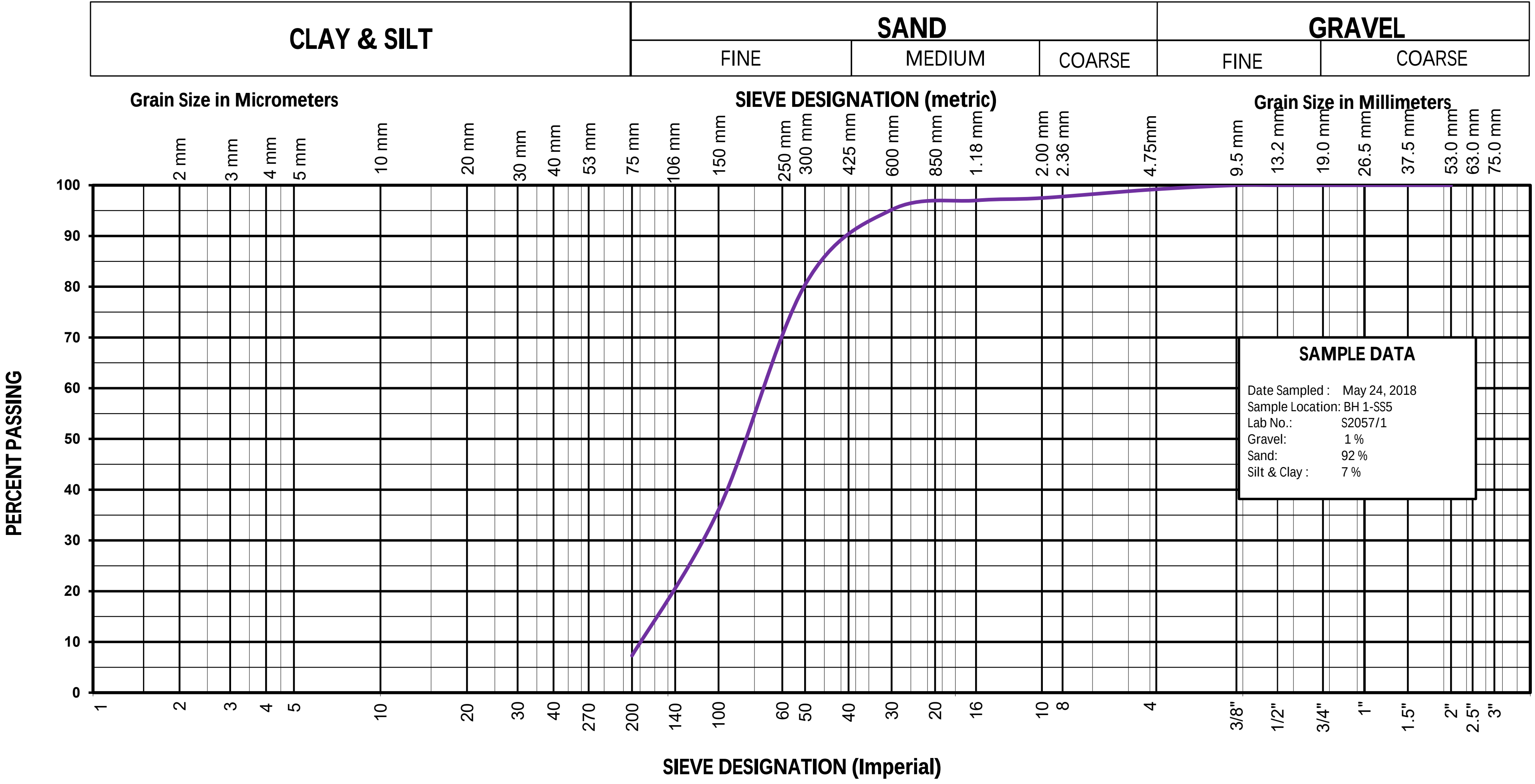
Note 1: Soils are classified and described according to their engineering properties and behavior.

Note 2: The modifying adjectives used to define the actual or estimated percentage range by weight of minor components are consistent with the Canadian Foundation Engineering Manual (3rd Edition, Canadian Geotechnical Society, 1992)

ENCLOSURES

Enclosure A: Laboratory Test Results

UNIFIED SOIL CLASSIFICATION SYSTEM



SAMPLE DATA

Date Sampled : May 24, 2018
Sample Location: BH 1-SS5
Lab No.: S2057/1
Gravel: 1 %
Sand: 92 %
Silt & Clay : 7 %

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SHAD & ASSOCIATES INC.

GRAIN SIZE ANALYSIS

Project :

Preliminary Geotechnical Investigation

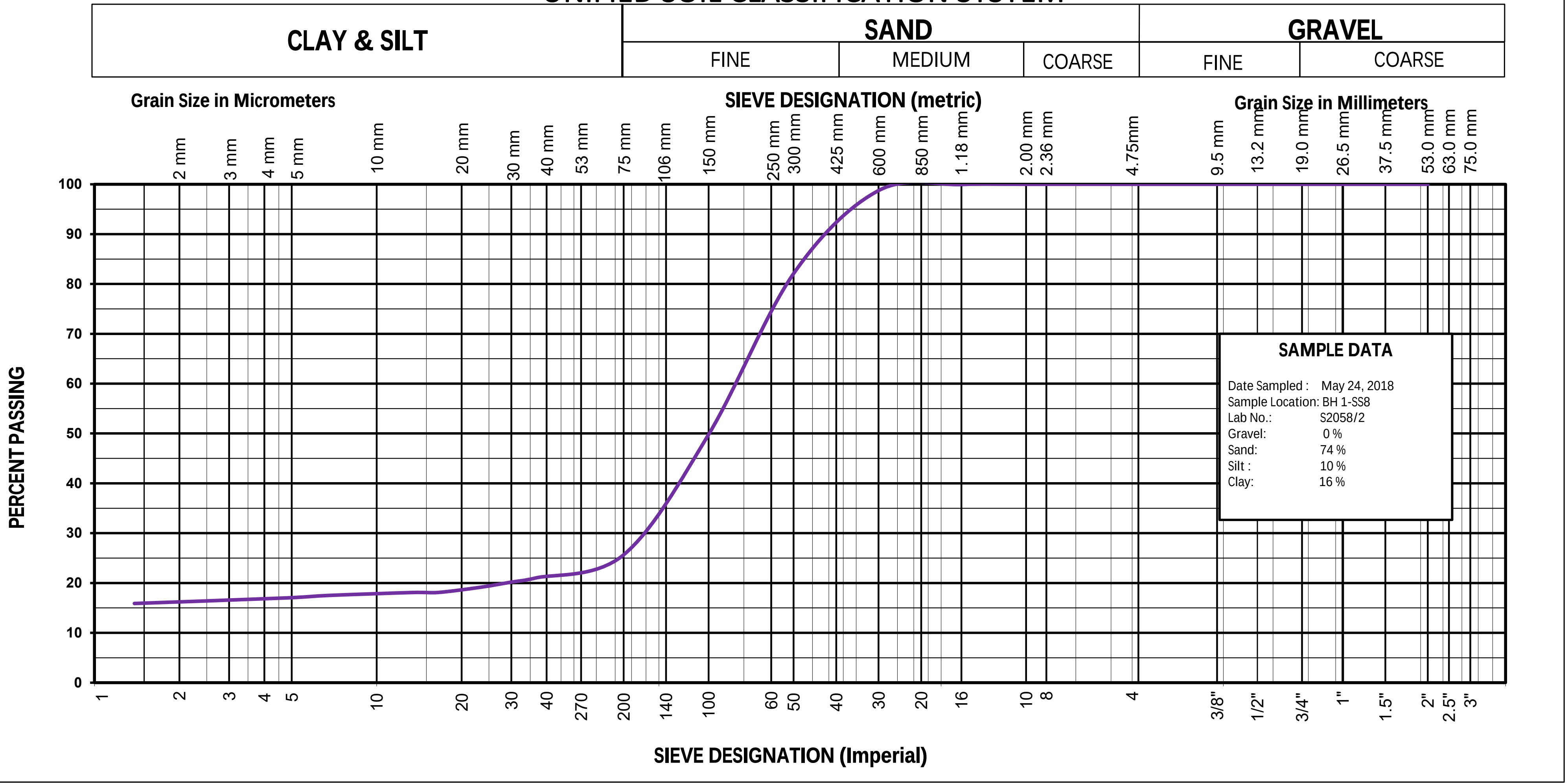
Project No.:

T18733

Client:

Mansfield Ski Club

UNIFIED SOIL CLASSIFICATION SYSTEM



SAMPLE DATA

Date Sampled : May 24, 2018
Sample Location: BH 1-SS8
Lab No.: S2058/2
Gravel: 0 %
Sand: 74 %
Silt : 10 %
Clay: 16 %

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GRAIN SIZE ANALYSIS

Project :

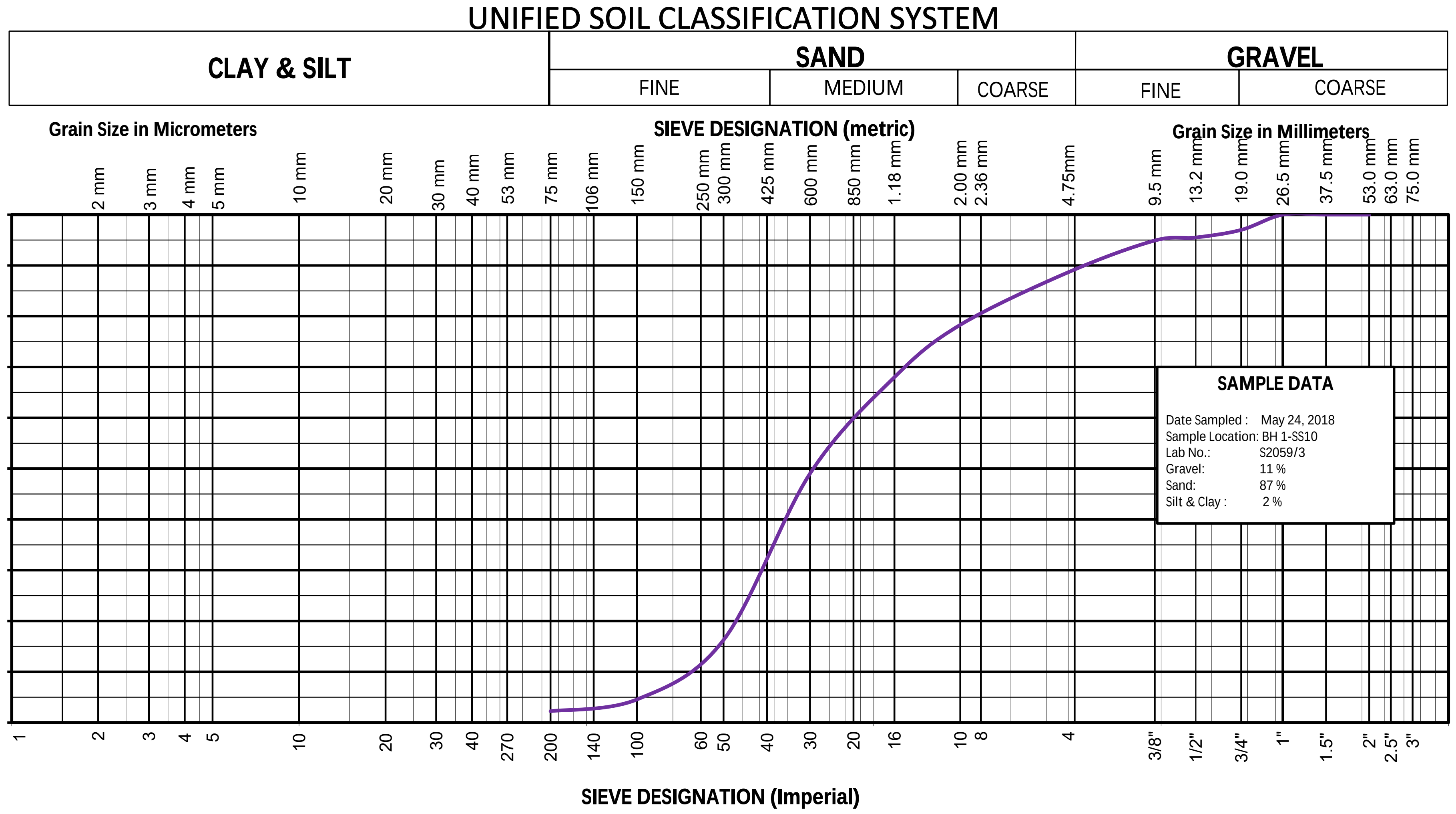
Preliminary Geotechnical Investigation

Project No.:

T18733

Client:

Mansfield Ski Club



SAMPLE DATA

Date Sampled : May 24, 2018
Sample Location: BH 1-SS10
Lab No.: S2059/3
Gravel: 11 %
Sand: 87 %
Silt & Clay : 2 %

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GRAIN SIZE ANALYSIS

Project :

Preliminary Geotechnical Investigation

Project No.:

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Client:

