
Functional Servicing Report

**1128 & 1134 Printery Road, St. Jacob
Township of Woolwich**

September 2025



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Project No.: 4311

September XX, 2025

Will-O Homes
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Attention: Mr. Kevin Smith
Owner

Dear Mr. Smith,

**Re: Functional Servicing Report
1128 & 1134 Printery Road, St. Jacobs
Township of Woolwich**

Please find our Functional Servicing Report for the above-noted project, in support of re-zoning approval.

Our servicing report identifies constraints for environmental issues, sanitary sewerage, water supply, and storm drainage/stormwater management. Our report also considers grading constraints, transportation, and utility availability. Where necessary, reasonable assumptions based on normal industry practices have been used and are described as such.

It is our opinion that adequate services exist to support this project. Recommendations from our report shall be incorporated into the detailed design phase of the project, following approval of the Re-zoning application.

Yours very truly,

MERITECH ENGINEERING



Xiaochen Cai
CAD Designer

XCC
Enclosures (0)

cc



Brian Enter, P.Eng.
Senior Engineer

Executive Summary

The property is approximately 1.0 hectares in size and is bounded by Printery Road to the north, King Street to the west and existing agricultural areas to the east and south in the Village of St. Jacobs, Township of Woolwich.

The property is proposed to include twelve freehold townhouse units on the west portion of the site fronting onto Printery Road, and seventeen townhouse units on a private roadway within a standard condominium block.

The proposed site will be provided with adequate supply for both domestic and firefighting water and standard sanitary servicing connections by gravity except for some basements, which will need to be pumped. Capacity in the existing 200mm sanitary sewer is expected to be adequate.

Stormwater management is to be provided with storm detention for the condominium block. The storm servicing and stormwater management will be in accordance with Township and Regional requirements. Matching post-development peak flow rates to match pre-development peak flow rates for 5-year and 100-year storm events were targeted where possible. A combination of onsite storage and the remaining capacity of the Valleyview SWM pond will be used for quantity control. Quality control will also be provided by the downstream SWM pond.

Approval agencies shall review and approve this document in support of Re-zoning approval.

Disclaimer

This report was prepared by Meritech Engineering for Will-O Homes. The comments, recommendations and materials presented in this report reflect our best judgement in light of the information available at the time of preparation. Except for approval and commenting municipalities and agencies in their review and approval of this project, any use which a third party makes of this report, or any reliance upon, or decisions as a result of, are the responsibility of such third parties. Meritech Engineering accepts no responsibility for damages suffered by any third party, other than an approval or commenting municipality or agency, as a result of decisions made or actions taken based on this report.

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Introduction

The site is about 1.0 hectare in size, as shown in Figure 1. It is located at the southern limit of the village of St. Jacobs in the Township of Woolwich, within the Regional Municipality of Waterloo. It is currently zoned Residential Settlement (R-1) & Agricultural (A) and is bounded by Mixed High Density (R-5) & R-1 residential zoning to the north and east, by M-5 industrial zoning to the west, and agricultural to the south.

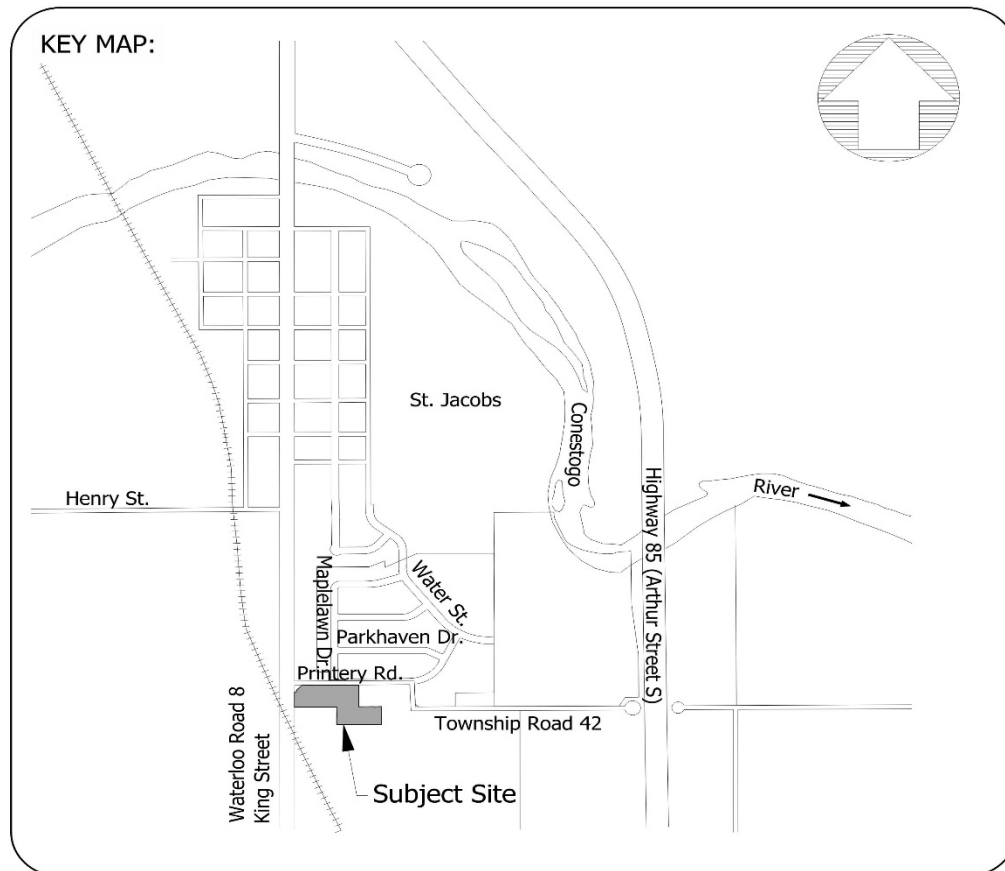


Figure 1: Site Location

The proposed development for this site consists of 12 freehold townhouse units and 17 condominium townhouse on a private roadway with a cul-de-sac at the end. A single entrance for the condominium block will be located on Printery Road.

Approach

The following flowchart explains a typical submission and approval process. The section highlighted in grey indicates the status of this circulation:

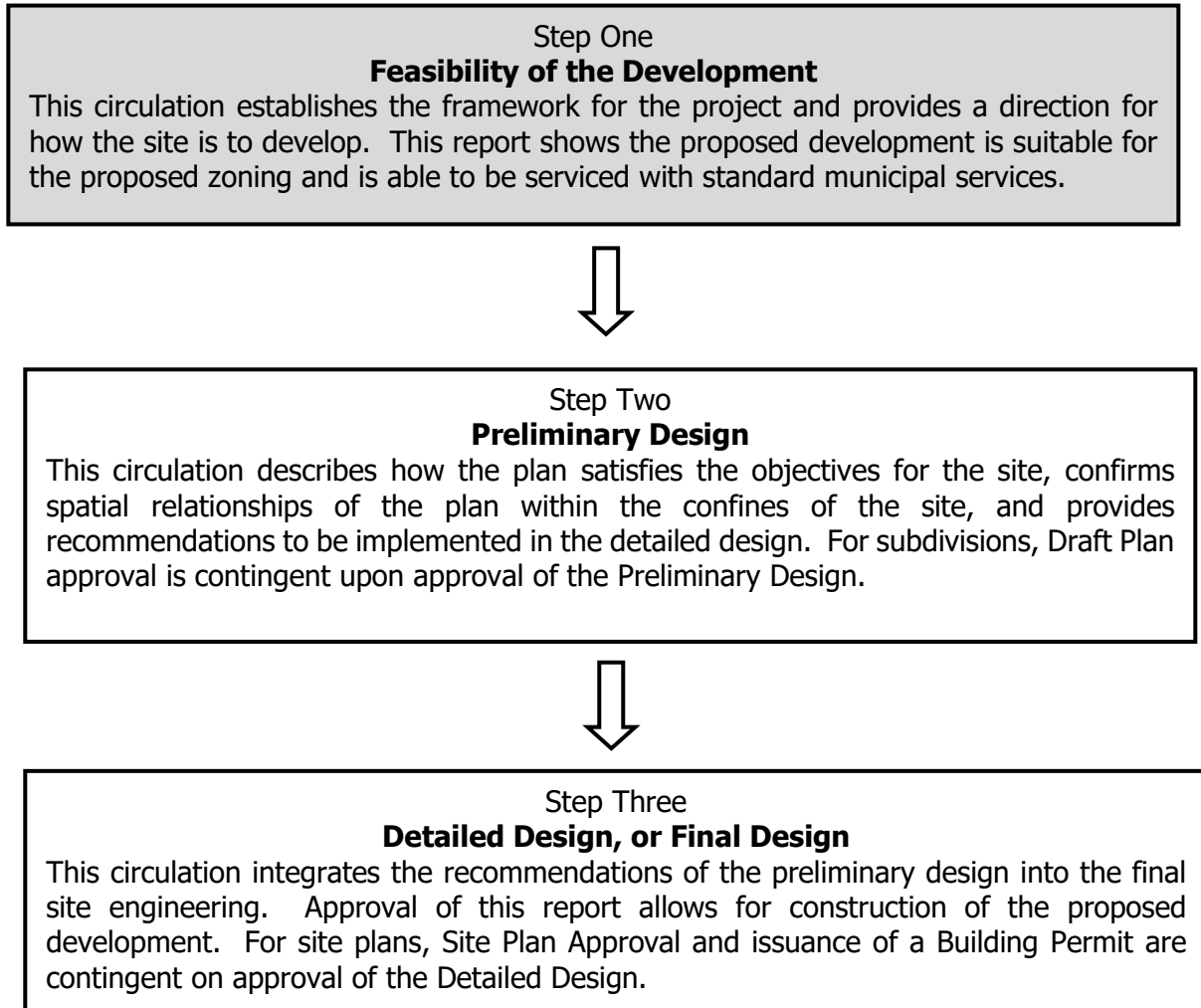


Figure 2: Approach Flowchart

Policy Framework

This chapter outlines the framework which the plan is built upon. Previous studies, municipal and provincial standards, as well as any field investigations undertaken to support the project, are examples of information described in this chapter. This background information is then used to build an appropriate plan for the site. The next chapter, Objectives and Targets, describes the site-specific requirements noted from the following sources:

MECP Guidelines

Stormwater Management Planning and Design Manual, Ministry of the Environment, 2003

This manual provides guidelines on the planning and design of stormwater management facilities in Ontario. It prescribes objectives for quality and quantity control, design calculation parameters and example of appropriate stormwater management measures.

Regional Guidelines

Region of Waterloo and Area Design Guidelines and Supplemental Specifications for Municipal Services (DGSSMS), 2024

The design portion of this annually updated document (Part B) should be considered as guidelines that provides the municipalities' design preferences under normal circumstances. These guidelines are read together with Municipal guidelines and standards in place.

Municipal Guidelines

Engineering Development and Infrastructure Manual, Township of Woolwich, 2022

The manual provides design guidelines for servicing and grading of residential development site within Township of Woolwich.

Conservation Authority Guidelines

Greater Golden Horseshoe Area Conservation Authority Erosion & Siltation Control Guideline for Urban Construction, December 2006

This document describes the methodology for determining the erosion potential of a site and the measures that should be undertaken to mitigate construction disturbance.

Pre-Consultation

Pre-Submission Comments from the Township of Woolwich dated July 26, 2024, and from the Region of Waterloo have been included in Appendix E. Key items from these comments are included in the following chapter 'Objective and Criteria'.

Geotechnical Studies

CMT Engineering Inc. completed a geotechnical investigation in December 2024, included in Appendix F. Key findings from the report include:

- General subsurface soil conditions are average 0.35m topsoil, sand, silty sand with clay and silt.
- Groundwater conditions are confirmed by monitoring wells on site. Based on the groundwater table, the groundwater was variable on-site, with some areas being observed with high ground water levels.
- Recommendations for the development are provided, such as construction dewatering consideration, the proposed road structure, and building foundation requirements.



Figure 3: Existing Conditions (Google Street view)

Objectives and Criteria

This section outlines the objectives and criteria for the wide variety of issues considered in this report; the following Discussion section will demonstrate how the objectives presented have been achieved and how the criteria are met.

Sanitary Servicing

The primary objective with respect to sanitary servicing is that a sanitary sewer system servicing the site can be constructed as per MECP, Region of Waterloo (DGSSMS), and Township of Woolwich standards. The development will outlet into existing infrastructure adjacent to the site.

Water Servicing

There are two objectives regarding water servicing: provide domestic water supply as per Provincial, Regional, and Township requirements, and ensure that an adequate fire-fighting water supply is available as per "Water Supply for Public Fire Protection", Fire Underwriters Survey and other Regional requirements.

Storm Servicing

The primary objective with respect to storm servicing is that a storm sewer system servicing the site can be constructed as per MECP, Region of Waterloo (DGSSMS), and Township of Woolwich standards. It is necessary to demonstrate that outlets have the capacity for this development.

Stormwater Management

Post-development peak flow rates are to match pre-development peak flow rates for the 5-year and 100-year design storm events and are to be treated to an enhanced level of water quality control.

Grading and Drainage

The typical objective is to reduce the cost of the development by minimizing earthworks costs, excessive retaining walls, etc., in addition to meeting the municipality's requirements related to the grading of useable yards.

Transportation

The Township of Woolwich has indicated a road widening will be required along the frontage of Printery Road, in addition to a daylight triangle at the intersection of Printery Road and King Street. The road network proposed on the Draft Plan should meet the standards of the Municipality.

Utilities

The following utility companies are required to confirm their ability to service the development:

- Waterloo North Hydro
- Bell Canada
- Rogers Cable
- Enbridge Gas

Discussion

Site Design

As shown on the conceptual site plan (Appendix A), the site is comprised of a total of 29 units including freehold townhouses fronting onto Printery Road and condominium townhouse units on a private roadway. The proposed water, sanitary services will be connected to existing municipal services on Printery Road. Storm servicing will outlet to three different locations including Printery Road storm sewer, King Street, and a the Core Environmental Area/Forest Buffer ("Forest"). The layout of these features is illustrated in the conceptual site grading and servicing plan attached in Appendix B.

Sanitary Servicing

The eastern portion of the development (the condominium site) is proposed to be constructed with an internal 200mm diameter sanitary sewer with a connection to the existing sewer on Printery Road.

For the western portion of the development, the freehold townhouse units will be serviced with a proposed 200mm diameter sanitary sewer extension along Printery Road from the intersection of Printery Road and Maplelawn Drive. A MECP CLI application will be required for the new sanitary sewer extension.

Due to the elevation of the existing municipal sanitary sewer, some of the units in the condominium site may need to have any fixtures in the basement internally pumped. Review of the extent of this constraint will need to be completed during detailed design.

Based on the unit counts presented in the Concept Plan, peak flows were determined by applying peaking factors to the average day and infiltration demands shown in Table 1, Engineering Development and Infrastructure Manual 2022 from Township of Woolwich.

Unit Type	Flow
Residential	305 L/cap/day
Infiltration	0.15 L/s/ha

Table 1: Average Daily Flows

The proposed development of total 29 townhouse units will generate peak flows of approximately 1.2 L/s. This peak flow rate is about 4.5% of the capacity of the 200mm diameter sewer servicing the site. The preliminary calculations are attached in Appendix C .

According to the Region of Waterloo 2023 Water and Wastewater Monitoring Report, there is 294m³/d of remaining capacity available in the St. Jacobs Wastewater Treatment Plant. Although some of this capacity may be previously allocated, it is likely there is sufficient capacity for this relatively small increase from this proposed development. This should be confirmed by the Region.

Water Servicing

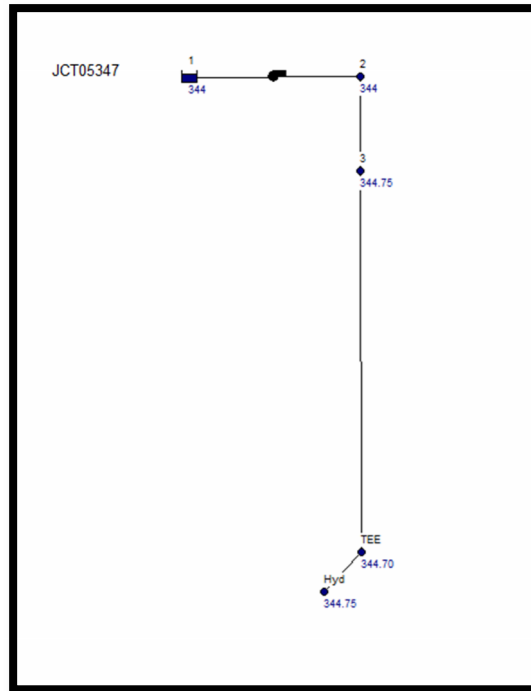
The existing watermain on Printery Road is a 250mm diameter PVC main. One existing fire hydrant is located at the intersection of Printery Road and Maplelawn Drive. Another existing fire hydrant is directly across from the proposed western townhouse on King Street North.

To service the condominium development it is proposed to construct a 200mm diameter watermain to provide water for an internal hydrant and 25mm water services to the individual units. The proposed water servicing layout on the Preliminary Grading and Servicing plan is attached in Appendix B.

It is estimated the proposed development will generate a base 'domestic' water demand of 0.19L/s for the design population of 71 people at a base demand of 225L/cap/day. This flow is negligible compared to the required fire flow for the site. See Appendix C for the calculation.

The Region of Waterloo has provided pressure information for junction JCT_05347, located at the intersection of Printery Road and Maplelawn Drive. It shows the local watermain system is having up to 118.6L/s available while maintaining a pressure of 27.8m (Appendix C). Proposed fire flow to the site per FUS mentioned above has been calculated as requiring 106 L/s in the worst-case scenarios, assuming the proposed firewall is considered in the detailed design. Detail fire flow for townhouse block 1-5 is calculation in Appendix C.

The site was further evaluated with EPANET modelling. Shown in Figure 4 is the EPANET schematic.

**Figure 4: Schematic**

Analysis Results

Shown in Table 2 are the results from the maximum day and fire modelling scenario run for the internal fire hydrant node. As the pressure at the worst-case node for the scenario is above the minimum 140kPa pressure required from the DGSSMS, it is determined that during the max day plus fire scenarios results for fire flows applied to the hydrant node are attached.

Hydrant	Total Flow Rate (L/s)	Modelled Minimum Residual Pressure kPa (m)
1	106	256.1 (26.12)

Table 2: Fire Flow Simulation Results

The available flow and residual pressure data from the Region of Waterloo water modelling report were used to create a water flow curve (see Figure 3-3) for water modelling in EPANET.

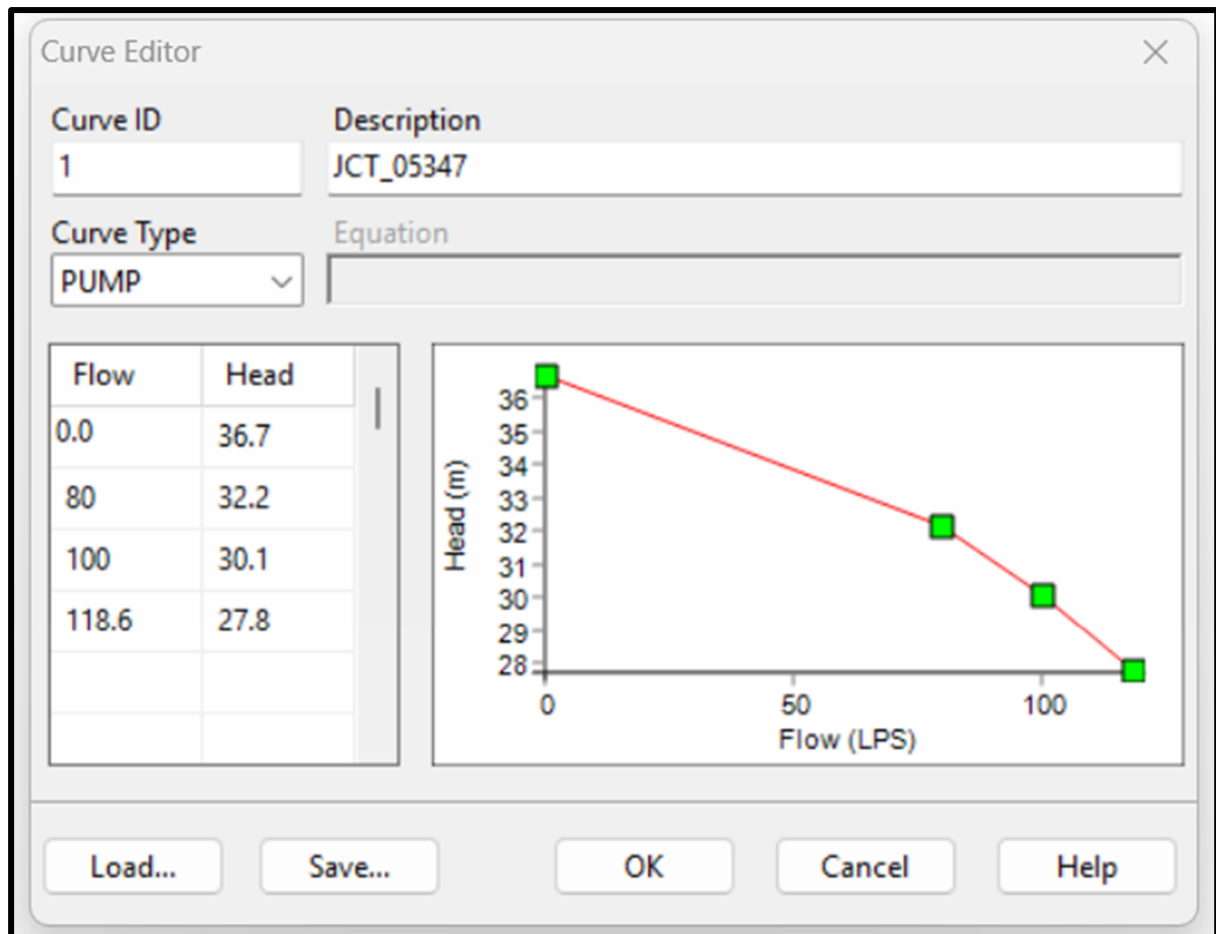


Figure 5: Fire Flow Curve in EPANET

In the water modelling, the proposed watermain is sized up to 200mm diameter to maintain the maximum velocity in all flow conditions, 5m/s per DGSSMS guidelines.

Pre-application comments from the Township indicate the site is located between the high and low water pressure zones. A pressure reducing valve (PRV) and backflow prevention device may be required for the site. Individual PRVs will be required within each of the freehold townhouses or at the watermain connection for the main extension.

Storm Servicing

The existing topography directs sheet flow from the north to the south-east boundary of the site for the majority of the site where runoff drains to the woodland buffer ("Forest" outlet) of the Core Environmental area. A westerly portion of the site currently drains to an existing 100mm diameter storm sewer connection that drains to the municipal storm sewer on King St N which ultimately outlets to the municipal ditch south of 1140 King St N.

The private condominium block will be serviced with proposed storm sewers and catch basins. The sewer will connect to the existing Printery Road storm sewer.

A separate storm sewer for the conveyance of minor flows is proposed along the rear of the freehold units, through the condominium site, that will outlet to the "Forest" outlet. This storm sewer will also provide conveyance for existing external drainage from 1124 and 1118 Printery Road. This sewer shows in cyan in the Preliminary Servicing and Grading Plan. An easement through the condominium block in favour of each of the dependent lots will be required to provide rights for conveyance and future maintenance.

A storm sewer extension on Printery Road is proposed to meet the Township's requirement for providing a storm connection for storm laterals. The sewer flow direction will need to be split between east and west since the existing sewer draining to the east is shallow and can only be extended along half of the freehold lots. A MECP CLI application will be required for the new sewer extension.

Foundation drains are to be pumped and directly connect to storm laterals for all units.

Stormwater Management

Existing Conditions

The existing topography directs sheet flow from the site to three different outlet points. The major part of the site drains from the northern site limits to the southeast boundary of the site to the existing forest and agriculture area.

A westerly portion of the site currently drains to an existing swale adjacent to King Street and ultimately outlets to the municipal ditch south of 1140 King Street North.

Another small north part of the site drains to Printery Street storm sewers which outlets into the existing Valley Heights Subdivision Storm Water Management (SWM) facility at the corner of Old Scout Place & Printery Road to the east of the proposed development.

Proposed Strategy

It is proposed that the three existing storm outlet points (King Street drainage to the south, Printery Road draining to the east to an existing SWM Pond, and overland to the Core Environmental Area to the southeast) continue to be utilized with a best-efforts approach to proportionately matching post storm runoff to existing runoff rates. For some areas, grading constraints and the requirement to minimize drainage directed to adjacent lands requires that some of the runoff be split with minor and major flows being directed to different outlet points. The 10-year storm was used as the threshold for the split of major and minor flows estimating a surcharged storm sewer conveyance condition. This split is shown on Figure 7 with the different flow arrows. MIDUSS modelling of the 10-year threshold values used in the diversion commands is found in Appendix D2.

King Street

Minor Flows

- Minor runoff from the western, front portion of the freehold lots will drain to King Street storm sewer via Printery Road.

Major Flows

- Major flows from all of the freehold fronts will be conveyed to King Street due to location of the existing high point in the roadway.
- Overland flows from the rear yards of the Freehold Towns will also flow to King St ditch.

Printery Road

All of the runoff (major and minor) from all but a small eastern and southern portion of the condominium townhouse project will be captured and conveyed to Printery Road. This runoff will first be detained with a combination of surface ponding and a proposed underground detention tank. A total of approximately 111m³. The controlled runoff will be conveyed to the Printery Road storm sewer. We have modeled and confirmed that there is minimal impact on the existing Valley Heights Subdivision Storm Water Management (SWM) Pond function.

Core Environmental Area/"Forest"

The remaining portion of the site as well as some external areas of neighbouring properties to the north will be conveyed to the "Forest". This includes:

Minor Flows

- Flows from the following "clean runoff" areas will be conveyed to the "Forest" outlet:
 - o the rear yards of the freehold townhouses
 - o the back portion of the roofs and rear yards of the northern condominium townhouses
 - o the residential lands to the northeast,
 - o the rears of the southern condominium townhouses
 - o and the amenity area.

Major Flows

- Same as above less the major flows from the rears of the freehold towns.

We note that runoff to the "forest" will contribute to maintaining existing surface runoff to the existing Core Environmental Area directly to the east of the proposed development. Peak flows are lower than existing conditions given the reduction in the contributing drainage area, refer to Table 6.

Water Quantity

Hydrologic Model

Hydrologic modelling was performed using MIDUSS software, a widely accepted urban development model. It has been used for many years in the Region of Waterloo. A Chicago-type storm was selected and coefficients for the various storm events were taken from the City of Kitchener according to the Township of Woolwich Manual 2022.

Rainfall Data

Storm Event	Definition	a	b	c	r
5-year, 4 hour	Minor system	1593	11	0.8789	0.40
10-year, 4 hour	Diversion storm	2221	12	0.9080	0.40
100-year, 4 hour	Major system	4688	17	0.9624	0.40

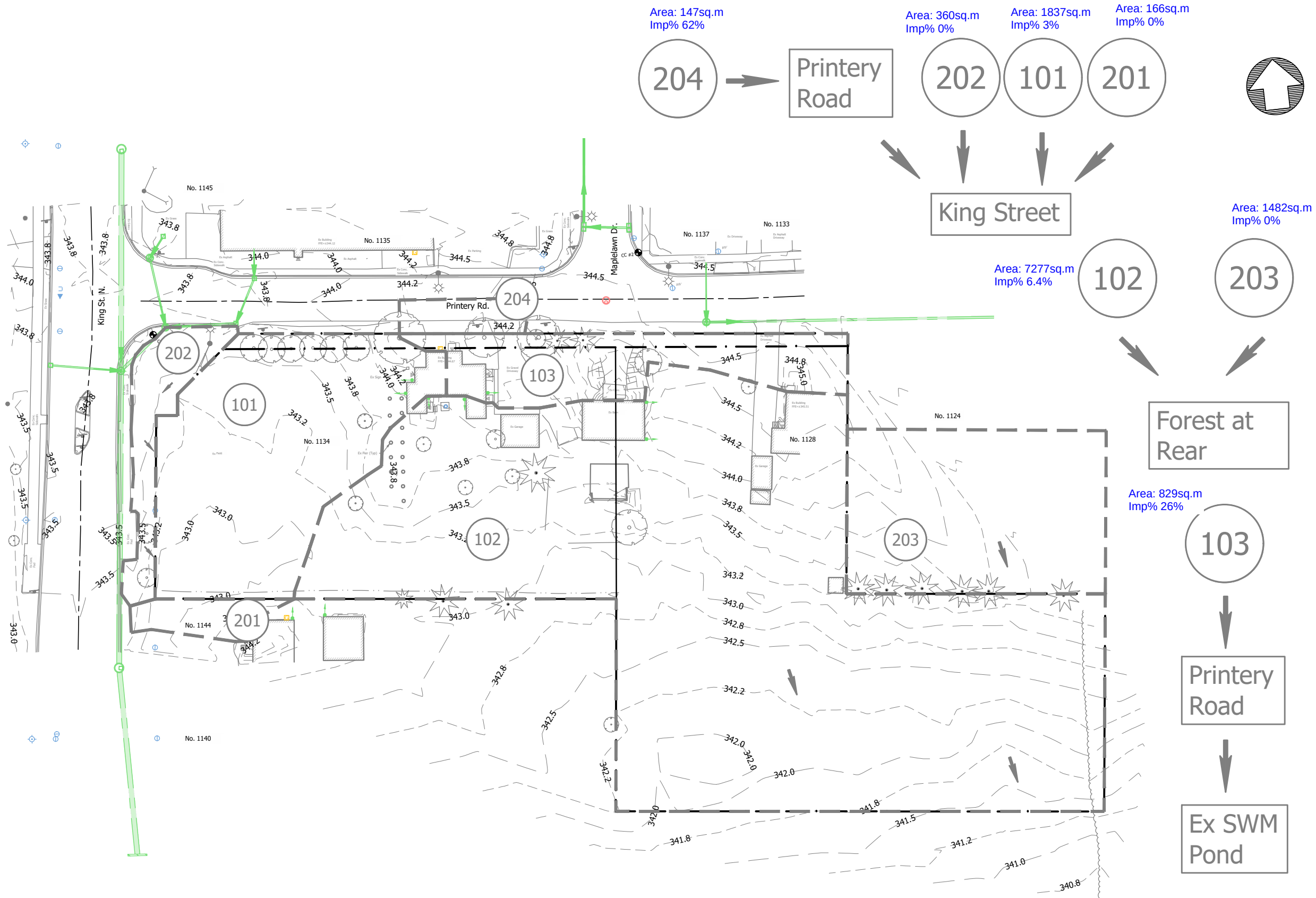
Table 3: Coefficients for Synthetic Design Storms

Pre-Development

The site was subdivided into pre-development catchments as shown in Figure 6. The majority of the existing runoff flows to the south, with an external catchment top the northeast directing flow through the site to the existing forest area. The remaining western site areas sheet flows to the west to King Street ditch and then a small portion to the north to Printery Road. Suitable modelling parameters for each of the catchments were chosen, as presented in Table 3, which generated peak flows from each catchment also summarized in Table 4. The SCS curve number (CN) for the site was selected as 68, which represents the existing condition of cultivated land with conservation treatment conditions between type A and B soil.

Catchment	Area (ha)			Imper- vious (%)	Slope Length (m)	Slope Gradient (%)	SCS CN (pervious)	Peak Flow (m ³ /s)	
	Controlled	Uncontrolled	Total					5-year	100- year
Internal									
101		0.18	0.18	3.0	15	3	68	0.006	0.029
102		0.73	0.73	6.4	15	3	68	0.025	0.120
103		0.08	0.08	26	15	2	68	0.007	0.016
External									
201		0.02	0.02	0.0	15	2	68	0.001	0.003
202		0.04	0.04	0.0	15	2	68	0.001	0.006
203		0.15	0.15	0.0	15	3	68	0.005	0.024
204		0.02	0.02	62	30	1	68	0.004	0.007
Total		1.22	1.22						

Table 4: Pre-Development Modelling Parameters



Pre-Development Catchment Plan
1134 Printery Road, St. Jacobs

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Post-Development

Post-development catchments incorporate the routing of the minor and major storm systems to the proposed stormwater management facility. Figure 7 shows the catchment areas for the proposed project. Suitable modeling parameters were selected for each catchment, as presented in Table 5. The SCS curve number (CN) for the site is 77, which represents residential townhouse for type A soil. The SCS curve number for the external site is the same as the pre-development soil type condition.

Catchment	Area (ha)			Imper- vious (%)	Slope Length (m)	Slope Gradi- ent (%)	SCS CN (per v)	Uncontrolled Peak Flow (m ³ /s)	
	Controlled	Uncontrolled	Total					5-year	100-year
Internal									
1701	0.26		0.26	80	30	1	77	0.061	0.118
1503		0.09	0.09	63	15	3	77	0.019	0.036
1504		0.09	0.09	63	15	3	77	0.019	0.038
1505		0.04	0.04	22	20	2	77	0.003	0.011
1506		0.06	0.06	34	33	2	77	0.006	0.015
1501		0.24	0.24	24	40	2	77	0.018	0.023 (Diversion)
1502		0.21	0.21	26	40	2	77	0.017	0.033
External									
1601		0.02	0.02	0	15	2	68	0.001	0.001 (Diversion)
1602		0.04	0.04	0	15	2	68	0.001	0.006
1603		0.15	0.15	0	15	3	68	0.005	0.024
1604		0.02	0.02	62	30	1	68	0.004	0.007
Total	0.26	0.96	1.22						

Table 5: Post-Development Modelling Parameters

MIDUSS modelling was completed for the outlets and results of the pre-development and post-development results are shown in tables below.

King Street Outlet

Modelling results can be reviewed in a model containing both King St and "Forest" Outlet in Appendix D2.

Event/Condition	5-year (m ³ /s)	100-year (m ³ /s)
Pre-development to King Street North	0.009	0.042
Post-development to King Street North	0.019	0.071

Table 6: Peak Flow to King Street North Comparison

Due to the proposed development layout and grading constraints, opportunity for storm runoff detention is limited and the post-development peak flows will be slightly increased for the King Street outlet. In comparison to the larger relative increase, the absolute increase is not large.

"Forest" Outlet

Event/Condition	5-year (m ³ /s)	100-year (m ³ /s)
Pre-development to Forest at rear	0.030	0.144
Post-development to Forest at rear	0.042	0.094

Table 7: Peak Flow to Forest at rear Comparison

The post-development peak flows from the proposed development will increase slightly for the 5-year storm but will be significantly reduced during major storm events compared to existing conditions. See Appendix D2 for the modelling results.