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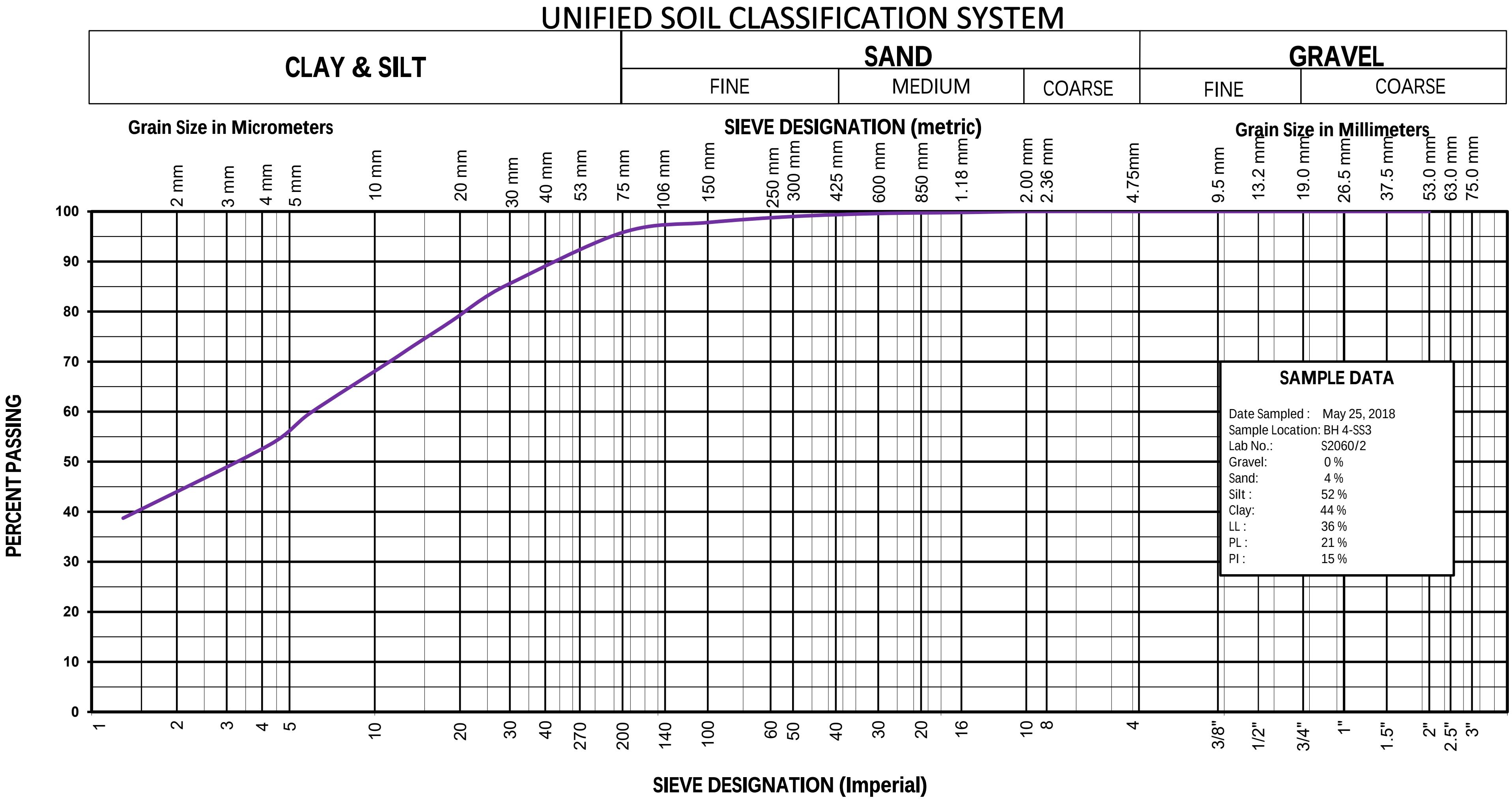

SAMPLE DATA

Date Sampled :	May 25, 2018
Sample Location:	BH 4-SS3
Lab No.:	S2060/2
Gravel:	0 %
Sand:	4 %
Silt :	52 %
Clay:	44 %
LL :	36 %
PL :	21 %
PI :	15 %

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GRAIN SIZE ANALYSIS

Project :

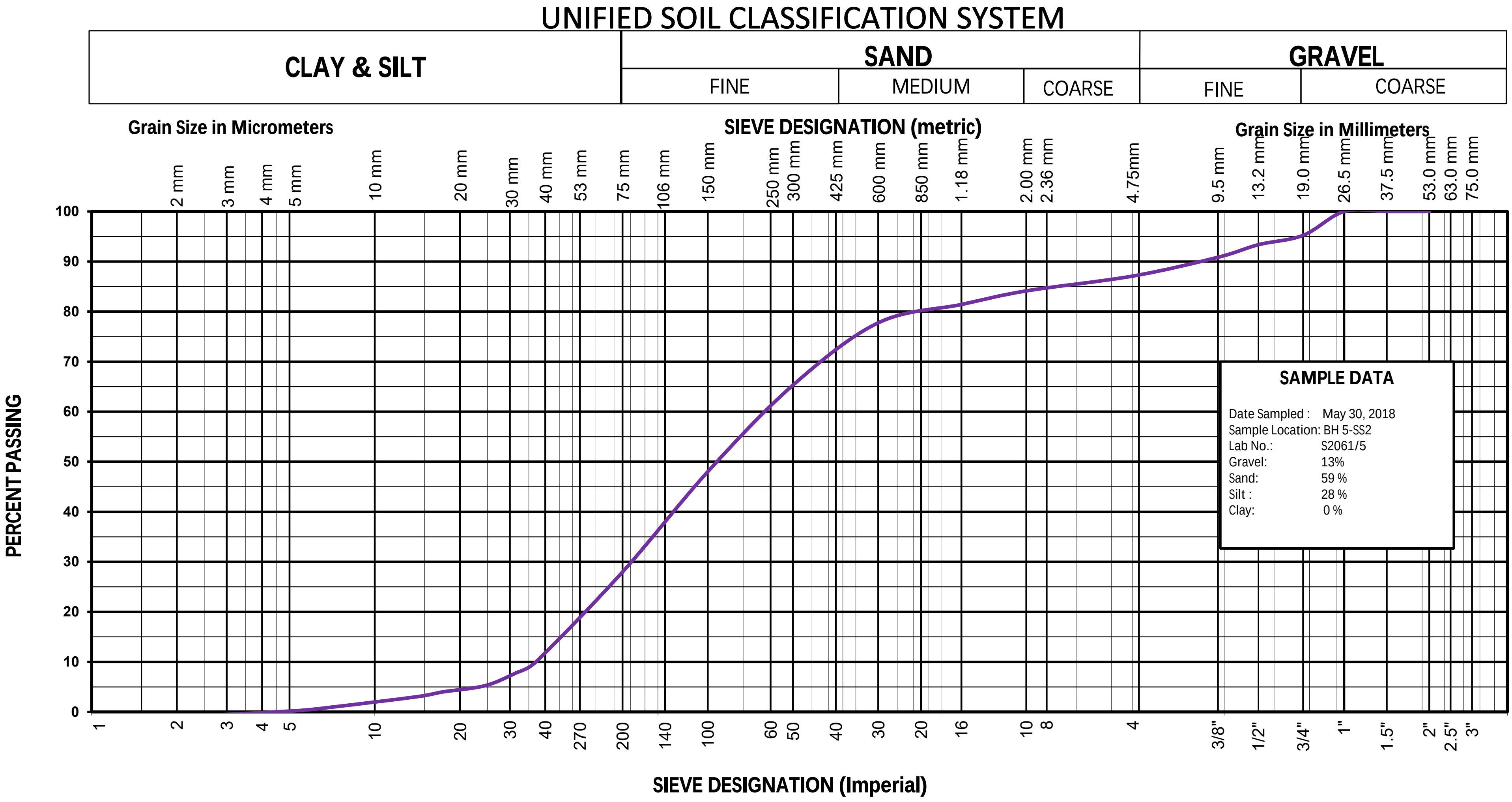
Preliminary Geotechnical Investigation

Project No.:

T18733

Client:

Mansfield Ski Club



SAMPLE DATA

Date Sampled : May 30, 2018
Sample Location: BH 5-SS2
Lab No.: S2061/5
Gravel: 13%
Sand: 59 %
Silt : 28 %
Clay: 0 %

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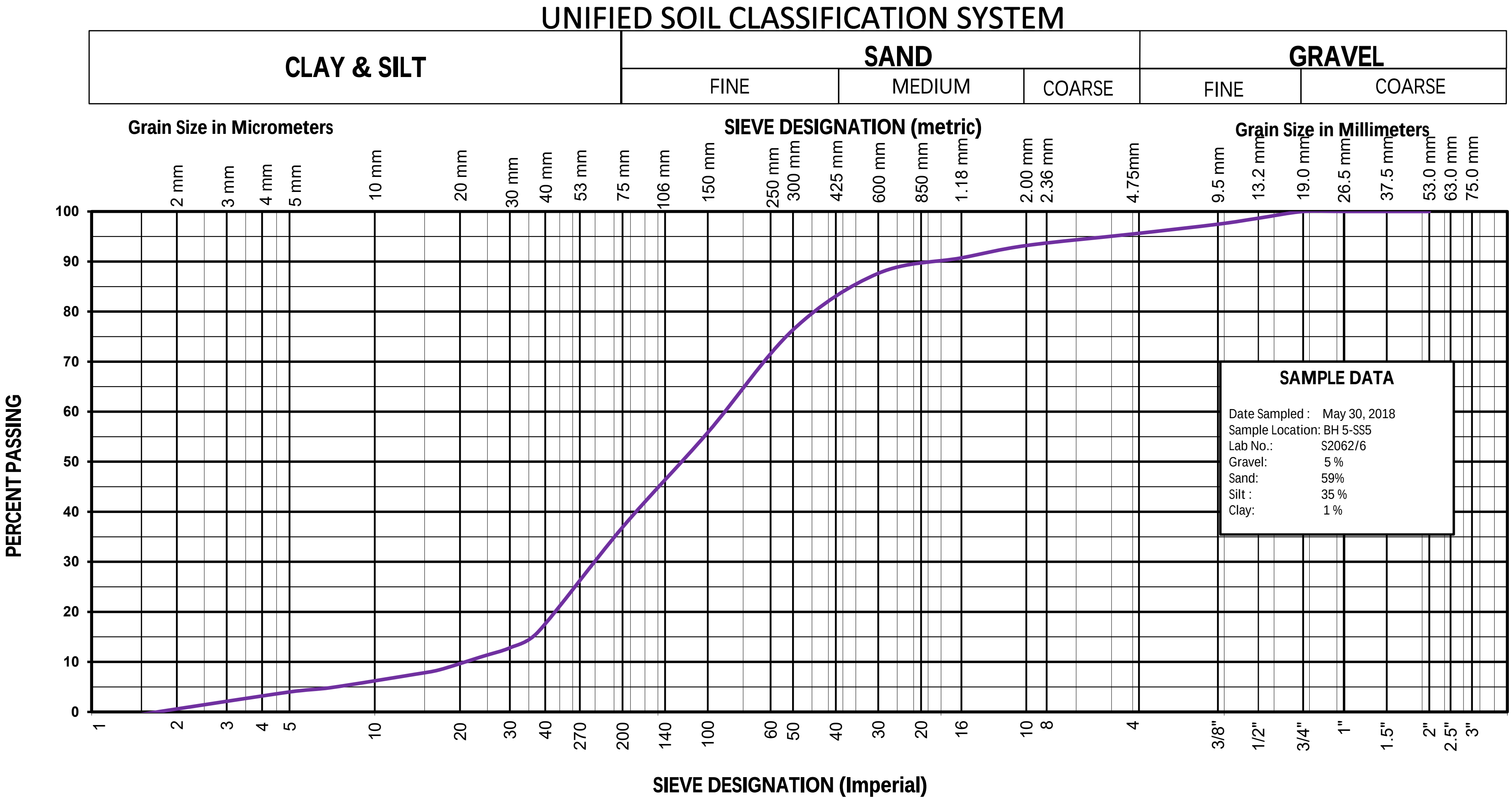
GRAIN SIZE ANALYSIS

Project : **Preliminary Geotechnical Investigation**

Project No.: **T18733**

Client: **Mansfield Ski Club**



SAMPLE DATA

Date Sampled : May 30, 2018
Sample Location: BH 5-SS5
Lab No.: S2062/6
Gravel: 5 %
Sand: 59%
Silt : 35 %
Clay: 1 %

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GRAIN SIZE ANALYSIS

Project :

Preliminary Geotechnical Investigation

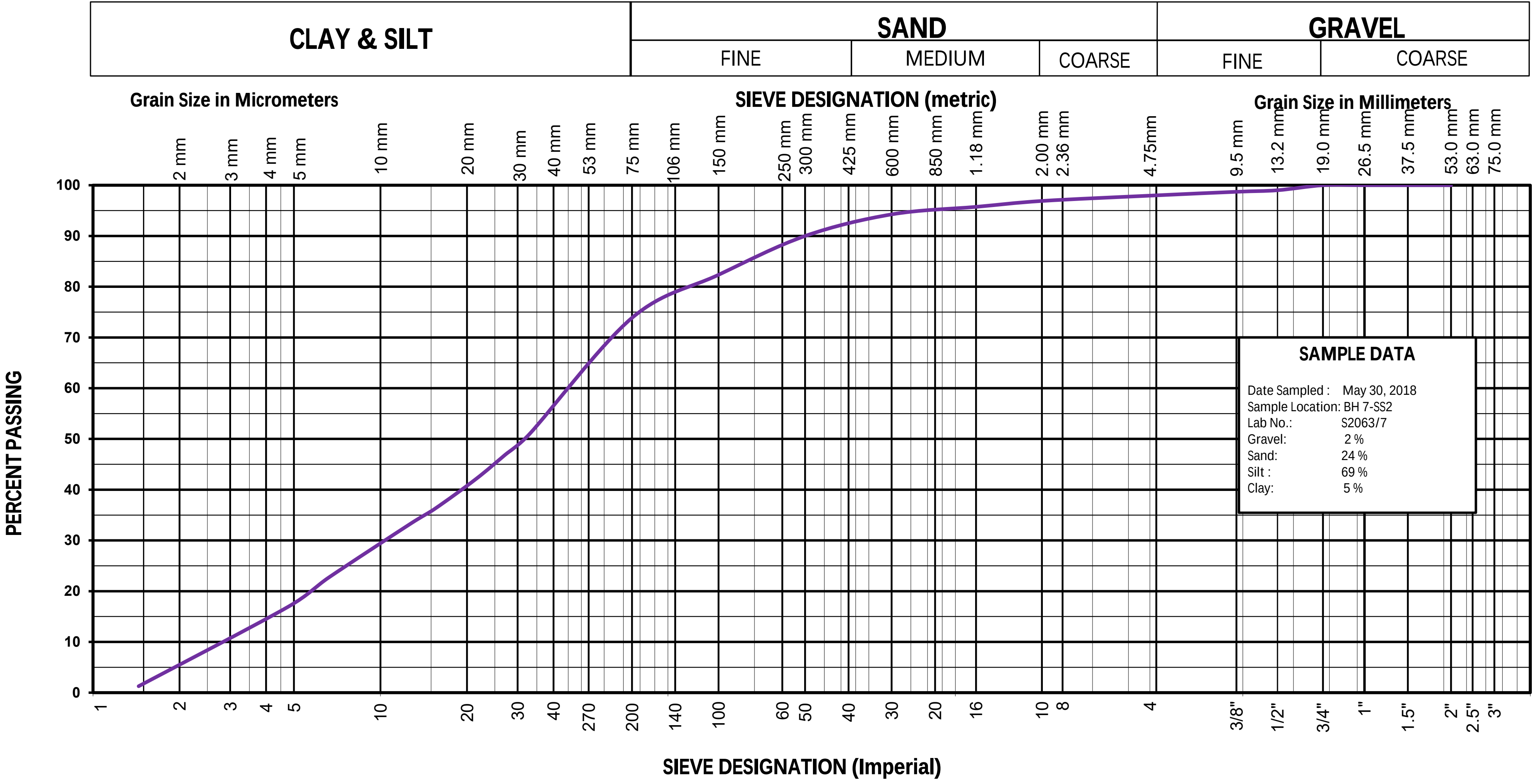
Project No.:

T18733

Client:

Mansfield Ski Club

UNIFIED SOIL CLASSIFICATION SYSTEM



SAMPLE DATA

Date Sampled : May 30, 2018
Sample Location: BH 7-SS2
Lab No.: S2063/7
Gravel: 2 %
Sand: 24 %
Silt : 69 %
Clay: 5 %

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GRAIN SIZE ANALYSIS

Project :

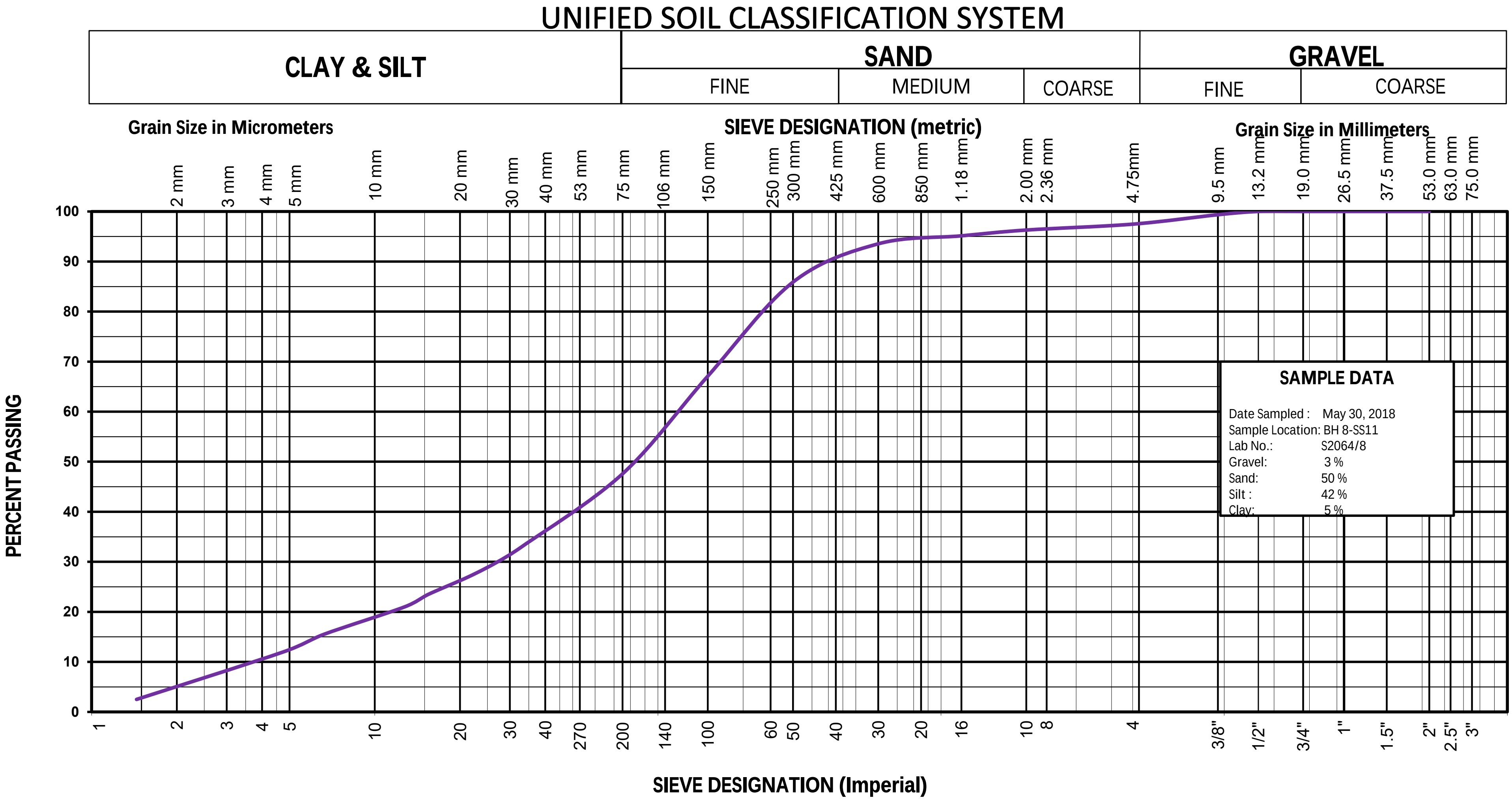
Preliminary Geotechnical Investigation

Project No.:

T18733

Client:

Mansfield Ski Club



SAMPLE DATA

Date Sampled : May 30, 2018
Sample Location: BH 8-SS11
Lab No.: S2064/8
Gravel: 3 %
Sand: 50 %
Silt : 42 %
Clay: 5 %

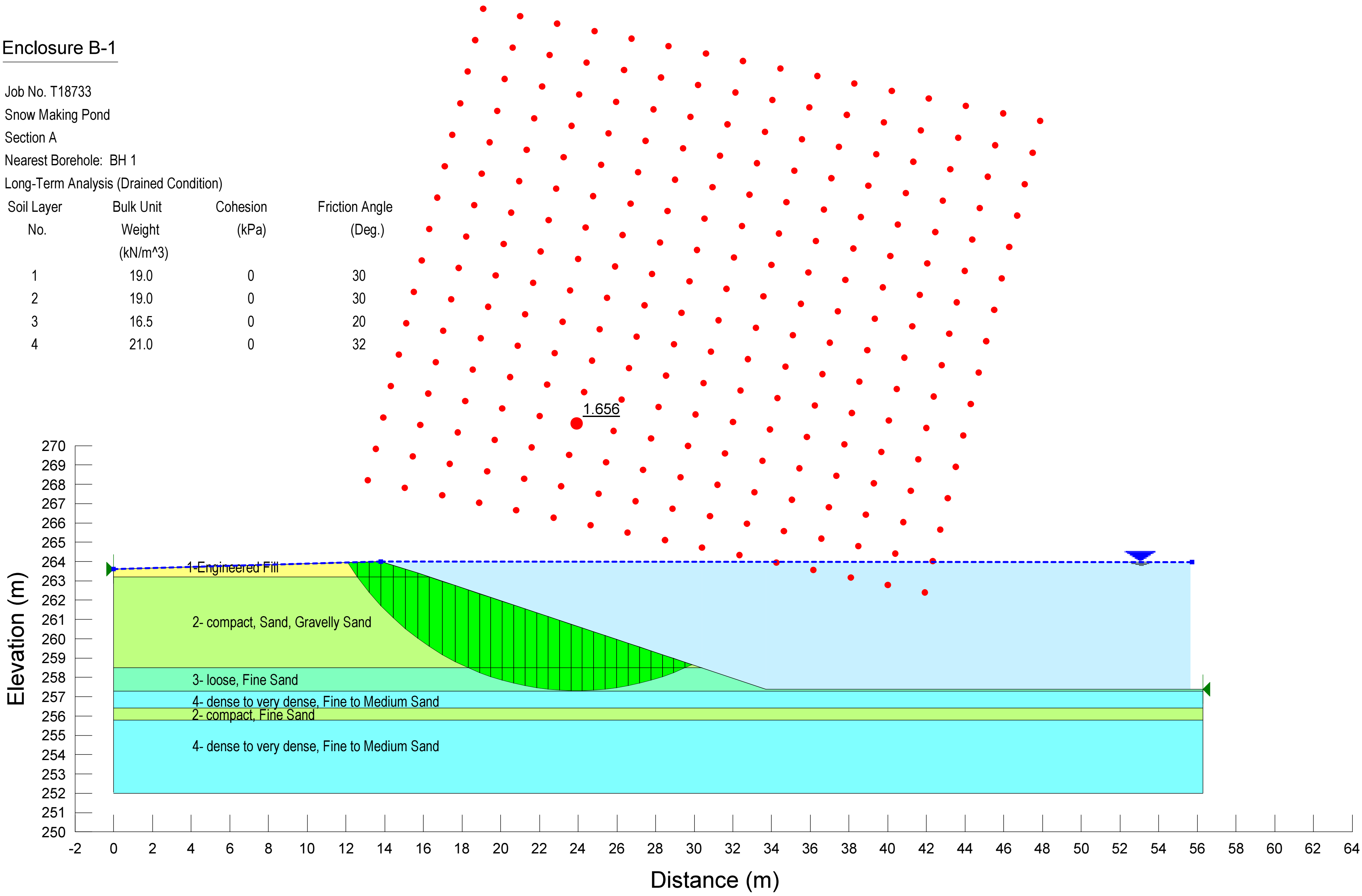
SHAD & ASSOCIATES INC. 83 Citation Drive, Unit 9 Vaughan, Ontario L4K 2Z6 Tel: 905) 760-5566 Fax: (905) 760-5567 www.shadinc.ca	**GRAIN SIZE ANALYSIS**	**Project :** **Preliminary Geotechnical Investigation**	**Project No.:** **T18733**
		Client: **Mansfield Ski Club**	

Enclosure B: Slope Stability Analysis Results

Enclosure B-1

Job No. T18733
Snow Making Pond
Section A
Nearest Borehole: BH 1
Long-Term Analysis (Drained Condition)

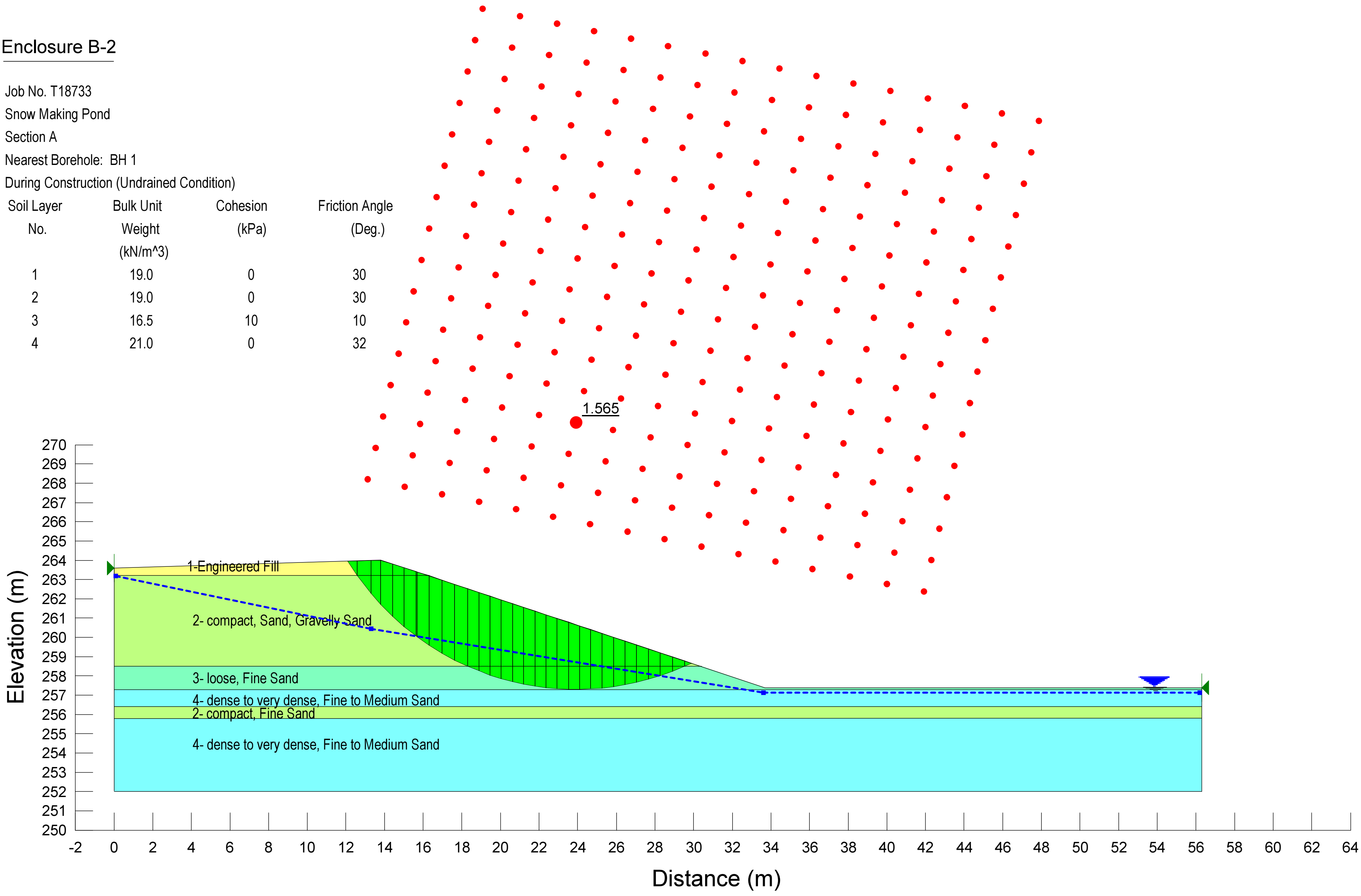
Soil Layer No.	Bulk Unit Weight (kN/m^3)	Cohesion (kPa)	Friction Angle (Deg.)
1	19.0	0	30
2	19.0	0	30
3	16.5	0	20
4	21.0	0	32



Enclosure B-2

Job No. T18733
Snow Making Pond
Section A
Nearest Borehole: BH 1
During Construction (Undrained Condition)