Printery Road Outlet

Catchment 1701 and 1505 as well as minor flows from 1504 and 1604 will be directed to the Printery Road and runoff conveyed to the existing Valley Heights Subdivision SWM facility at the corner of Old Scout Place & Printery Road to the east of the proposed development. As noted earlier, the strategy is to provide quantity controls for some of this contributing area and connect to the storm sewer on Printery Road and utilize additional capacity in the Valley View Subdivision SWM Pond. We note that the SWM strategy for the proposed development for 1065-1087 Old Scout Road also plans to utilize spare capacity in the Valleyview Heights Subdivision SWM facility. Attached are six pages from its storm management and servicing brief in Appendix G. See page 3 in Appendix G for the proposed rational for the Old Scout Place development and Table 8 in Appendix G for the "allowable" design criteria for the original SWM Pond. The strategy for this development site is to utilize the same approach proposed for Old Scout Road development.

We have modified the original MIDUSS model from Valleyview Subdivision (which was also revised as part of the previously submitted Old Scout Place application). Our modifications include:

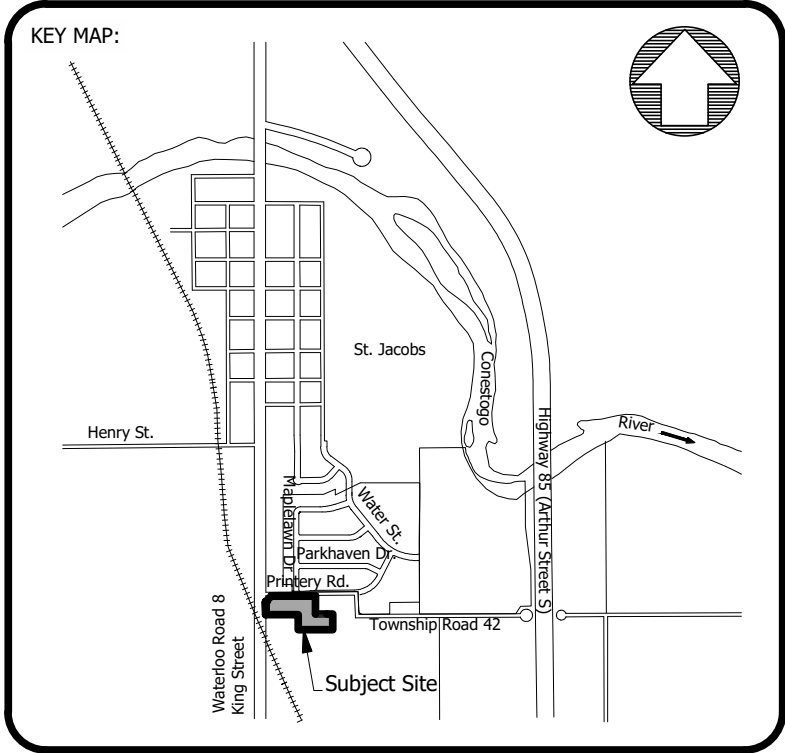
- Reducing catchment 801 since some of that catchment is reflected in the subject lands catchments addressed in the following point.
- Inserting the catchments for the subject lands that are proposed to be conveyed to the SWM Pond.

Based on our modelling (in Appendix D3), see Table 8 below for a summary of the proposed performance of the Valleyview Heights SWM Pond for 100-year storm event.

Event/Condition	Peak outflow (m ³ /s)	Storage Volume (m ³)	Ponding Elevation (m)
Allowable per original SWM Pond Design Criteria	0.476	5,237	341.80
Results of proposed 1065 Old Scout Place Development	0.415	5,167	341.78
Results including 1065 Old Scout Place & 1134 Printery Road Development	0.437	5,243	341.801

Table 8: 100-year Existing SWM Pond Performance Comparison

It is our finding that the existing Valleyview SWM Pond can serve both 1065 Old Scout Place (proposed) and the subject development adequately and still maintain a proper freeboard allowance for the pond and generally meet the original allowable design criteria.



Project Notes

1. This drawing is to be read in conjunction with the standard notes, specifications and details shown on Meritech dwg 4331-1 and the following additional information:

- a. Draft Plan by GSP Group, dated Aug 2024
- b. Architectural Plans by <<>>, dated <<Mmm yyyy>>
- c. Landscape Plans by <<>>, dated <<Mmm yyyy>>
- d. Geotechnical Report by <<>>, dated <<Mmm yyyy>>
- e. Functional Servicing Report by Meritech Engineering, dated Dec 2024

2. Survey and elevations:

- a. Topographic survey completed by Automated Engineering Technologies Ltd., dated Nov 2024.
- b. Geodetic reference elevation: BM-Cosine #0019658203 CGVD2013
Elev= 329.832m
- c. Local reference elevation: CC#1 N 48195563.621 E 5359939.036 Elev= 343.798m
- d. Local reference elevation: CC#2 N 48195563.621 E 5359939.036 Elev= 344.526m

-  Major Overland Flow
-  Minor Flows (to same destination as Major)
-  Minor Flows (to different destination from Major)

Water Quality

It is proposed that the required quality control improvements will be provided by the existing downstream SWM facility. Most of the development area not captured in the SWM Pond can all be considered "clean" as they are roofs and yards. The only minor portion not captured are the driveways of the western half of the freehold townhouses which cannot be conveyed since the Printery Road storm sewer is very shallow and cannot be extended further.

Grading and Drainage

The conceptual grading design has been completed to convey storm runoff away from buildings and to facilitate the SWM strategy, refer to Conceptual Grading Plan in Appendix B. Proposed grading includes a perched swale along the year of the freehold units to convey this runoff from draining to the adjacent lands to the south. Retaining walls are also proposed to account for lifting the condominium site to achieve overland drainage from this area to Printery Road.

Utilities

The following utilities currently exist directly adjacent to the proposed development and are expected to be able to extend services to the development:

- Waterloo North Hydro
- Bell Canada
- Rogers Cable
- Enbridge Gas

Conclusions

Sanitary and water services for the development are proposed to be provided from existing infrastructure on Printery Road. We note the qualification that some units will likely require that sanitary is pumped for basements.

The storm servicing and stormwater management plan includes a combination of on site controls and detention and the remaining capacity of the existing Valley Heights Subdivision SWM facility to provide quantity and quality control. Post-development to pre-development peak flows will be attenuated for some areas, while other will be exceeded with minor absolute increases.

Recommendations

Further design stages shall incorporate the conclusions and recommendations stemming from this report.

Approval agencies shall review and approve this document as a suitable approach to re-zoning approval.

References

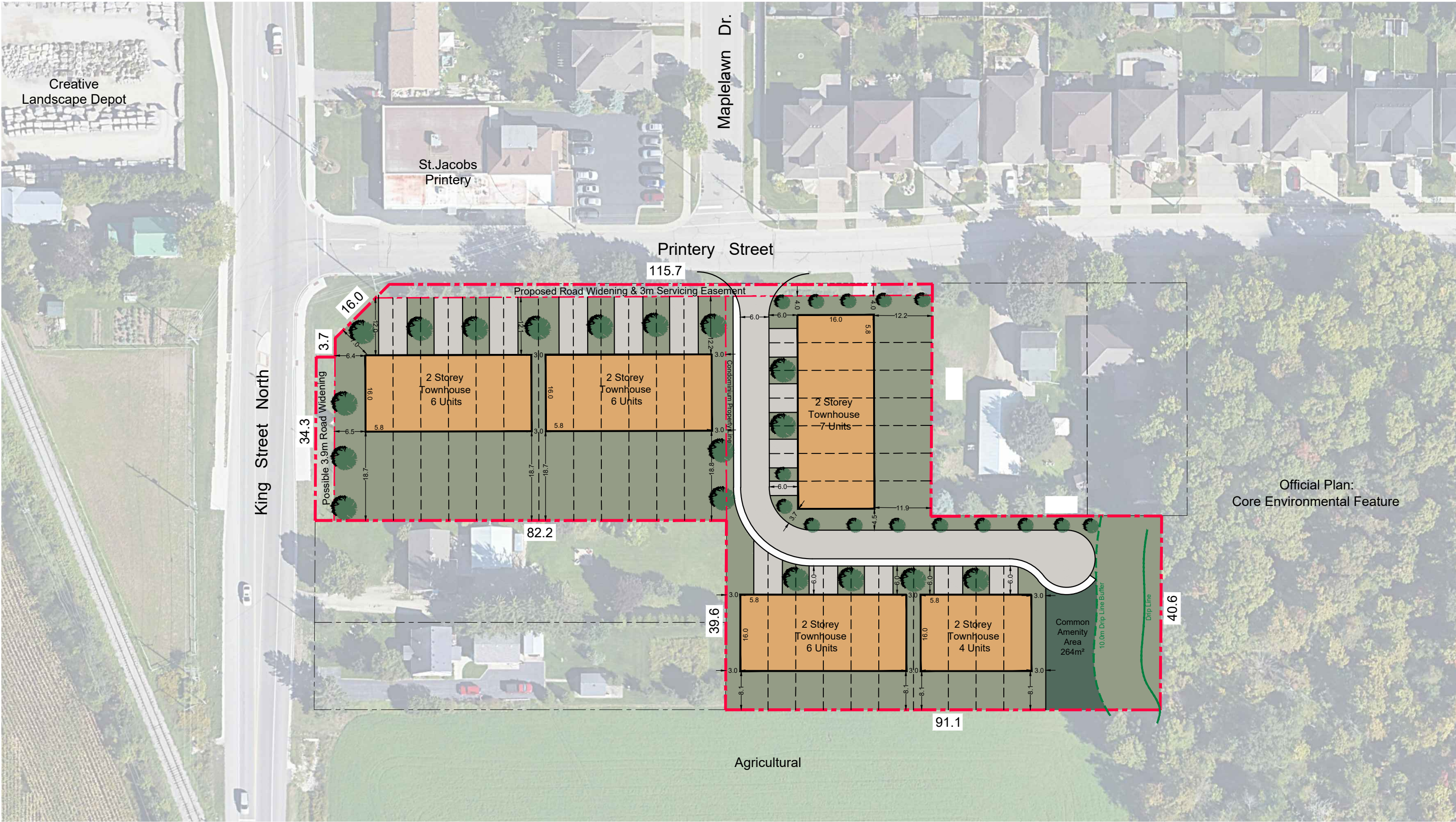
Township of Woolwich, Engineering Development and Infrastructure Manual
March 2022

Region of Waterloo and Area Municipalities, Design Guidelines and Supplemental Specifications for Municipal Services Guidelines (DGSSMS)
February 2024

Ministry of the Environment, Stormwater Management Planning & Design Manual
March 2003

Appendix A: Concept Plan

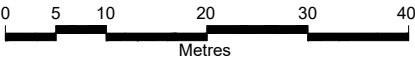




DEVELOPMENT CONCEPT

1128 & 1134 Printery Street, St.Jacobs

Site Area: 9,915m²
Units: 29 Units
Unit Size : 92.8m²



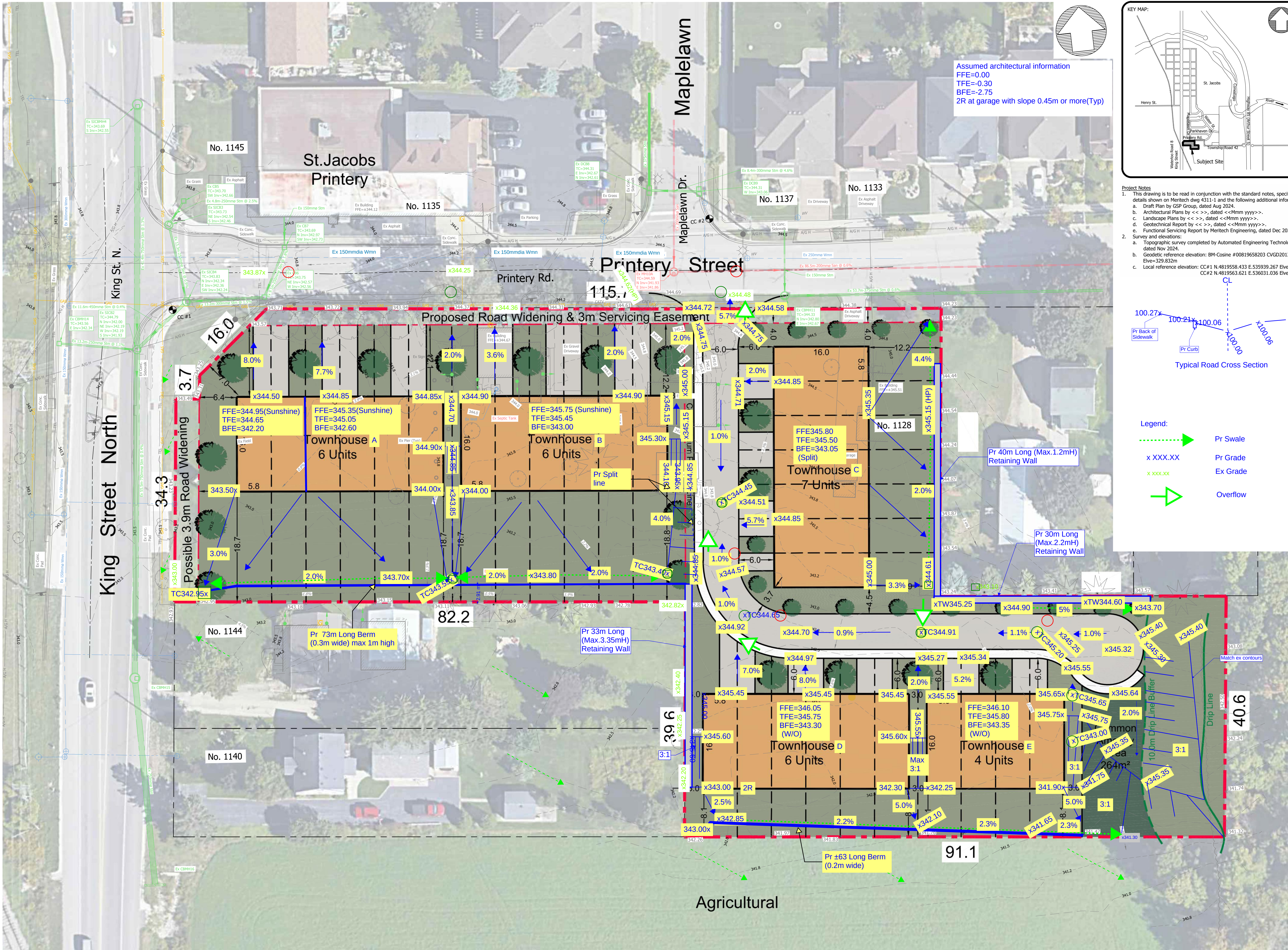
NOTE: This concept should be considered as a preliminary demonstration model that illustrates an 'order of magnitude' development scenario for the site. The number of units, floor area and parking supply are approximate and subject to more detailed design as well as municipal planning approvals.

Scale 1:750 | August 13, 2024 | Project No.: 21306 | Drawn By: EF

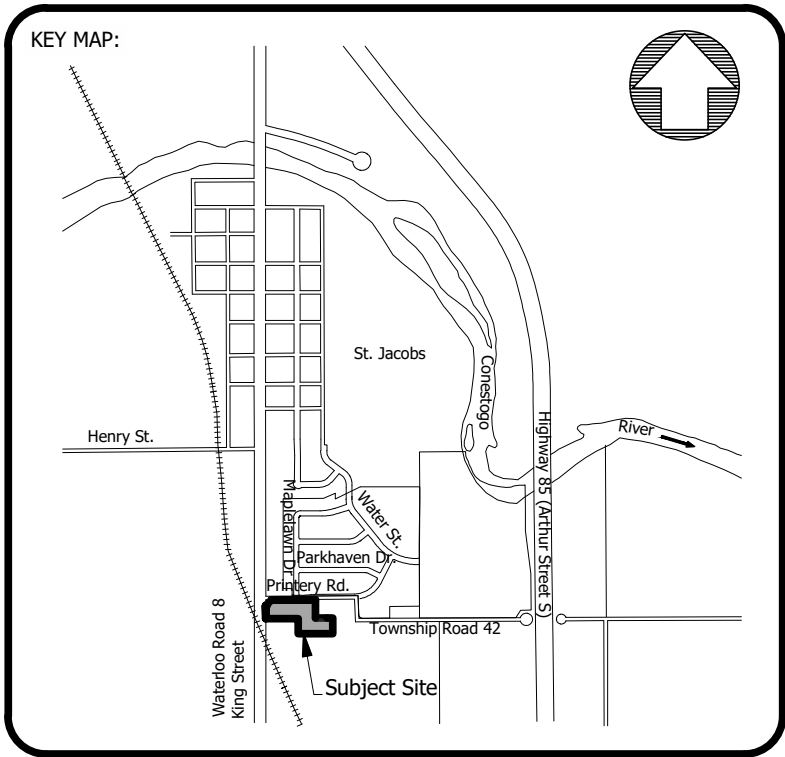


Appendix B: Design Drawings

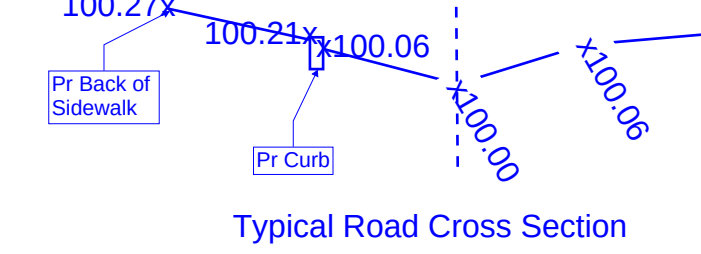




Assumed architectural information
FFE=-0.00
TFE=-0.30
BFE=-2.75
2R at garage with slope 0.45m or more(Typ)



- Project Notes
- This drawing is to be read in conjunction with the standard notes, specifications and details shown on Meritech dwg 4311-1 and the following additional information:
 - Draft Plan by GSP Group, dated Aug 2024.
 - Architectural Plans by <<>>, dated <<Mmm yyyy>>.
 - Landscape Plans by <<>>, dated <<Mmm yyyy>>.
 - Geotechnical Report by <<>>, dated <<Mmm yyyy>>.
 - Functional Servicing Report by Meritech Engineering, dated Dec 2024.
 - Survey and elevations:
 - Topographic survey completed by Automated Engineering Technologies Ltd., dated Nov 2024.
 - Geodetic reference elevation: BM-Cosine #00819658203 CVGD2013 Elve=329.832m
 - Local reference elevation: CC#1 N.4819558.433 E.535939.267 Elve=343.798m
CC#2 N.4819563.621 E.536031.036 Elve=344.462m



- Legend:
- Pr Swale
 - x XXX.XX Pr Grade
 - x XXX.XX Ex Grade
 - Overflow

1315 Balguy Street North, Suite 202 Cambridge
T 519.621.1140 F 519.623.7334 www.meritech.ca

Information shown on this plan is compiled from various sources, and is intended to be used as a guide only. The Contractor is responsible for verifying all data and information related to this project, and for making any necessary adjustments to the plan. The Contractor is responsible for soiling all site responsibility of said discrepancies on the Contractor, so all use of this plan is made with the understanding that the Contractor is responsible for any errors or omissions.

meritech engineering

1315 Balguy Street North, Suite 202 Cambridge
T 519.621.1140 F 519.623.7334 www.meritech.ca

OWNER: Will-O Homes

LOCATION: The Village of St. Jacobs

PROJECT: 1134 Printery Road, St. Jacobs

R-Plan

DESIGNED BY: XCC

CHECKED BY: BRE

DATE: Jan 10, 2025

FILE NAME: 4311

DRAWING: 4311-CP1

SHEET: 1 of 2

CONTRACT: 1300

SCALE: 1:300

DATE: Jan 14, 2025

ISSUED FOR REVIEW AND APPROVAL

REVISION/ISSUE

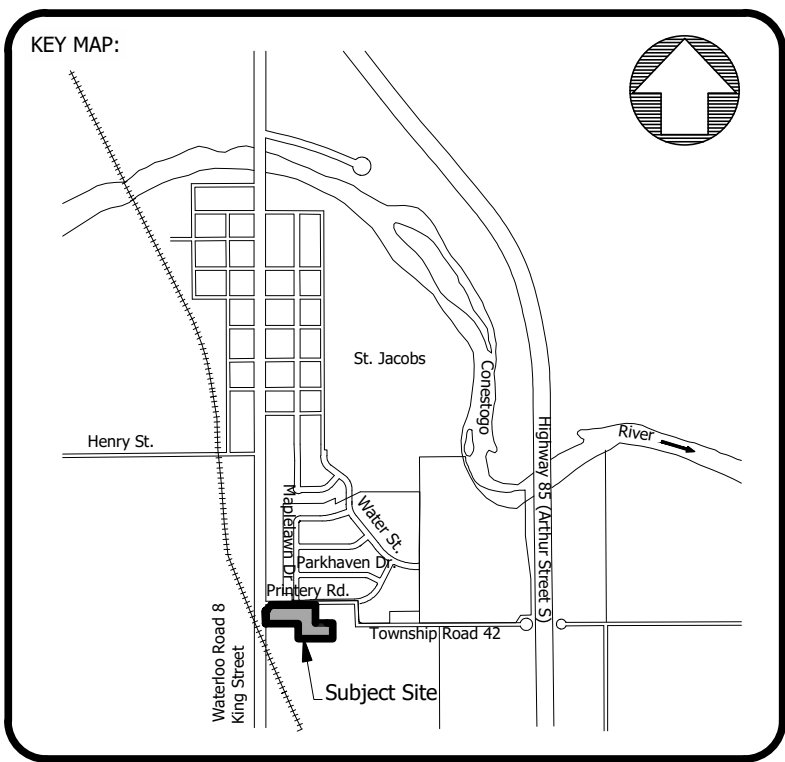
2. Water Servicing Updated

1. Issued for Review and Approval

DATE

BY

Filename: C:\Users\XMACOEN\Meritech Engineering\RD - DOCS\4311\CA01\Sheets\4311.dwg - 4311-CP - Plotted: December 9, 2024 10:57 AM, XMACOEN



Project Notes

a. This drawing is to be read in conjunction with the standard notes, specifications and details shown on Meritech dwg 4311-1 and the following additional information:

- a. Draft Plan by GSP Group, dated Aug 2024.
- b. Architectural Plans by <<>>, dated <<Mmm yyyy>>.
- c. Landscape Plans by <<>>, dated <<Mmm yyyy>>.
- d. Geotechnical Report by <<>>, dated <<Mmm yyyy>>.
- e. Functional Servicing Report by Meritech Engineering, dated Dec 2024.

2. Survey and elevations:

- a. Topographic survey completed by Automated Engineering Technologies Ltd., dated Nov 2024.
- b. Geodetic reference elevation: BM-Cosine #00819658203 CVGD2011 Elev=-329.82m
- c. Local reference elevation: CFC#1 N 4819558.432 E 536039.267 Elev=343.768m
- d. CFC#2 N 4819563.621 E 535931.036 Elev=344.492m

Legend:

	Pr Clean Stm to Ex Forest and Manhole
	Pr Stm to Ex Pond and Manhole
	Pr San and Manhole
	Pr Water Manhole and Valve
	Pr Water Service

[illegible]

Appendix C: Calculations





ENGINEERING AND ENVIRONMENTAL SERVICES

Water and Wastewater Services

150 Frederick Street 7th Floor
Kitchener Ontario N2G 4J3 Canada
Telephone: 519-575-4400; TTY: 519-575-4608
Email: waterservices@regionofwaterloo.ca
www.regionofwaterloo.ca/water

Susie Cai
Meritech Engineering
1315 Bishop Street North, Cambridge
susiec@meritech.ca

Date: February 4, 2025

Dear: Susie Cai

Re: 1134 Printery Road

Please find the results of the modeling simulations for boundary conditions requested on December 24, 2024. The results include a figure showing the location of the node from the Region's model. Attached are a series of spreadsheets containing results for Average Day, Maximum Day demands and available fire flows for node JCT_05347 located Printery Road and Maplawn Drive. The diurnal 24-hour demand distribution accounts for the minimum hour and peak hour peaking factors. The maximum pressure on the average day represents the minimum hour, and the minimum pressure on the maximum day represents the peak hour.

Table 1 – Modeling Results

Node	Elevation (mASL)	Demand		Fire Flow Results	
		Ave Day (L/s)	Max Day (L/s)	Design Flow (L/s)	Design Pressure (m)
JCT_05347	344.0	0.2	0.3	118.6	27.8

A fire flow analysis shows the maximum flow available at a node with an associated design pressure during the maximum day scenario while maintaining the minimum design pressure of 14 m (140 kPa) at all nodes within the pressure zone.

If you have any questions, please contact me

A handwritten signature in black ink, appearing to read "KD", with a long horizontal line extending to the right.

Kevin Dolishny P.Eng.
Senior Engineer, Water Services
c. 226.751.4551
e. kdolishny@regionofwaterloo.ca

St. Jacobs

Printery Road & Maplelawn Drive

JCT_05347 Average Day 24 Hour Simulation

Time	Demand (L/s)	Head (m)	Pressure (m)
00:00 hrs	0.12	380.76	36.76
01:00 hrs	0.13	380.76	36.76
02:00 hrs	0.14	380.76	36.76
03:00 hrs	0.13	380.76	36.76
04:00 hrs	0.11	380.76	36.76
05:00 hrs	0.16	380.76	36.76
06:00 hrs	0.35	380.75	36.75
07:00 hrs	0.38	380.75	36.75
08:00 hrs	0.35	380.75	36.75
09:00 hrs	0.34	380.75	36.75
10:00 hrs	0.32	380.75	36.75
11:00 hrs	0.31	380.75	36.75
12:00 hrs	0.29	380.75	36.75
13:00 hrs	0.27	380.75	36.75
14:00 hrs	0.25	380.76	36.76
15:00 hrs	0.27	380.76	36.76
16:00 hrs	0.28	380.75	36.75
17:00 hrs	0.33	380.75	36.75
18:00 hrs	0.35	380.75	36.75
19:00 hrs	0.36	380.75	36.75
20:00 hrs	0.33	380.75	36.75
21:00 hrs	0.30	380.76	36.76
22:00 hrs	0.24	380.76	36.76
23:00 hrs	0.15	380.76	36.76

Average Day HGL:

380.76

Minimum Hour:

380.76

JCT_05347 Maximum Day 24 Hour Simulation

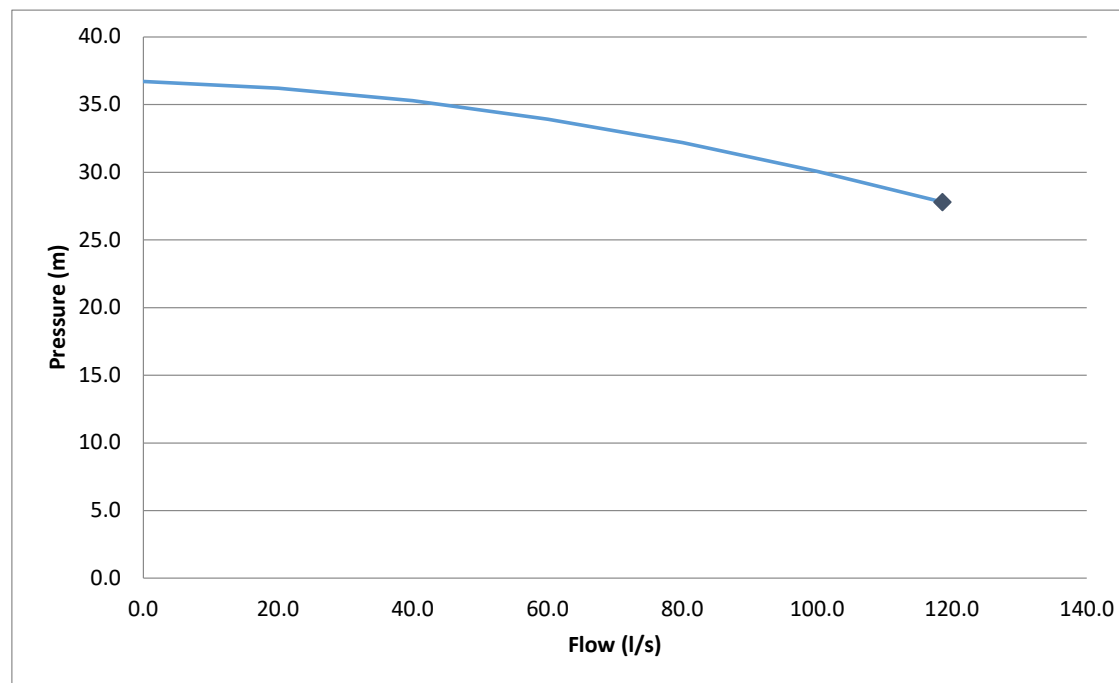
Time	Demand (L/s)	Head (m)	Pressure (m)
00:00 hrs	0.35	380.75	36.75
01:00 hrs	0.25	380.76	36.76
02:00 hrs	0.24	380.76	36.76
03:00 hrs	0.27	380.76	36.76
04:00 hrs	0.29	380.75	36.75
05:00 hrs	0.45	380.74	36.74
06:00 hrs	0.46	380.74	36.74
07:00 hrs	0.47	380.73	36.73
08:00 hrs	0.67	380.71	36.71
09:00 hrs	0.70	380.70	36.70
10:00 hrs	0.71	380.70	36.70
11:00 hrs	0.75	380.69	36.69
12:00 hrs	0.56	380.71	36.71
13:00 hrs	0.28	380.75	36.75
14:00 hrs	0.41	380.74	36.74
15:00 hrs	0.23	380.76	36.76
16:00 hrs	0.18	380.76	36.76
17:00 hrs	0.16	380.76	36.76
18:00 hrs	0.19	380.76	36.76
19:00 hrs	0.23	380.76	36.76
20:00 hrs	0.26	380.75	36.75
21:00 hrs	0.38	380.75	36.75
22:00 hrs	0.40	380.75	36.75
23:00 hrs	0.37	380.75	36.75

Maximum Day HGL:

380.74

Peak Hour:

380.69



7LPH \$0 'DWH \$XWKRU DIRBXP HQW 3DWK , ? .QIR:DWHU20RGHOLQJ 5HTXHVWV? 20HULWHEK? 3ULQWHU\ 5RDG? B35,17(5



Region of Waterloo

(1*,1((5,1* \$1'
(19,5210(17\$/ 6(59,&(6
:DWHU DQG :DVWHZDWHU 6
)UHG HULFN 6WUHHW
.LWFKHQHU 21 &DQDGD 1 *
7HOHSKRQH
)D[
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-XQFWLRQ

● \$FWLYH

3LSH

— \$FWLYH

6XEMHFW 6LWH

:DWHU3UHVVXUH

3ULQWHU\ 5F
6W -DFREV

0HWHUV

Fire Flow Calculations

1999 Fire Underwriters Survey (FUS) Method

Project: Printery Road
File: 4311
Calculated by: XCC
Date: 22-Sep-25
Checked by: BRE
Date: 24-Sep-25

Townhouse Block 1 with 2hrs fire wall

Buildings require a sufficient amount of water, based on the FUS, for fire fighting purposes.
The required fire flow (L/minute) is expressed by the equation:

where **C** = Coefficient related to the type of construction.

A = Floor area (m²)

$$F = 220 \cdot C \cdot \sqrt{A}$$

- A) Building structure 'C'
B) A (m²)
C) # Floors (excl. basement)

=	1.0
=	280.00
=	2

- D) F (L/min)
Rounded

=	5206
=	5000

- E) Type of occupancy/contents

- ☐ Non-Combustible
☒ Limited Combustible
☐ Combustible
☐ Free Burning
☐ Rapid Burning

Fire hazard adjustment
Adjustment
F_{adj} (L/min)

=	-15%
=	-750
=	4250

- F) % reduction
based on sprinkler
system effectiveness
Reduction

=	0.00%
=	0

- G)

Distance to nearest building (m) % addition

N	30.2	5%
E	3.0	25%
S	22.0	10%
W	Fire Wall	10%

**% addition based on
building separation
Addition**

=	50%
+	2125

- H) Total Fire Flow

=	6375	L/min
=	106	L/sec

Fire Flow Calculations

1999 Fire Underwriters Survey (FUS) Method

Project: Printery Road
File: 4311
Calculated by: XCC
Date: 22-Sep-25
Checked by: BRE
Date: 24-Sep-25

Townhouse Block 2 with 2hrs fire wall

Buildings require a sufficient amount of water, based on the FUS, for fire fighting purposes.
The required fire flow (L/minute) is expressed by the equation:

where **C** = Coefficient related to the type of construction.

A = Floor area (m²)

$$F = 220 \cdot C \cdot \sqrt{A}$$

- A) Building structure 'C'
B) A (m²)
C) # Floors (excl. basement)

=	1.0
=	280.00
=	2

- D) F (L/min)
Rounded

=	5206
=	5000

- E) Type of occupancy/contents

- ☐ Non-Combustible ☐ Free Burning
☒ Limited Combustible ☐ Rapid Burning
☐ Combustible

Fire hazard adjustment
Adjustment
F_{adj} (L/min)

=	-15%
=	-750
=	4250

- F) % reduction
based on sprinkler
system effectiveness
Reduction

=	0.00%
=	0

- G)

Distance to nearest building (m) % addition

N	30.2	5%
E	Fire Wall	10%
S	24.0	10%
W	3.0	25%

% addition based on
building separation
Addition

=	50%
+	2125

- H) Total Fire Flow

=	6375	L/min
=	106	L/sec

Fire Flow Calculations

1999 Fire Underwriters Survey (FUS) Method

Project: Printery Road
File: 4311
Calculated by: XCC
Date: 22-Sep-25
Checked by: BRE
Date: 24-Sep-25

Townhouse Block 3 with 2hrs fire wall

Buildings require a sufficient amount of water, based on the FUS, for fire fighting purposes.
The required fire flow (L/minute) is expressed by the equation:

where **C** = Coefficient related to the type of construction.

A = Floor area (m²)

$$F = 220 \cdot C \cdot \sqrt{A}$$

- A) Building structure 'C'
B) A (m²)
C) # Floors (excl. basement)

=	1.0
=	278.00
=	2

- D) F (L/min)
Rounded

=	5188
=	5000

- E) Type of occupancy/contents

- ☐ Non-Combustible ☐ Free Burning
☒ Limited Combustible ☐ Rapid Burning
☐ Combustible

Fire hazard adjustment
Adjustment
F_{adj} (L/min)

=	-15%
=	-750
=	4250

- F) % reduction
based on sprinkler
system effectiveness
Reduction

=	0.00%
=	0

- G)

Distance to nearest building (m) % addition

N	Fire Wall	10%
E	22.0	10%
S	18.0	15%
W	18.0	15%

% addition based on
building separation
Addition

=	50%
+	2125

- H) Total Fire Flow

=	6375	L/min
=	106	L/sec

Fire Flow Calculations

1999 Fire Underwriters Survey (FUS) Method

Project: Printery Road
File: 4311
Calculated by: XCC
Date: 22-Sep-25
Checked by: BRE
Date: 24-Sep-25

Townhouse Block 4 with 2hrs fire wall

Buildings require a sufficient amount of water, based on the FUS, for fire fighting purposes.
The required fire flow (L/minute) is expressed by the equation:

$$F = 220 \cdot C \cdot \sqrt{A}$$

where **C** = Coefficient related to the type of construction.