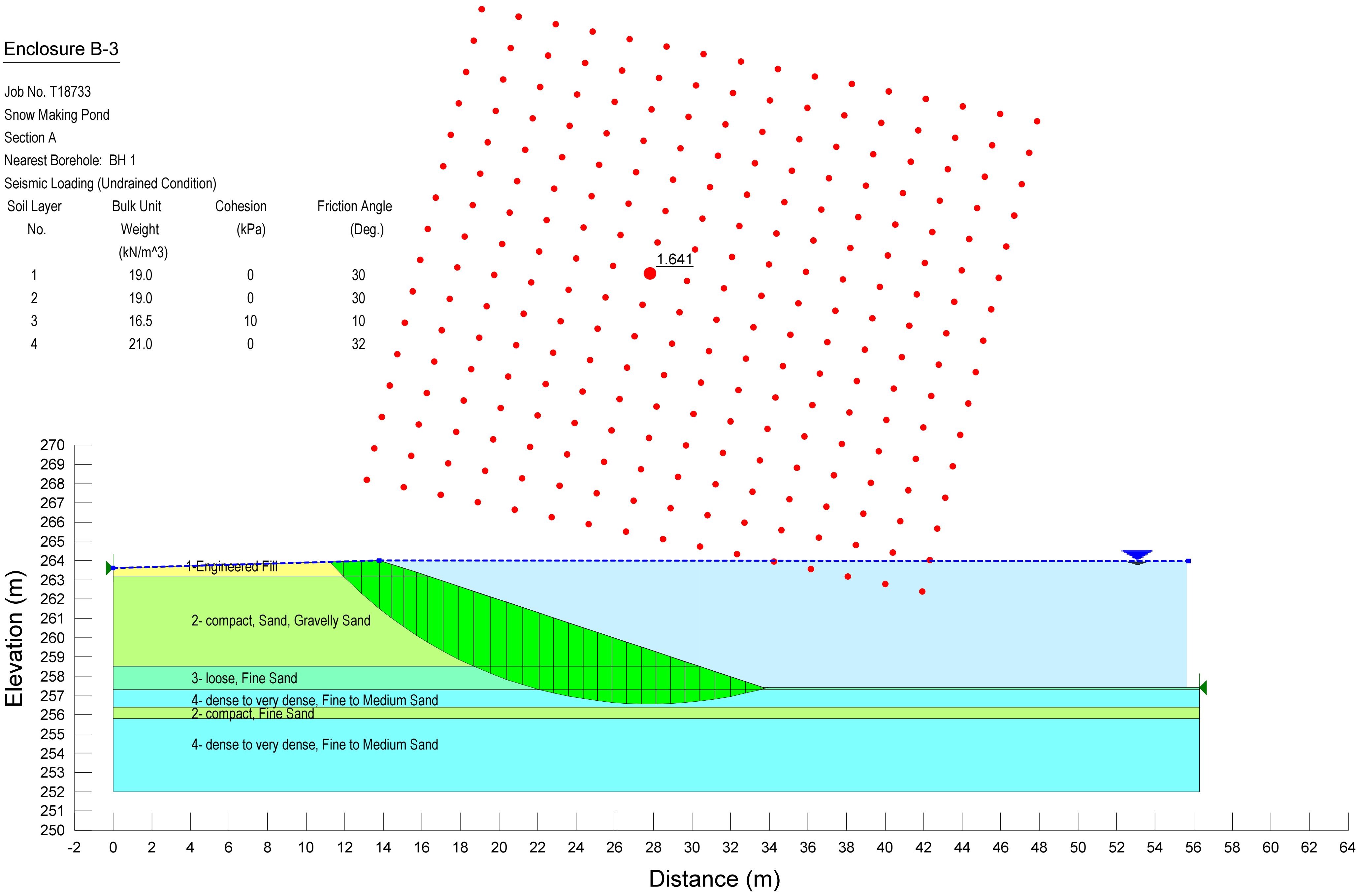
Soil Layer No.	Bulk Unit Weight (kN/m^3)	Cohesion (kPa)	Friction Angle (Deg.)
1	19.0	0	30
2	19.0	0	30
3	16.5	10	10
4	21.0	0	32



Enclosure B-3

Job No. T18733
Snow Making Pond
Section A
Nearest Borehole: BH 1
Seismic Loading (Undrained Condition)

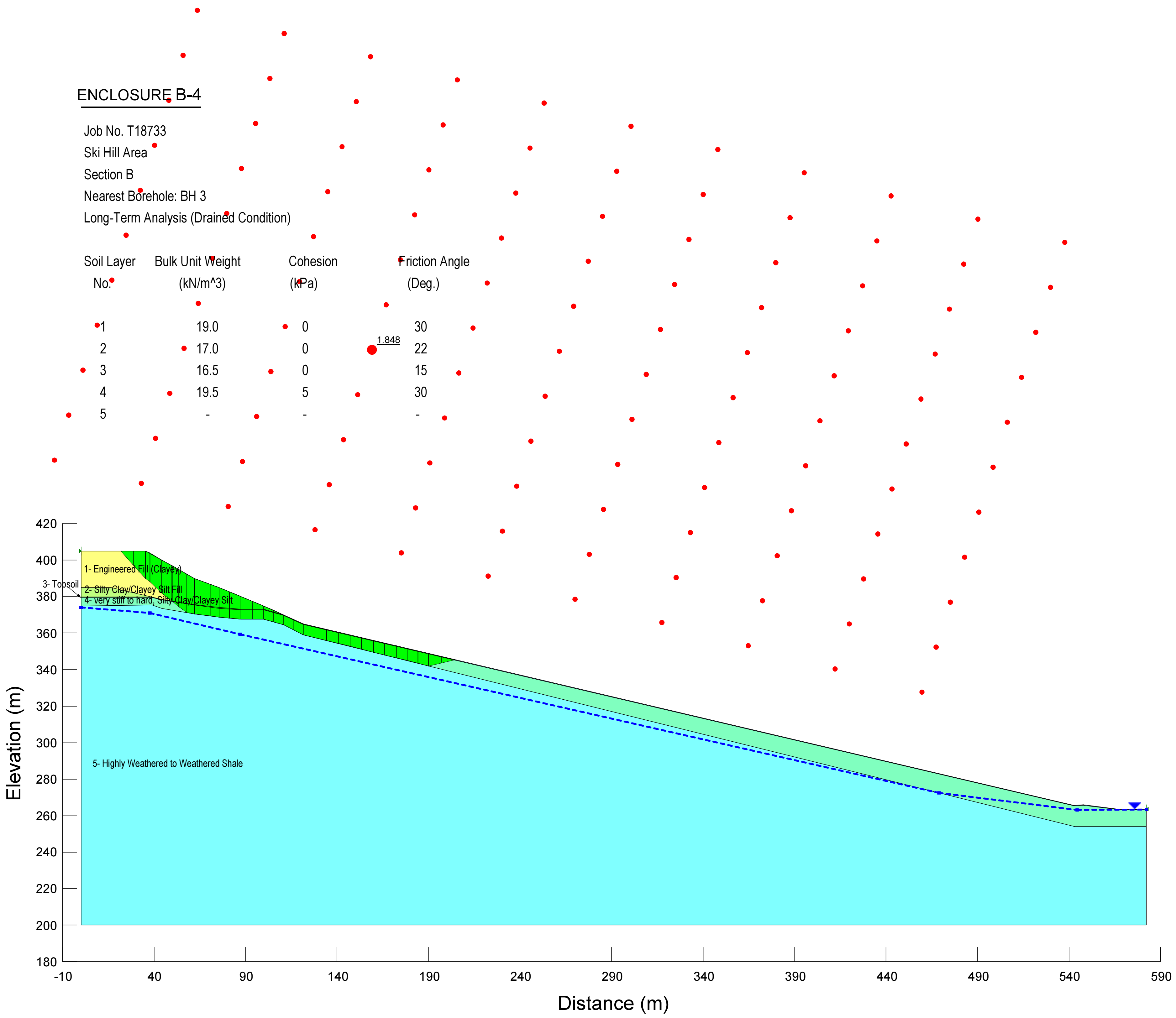
Soil Layer No.	Bulk Unit Weight (kN/m^3)	Cohesion (kPa)	Friction Angle (Deg.)
1	19.0	0	30
2	19.0	0	30
3	16.5	10	10
4	21.0	0	32



ENCLOSURE B-4

Job No. T18733
Ski Hill Area
Section B
Nearest Borehole: BH 3
Long-Term Analysis (Drained Condition)

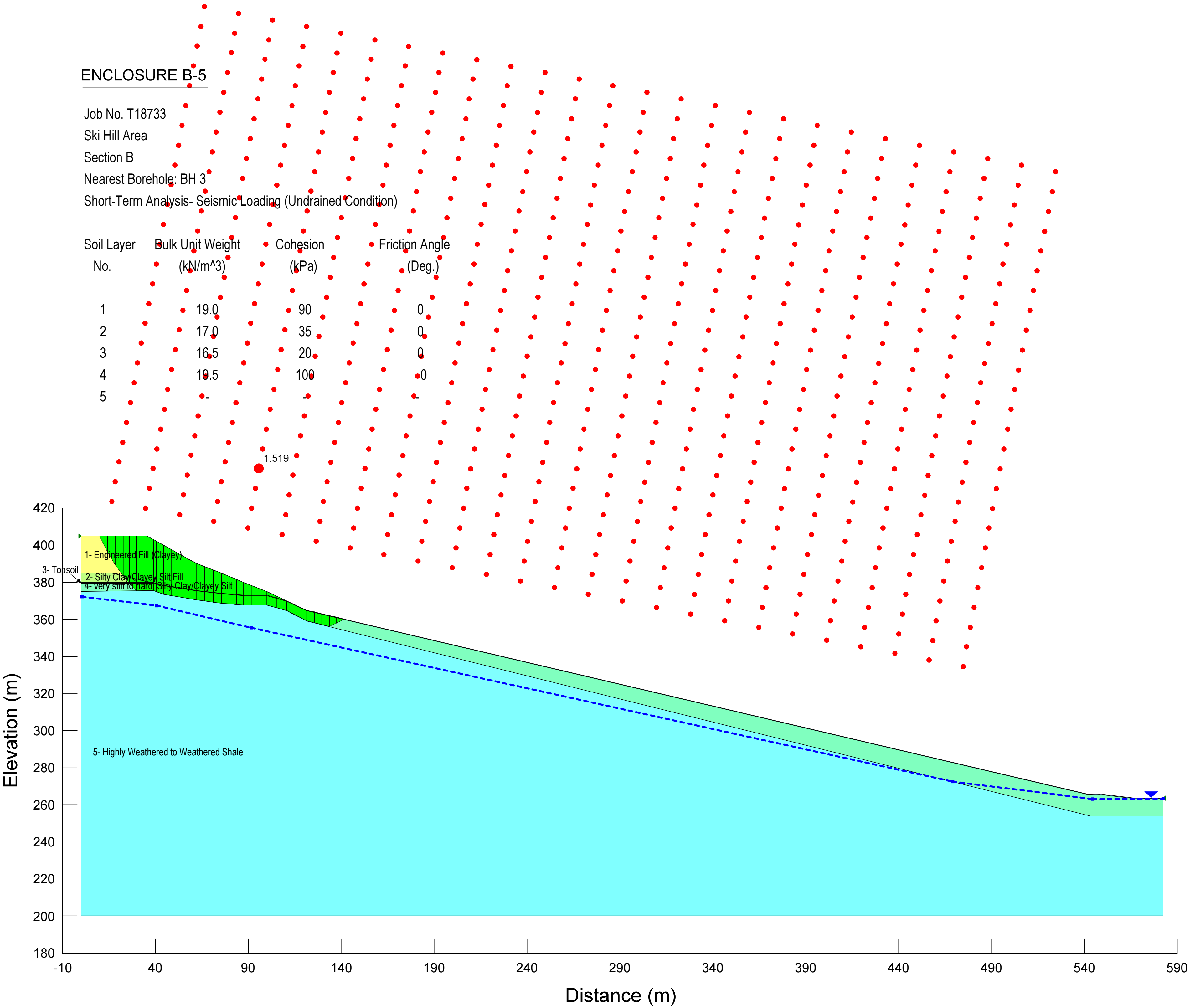
Soil Layer No.	Bulk Unit Weight (kN/m^3)	Cohesion (kPa)	Friction Angle (Deg.)
1	19.0	0	30
2	17.0	0	22
3	16.5	0	15
4	19.5	5	30
5	-	-	-



ENCLOSURE B-5

Job No. T18733
Ski Hill Area
Section B
Nearest Borehole: BH 3
Short-Term Analysis- Seismic Loading (Undrained Condition)

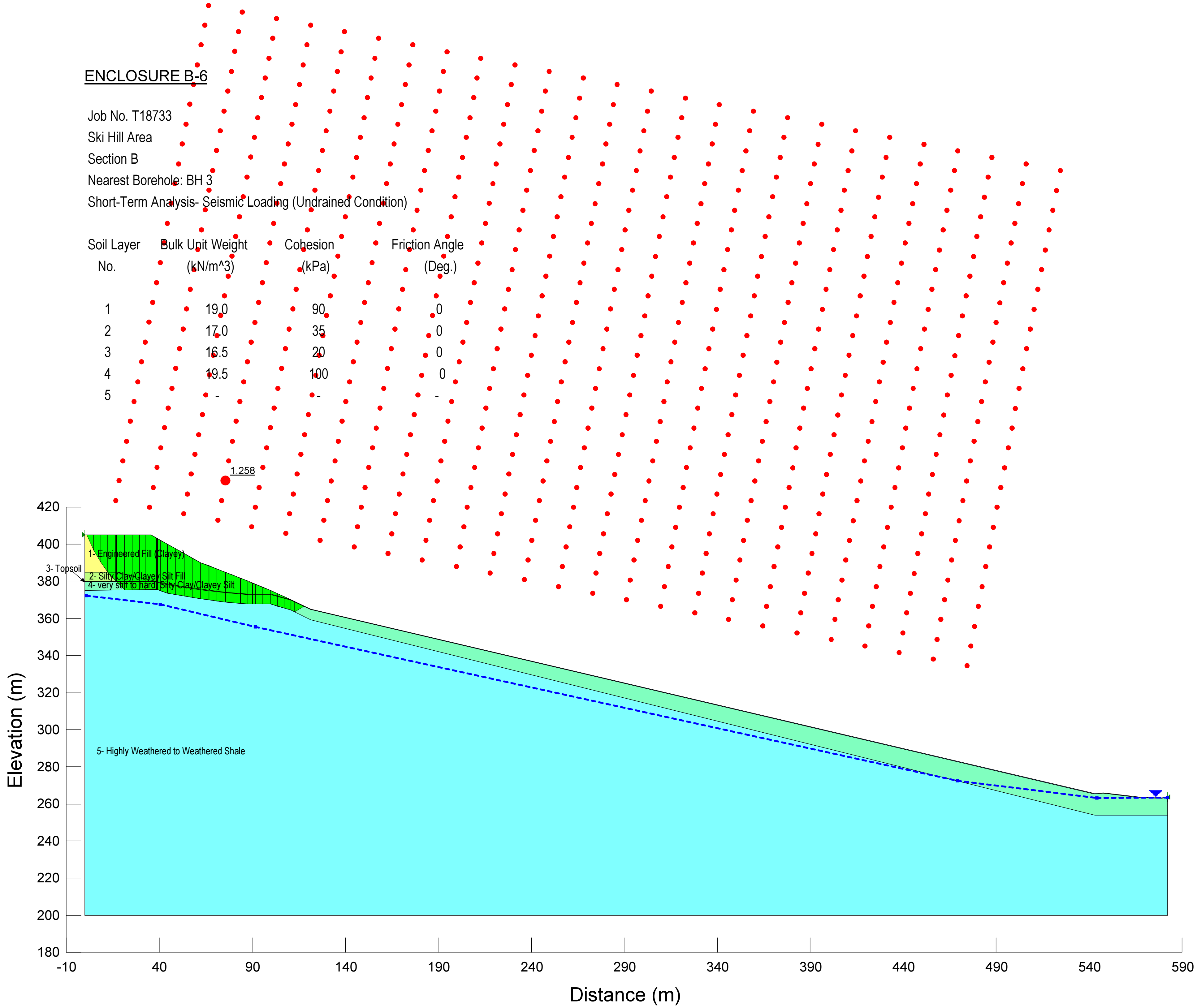
Soil Layer No.	Bulk Unit Weight (kN/m^3)	Cohesion (kPa)	Friction Angle (Deg.)
1	19.0	90	0
2	17.0	35	0
3	16.5	20	0
4	19.5	100	0
5	-	-	-



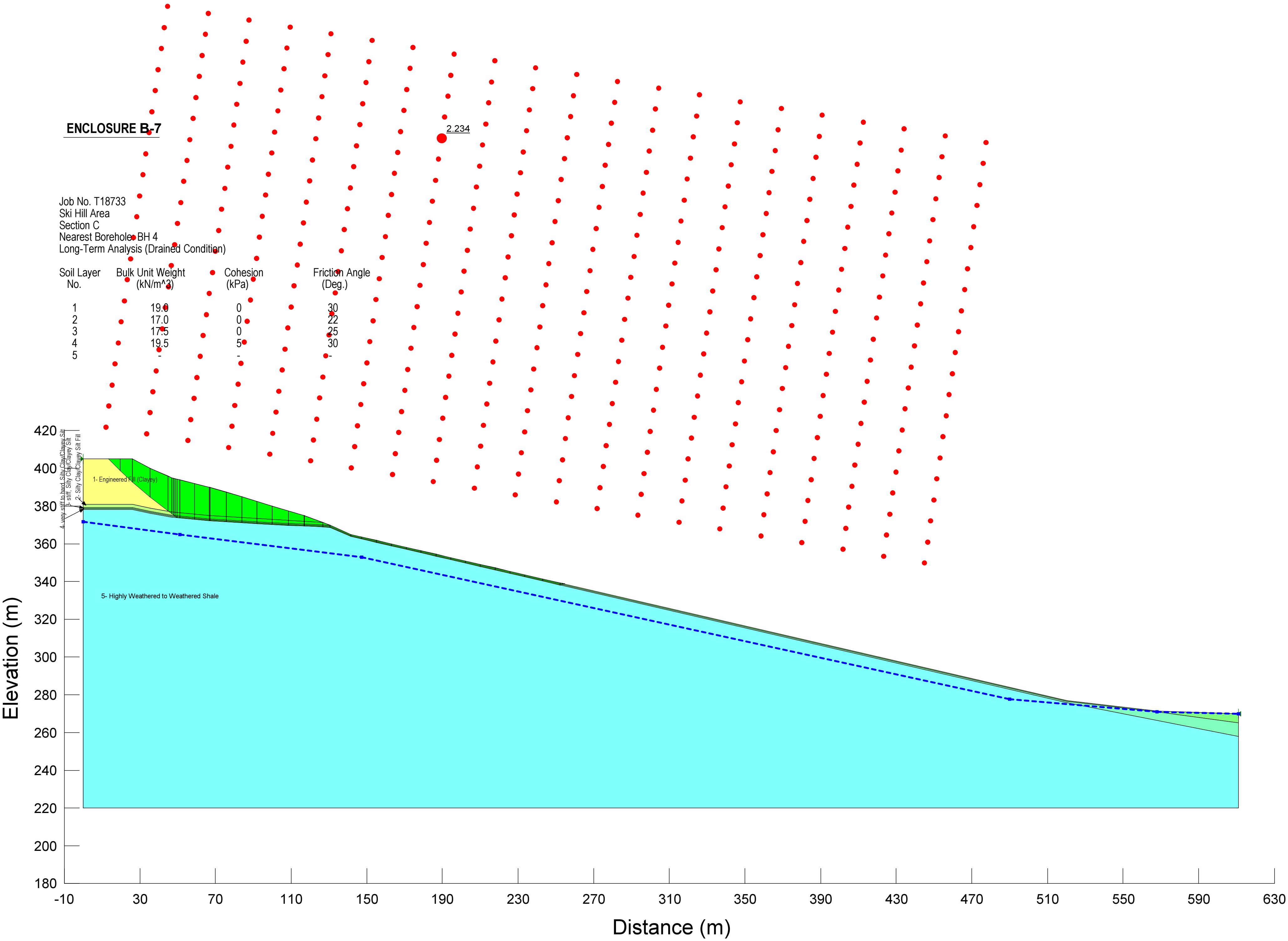
ENCLOSURE B-6

Job No. T18733
Ski Hill Area
Section B
Nearest Borehole: BH 3
Short-Term Analysis- Seismic Loading (Undrained Condition)

Soil Layer No.	Bulk Unit Weight (kN/m^3)	Cohesion (kPa)	Friction Angle (Deg.)
1	19.0	90	0
2	17.0	35	0
3	16.5	20	0
4	19.5	100	0
5	-	-	-



ENCLOSURE B-7



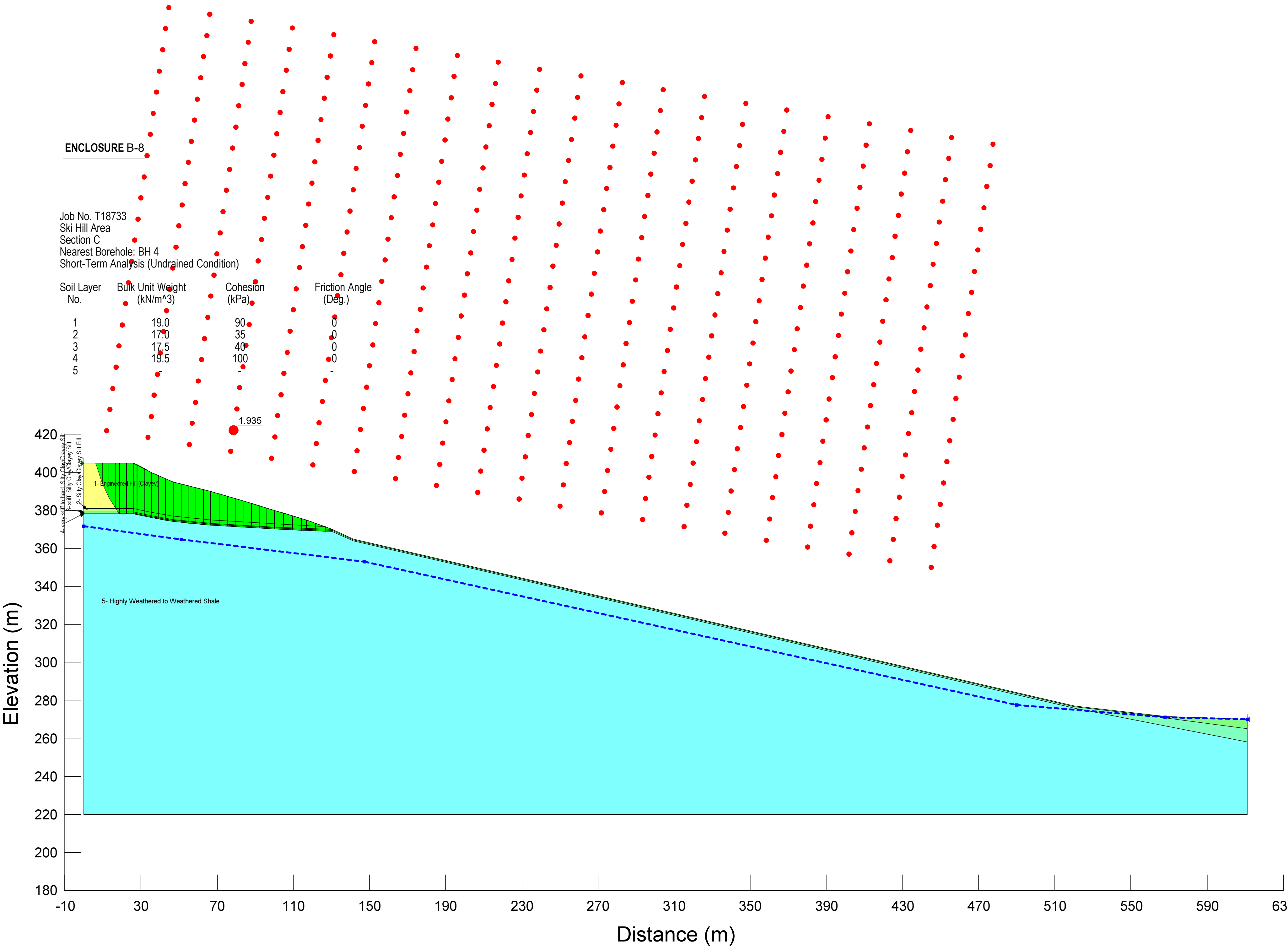
Job No. T18733
Ski Hill Area
Section C
Nearest Borehole: BH 4
Long-Term Analysis (Drained Condition)

Soil Layer No.	Bulk Unit Weight (kN/m^3)	Cohesion (kPa)	Friction Angle (Deg.)
1	19.0	0	30
2	17.0	0	22
3	17.5	0	25
4	19.5	5	30
5	-	-	-

ENCLOSURE B-8

Job No. T18733
Ski Hill Area
Section C
Nearest Borehole: BH 4
Short-Term Analysis (Undrained Condition)

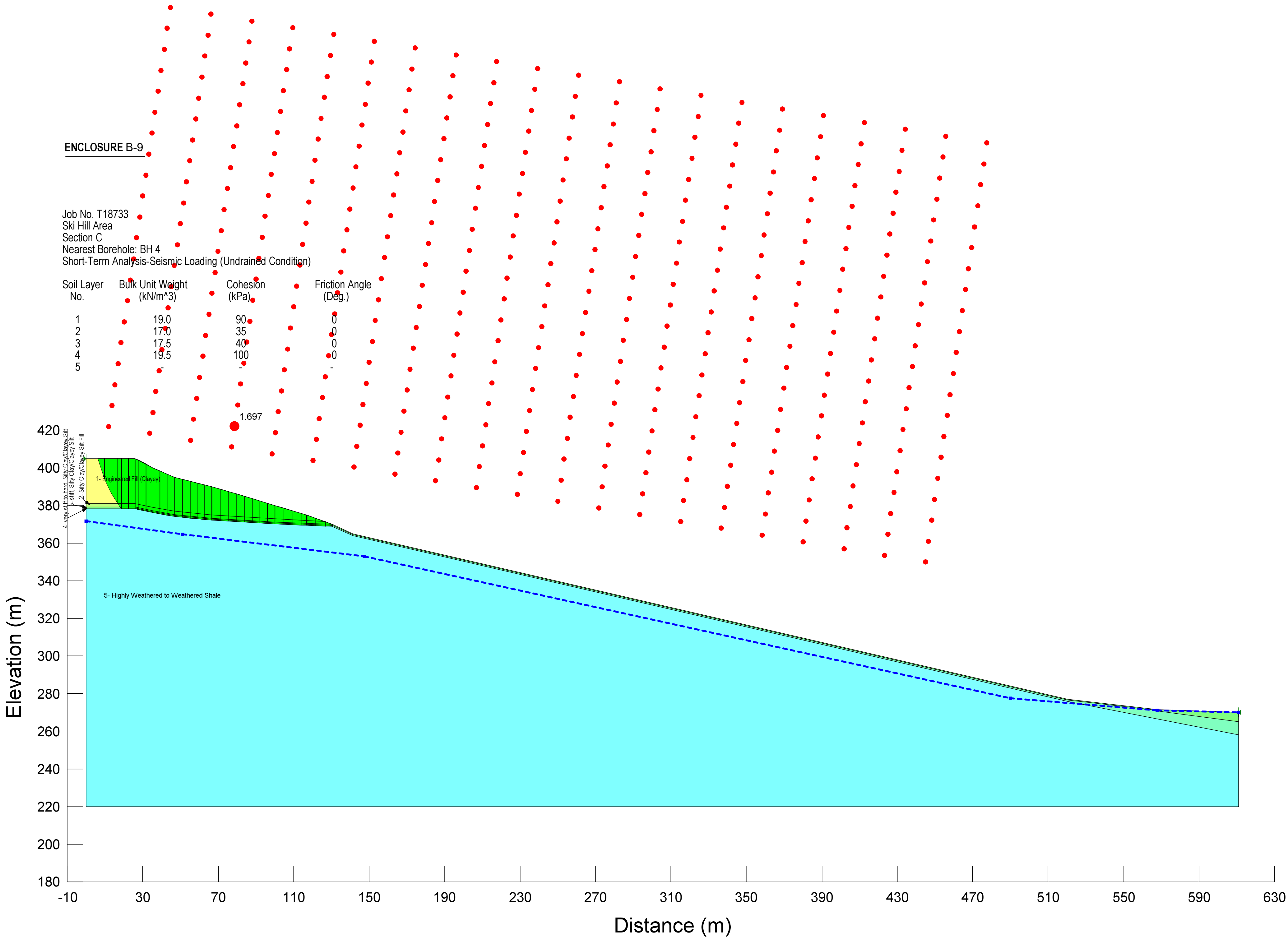
Soil Layer No.	Bulk Unit Weight (kN/m^3)	Cohesion (kPa)	Friction Angle (Deg.)
1	19.0	90	0
2	17.0	35	0
3	17.5	40	0
4	19.5	100	0
5	-	-	-



ENCLOSURE B-9

Job No. T18733
Ski Hill Area
Section C
Nearest Borehole: BH 4
Short-Term Analysis-Seismic Loading (Undrained Condition)