A = Floor area (m²)

- A) Building structure 'C'
B) A (m²)
C) # Floors (excl. basement)

=	1.0
=	279.00
=	2

- D) F (L/min)
Rounded

=	5197
=	5000

- E) Type of occupancy/contents

- ☐ Non-Combustible ☐ Free Burning
☒ Limited Combustible ☐ Rapid Burning
☐ Combustible

Fire hazard adjustment
Adjustment
F_{adj} (L/min)

=	-15%
=	-750
=	4250

- F) % reduction
based on sprinkler
system effectiveness
Reduction

=	0.00%
-	0

- G)

Distance to nearest building (m) % addition

N	18.0	15%
E	3.0	25%
S	50.0	0%
W	Fire Wall	10%

**% addition based on
building separation
Addition**

=	50%
+	2125

- H) Total Fire Flow

=	6375	L/min
=	106	L/sec

Fire Flow Calculations

1999 Fire Underwriters Survey (FUS) Method

Project: Printery Road
File: 4311
Calculated by: XCC
Date: 22-Sep-25
Checked by: BRE
Date: 24-Sep-25

Townhouse Block 5 with 2hrs fire wall

Buildings require a sufficient amount of water, based on the FUS, for fire fighting purposes.
The required fire flow (L/minute) is expressed by the equation:

where **C** = Coefficient related to the type of construction.

A = Floor area (m²)

$$F = 220 \cdot C \cdot \sqrt{A}$$

- A) Building structure 'C'
B) A (m²)
C) # Floors (excl. basement)

=	1.0
=	184.00
=	2

- D) F (L/min)
Rounded

=	4220
=	4000

- E) Type of occupancy/contents

- ☐ Non-Combustible ☐ Free Burning
☒ Limited Combustible ☐ Rapid Burning
☐ Combustible

Fire hazard adjustment
Adjustment
F_{adj} (L/min)

=	-15%
=	-600
=	3400

- F) % reduction
based on sprinkler
system effectiveness
Reduction

=	0.00%
=	0

- G)

Distance to nearest building (m) % addition

N	25.8	10%
E	Fire Wall	10%
S	50.0	0%
W	3.0	25%

**% addition based on
building separation
Addition**

=	45%
+	1530

- H) Total Fire Flow

=	4930	L/min
=	82	L/sec

```

*****
*                               E P A N E T                               *
*                               Hydraulic and Water Quality                 *
*                               Analysis for Pipe Networks                   *
*                               Version 2.2                                *
*****

```

Input File: 4311.Max Day plus Fire.net

Link - Node Table:

Link ID	Start Node	End Node	Length m	Diameter mm	
1	2	3	12.3	200	
3	3	TEE	47	200	
4	TEE	Hyd	3	200	
2	1	2	#N/A	#N/A	Pump

Energy Usage:

Pump	Usage Factor	Avg. Effic.	Kw-hr /m3	Avg. Kw	Peak Kw	Cost /day
2	100.00	75.00	0.11	40.71	40.71	0.00
Demand Charge:						0.00
Total Cost:						0.00

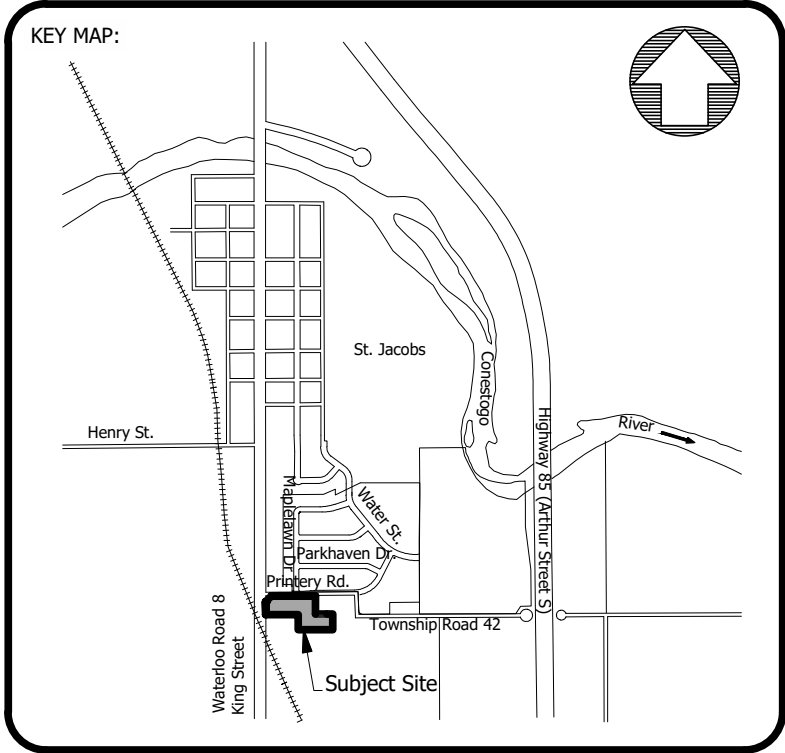
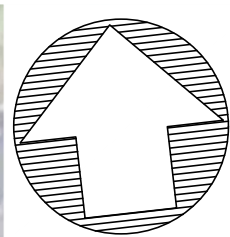
Node Results:

Node ID	Demand LPS	Head m	Pressure m	Quality
2	0.00	373.33	29.33	0.00
TEE	0.00	370.98	26.28	0.00
Hyd	106.00	370.87	26.12	0.00
3	0.20	372.84	28.09	0.00
1	-106.20	344.00	0.00	0.00 Reservoir

Link Results:

Link ID	Flow LPS	Velocity m/s	Headloss m/km	Status
1	106.20	3.38	39.72	Open
3	106.00	3.37	39.58	Open

4	106.00	3.37	39.58	Open
2	106.20	0.00	-29.33	Open Pump



- Project Notes**
- This drawing is to be read in conjunction with the standard notes, specifications and details shown on Meritech dwg 4311-1 and the following additional information:
 - Draft Plan by GSP Group, dated Aug 2024.
 - Architectural Plans by <<>>, dated <<Mmm yyyy>>.
 - Landscape Plans by <<>>, dated <<Mmm yyyy>>.
 - Geotechnical Report by <<>>, dated <<Mmm yyyy>>.
 - Functional Servicing Report by Meritech Engineering, dated Dec 2024.
 - Survey and elevations:
 - Topographic survey completed by Automated Engineering Technologies Ltd., dated Nov 2024.
 - Geodetic reference elevation: BM-Cosine #00819658203 CVGD2013 Elve=329.832m
 - Local reference elevation: CC#1 N.4819558.433 E.535939.267 Elve=343.798m CC#2 N.4819563.621 E.536031.036 Elve=344.462m

- Legend:**
- Pr Water Manhole and Valve
 - Pr Water Service
 - Pr Firewall Location
 - Pr 40m Long (Max.1.2mH) Retaining Wall
 - Pr 30m Long (Max.1.5mH) Retaining Wall

DRAWING: Conceptual Firewall Plan		OWNER: Will-O Homes		PROJECT: 1134 Printery Road, St. Jacobs R-Plan	
DESIGNED BY: XCC	CHECKED BY: BRE	CONTRACT:	LOCATION: The Village of St. Jacobs	PROJECT: 1134 Printery Road, St. Jacobs R-Plan	FILE NAME: 4311
DRAWN BY: XCC	DATE: Jan 10, 2025	SCALE: 1:300	ISSUED FOR REVIEW AND APPROVAL	DATE	BY
SHEET: 1 of 1		REVISION/ISSUE		DATE	BY
		1.		Sep 23, 2025	XCC

Appendix D: Modelling



Appendix D.1: Pre-Development Conditions



```

"          MIDUSS Output ----->"
"          MIDUSS version                      Version 2.25  rev. 473"
"          MIDUSS created                      February 7, 2010"
"          10  Units used:                      ie METRIC"
"          Job folder:                        C:\M\Meritech Engineering\PRJ - DOCS\4311\
"                                              60-Design\SWM\Miduss"
"          Output filename:                    4311.x5yrJan0103"
"          Licensee name:                      SusieC"
"          Company                            Meritech Engineering"
"          Date & Time last used:              2025-01-03 at 3:27:32 PM"
" 31      TIME PARAMETERS"
"          5.000  Time Step"
"          180.000 Max. Storm length"
"          1500.000 Max. Hydrograph"
" 81      ADD COMMENT=====
"          1  Lines of comment"
"          5yr pre-development"
" 32      STORM Chicago storm"
"          1  Chicago storm"
"          1593.000 Coefficient A"
"          11.000  Constant B"
"          0.879  Exponent C"
"          0.400  Fraction R"
"          180.000 Duration"
"          1.000  Time step multiplier"
"          Maximum intensity          139.250  mm/hr"
"          Total depth                47.240  mm"
"          6  005hyd  Hydrograph extension used in this file"
" 33      CATCHMENT 204"
"          1  Triangular SCS"
"          1  Equal length"
"          1  SCS method"
"          204  To King Street Finally"
"          62.000 % Impervious"
"          0.020  Total Area"
"          30.000 Flow length"
"          1.000  Overland Slope"
"          0.008  Pervious Area"
"          30.000 Pervious length"
"          1.000  Pervious slope"
"          0.012  Impervious Area"
"          30.000 Impervious length"
"          1.000  Impervious slope"
"          0.250  Pervious Manning 'n'"
"          68.000 Pervious SCS Curve No."
"          0.170  Pervious Runoff coefficient"
"          0.100  Pervious Ia/S coefficient"
"          11.953 Pervious Initial abstraction"
"          0.015  Impervious Manning 'n'"
"          98.000 Impervious SCS Curve No."

```

"	0.875	Impervious Runoff coefficient"			
"	0.100	Impervious Ia/S coefficient"			
"	0.518	Impervious Initial abstraction"			
"		0.004	0.000	0.000	0.000 c.m/sec"
"		Catchment 204	Pervious	Impervious	Total Area "
"		Surface Area	0.008	0.012	0.020 hectare"
"		Time of concentration	30.104	2.438	5.386 minutes"
"		Time to Centroid	135.694	89.497	94.420 minutes"
"		Rainfall depth	47.240	47.240	47.240 mm"
"		Rainfall volume	3.59	5.86	9.45 c.m"
"		Rainfall losses	39.199	5.921	18.567 mm"
"		Runoff depth	8.040	41.319	28.673 mm"
"		Runoff volume	0.61	5.12	5.73 c.m"
"		Runoff coefficient	0.170	0.875	0.607 "
"		Maximum flow	0.000	0.004	0.004 c.m/sec"
" 40		HYDROGRAPH Add Runoff "			
"	4	Add Runoff "			
"		0.004	0.004	0.000	0.000"
" 33		CATCHMENT 101"			
"	1	Triangular SCS"			
"	1	Equal length"			
"	1	SCS method"			
"	101	from site"			
"	3.000	% Impervious"			
"	0.180	Total Area"			
"	15.000	Flow length"			
"	3.000	Overland Slope"			
"	0.175	Pervious Area"			
"	15.000	Pervious length"			
"	3.000	Pervious slope"			
"	0.005	Impervious Area"			
"	15.000	Impervious length"			
"	3.000	Impervious slope"			
"	0.250	Pervious Manning 'n'"			
"	68.000	Pervious SCS Curve No."			
"	0.170	Pervious Runoff coefficient"			
"	0.100	Pervious Ia/S coefficient"			
"	11.953	Pervious Initial abstraction"			
"	0.015	Impervious Manning 'n'"			
"	98.000	Impervious SCS Curve No."			
"	0.869	Impervious Runoff coefficient"			
"	0.100	Impervious Ia/S coefficient"			
"	0.518	Impervious Initial abstraction"			
"		0.006	0.004	0.000	0.000 c.m/sec"
"		Catchment 101	Pervious	Impervious	Total Area "
"		Surface Area	0.175	0.005	0.180 hectare"
"		Time of concentration	14.285	1.157	12.493 minutes"
"		Time to Centroid	117.516	87.616	113.434 minutes"
"		Rainfall depth	47.240	47.240	47.240 mm"
"		Rainfall volume	82.48	2.55	85.03 c.m"

"	Rainfall losses	39.208	6.181	38.217	mm"
"	Runoff depth	8.032	41.059	9.023	mm"
"	Runoff volume	14.02	2.22	16.24	c.m"
"	Runoff coefficient	0.170	0.869	0.191	"
"	Maximum flow	0.005	0.002	0.006	c.m/sec"
" 40	HYDROGRAPH Add Runoff "				
"	4 Add Runoff "				
"	0.006 0.007 0.000 0.000"				
" 33	CATCHMENT 201"				
"	1 Triangular SCS"				
"	1 Equal length"				
"	1 SCS method"				
"	201 South neighbour To King Street"				
"	0.000 % Impervious"				
"	0.020 Total Area"				
"	15.000 Flow length"				
"	2.000 Overland Slope"				
"	0.020 Pervious Area"				
"	15.000 Pervious length"				
"	2.000 Pervious slope"				
"	0.000 Impervious Area"				
"	15.000 Impervious length"				
"	2.000 Impervious slope"				
"	0.250 Pervious Manning 'n'"				
"	68.000 Pervious SCS Curve No."				
"	0.170 Pervious Runoff coefficient"				
"	0.100 Pervious Ia/S coefficient"				
"	11.953 Pervious Initial abstraction"				
"	0.015 Impervious Manning 'n'"				
"	98.000 Impervious SCS Curve No."				
"	0.000 Impervious Runoff coefficient"				
"	0.100 Impervious Ia/S coefficient"				
"	0.518 Impervious Initial abstraction"				
"	0.001 0.007 0.000 0.000 c.m/sec"				
"	Catchment 201 Pervious Impervious Total Area "				
"	Surface Area 0.020 0.000 0.020 hectare"				
"	Time of concentration 16.132 1.307 16.132 minutes"				
"	Time to Centroid 119.698 87.817 119.698 minutes"				
"	Rainfall depth 47.240 47.240 47.240 mm"				
"	Rainfall volume 9.45 0.00 9.45 c.m"				
"	Rainfall losses 39.230 5.949 39.230 mm"				
"	Runoff depth 8.010 41.291 8.010 mm"				
"	Runoff volume 1.60 0.00 1.60 c.m"				
"	Runoff coefficient 0.170 0.000 0.170 "				
"	Maximum flow 0.001 0.000 0.001 c.m/sec"				
" 40	HYDROGRAPH Add Runoff "				
"	4 Add Runoff "				
"	0.001 0.008 0.000 0.000"				
" 33	CATCHMENT 202"				
"	1 Triangular SCS"				

```

"          1   Equal length"
"          1   SCS method"
"        202   Road and west area to KingStreet"
"        0.000 % Impervious"
"        0.040 Total Area"
"       15.000 Flow length"
"        2.000 Overland Slope"
"        0.040 Pervious Area"
"       15.000 Pervious length"
"        2.000 Pervious slope"
"        0.000 Impervious Area"
"       15.000 Impervious length"
"        2.000 Impervious slope"
"        0.250 Pervious Manning 'n'"
"       68.000 Pervious SCS Curve No."
"        0.170 Pervious Runoff coefficient"
"        0.100 Pervious Ia/S coefficient"
"       11.953 Pervious Initial abstraction"
"        0.015 Impervious Manning 'n'"
"       98.000 Impervious SCS Curve No."
"        0.000 Impervious Runoff coefficient"
"        0.100 Impervious Ia/S coefficient"
"        0.518 Impervious Initial abstraction"
"          0.001      0.008      0.000      0.000 c.m/sec"
"      Catchment 202      Pervious      Impervious Total Area "
"      Surface Area      0.040      0.000      0.040      hectare"
"      Time of concentration 16.132      1.307      16.132      minutes"
"      Time to Centroid    119.698      87.817      119.698      minutes"
"      Rainfall depth      47.240      47.240      47.240      mm"
"      Rainfall volume      18.90      0.00      18.90      c.m"
"      Rainfall losses      39.230      5.949      39.230      mm"
"      Runoff depth         8.010      41.291      8.010      mm"
"      Runoff volume        3.20      0.00      3.20      c.m"
"      Runoff coefficient    0.170      0.000      0.170      "
"      Maximum flow         0.001      0.000      0.001      c.m/sec"
" 40      HYDROGRAPH Add Runoff "
"      4      Add Runoff "
"          0.001      0.009      0.000      0.000"
" 40      HYDROGRAPH Copy to Outflow"
"      8      Copy to Outflow"
"          0.001      0.009      0.009      0.000"
" 40      HYDROGRAPH Combine      10"
"      6      Combine "
"     10      Node #"
"          combine total"
"          Maximum flow          0.009      c.m/sec"
"          Hydrograph volume      26.782      c.m"
"          0.001      0.009      0.009      0.009"
" 40      HYDROGRAPH Start - New Tributary"
"      2      Start - New Tributary"