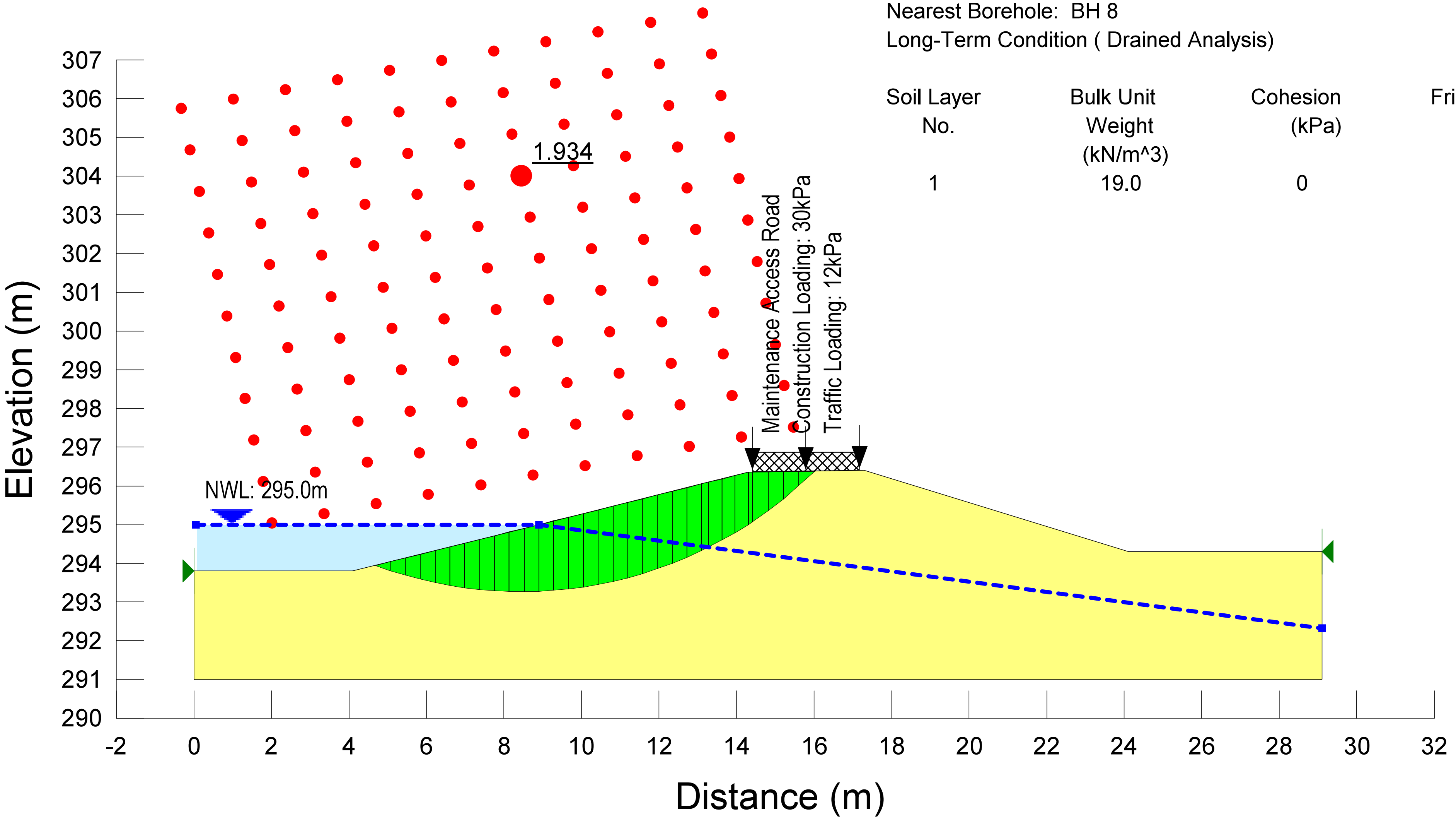
Soil Layer No.	Bulk Unit Weight (kN/m^3)	Cohesion (kPa)	Friction Angle (Deg.)
1	19.0	90	0
2	17.0	35	0
3	17.5	40	0
4	19.5	100	0
5	-	-	-



Enclosure B-10

Job No. T18733
Dry Detention Basin (Pond Side)
Section D
Nearest Borehole: BH 8
Long-Term Condition (Drained Analysis)

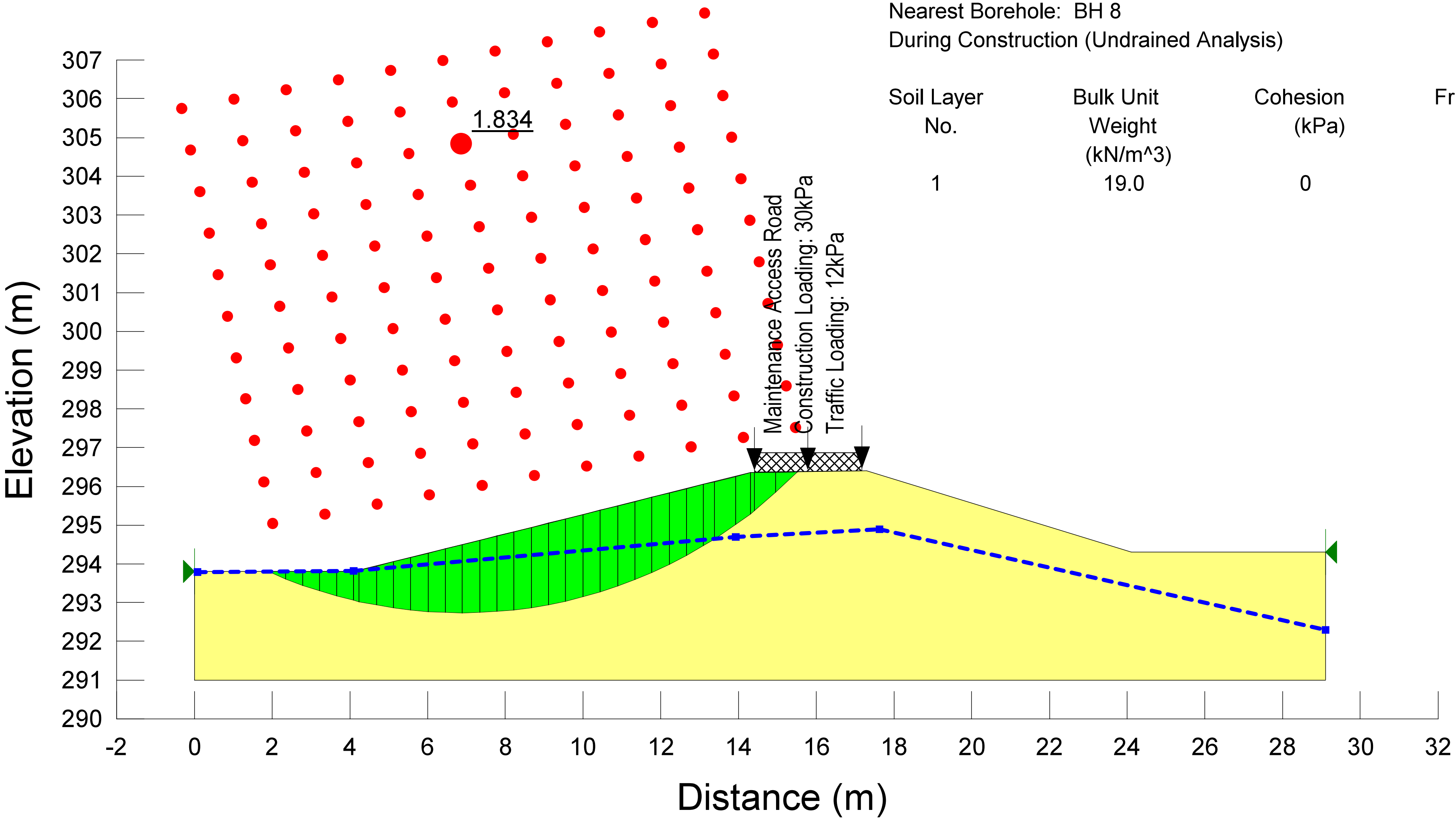
Soil Layer No.	Bulk Unit Weight (kN/m^3)	Cohesion (kPa)	Friction Angle (Deg.)
1	19.0	0	30



Enclosure B-11

Job No. T18733
Dry Detention Basin (Pond Side)
Section D
Nearest Borehole: BH 8
During Construction (Undrained Analysis)

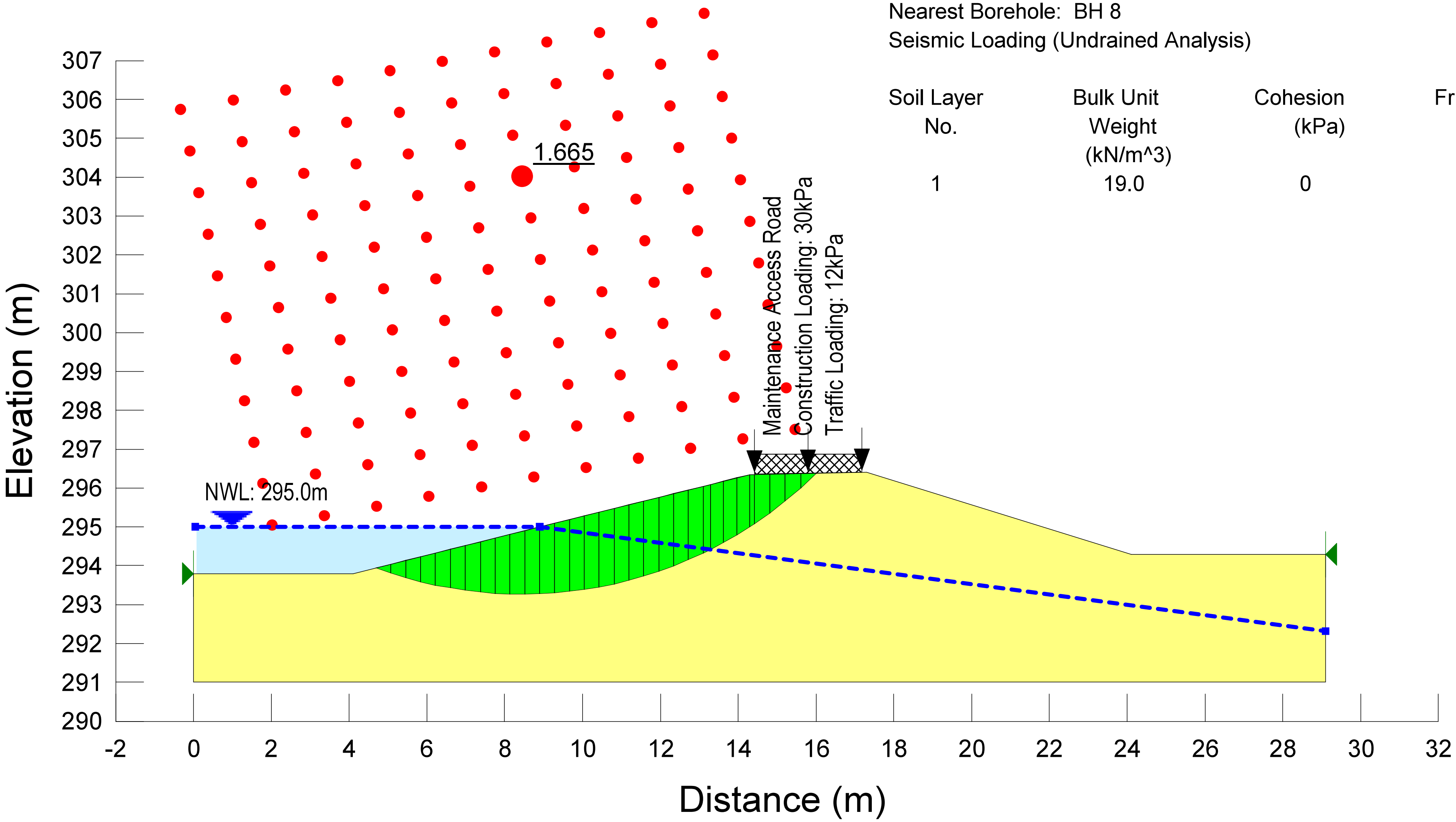
Soil Layer No.	Bulk Unit Weight (kN/m^3)	Cohesion (kPa)	Friction Angle (Deg.)
1	19.0	0	30



Enclosure B-12

Job No. T18733
Dry Detention Basin (Pond Side)
Section D
Nearest Borehole: BH 8
Seismic Loading (Undrained Analysis)

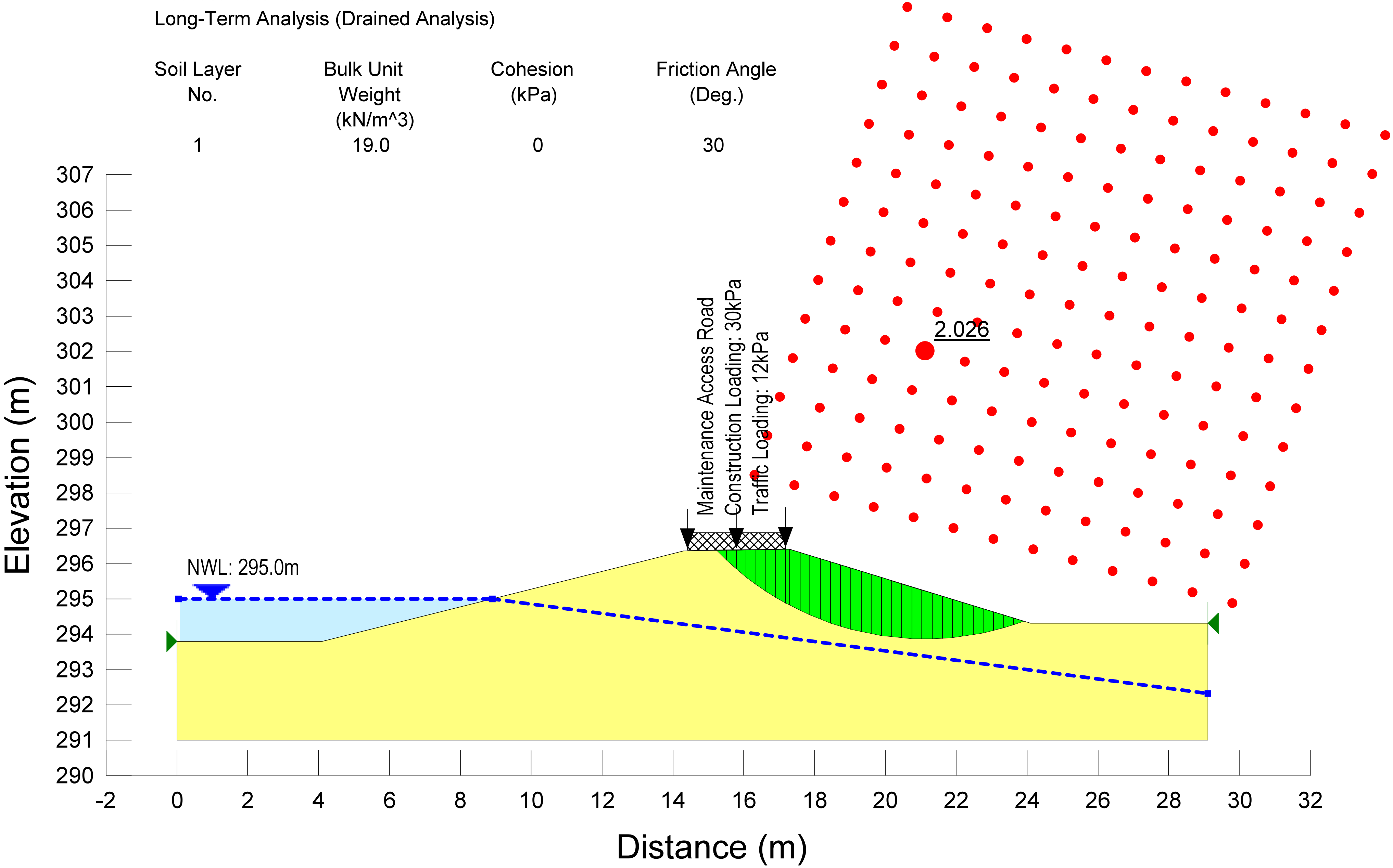
Soil Layer No.	Bulk Unit Weight (kN/m^3)	Cohesion (kPa)	Friction Angle (Deg.)
1	19.0	0	30