```

"		0.001	0.000	0.009	0.009"
" 33	CATCHMENT 102"				
"	1	Triangular SCS"			
"	1	Equal length"			
"	1	SCS method"			
"	102	Major Site to forest"			
"	6.400	% Impervious"			
"	0.730	Total Area"			
"	15.000	Flow length"			
"	3.000	Overland Slope"			
"	0.683	Pervious Area"			
"	15.000	Pervious length"			
"	3.000	Pervious slope"			
"	0.047	Impervious Area"			
"	15.000	Impervious length"			
"	3.000	Impervious slope"			
"	0.250	Pervious Manning 'n'"			
"	68.000	Pervious SCS Curve No."			
"	0.170	Pervious Runoff coefficient"			
"	0.100	Pervious Ia/S coefficient"			
"	11.953	Pervious Initial abstraction"			
"	0.015	Impervious Manning 'n'"			
"	98.000	Impervious SCS Curve No."			
"	0.869	Impervious Runoff coefficient"			
"	0.100	Impervious Ia/S coefficient"			
"	0.518	Impervious Initial abstraction"			
"		0.025	0.000	0.009	0.009 c.m/sec"
"	Catchment 102	Pervious	Impervious	Total Area	"
"	Surface Area	0.683	0.047	0.730	hectare"
"	Time of concentration	14.285	1.157	10.885	minutes"
"	Time to Centroid	117.516	87.616	109.772	minutes"
"	Rainfall depth	47.240	47.240	47.240	mm"
"	Rainfall volume	322.78	22.07	344.85	c.m"
"	Rainfall losses	39.208	6.181	37.094	mm"
"	Runoff depth	8.032	41.059	10.146	mm"
"	Runoff volume	54.88	19.18	74.06	c.m"
"	Runoff coefficient	0.170	0.869	0.215	"
"	Maximum flow	0.021	0.015	0.025	c.m/sec"
" 40	HYDROGRAPH Add Runoff "				
"	4	Add Runoff "			
"		0.025	0.025	0.009	0.009"
" 33	CATCHMENT 203"				
"	1	Triangular SCS"			
"	1	Equal length"			
"	1	SCS method"			
"	203	External area path site to forest"			
"	0.000	% Impervious"			
"	0.150	Total Area"			
"	15.000	Flow length"			
"	3.000	Overland Slope"			

"	0.150	Pervious Area"			
"	15.000	Pervious length"			
"	3.000	Pervious slope"			
"	0.000	Impervious Area"			
"	15.000	Impervious length"			
"	3.000	Impervious slope"			
"	0.250	Pervious Manning 'n'"			
"	68.000	Pervious SCS Curve No."			
"	0.170	Pervious Runoff coefficient"			
"	0.100	Pervious Ia/S coefficient"			
"	11.953	Pervious Initial abstraction"			
"	0.015	Impervious Manning 'n'"			
"	98.000	Impervious SCS Curve No."			
"	0.000	Impervious Runoff coefficient"			
"	0.100	Impervious Ia/S coefficient"			
"	0.518	Impervious Initial abstraction"			
"		0.005	0.025	0.009	0.009 c.m/sec"
"		Catchment 203	Pervious	Impervious	Total Area "
"		Surface Area	0.150	0.000	0.150 hectare"
"		Time of concentration	14.285	1.157	14.285 minutes"
"		Time to Centroid	117.516	87.616	117.515 minutes"
"		Rainfall depth	47.240	47.240	47.240 mm"
"		Rainfall volume	70.86	0.00	70.86 c.m"
"		Rainfall losses	39.208	6.181	39.208 mm"
"		Runoff depth	8.032	41.059	8.032 mm"
"		Runoff volume	12.05	0.00	12.05 c.m"
"		Runoff coefficient	0.170	0.000	0.170 "
"		Maximum flow	0.005	0.000	0.005 c.m/sec"
" 40		HYDROGRAPH Add Runoff "			
"	4	Add Runoff "			
"		0.005	0.030	0.009	0.009"
" 40		HYDROGRAPH Copy to Outflow"			
"	8	Copy to Outflow"			
"		0.005	0.030	0.030	0.009"
" 40		HYDROGRAPH Combine 10"			
"	6	Combine "			
"	10	Node #"			
"		combine total"			
"		Maximum flow	0.038		c.m/sec"
"		Hydrograph volume	112.894		c.m"
"		0.005	0.030	0.030	0.038"
" 40		HYDROGRAPH Start - New Tributary"			
"	2	Start - New Tributary"			
"		0.005	0.000	0.030	0.038"
" 33		CATCHMENT 103"			
"	1	Triangular SCS"			
"	1	Equal length"			
"	1	SCS method"			
"	103	To printery road"			
"	26.000	% Impervious"			

"	0.080	Total Area"			
"	15.000	Flow length"			
"	2.000	Overland Slope"			
"	0.059	Pervious Area"			
"	15.000	Pervious length"			
"	2.000	Pervious slope"			
"	0.021	Impervious Area"			
"	15.000	Impervious length"			
"	2.000	Impervious slope"			
"	0.250	Pervious Manning 'n'"			
"	68.000	Pervious SCS Curve No."			
"	0.170	Pervious Runoff coefficient"			
"	0.100	Pervious Ia/S coefficient"			
"	11.953	Pervious Initial abstraction"			
"	0.015	Impervious Manning 'n'"			
"	98.000	Impervious SCS Curve No."			
"	0.874	Impervious Runoff coefficient"			
"	0.100	Impervious Ia/S coefficient"			
"	0.518	Impervious Initial abstraction"			
"	0.007	0.000	0.030	0.038 c.m/sec"	
"	Catchment 103	Pervious	Impervious	Total Area	"
"	Surface Area	0.059	0.021	0.080	hectare"
"	Time of concentration	16.132	1.307	6.581	minutes"
"	Time to Centroid	119.698	87.817	99.158	minutes"
"	Rainfall depth	47.240	47.240	47.240	mm"
"	Rainfall volume	27.97	9.83	37.79	c.m"
"	Rainfall losses	39.230	5.949	30.577	mm"
"	Runoff depth	8.010	41.291	16.663	mm"
"	Runoff volume	4.74	8.59	13.33	c.m"
"	Runoff coefficient	0.170	0.874	0.353	"
"	Maximum flow	0.002	0.007	0.007	c.m/sec"
" 40	HYDROGRAPH Add Runoff "				
"	4 Add Runoff "				
"	0.007	0.007	0.030	0.038"	
" 40	HYDROGRAPH Copy to Outflow"				
"	8 Copy to Outflow"				
"	0.007	0.007	0.007	0.038"	
" 40	HYDROGRAPH Combine 10"				
"	6 Combine "				
"	10 Node #"				
"	combine total"				
"	Maximum flow		0.042	c.m/sec"	
"	Hydrograph volume		126.224	c.m"	
"	0.007	0.007	0.007	0.042"	
" 38	START/RE-START TOTALS 103"				
"	3 Runoff Totals on EXIT"				
"	Total Catchment area			1.220	hectare"
"	Total Impervious area			0.085	hectare"
"	Total % impervious			6.993"	
" 19	EXIT"				

```

"          MIDUSS Output ----->"
"          MIDUSS version                      Version 2.25  rev. 473"
"          MIDUSS created                      February 7, 2010"
"          10  Units used:                      ie METRIC"
"          Job folder:                        C:\M\Meritech Engineering\PRJ - DOCS\4311\"
"                                           60-Design\SWM\Miduss"
"          Output filename:                    4311.x100yrJan032025"
"          Licensee name:                      SusieC"
"          Company                            Meritech Engineering"
"          Date & Time last used:              2025-01-03 at 3:33:17 PM"
" 31      TIME PARAMETERS"
"          5.000  Time Step"
"          180.000 Max. Storm length"
"          1500.000 Max. Hydrograph"
" 81      ADD COMMENT=====
"          1  Lines of comment"
"          100yr pre-development"
" 32      STORM Chicago storm"
"          1  Chicago storm"
"          4688.000 Coefficient A"
"          17.000  Constant B"
"          0.962  Exponent C"
"          0.400  Fraction R"
"          180.000 Duration"
"          1.000  Time step multiplier"
"          Maximum intensity          239.650  mm/hr"
"          Total depth                87.263  mm"
"          6  100hyd  Hydrograph extension used in this file"
" 33      CATCHMENT 204"
"          1  Triangular SCS"
"          1  Equal length"
"          1  SCS method"
"          204  To King Street Finally"
"          62.000 % Impervious"
"          0.020  Total Area"
"          30.000 Flow length"
"          1.000  Overland Slope"
"          0.008  Pervious Area"
"          30.000 Pervious length"
"          1.000  Pervious slope"
"          0.012  Impervious Area"
"          30.000 Impervious length"
"          1.000  Impervious slope"
"          0.250  Pervious Manning 'n'"
"          68.000 Pervious SCS Curve No."
"          0.333  Pervious Runoff coefficient"
"          0.100  Pervious Ia/S coefficient"
"          11.953 Pervious Initial abstraction"
"          0.015  Impervious Manning 'n'"
"          98.000 Impervious SCS Curve No."

```

"	0.925	Impervious Runoff coefficient"			
"	0.100	Impervious Ia/S coefficient"			
"	0.518	Impervious Initial abstraction"			
"	0.007	0.000	0.000	0.000 c.m/sec"	
"	Catchment 204	Pervious	Impervious	Total Area	"
"	Surface Area	0.008	0.012	0.020	hectare"
"	Time of concentration	16.589	1.938	4.587	minutes"
"	Time to Centroid	114.895	86.528	91.657	minutes"
"	Rainfall depth	87.263	87.263	87.263	mm"
"	Rainfall volume	6.63	10.82	17.45	c.m"
"	Rainfall losses	58.191	6.526	26.159	mm"
"	Runoff depth	29.072	80.737	61.104	mm"
"	Runoff volume	2.21	10.01	12.22	c.m"
"	Runoff coefficient	0.333	0.925	0.700	"
"	Maximum flow	0.001	0.007	0.007	c.m/sec"
" 40	HYDROGRAPH Add Runoff "				
"	4	Add Runoff "			
"	0.007	0.007	0.000	0.000"	
" 33	CATCHMENT 101"				
"	1	Triangular SCS"			
"	1	Equal length"			
"	1	SCS method"			
"	101	from site"			
"	3.000	% Impervious"			
"	0.180	Total Area"			
"	15.000	Flow length"			
"	3.000	Overland Slope"			
"	0.175	Pervious Area"			
"	15.000	Pervious length"			
"	3.000	Pervious slope"			
"	0.005	Impervious Area"			
"	15.000	Impervious length"			
"	3.000	Impervious slope"			
"	0.250	Pervious Manning 'n'"			
"	68.000	Pervious SCS Curve No."			
"	0.332	Pervious Runoff coefficient"			
"	0.100	Pervious Ia/S coefficient"			
"	11.953	Pervious Initial abstraction"			
"	0.015	Impervious Manning 'n'"			
"	98.000	Impervious SCS Curve No."			
"	0.901	Impervious Runoff coefficient"			
"	0.100	Impervious Ia/S coefficient"			
"	0.518	Impervious Initial abstraction"			
"	0.029	0.007	0.000	0.000 c.m/sec"	
"	Catchment 101	Pervious	Impervious	Total Area	"
"	Surface Area	0.175	0.005	0.180	hectare"
"	Time of concentration	7.871	0.920	7.334	minutes"
"	Time to Centroid	104.280	85.207	102.805	minutes"
"	Rainfall depth	87.263	87.263	87.263	mm"
"	Rainfall volume	152.36	4.71	157.07	c.m"

"	Rainfall losses	58.265	8.642	56.776	mm"
"	Runoff depth	28.999	78.621	30.487	mm"
"	Runoff volume	50.63	4.25	54.88	c.m"
"	Runoff coefficient	0.332	0.901	0.349	"
"	Maximum flow	0.028	0.003	0.029	c.m/sec"
" 40	HYDROGRAPH Add Runoff "				
"	4 Add Runoff "				
"	0.029 0.034 0.000 0.000"				
" 33	CATCHMENT 201"				
"	1 Triangular SCS"				
"	1 Equal length"				
"	1 SCS method"				
"	201 South neighbour To King Street"				
"	0.000 % Impervious"				
"	0.020 Total Area"				
"	15.000 Flow length"				
"	2.000 Overland Slope"				
"	0.020 Pervious Area"				
"	15.000 Pervious length"				
"	2.000 Pervious slope"				
"	0.000 Impervious Area"				
"	15.000 Impervious length"				
"	2.000 Impervious slope"				
"	0.250 Pervious Manning 'n' "				
"	68.000 Pervious SCS Curve No. "				
"	0.332 Pervious Runoff coefficient"				
"	0.100 Pervious Ia/S coefficient"				
"	11.953 Pervious Initial abstraction"				
"	0.015 Impervious Manning 'n' "				
"	98.000 Impervious SCS Curve No. "				
"	0.000 Impervious Runoff coefficient"				
"	0.100 Impervious Ia/S coefficient"				
"	0.518 Impervious Initial abstraction"				
"	0.003 0.034 0.000 0.000 c.m/sec"				
"	Catchment 201 Pervious Impervious Total Area "				
"	Surface Area 0.020 0.000 0.020 hectare"				
"	Time of concentration 8.890 1.039 8.890 minutes"				
"	Time to Centroid 105.473 85.361 105.473 minutes"				
"	Rainfall depth 87.263 87.263 87.263 mm"				
"	Rainfall volume 17.45 0.00 17.45 c.m"				
"	Rainfall losses 58.307 7.853 58.307 mm"				
"	Runoff depth 28.957 79.410 28.957 mm"				
"	Runoff volume 5.79 0.00 5.79 c.m"				
"	Runoff coefficient 0.332 0.000 0.332 "				
"	Maximum flow 0.003 0.000 0.003 c.m/sec"				
" 40	HYDROGRAPH Add Runoff "				
"	4 Add Runoff "				
"	0.003 0.037 0.000 0.000"				
" 33	CATCHMENT 202"				
"	1 Triangular SCS"				

```

"          1   Equal length"
"          1   SCS method"
"        202   Road and west area to KingStreet"
"        0.000 % Impervious"
"        0.040 Total Area"
"       15.000 Flow length"
"        2.000 Overland Slope"
"        0.040 Pervious Area"
"       15.000 Pervious length"
"        2.000 Pervious slope"
"        0.000 Impervious Area"
"       15.000 Impervious length"
"        2.000 Impervious slope"
"        0.250 Pervious Manning 'n'"
"       68.000 Pervious SCS Curve No."
"        0.332 Pervious Runoff coefficient"
"        0.100 Pervious Ia/S coefficient"
"       11.953 Pervious Initial abstraction"
"        0.015 Impervious Manning 'n'"
"       98.000 Impervious SCS Curve No."
"        0.000 Impervious Runoff coefficient"
"        0.100 Impervious Ia/S coefficient"
"        0.518 Impervious Initial abstraction"
"          0.006      0.037      0.000      0.000 c.m/sec"
"      Catchment 202      Pervious      Impervious Total Area "
"      Surface Area      0.040      0.000      0.040      hectare"
"      Time of concentration 8.890      1.039      8.890      minutes"
"      Time to Centroid 105.473      85.361      105.473      minutes"
"      Rainfall depth      87.263      87.263      87.263      mm"
"      Rainfall volume      34.91      0.00      34.91      c.m"
"      Rainfall losses      58.307      7.853      58.307      mm"
"      Runoff depth      28.957      79.410      28.957      mm"
"      Runoff volume      11.58      0.00      11.58      c.m"
"      Runoff coefficient      0.332      0.000      0.332      "
"      Maximum flow      0.006      0.000      0.006      c.m/sec"
" 40      HYDROGRAPH Add Runoff "
"      4      Add Runoff "
"          0.006      0.042      0.000      0.000"
" 40      HYDROGRAPH Copy to Outflow"
"      8      Copy to Outflow"
"          0.006      0.042      0.042      0.000"
" 40      HYDROGRAPH Combine 10"
"      6      Combine "
"     10      Node #"
"          combine total"
"          Maximum flow          0.042      c.m/sec"
"          Hydrograph volume      84.472      c.m"
"          0.006      0.042      0.042      0.042"
" 40      HYDROGRAPH Start - New Tributary"
"      2      Start - New Tributary"

```

"		0.006	0.000	0.042	0.042"
" 33	CATCHMENT 102"				
"	1	Triangular SCS"			
"	1	Equal length"			
"	1	SCS method"			
"	102	Major Site to forest"			
"	6.400	% Impervious"			
"	0.730	Total Area"			
"	15.000	Flow length"			
"	3.000	Overland Slope"			
"	0.683	Pervious Area"			
"	15.000	Pervious length"			
"	3.000	Pervious slope"			
"	0.047	Impervious Area"			
"	15.000	Impervious length"			
"	3.000	Impervious slope"			
"	0.250	Pervious Manning 'n'"			
"	68.000	Pervious SCS Curve No."			
"	0.332	Pervious Runoff coefficient"			
"	0.100	Pervious Ia/S coefficient"			
"	11.953	Pervious Initial abstraction"			
"	0.015	Impervious Manning 'n'"			
"	98.000	Impervious SCS Curve No."			
"	0.901	Impervious Runoff coefficient"			
"	0.100	Impervious Ia/S coefficient"			
"	0.518	Impervious Initial abstraction"			
"		0.120	0.000	0.042	0.042 c.m/sec"
"	Catchment 102	Pervious	Impervious	Total Area	"
"	Surface Area	0.683	0.047	0.730	hectare"
"	Time of concentration	7.871	0.920	6.784	minutes"
"	Time to Centroid	104.280	85.207	101.298	minutes"
"	Rainfall depth	87.263	87.263	87.263	mm"
"	Rainfall volume	596.25	40.77	637.02	c.m"
"	Rainfall losses	58.265	8.642	55.089	mm"
"	Runoff depth	28.999	78.621	32.175	mm"
"	Runoff volume	198.14	36.73	234.88	c.m"
"	Runoff coefficient	0.332	0.901	0.369	"
"	Maximum flow	0.109	0.027	0.120	c.m/sec"
" 40	HYDROGRAPH Add Runoff "				
"	4	Add Runoff "			
"		0.120	0.120	0.042	0.042"
" 33	CATCHMENT 203"				
"	1	Triangular SCS"			
"	1	Equal length"			
"	1	SCS method"			
"	203	External area path site to forest"			
"	0.000	% Impervious"			
"	0.150	Total Area"			
"	15.000	Flow length"			
"	3.000	Overland Slope"			

"	0.150	Pervious Area"			
"	15.000	Pervious length"			
"	3.000	Pervious slope"			
"	0.000	Impervious Area"			
"	15.000	Impervious length"			
"	3.000	Impervious slope"			
"	0.250	Pervious Manning 'n'"			
"	68.000	Pervious SCS Curve No."			
"	0.332	Pervious Runoff coefficient"			
"	0.100	Pervious Ia/S coefficient"			
"	11.953	Pervious Initial abstraction"			
"	0.015	Impervious Manning 'n'"			
"	98.000	Impervious SCS Curve No."			
"	0.000	Impervious Runoff coefficient"			
"	0.100	Impervious Ia/S coefficient"			
"	0.518	Impervious Initial abstraction"			
"		0.024	0.120	0.042	0.042 c.m/sec"
"		Catchment 203	Pervious	Impervious	Total Area "
"		Surface Area	0.150	0.000	0.150 hectare"
"		Time of concentration	7.871	0.920	7.871 minutes"
"		Time to Centroid	104.280	85.207	104.280 minutes"
"		Rainfall depth	87.263	87.263	87.263 mm"
"		Rainfall volume	130.90	0.00	130.90 c.m"
"		Rainfall losses	58.265	8.642	58.265 mm"
"		Runoff depth	28.999	78.621	28.999 mm"
"		Runoff volume	43.50	0.00	43.50 c.m"
"		Runoff coefficient	0.332	0.000	0.332 "
"		Maximum flow	0.024	0.000	0.024 c.m/sec"
" 40		HYDROGRAPH Add Runoff "			
"	4	Add Runoff "			
"		0.024	0.144	0.042	0.042"
" 40		HYDROGRAPH Copy to Outflow"			
"	8	Copy to Outflow"			
"		0.024	0.144	0.144	0.042"
" 40		HYDROGRAPH Combine 10"			
"	6	Combine "			
"	10	Node #"			
"		combine total"			
"		Maximum flow	0.186		c.m/sec"
"		Hydrograph volume	362.846		c.m"
"		0.024	0.144	0.144	0.186"
" 40		HYDROGRAPH Start - New Tributary"			
"	2	Start - New Tributary"			
"		0.024	0.000	0.144	0.186"
" 33		CATCHMENT 103"			
"	1	Triangular SCS"			
"	1	Equal length"			
"	1	SCS method"			
"	103	To printery road"			
"	26.000	% Impervious"			

"	0.080	Total Area"			
"	15.000	Flow length"			
"	2.000	Overland Slope"			
"	0.059	Pervious Area"			
"	15.000	Pervious length"			
"	2.000	Pervious slope"			
"	0.021	Impervious Area"			
"	15.000	Impervious length"			
"	2.000	Impervious slope"			
"	0.250	Pervious Manning 'n'"			
"	68.000	Pervious SCS Curve No."			
"	0.332	Pervious Runoff coefficient"			
"	0.100	Pervious Ia/S coefficient"			
"	11.953	Pervious Initial abstraction"			
"	0.015	Impervious Manning 'n'"			
"	98.000	Impervious SCS Curve No."			
"	0.910	Impervious Runoff coefficient"			
"	0.100	Impervious Ia/S coefficient"			
"	0.518	Impervious Initial abstraction"			
"		0.016	0.000	0.144	0.186 c.m/sec"
"		Catchment 103	Pervious	Impervious	Total Area "
"		Surface Area	0.059	0.021	0.080 hectare"
"		Time of concentration	8.890	1.039	5.037 minutes"
"		Time to Centroid	105.473	85.361	95.604 minutes"
"		Rainfall depth	87.263	87.263	87.263 mm"
"		Rainfall volume	51.66	18.15	69.81 c.m"
"		Rainfall losses	58.307	7.853	45.189 mm"
"		Runoff depth	28.957	79.410	42.075 mm"
"		Runoff volume	17.14	16.52	33.66 c.m"
"		Runoff coefficient	0.332	0.910	0.482 "
"		Maximum flow	0.009	0.012	0.016 c.m/sec"
" 40		HYDROGRAPH Add Runoff "			
"	4	Add Runoff "			
"		0.016	0.016	0.144	0.186"
" 40		HYDROGRAPH Copy to Outflow"			
"	8	Copy to Outflow"			
"		0.016	0.016	0.016	0.186"
" 40		HYDROGRAPH Combine 10"			
"	6	Combine "			
"	10	Node #"			
"		combine total"			
"		Maximum flow		0.200	c.m/sec"
"		Hydrograph volume		396.506	c.m"
"		0.016	0.016	0.016	0.200"
" 38		START/RE-START TOTALS 103"			
"	3	Runoff Totals on EXIT"			
"		Total Catchment area		1.220	hectare"
"		Total Impervious area		0.085	hectare"
"		Total % impervious		6.993"	
" 19		EXIT"			

Appendix D.2: Post-Development Conditions



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"          MIDUSS Output ----->"
"          MIDUSS version                      Version 2.25  rev. 473"
"          MIDUSS created                      February 7, 2010"
"          10  Units used:                      ie METRIC"
"          Job folder:                      C:\M\Meritech Engineering\PRJ - DOCS\4311\
"                                           60-Design\SWM\Miduss"
"          Output filename:                      4311.d5yrJan0109"
"          Licensee name:                      SusieC"
"          Company                      Meritech Engineering"
"          Date & Time last used:                      2025-01-09 at 11:26:31 AM"
" 81      ADD COMMENT=====
"          1  Lines of comment"
"          5yr post development"
" 31      TIME PARAMETERS"
"          5.000  Time Step"
"          180.000  Max. Storm length"
"          1500.000  Max. Hydrograph"
" 32      STORM Chicago storm"
"          1  Chicago storm"
"          1593.000  Coefficient A"
"          11.000  Constant B"
"          0.879  Exponent C"
"          0.400  Fraction R"
"          180.000  Duration"
"          1.000  Time step multiplier"
"          Maximum intensity                      139.250  mm/hr"
"          Total depth                      47.240  mm"
"          6  005hyd  Hydrograph extension used in this file"
" 33      CATCHMENT 1601"
"          1  Triangular SCS"
"          1  Equal length"
"          1  SCS method"
"          1601  same 201"
"          0.000  % Impervious"
"          0.020  Total Area"
"          15.000  Flow length"
"          2.000  Overland Slope"
"          0.020  Pervious Area"
"          15.000  Pervious length"
"          2.000  Pervious slope"
"          0.000  Impervious Area"
"          15.000  Impervious length"
"          2.000  Impervious slope"
"          0.250  Pervious Manning 'n'"
"          68.000  Pervious SCS Curve No."
"          0.170  Pervious Runoff coefficient"
"          0.100  Pervious Ia/S coefficient"
"          11.953  Pervious Initial abstraction"
"          0.015  Impervious Manning 'n'"
"          98.000  Impervious SCS Curve No."

```

"	0.000	Impervious Runoff coefficient"			
"	0.100	Impervious Ia/S coefficient"			
"	0.518	Impervious Initial abstraction"			
"	0.001	0.000	0.000	0.000 c.m/sec"	
"		Catchment 1601	Pervious	Impervious	Total Area "
"		Surface Area	0.020	0.000	0.020 hectare"
"		Time of concentration	16.133	1.307	16.132 minutes"
"		Time to Centroid	119.698	87.817	119.698 minutes"
"		Rainfall depth	47.240	47.240	47.240 mm"
"		Rainfall volume	9.45	0.00	9.45 c.m"
"		Rainfall losses	39.230	5.949	39.230 mm"
"		Runoff depth	8.010	41.291	8.010 mm"
"		Runoff volume	1.60	0.00	1.60 c.m"
"		Runoff coefficient	0.170	0.000	0.170 "
"		Maximum flow	0.001	0.000	0.001 c.m/sec"
" 40		HYDROGRAPH Add Runoff "			
"	4	Add Runoff "			
"	0.001	0.001	0.000	0.000"	
" 33		CATCHMENT 1501"			
"	1	Triangular SCS"			
"	1	Equal length"			
"	1	SCS method"			
"	1501	west site rear yard"			
"	24.000	% Impervious"			
"	0.240	Total Area"			
"	40.000	Flow length"			
"	2.000	Overland Slope"			
"	0.182	Pervious Area"			
"	40.000	Pervious length"			
"	2.000	Pervious slope"			
"	0.058	Impervious Area"			
"	40.000	Impervious length"			
"	2.000	Impervious slope"			
"	0.250	Pervious Manning 'n'"			
"	77.000	Pervious SCS Curve No."			
"	0.288	Pervious Runoff coefficient"			
"	0.100	Pervious Ia/S coefficient"			
"	7.587	Pervious Initial abstraction"			
"	0.015	Impervious Manning 'n'"			
"	98.000	Impervious SCS Curve No."			
"	0.876	Impervious Runoff coefficient"			
"	0.100	Impervious Ia/S coefficient"			
"	0.518	Impervious Initial abstraction"			
"	0.018	0.001	0.000	0.000 c.m/sec"	
"		Catchment 1501	Pervious	Impervious	Total Area "
"		Surface Area	0.182	0.058	0.240 hectare"
"		Time of concentration	21.436	2.354	12.088 minutes"
"		Time to Centroid	124.266	89.353	107.163 minutes"
"		Rainfall depth	47.240	47.240	47.240 mm"
"		Rainfall volume	86.17	27.21	113.38 c.m"

"	Rainfall losses	33.639	5.879	26.977	mm"
"	Runoff depth	13.601	41.361	20.263	mm"
"	Runoff volume	24.81	23.82	48.63	c.m"
"	Runoff coefficient	0.288	0.876	0.429	"
"	Maximum flow	0.008	0.017	0.018	c.m/sec"
" 40	HYDROGRAPH Add Runoff "				
"	4 Add Runoff "				
"	0.018 0.018 0.000 0.000"				
" 33	CATCHMENT 1502"				
"	1 Triangular SCS"				
"	1 Equal length"				
"	1 SCS method"				
"	1502 South rear yard"				
"	26.000 % Impervious"				
"	0.210 Total Area"				
"	40.000 Flow length"				
"	2.000 Overland Slope"				
"	0.155 Pervious Area"				
"	40.000 Pervious length"				
"	2.000 Pervious slope"				
"	0.055 Impervious Area"				
"	40.000 Impervious length"				
"	2.000 Impervious slope"				
"	0.250 Pervious Manning 'n'"				
"	77.000 Pervious SCS Curve No."				
"	0.288 Pervious Runoff coefficient"				
"	0.100 Pervious Ia/S coefficient"				
"	7.587 Pervious Initial abstraction"				
"	0.015 Impervious Manning 'n'"				
"	98.000 Impervious SCS Curve No."				
"	0.876 Impervious Runoff coefficient"				
"	0.100 Impervious Ia/S coefficient"				
"	0.518 Impervious Initial abstraction"				
"	0.017 0.018 0.000 0.000 c.m/sec"				
"	Catchment 1502 Pervious Impervious Total Area "				
"	Surface Area 0.155 0.055 0.210 hectare"				
"	Time of concentration 21.436 2.354 11.579 minutes"				
"	Time to Centroid 124.266 89.353 106.232 minutes"				
"	Rainfall depth 47.240 47.240 47.240 mm"				
"	Rainfall volume 73.41 25.79 99.20 c.m"				
"	Rainfall losses 33.639 5.879 26.421 mm"				
"	Runoff depth 13.601 41.361 20.818 mm"				
"	Runoff volume 21.14 22.58 43.72 c.m"				
"	Runoff coefficient 0.288 0.876 0.441 "				
"	Maximum flow 0.007 0.016 0.017 c.m/sec"				
" 40	HYDROGRAPH Add Runoff "				
"	4 Add Runoff "				
"	0.017 0.035 0.000 0.000"				
" 33	CATCHMENT 1603"				
"	1 Triangular SCS"				