Enclosure B-13

Job No. T18733
Dry Detention Basin (Outside)
Section D
Nearest Borehole: BH 8
Long-Term Analysis (Drained Analysis)

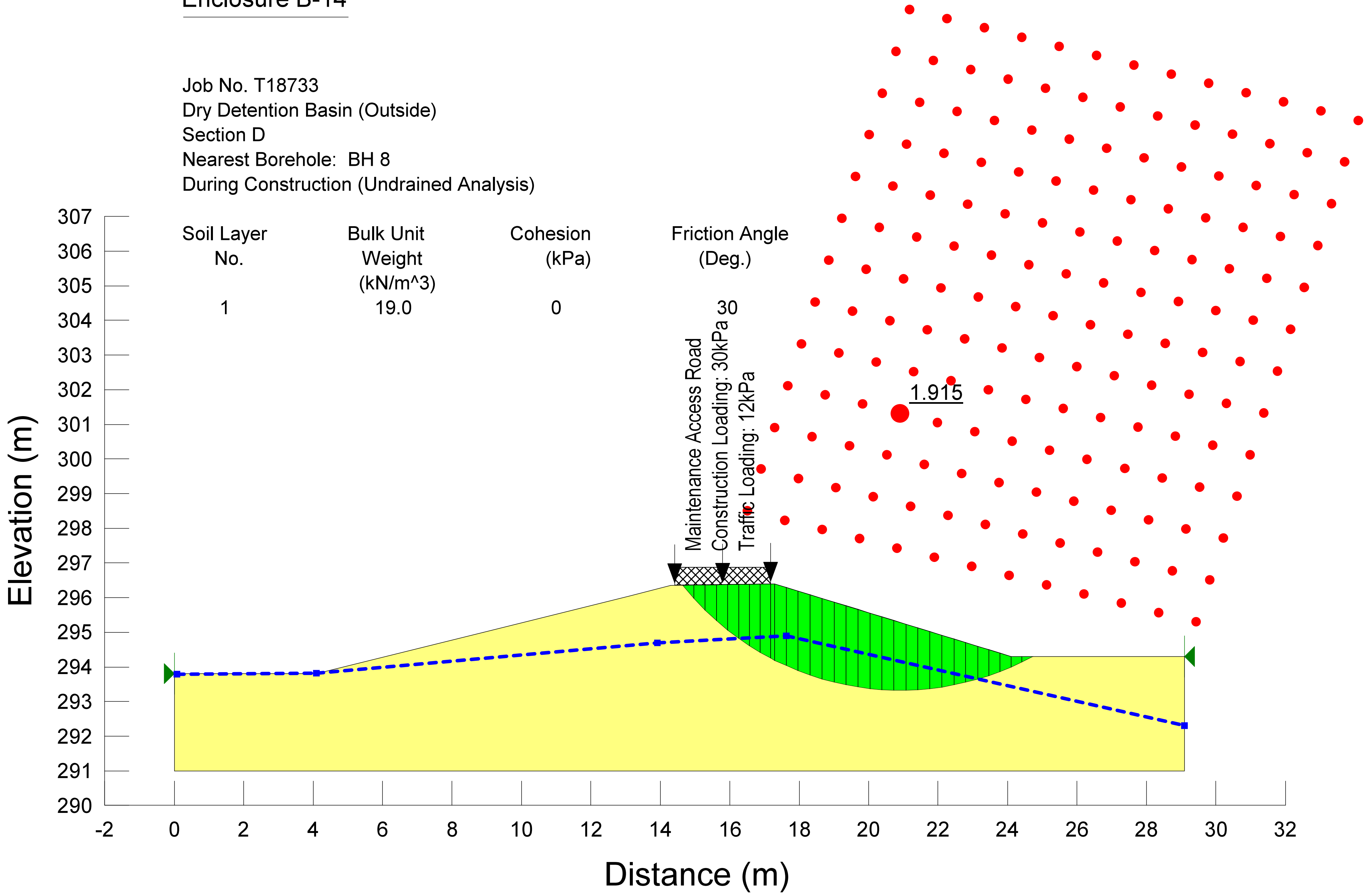
Soil Layer No.	Bulk Unit Weight (kN/m^3)	Cohesion (kPa)	Friction Angle (Deg.)
1	19.0	0	30



Enclosure B-14

Job No. T18733
Dry Detention Basin (Outside)
Section D
Nearest Borehole: BH 8
During Construction (Undrained Analysis)

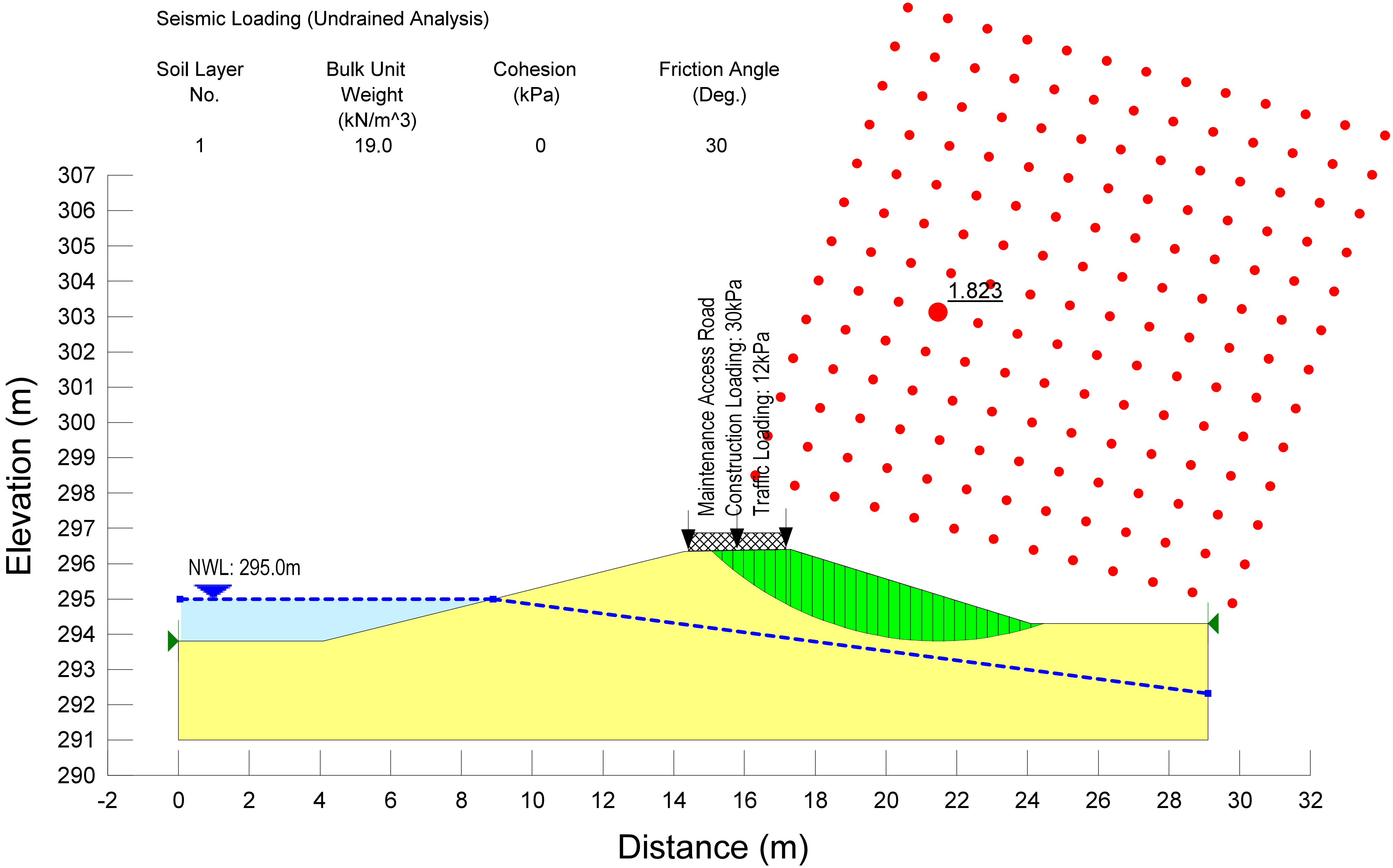
Soil Layer No.	Bulk Unit Weight (kN/m^3)	Cohesion (kPa)	Friction Angle (Deg.)
1	19.0	0	30



Enclosure B-15

Job No. T18733
Dry Detention Basin (Outside)
Section D
Nearest Borehole: BH 8
Seismic Loading (Undrained Analysis)

Soil Layer No.	Bulk Unit Weight (kN/m^3)	Cohesion (kPa)	Friction Angle (Deg.)
1	19.0	0	30



APPENDECIES

Appendix A: Site Specific Seismic Hazard Parameters as Per 2015 NBC of Canada

2015 National Building Code Seismic Hazard Calculation

INFORMATION: Eastern Canada English (613) 995-5548 français (613) 995-0600 Facsimile (613) 992-8836
Western Canada English (250) 363-6500 Facsimile (250) 363-6565

June 15, 2018

Site: 44.1977 N, 80.0598 W User File Reference: Mansfield Ski Club

Requested by: ,

National Building Code ground motions: 2% probability of exceedance in 50 years (0.000404 per annum)

Sa(0.05)	Sa(0.1)	**Sa(0.2)**	Sa(0.3)	**Sa(0.5)**	**Sa(1.0)**	**Sa(2.0)**	**Sa(5.0)**	**Sa(10.0)**	**PGA (g)**	**PGV (m/s)**
0.079	0.109	**0.105**	0.089	**0.074**	**0.045**	**0.023**	**0.0057**	**0.0025**	**0.062**	**0.060**

Notes. Spectral (Sa(T), where T is the period in seconds) and peak ground acceleration (PGA) values are given in units of g (9.81 m/s^2). Peak ground velocity is given in m/s. Values are for "firm ground" (NBCC 2015 Site Class C, average shear wave velocity 450 m/s). NBCC2015 and CSAS6-14 values are specified in **bold** font. Three additional periods are provided - their use is discussed in the NBCC2015 Commentary. Only 2 significant figures are to be used. ***These values have been interpolated from a 10-km-spaced grid of points. Depending on the gradient of the nearby points, values at this location calculated directly from the hazard program may vary. More than 95 percent of interpolated values are within 2 percent of the directly calculated values.***

Ground motions for other probabilities:

Probability of exceedance per annum	0.010	0.0021	0.001
Probability of exceedance in 50 years	40%	10%	5%
Sa(0.05)	0.0098	0.031	0.048
Sa(0.1)	0.016	0.045	0.069
Sa(0.2)	0.017	0.046	0.069
Sa(0.3)	0.016	0.041	0.060
Sa(0.5)	0.012	0.034	0.049
Sa(1.0)	0.0060	0.020	0.030
Sa(2.0)	0.0026	0.0096	0.015
Sa(5.0)	0.0006	0.0021	0.0036
Sa(10.0)	0.0004	0.0010	0.0015
PGA	0.0086	0.026	0.039
PGV	0.0072	0.024	0.038

References

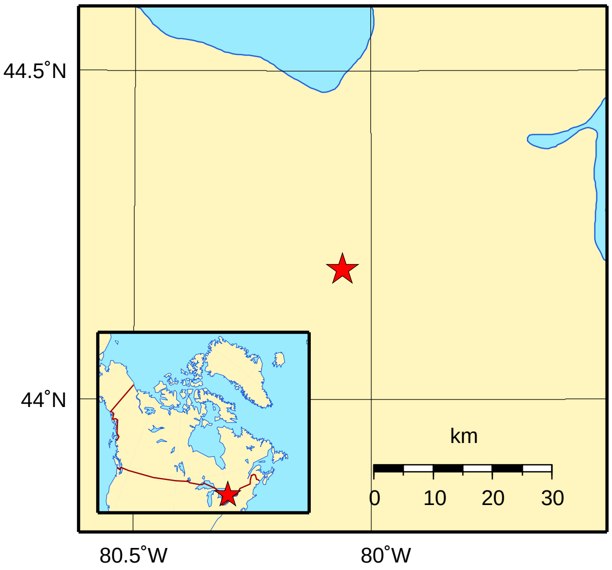
National Building Code of Canada 2015 NRCC no. 56190;
Appendix C: Table C-3, Seismic Design Data for Selected Locations in Canada

User's Guide - NBC 2015, Structural Commentaries NRCC no. xxxxxx (in preparation)
Commentary J: Design for Seismic Effects

Geological Survey of Canada Open File 7893 Fifth Generation Seismic Hazard Model for Canada: Grid values of mean hazard to be used with the 2015 National Building Code of Canada

See the websites *www.EarthquakesCanada.ca* and *www.nationalcodes.ca* for more information

Aussi disponible en français



Natural Resources Canada Ressources naturelles Canada

Canada

SHAD & ASSOCIATES INC.

March 20, 2020
Ref. No.: T18733

Mansfield Ski Club
628213 Sideroad 15, Mulmur, Ontario, L9V 3M6

Attention: **Mr. Finley McEwen**

RE: **Recommended Gravel Fire Route Pavement Thickness**
Mansfield Ski Club
628213 SDRD 15, Mulmur, Ontario

Based on your information, we understand that a gravel fire route is proposed to be constructed on a portion of the gravel driveway at the above captioned site. We wish to mention that a feasibility geotechnical assessment was previously carried out at above property and our recommendations were provided to the Client in Shad Report T18733 dated June 22, 2018. As requested, this addendum letter report is prepared to provide our recommendations for the proposed pavement thickness and its construction at the above captioned site.

- Pavement Thickness

In accordance with the 2018 report, Boreholes 5 and 6 appear to be located close to the north end of the proposed fire route. Based on the subsurface conditions encountered at these boreholes, below some fill (generally consisting of silty sand/sandy silt fill and/or granular fill), the site was underlain by a competent and compact to very dense silty sand till. However, some topsoil was also noted interbedded within the fill at Borehole 6. The groundwater level was monitored during and upon completion of drilling and it was measured at 3.2 m and 4.3 m below existing ground surface at Boreholes 5 and 6, respectively.

Considering the subsurface information, for a trouble-free performance of the proposed pavement, we would recommend the existing topsoil and fill to be removed and the excavated subgrade to be raised up to the design grade to accept the pavement structure using properly placed and compacted engineered fill in accordance with the recommendations provided in Section 4.3.4: Engineered Fill of the 2018 report. Assuming this and using good engineering and construction practice, the following minimum pavement structure for the proposed gravel fire route may be used:

PAVEMENT STRUCTURE	COMPACTION	PAVEMENT THICKNESS (mm)
Granular ‘A’ Base	100%	150
Granular ‘B’ Sub-base	100%	450

Alternatively, the pavement thickness could be reduced to 400 mm (Granular ‘A’: 150 mm and Granular ‘B’: 250 mm) by strengthening the subgrade by including a layer of BX1200 Geogrid. The geogrid should be extended out at least 1.0 m beyond the route footprint. To ensure the longevity of the pavement, the roadbed should be well drained at all times.

- Construction Comments

In order to provide a durable pavement structure, the following pavement construction method is recommended.

The subgrade should be adequately prepared to receive the sub-base course. Any disturbed and wet subgrade materials should be removed, and the top of the subgrade should then be inspected and approved by proof-rolling by qualified geotechnical personnel. Cavities created by the removal of unsuitable materials should be backfilled with approved, inorganic fill materials similar to the existing subgrade material. All new fill should be placed in maximum 200 mm loose lifts within ±2% of its optimum moisture content, and each lift compacted with suitable equipment to minimum 98% Standard Proctor Maximum Dry Density, before placing the next lift. If construction of the roadfill is carried out in wet weather, the thickness of the sub-base course may need to be increased.

Special attention should be paid to proper grading of the subgrade surface. Depressions and undulations should be eliminated and, to permit quick drainage, the subgrade surface should be sloped towards ditches, sub-drains and/or catch-basins.

It is recommended that a programme of geotechnical/material inspection and testing be carried out during the construction phase of the project to confirm that the conditions exposed in the excavations are consistent with those encountered in the boreholes and the design assumptions, and to confirm that the various project specifications and materials requirements are being met.

- Closure

It should be noted that this letter report is prepared as an addendum to Shad Report T18733 dated June 22, 2018 and should be referenced for more information.

We trust that the above is an accordance with your current requirements. Should you require additional information or clarification, please contact our office.

Sincerely,
Shad & Associates Inc.

S. Chong

LICENSED PROFESSIONAL ENGINEER
H. SHAD
PROVINCE OF ONTARIO

H. Shad

Stephen Chong, P. Eng.
Senior Engineer

Houshang Shad, Ph. D., P. Eng.
Principal

April 22, 2020
Ref. No.: T18733

Mansfield Ski Club
c/o WMI & Associates Limited
119 Collier Street
Barrie, Ontario
L4M 1H5

Attention: **Mr. Andrew Windrem**

RE: **Addendum Geotechnical Report**
Mansfield Ski Club
628213 SDRD 15, Mulmur, Ontario

Further to your email of April 17, 2020 and our conversation, this addendum report is prepared to provide our geotechnical opinion and recommendations on the following Items:

1) Asphalt pavement structure for entrance off 15th Sideroad and fire route;
2) Maintenance access to the Dry Pond basin;
3) Sewers & watermain;
4) Snow Making Pond;
5) 2.0 m wide berm east of Dry Pond; and
6) Enhanced seeded grass swale along the east side of the parking lot.

The Items are discussed below. We wish to mention that a feasibility geotechnical assessment was previously carried out at the property and our recommendations were provided to the Client in Shad Report T18733 dated June 22, 2018. This addendum report is prepared as an addendum to the 2018 report.

1) Asphalt Pavement Structure for Site Entrance off 15th Sideroad & Fire Route

Based on our conversation, we understand that the entrance will have a heavy duty use and that part of the fire route inside the property will also be asphalt paved.

Considering the subsurface information encountered at Boreholes 5, 6 and 8, for a trouble-free performance of the proposed asphalt pavement, we would recommend the existing topsoil and/or fill to be removed down to competent inorganic and undisturbed subgrade. The exposed native subgrade should then be inspected and approved by experienced geotechnical staff. Following its approval, the subgrade should be raised up to the design grades to accept the pavement structure using properly placed and compacted engineered fill in accordance with the recommendations provided in Section 4.3.4: Engineered Fill of the 2018 report. Assuming this and using good engineering and construction practice, the minimum pavement structure provided in Table 1 may be used.

Table 1: Recommended Minimum Pavement Structure

Pavement Structure	Compaction	Heavy Duty & Fire Route (mm)
HL-3 Asphaltic Concrete HL-8 Asphaltic Concrete	97% Marshall Density	50 50
Granular ‘A’ Base	100%	150
Granular ‘B’ Sub-base	100%	350

Note: HL-3 and HL-8 asphaltic Concrete to conform to OPSS 1150 & 310

To ensure the longevity of the pavement, the roadbed should be well drained at all times. We recommend that full-length perforated sub-drains of 150 mm diameter be installed along both sides of the road, below the roadbed level, to ensure effective drainage. The sub-drain should be surrounded by 20 mm size clear stone drainage zone of minimum 150 mm thickness, which should have non-woven geotextile (Terrafix 270R or approved equal) wraparound to minimize infiltration of fines in pipes which would reduce their effectiveness.

The granular materials should be compacted as per American Society for Testing and Material’s Number D698. The placing, spreading and rolling of the asphalt should be in accordance with Ontario Provincial Standard Specifications Form 310, or equivalent.

Construction traffic over exposed subgrade materials should be minimized, and temporary construction hauling routes should be established. If these routes coincide with future paved areas, adequately reinforced haul roads (increased thickness of granular base, use of geo-fabrics, etc.) should be constructed to reduce disturbance to the subgrade soils. These provisions are particularly important if the construction is scheduled during wet and cold season.

1.1 Construction Comments

In order to provide a durable pavement structure, the following pavement construction method is recommended.

The subgrade should be adequately prepared to receive the sub-base course. Any disturbed and wet subgrade materials should be removed, and the top of the subgrade should then be inspected and approved, by proof-rolling, by qualified geotechnical personnel. Cavities created by the removal of unsuitable materials should be backfilled with approved, inorganic fill materials similar to the existing subgrade material. All new fill should be placed in maximum 200 mm loose lifts within ±2% of its optimum moisture content, and each lift compacted with suitable equipment to minimum 95% Standard Proctor Maximum Dry Density, before placing the next lift.

The uppermost zones of the roadfill, within 1.0 m of the roadbed, should be compacted to minimum 98% Standard Proctor Maximum Dry Density. If construction of the roadfill is carried out in wet weather, the thickness of the sub-base course should be increased.

Special attention should be paid to proper grading of the subgrade surface. Depressions and undulations should be eliminated and, to permit quick drainage, the subgrade surface should be sloped towards ditches, sub-drains and/or catch-basins.

2) Maintenance access to the Dry Pond basin

According to the information provided to us, we understand that a 3.0 m wide gravel access road will be constructed in the pond. Based on the subsurface conditions encountered at Borehole 8 and the considerable presence of fill and topsoil, all the unsuitable material would need to be removed and the grade raised up to the design elevations using properly placed and compacted engineered fill. (For additional information on the construction of the dry pond, reference should be made to Section 4.4 of the 2018 report). Assuming this, we recommend the 3.0 m wide gravel access road to consist of 150 mm of Granular B overlain by 150 mm of Granular A. The pavement structure should be placed in maximum 150 mm loose lifts within ±2% of its optimum moisture content, and each lift compacted to 100% of the material's Standard Proctor Maximum Dry Density.

3) Sewers & Watermain

According to Drawings GENN and SSOP (with a SPA 1st submission date of February 7, 2020), we understand that the depth of proposed services will be within 4.2 m of the road grade. The following discussion is based on this assumption.

3.1 Trenching

Trench excavations should be carried out as per the Safety Regulations of the Province of Ontario. Considering the subsurface conditions encountered at Boreholes 5, 6 and 7, below the existing topsoil and fill, the sewer trenches will be predominantly excavated within the compact to very dense, but generally dense to very dense silty sand to sandy silt till. These deposits are classified in Section 4.3.5 of the 2018 report in accordance with the Ontario Health and Safety Regulations. Within these soils, the side slopes of excavations are expected to be temporarily stable at 1H:1V, although above the groundwater level in the dense to very dense silty sand to sandy silt till, the bottom 1.2 m of the trench walls could be excavated close to vertical. Flatter slopes may be required in surficial topsoil and fill layers and below the groundwater level in silty sand to sandy silt till. Approved trench boxes or equivalent may be used to limit the extent of the excavation, if required.

Groundwater seepage within the glacial deposits should be minor and manageable by gravity drainage and pumping from filtered sumps. However, increased seepage may occur from any perched water condition within the topsoil and fill, which may require a series of sump pumps. Increased seepage should also be expected if the excavation is extended below the groundwater level in the silty sand to sandy silt till. We recommend that once the pipe inverts are finalized and before construction, the groundwater conditions at the site to be further assessed by test pitting to ensure that the most suitable dewatering methodology is selected. In no case should the pipes be placed on dilated or disturbed subsoil.

Attention is called to the possible presence of cobbles and/or boulders that may be encountered during the excavation in the glacial till deposits.

Normal excavation equipment will be suitable for making trenches within soils in which the proposed underground services will be installed. The terms describing the relative density (compact, dense, very dense) of soil strata give an indication of the effort needed for excavation.

3.2 Bedding

The boreholes showed that the sewer pipes will be predominantly laid within a compact to very dense silty sand to sandy silt till or engineered fill which are considered to be suitable to support the pipes. The recommended minimum thickness of granular bedding for normal Class 'B' Type of bedding (i.e., compacted granular bedding material – OPSD-802) below the invert is 150 mm. The thickness of the bedding may, however, have to be increased depending on the pipe diameter or if wet or weak subgrade conditions are encountered.

3.3 Backfill

Based on the visual and tactile examination of the soil samples, the on-site inorganic excavated soils could be re-used as backfill in service trenches. The moisture contents at the time of construction should be at or near optimum. The backfill should be placed in maximum 200 mm thick layers at or near (±2%) their optimum moisture content, and each layer should be compacted to at least 95% Standard Proctor Maximum Dry Density. This value should be increased to at least 98% within 1.0 m of the road subgrade surface.

The excavated native deposits may require reconditioning (e.g., wetting or drying) prior to reuse. The on-site excavated soils should not be used in confined areas (e.g., around catch-basins and laterals under roadways) where heavy compaction equipment cannot be operated. The use of good backfill together with an appropriate frost taper would be preferable in confined areas. Unsuitable materials such as organic soils, boulders, cobbles, frozen soils, etc., should not be used for backfilling.

We recommend that frost tapers be provided at backfilled trenches to ensure gradual transition from the frost-free materials to the frost susceptible natural soil, otherwise differential frost heaving may occur. Frost taper would not be necessary if the backfill material can be matched within the frost zone (i.e. within about 1.6 m depth below the pavement surface) with subgrade-type material.

The need for anti-seepage collars should be assessed during site servicing.

4) Snow Making Pond

The design and construction of the snow making pond were discussed in Section 4.1 of the 2018 report. The conditions were further discussed with Mr. Dan Hurley of Tatham Engineering Limited on April 20, 2020. Considering the subsurface conditions encountered at Borehole 1, below some surficial topsoil and fill, the site is predominantly underlain by wet and sandy deposit with the short-term groundwater level being measured at 0.9 m above the ground surface. Currently, the proposed pond is designed to extend to a depth of about 6 m or so below the existing grade. Considering these, from a geotechnical viewpoint, we would recommend the pond not to be lined, if allowed. For the unlined pond, the base and walls of the pond would still need to be protected against erosion and washout, perhaps through the use of riprap stones, separated from the base and walls using a suitable geofabric separator, such as Terrafix 300 or 360. However, if the pond must be lined, for an economical design, we would recommend reducing the pond depth below the existing ground surface as much as possible in attempt to reduce the uplift hydrostatic pressure. The uplift pressure would need to be counterbalanced (using weight placed over the liner) or the pressure would need to be minimized by permanent water level lowering (by using a subsurface drainage network connected to a frost-free outlet). We would also need to ensure that any manholes or associated structures (such as wet well or pumping house, etc.) are assess for the uplift condition to ensure that they do not float. The liner could be clayey or geosynthetic. We would recommend that once the pond design is known, we should review and provide additional geotechnical recommendations.

5) 2.0 m wide berm east of Dry Pond

Considering the existing and design grades for the proposed dry pond, we understand that following the east berm of the pond, the grade will fall from Elevation 296.40 m to the existing grades at approximately 294.3 m at a gradient of 3H:1V. This proposal was modelled for slope stability analysis and the proposed outside berm of the pond was found to be stable. Reference should be made to Section 4.4 of the 2018 report for full details. We would recommend the berm to be vegetated to minimize surface erosion and localized gulleying.

6) Enhanced seeded grass swale along the east side of the parking lot

According to Drawings SP.1 (dated January 2020) and SGRS (with a SPA 1st submission date of February 7, 2020), we understand that an enhanced seeded grass swale is proposed to be constructed on the east side of the proposed parking lot. The proposed swale will have its bottom invert elevation on the north end at about El.297.08 m, falling to El.295.65 m at the south end where it meets the dry pond basin. The proposed channel will be 1 m wide at the base and 0.5 m deep, with a side slope of 3H:1V. The swale will be topsoil seeded and a 100 mm diameter perforated subdrain will be installed at about 0.2 m below the base to minimize any potential for flooding.

Boreholes 7 and 8 are drilled near the north and south ends of the proposed swale, according to these boreholes, the proposed channel would be constructed in engineered fill. Assuming, the native onsite silty sand to sandy silt soils to be used for the earthworks, the soils would have permeability values of approximately 1×10^{-6} to 1×10^{-4} cm/sec, depending on the silt content, indicating a medium to low permeability condition.

- Closure

It is recommended that a programme of geotechnical/material inspection and testing be carried out during the construction phase of the project to confirm that the conditions exposed in the excavations are consistent with those encountered in the boreholes and the design assumptions, and to confirm that the various project specifications and materials requirements are being met.

It should be noted that this letter report is prepared as an addendum to Shad Report T18733 dated June 22, 2018 and should be referenced for more information.

We trust that the above is an accordance with your current requirements. Should you require additional information or clarification, please contact our office.

Sincerely,
Shad & Associates Inc.

S. Chong

LICENSED PROFESSIONAL ENGINEER
H. SHAD
PROVINCE OF ONTARIO

H. Shad

Stephen Chong, P. Eng.
Senior Engineer

Houshang Shad, Ph. D., P. Eng.
Principal

cc. Mr. Finley McEwen, Manfield Ski Club