```

"          1   Equal length"
"          1   SCS method"
"        1603   same 203"
"        0.000   % Impervious"
"        0.150   Total Area"
"       15.000   Flow length"
"        3.000   Overland Slope"
"        0.150   Pervious Area"
"       15.000   Pervious length"
"        3.000   Pervious slope"
"        0.000   Impervious Area"
"       15.000   Impervious length"
"        3.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       68.000   Pervious SCS Curve No."
"        0.170   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"       11.953   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.000   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"              0.005      0.035      0.000      0.000 c.m/sec"
"      Catchment 1603      Pervious      Impervious Total Area "
"      Surface Area      0.150      0.000      0.150      hectare"
"      Time of concentration 14.285      1.157      14.285      minutes"
"      Time to Centroid 117.516      87.616      117.515      minutes"
"      Rainfall depth      47.240      47.240      47.240      mm"
"      Rainfall volume      70.86      0.00      70.86      c.m"
"      Rainfall losses      39.208      6.181      39.208      mm"
"      Runoff depth      8.032      41.059      8.032      mm"
"      Runoff volume      12.05      0.00      12.05      c.m"
"      Runoff coefficient      0.170      0.000      0.170      "
"      Maximum flow      0.005      0.000      0.005      c.m/sec"
" 40      HYDROGRAPH Add Runoff "
"      4      Add Runoff "
"              0.005      0.036      0.000      0.000"
" 33      CATCHMENT 1506"
"          1   Triangular SCS"
"          1   Equal length"
"          1   SCS method"
"        1506   7units rear yard"
"       34.000   % Impervious"
"        0.060   Total Area"
"       33.000   Flow length"
"        2.000   Overland Slope"
"        0.040   Pervious Area"
"       33.000   Pervious length"
"        2.000   Pervious slope"

```

"	0.020	Impervious Area"			
"	33.000	Impervious length"			
"	2.000	Impervious slope"			
"	0.250	Pervious Manning 'n'"			
"	77.000	Pervious SCS Curve No."			
"	0.288	Pervious Runoff coefficient"			
"	0.100	Pervious Ia/S coefficient"			
"	7.587	Pervious Initial abstraction"			
"	0.015	Impervious Manning 'n'"			
"	98.000	Impervious SCS Curve No."			
"	0.878	Impervious Runoff coefficient"			
"	0.100	Impervious Ia/S coefficient"			
"	0.518	Impervious Initial abstraction"			
"	0.006	0.036	0.000	0.000	c.m/sec"
"	Catchment 1506	Pervious	Impervious	Total Area	"
"	Surface Area	0.040	0.020	0.060	hectare"
"	Time of concentration	19.099	2.097	8.706	minutes"
"	Time to Centroid	121.339	88.940	101.533	minutes"
"	Rainfall depth	47.240	47.240	47.240	mm"
"	Rainfall volume	18.71	9.64	28.34	c.m"
"	Rainfall losses	33.657	5.769	24.175	mm"
"	Runoff depth	13.583	41.471	23.065	mm"
"	Runoff volume	5.38	8.46	13.84	c.m"
"	Runoff coefficient	0.288	0.878	0.488	"
"	Maximum flow	0.002	0.006	0.006	c.m/sec"
" 40	HYDROGRAPH Add Runoff "				
"	4 Add Runoff "				
"	0.006	0.042	0.000	0.000"	
" 40	HYDROGRAPH Copy to Outflow"				
"	8 Copy to Outflow"				
"	0.006	0.042	0.042	0.000"	
" 40	HYDROGRAPH Combine 20"				
"	6 Combine "				
"	20 Node #"				
"	Forest"				
"	Maximum flow	0.042	c.m/sec"		
"	Hydrograph volume	119.840	c.m"		
"	0.006	0.042	0.042	0.042"	
" 40	HYDROGRAPH Start - New Tributary"				
"	2 Start - New Tributary"				
"	0.006	0.000	0.042	0.042"	
" 33	CATCHMENT 1503"				
"	1 Triangular SCS"				
"	1 Equal length"				
"	1 SCS method"				
"	1503 To King Street"				
"	63.000 % Impervious"				
"	0.090 Total Area"				
"	15.000 Flow length"				
"	3.000 Overland Slope"				

"	0.033	Pervious Area"
"	15.000	Pervious length"
"	3.000	Pervious slope"
"	0.057	Impervious Area"
"	15.000	Impervious length"
"	3.000	Impervious slope"
"	0.250	Pervious Manning 'n' "
"	77.000	Pervious SCS Curve No."
"	0.287	Pervious Runoff coefficient"
"	0.100	Pervious Ia/S coefficient"
"	7.587	Pervious Initial abstraction"
"	0.015	Impervious Manning 'n' "
"	98.000	Impervious SCS Curve No."
"	0.869	Impervious Runoff coefficient"
"	0.100	Impervious Ia/S coefficient"
"	0.518	Impervious Initial abstraction"
"	0.019	0.000 0.042 0.042 c.m/sec"
"	Catchment 1503	Pervious Impervious Total Area "
"	Surface Area	0.033 0.057 0.090 hectare"
"	Time of concentration	10.537 1.157 2.682 minutes"
"	Time to Centroid	110.610 87.616 91.355 minutes"
"	Rainfall depth	47.240 47.240 47.240 mm"
"	Rainfall volume	15.73 26.79 42.52 c.m"
"	Rainfall losses	33.666 6.181 16.351 mm"
"	Runoff depth	13.574 41.059 30.889 mm"
"	Runoff volume	4.52 23.28 27.80 c.m"
"	Runoff coefficient	0.287 0.869 0.654 "
"	Maximum flow	0.002 0.018 0.019 c.m/sec"
" 40	HYDROGRAPH Add Runoff "	
"	4 Add Runoff "	
"	0.019 0.019 0.042 0.042"	
" 33	CATCHMENT 1602"	
"	1 Triangular SCS"	
"	1 Equal length"	
"	1 SCS method"	
"	1602 same 202"	
"	0.000 % Impervious"	
"	0.040 Total Area"	
"	15.000 Flow length"	
"	2.000 Overland Slope"	
"	0.040 Pervious Area"	
"	15.000 Pervious length"	
"	2.000 Pervious slope"	
"	0.000 Impervious Area"	
"	15.000 Impervious length"	
"	2.000 Impervious slope"	
"	0.250 Pervious Manning 'n' "	
"	68.000 Pervious SCS Curve No."	
"	0.170 Pervious Runoff coefficient"	
"	0.100 Pervious Ia/S coefficient"	

"	11.953	Pervious Initial abstraction"			
"	0.015	Impervious Manning 'n'"			
"	98.000	Impervious SCS Curve No."			
"	0.000	Impervious Runoff coefficient"			
"	0.100	Impervious Ia/S coefficient"			
"	0.518	Impervious Initial abstraction"			
"		0.001	0.019	0.042	0.042 c.m/sec"
"		Catchment 1602	Pervious	Impervious	Total Area "
"		Surface Area	0.040	0.000	0.040 hectare"
"		Time of concentration	16.133	1.307	16.132 minutes"
"		Time to Centroid	119.698	87.817	119.698 minutes"
"		Rainfall depth	47.240	47.240	47.240 mm"
"		Rainfall volume	18.90	0.00	18.90 c.m"
"		Rainfall losses	39.230	5.949	39.230 mm"
"		Runoff depth	8.010	41.291	8.010 mm"
"		Runoff volume	3.20	0.00	3.20 c.m"
"		Runoff coefficient	0.170	0.000	0.170 "
"		Maximum flow	0.001	0.000	0.001 c.m/sec"
" 40		HYDROGRAPH Add Runoff "			
"	4	Add Runoff "			
"		0.001	0.019	0.042	0.042"
" 40		HYDROGRAPH Copy to Outflow"			
"	8	Copy to Outflow"			
"		0.001	0.019	0.019	0.042"
" 40		HYDROGRAPH Combine 25"			
"	6	Combine "			
"	25	Node #"			
"		to King Street"			
"		Maximum flow	0.019		c.m/sec"
"		Hydrograph volume	31.004		c.m"
"		0.001	0.019	0.019	0.019"
" 40		HYDROGRAPH Start - New Tributary"			
"	2	Start - New Tributary"			
"		0.001	0.000	0.019	0.019"
" 33		CATCHMENT 1504"			
"	1	Triangular SCS"			
"	1	Equal length"			
"	1	SCS method"			
"	1504	North from site and pr road "			
"	63.000	% Impervious"			
"	0.090	Total Area"			
"	15.000	Flow length"			
"	3.000	Overland Slope"			
"	0.033	Pervious Area"			
"	15.000	Pervious length"			
"	3.000	Pervious slope"			
"	0.057	Impervious Area"			
"	15.000	Impervious length"			
"	3.000	Impervious slope"			
"	0.250	Pervious Manning 'n'"			

"	77.000	Pervious SCS Curve No."				
"	0.287	Pervious Runoff coefficient"				
"	0.100	Pervious Ia/S coefficient"				
"	7.587	Pervious Initial abstraction"				
"	0.015	Impervious Manning 'n'"				
"	98.000	Impervious SCS Curve No."				
"	0.869	Impervious Runoff coefficient"				
"	0.100	Impervious Ia/S coefficient"				
"	0.518	Impervious Initial abstraction"				
"		0.019	0.000	0.019	0.019 c.m/sec"	
"		Catchment 1504	Pervious	Impervious	Total Area	"
"		Surface Area	0.033	0.057	0.090	hectare"
"		Time of concentration	10.537	1.157	2.682	minutes"
"		Time to Centroid	110.610	87.616	91.355	minutes"
"		Rainfall depth	47.240	47.240	47.240	mm"
"		Rainfall volume	15.73	26.79	42.52	c.m"
"		Rainfall losses	33.666	6.181	16.351	mm"
"		Runoff depth	13.574	41.059	30.889	mm"
"		Runoff volume	4.52	23.28	27.80	c.m"
"		Runoff coefficient	0.287	0.869	0.654	"
"		Maximum flow	0.002	0.018	0.019	c.m/sec"
" 40		HYDROGRAPH Add Runoff "				
"	4	Add Runoff "				
"		0.019	0.019	0.019	0.019"	
" 33		CATCHMENT 1604"				
"	1	Triangular SCS"				
"	1	Equal length"				
"	1	SCS method"				
"	1604	Printery Road"				
"	62.000	% Impervious"				
"	0.020	Total Area"				
"	30.000	Flow length"				
"	1.000	Overland Slope"				
"	0.008	Pervious Area"				
"	30.000	Pervious length"				
"	1.000	Pervious slope"				
"	0.012	Impervious Area"				
"	30.000	Impervious length"				
"	1.000	Impervious slope"				
"	0.250	Pervious Manning 'n'"				
"	68.000	Pervious SCS Curve No."				
"	0.170	Pervious Runoff coefficient"				
"	0.100	Pervious Ia/S coefficient"				
"	11.953	Pervious Initial abstraction"				
"	0.015	Impervious Manning 'n'"				
"	98.000	Impervious SCS Curve No."				
"	0.875	Impervious Runoff coefficient"				
"	0.100	Impervious Ia/S coefficient"				
"	0.518	Impervious Initial abstraction"				
"		0.004	0.019	0.019	0.019 c.m/sec"	

"	Catchment 1604	Pervious	Impervious	Total Area	"
"	Surface Area	0.008	0.012	0.020	hectare"
"	Time of concentration	30.104	2.438	5.386	minutes"
"	Time to Centroid	135.694	89.497	94.420	minutes"
"	Rainfall depth	47.240	47.240	47.240	mm"
"	Rainfall volume	3.59	5.86	9.45	c.m"
"	Rainfall losses	39.199	5.921	18.567	mm"
"	Runoff depth	8.040	41.319	28.673	mm"
"	Runoff volume	0.61	5.12	5.73	c.m"
"	Runoff coefficient	0.170	0.875	0.607	"
"	Maximum flow	0.000	0.004	0.004	c.m/sec"
" 40	HYDROGRAPH Add Runoff "				
"	4 Add Runoff "				
"	0.004 0.022 0.019 0.019"				
" 33	CATCHMENT 1505"				
"	1 Triangular SCS"				
"	1 Equal length"				
"	1 SCS method"				
"	1505 To Printery "				
"	22.000 % Impervious"				
"	0.040 Total Area"				
"	20.000 Flow length"				
"	2.000 Overland Slope"				
"	0.031 Pervious Area"				
"	20.000 Pervious length"				
"	2.000 Pervious slope"				
"	0.009 Impervious Area"				
"	20.000 Impervious length"				
"	2.000 Impervious slope"				
"	0.250 Pervious Manning 'n'"				
"	77.000 Pervious SCS Curve No."				
"	0.287 Pervious Runoff coefficient"				
"	0.100 Pervious Ia/S coefficient"				
"	7.587 Pervious Initial abstraction"				
"	0.015 Impervious Manning 'n'"				
"	98.000 Impervious SCS Curve No."				
"	0.878 Impervious Runoff coefficient"				
"	0.100 Impervious Ia/S coefficient"				
"	0.518 Impervious Initial abstraction"				
"	0.003 0.022 0.019 0.019 c.m/sec"				
"	Catchment 1505	Pervious	Impervious	Total Area	"
"	Surface Area	0.031	0.009	0.040	hectare"
"	Time of concentration	14.142	1.553	8.318	minutes"
"	Time to Centroid	115.139	88.105	102.631	minutes"
"	Rainfall depth	47.240	47.240	47.240	mm"
"	Rainfall volume	14.74	4.16	18.90	c.m"
"	Rainfall losses	33.659	5.780	27.526	mm"
"	Runoff depth	13.580	41.459	19.714	mm"
"	Runoff volume	4.24	3.65	7.89	c.m"
"	Runoff coefficient	0.287	0.878	0.417	"

"	Maximum flow	0.002	0.003	0.003	c.m/sec"
" 40	HYDROGRAPH Add Runoff "				
"	4 Add Runoff "				
"	0.003 0.025 0.019 0.019"				
" 40	HYDROGRAPH Copy to Outflow"				
"	8 Copy to Outflow"				
"	0.003 0.025 0.025 0.019"				
" 40	HYDROGRAPH Combine 30"				
"	6 Combine "				
"	30 Node #"				
"	To pond"				
"	Maximum flow	0.025			c.m/sec"
"	Hydrograph volume	41.421			c.m"
"	0.003 0.025 0.025 0.025"				
" 40	HYDROGRAPH Start - New Tributary"				
"	2 Start - New Tributary"				
"	0.003 0.000 0.025 0.025"				
" 33	CATCHMENT 1701"				
"	1 Triangular SCS"				
"	1 Equal length"				
"	1 SCS method"				
"	1701 To printery "				
"	80.000 % Impervious"				
"	0.260 Total Area"				
"	30.000 Flow length"				
"	1.000 Overland Slope"				
"	0.052 Pervious Area"				
"	30.000 Pervious length"				
"	1.000 Pervious slope"				
"	0.208 Impervious Area"				
"	30.000 Impervious length"				
"	1.000 Impervious slope"				
"	0.250 Pervious Manning 'n'"				
"	77.000 Pervious SCS Curve No."				
"	0.288 Pervious Runoff coefficient"				
"	0.100 Pervious Ia/S coefficient"				
"	7.587 Pervious Initial abstraction"				
"	0.015 Impervious Manning 'n'"				
"	98.000 Impervious SCS Curve No."				
"	0.875 Impervious Runoff coefficient"				
"	0.100 Impervious Ia/S coefficient"				
"	0.518 Impervious Initial abstraction"				
"	0.061 0.000 0.025 0.025 c.m/sec"				
"	Catchment 1701 Pervious Impervious Total Area "				
"	Surface Area 0.052 0.208 0.260 hectare"				
"	Time of concentration 22.207 2.438 3.940 minutes"				
"	Time to Centroid 125.244 89.497 92.213 minutes"				
"	Rainfall depth 47.240 47.240 47.240 mm"				
"	Rainfall volume 24.56 98.26 122.82 c.m"				
"	Rainfall losses 33.649 5.921 11.467 mm"				

"	Runoff depth	13.591	41.319	35.773	mm"
"	Runoff volume	7.07	85.94	93.01	c.m"
"	Runoff coefficient	0.288	0.875	0.757	"
"	Maximum flow	0.002	0.061	0.061	c.m/sec"
" 40	HYDROGRAPH Add Runoff "				
"	4 Add Runoff "				
"	0.061	0.061	0.025	0.025"	
" 40	HYDROGRAPH Copy to Outflow"				
"	8 Copy to Outflow"				
"	0.061	0.061	0.061	0.025"	
" 40	HYDROGRAPH Combine 30"				
"	6 Combine "				
"	30 Node #"				
"	To pond"				
"	Maximum flow	0.086		c.m/sec"	
"	Hydrograph volume	134.431		c.m"	
"	0.061	0.061	0.061	0.086"	
" 38	START/RE-START TOTALS 1701"				
"	3 Runoff Totals on EXIT"				
"	Total Catchment area		1.220	hectare"	
"	Total Impervious area		0.475	hectare"	
"	Total % impervious		38.951"		
" 19	EXIT"				

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"          MIDUSS Output ----->"
"          MIDUSS version                      Version 2.25  rev. 473"
"          MIDUSS created                      February 7, 2010"
"          10  Units used:                      ie METRIC"
"          Job folder:                        C:\M\Meritech Engineering\PRJ - DOCS\4311\
"                                              60-Design\SWM\Miduss"
"          Output filename:                    4311.div10yr601602Jan032025"
"          Licensee name:                      SusieC"
"          Company                            Meritech Engineering"
"          Date & Time last used:              2025-01-03 at 2:55:30 PM"
" 81      ADD COMMENT=====
"          1  Lines of comment"
"          601/602 div 10yr cal"
" 31      TIME PARAMETERS"
"          5.000  Time Step"
"          180.000 Max. Storm length"
"          1500.000 Max. Hydrograph"
" 32      STORM Chicago storm"
"          1  Chicago storm"
"          2221.000 Coefficient A"
"          12.000  Constant B"
"          0.908  Exponent C"
"          0.400  Fraction R"
"          180.000 Duration"
"          1.000  Time step multiplier"
"          Maximum intensity          169.551  mm/hr"
"          Total depth                56.290  mm"
"          6  010hyd  Hydrograph extension used in this file"
" 33      CATCHMENT 601"
"          1  Triangular SCS"
"          1  Equal length"
"          1  SCS method"
"          1601  same as 201"
"          0.000  % Impervious"
"          0.020  Total Area"
"          15.000 Flow length"
"          2.000  Overland Slope"
"          0.020  Pervious Area"
"          15.000 Pervious length"
"          2.000  Pervious slope"
"          0.000  Impervious Area"
"          15.000 Impervious length"
"          2.000  Impervious slope"
"          0.250  Pervious Manning 'n'"
"          68.000 Pervious SCS Curve No."
"          0.212  Pervious Runoff coefficient"
"          0.100  Pervious Ia/S coefficient"
"          11.953 Pervious Initial abstraction"
"          0.015  Impervious Manning 'n'"
"          98.000 Impervious SCS Curve No."

```

"	0.000	Impervious Runoff coefficient"			
"	0.100	Impervious Ia/S coefficient"			
"	0.518	Impervious Initial abstraction"			
"	0.001	0.000	0.000	0.000 c.m/sec"	
"	Catchment 601	Pervious	Impervious	Total Area	"
"	Surface Area	0.020	0.000	0.020	hectare"
"	Time of concentration	12.976	1.202	12.976	minutes"
"	Time to Centroid	113.768	0.000	113.768	minutes"
"	Rainfall depth	56.290	56.290	56.290	mm"
"	Rainfall volume	11.26	0.00	11.26	c.m"
"	Rainfall losses	44.353	56.290	44.353	mm"
"	Runoff depth	11.937	0.000	11.937	mm"
"	Runoff volume	2.39	0.00	2.39	c.m"
"	Runoff coefficient	0.212	0.000	0.212	"
"	Maximum flow	0.001	0.000	0.001	c.m/sec"
" 40	HYDROGRAPH Add Runoff "				
"	4	Add Runoff "			
"	0.001	0.001	0.000	0.000"	
" 33	CATCHMENT 1602"				
"	1	Triangular SCS"			
"	1	Equal length"			
"	1	SCS method"			
"	1602	same as 202"			
"	0.000	% Impervious"			
"	0.040	Total Area"			
"	15.000	Flow length"			
"	2.000	Overland Slope"			
"	0.040	Pervious Area"			
"	15.000	Pervious length"			
"	2.000	Pervious slope"			
"	0.000	Impervious Area"			
"	15.000	Impervious length"			
"	2.000	Impervious slope"			
"	0.250	Pervious Manning 'n'"			
"	68.000	Pervious SCS Curve No."			
"	0.212	Pervious Runoff coefficient"			
"	0.100	Pervious Ia/S coefficient"			
"	11.953	Pervious Initial abstraction"			
"	0.015	Impervious Manning 'n'"			
"	98.000	Impervious SCS Curve No."			
"	0.000	Impervious Runoff coefficient"			
"	0.100	Impervious Ia/S coefficient"			
"	0.518	Impervious Initial abstraction"			
"	0.002	0.001	0.000	0.000 c.m/sec"	
"	Catchment 602	Pervious	Impervious	Total Area	"
"	Surface Area	0.040	0.000	0.040	hectare"
"	Time of concentration	12.976	1.202	12.976	minutes"
"	Time to Centroid	113.768	86.719	113.768	minutes"
"	Rainfall depth	56.290	56.290	56.290	mm"
"	Rainfall volume	22.52	0.00	22.52	c.m"

"	Rainfall losses	44.353	6.369	44.353	mm"
"	Runoff depth	11.937	49.921	11.937	mm"
"	Runoff volume	4.77	0.00	4.77	c.m"
"	Runoff coefficient	0.212	0.000	0.212	"
"	Maximum flow	0.002	0.000	0.002	c.m/sec"
" 40	HYDROGRAPH Add Runoff "				
"	4 Add Runoff "				
"	0.002 0.003 0.000 0.000"				
" 40	HYDROGRAPH Copy to Outflow"				
"	8 Copy to Outflow"				
"	0.002 0.003 0.003 0.000"				
" 38	START/RE-START TOTALS 602"				
"	3 Runoff Totals on EXIT"				
"	Total Catchment area		0.060	hectare"	
"	Total Impervious area		0.000	hectare"	
"	Total % impervious		0.000"		
" 19	EXIT"				

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"          MIDUSS Output ----->"
"          MIDUSS version                      Version 2.25  rev. 473"
"          MIDUSS created                      February 7, 2010"
"          10  Units used:                      ie METRIC"
"          Job folder:                        C:\Users\XIAOCHEN\Meritech Engineering\
"                                           PRJ - DOCS\4311\60-Design\SWM\Miduss"
"          Output filename:                    4311.div10yrDec232024"
"          Licensee name:                      XIAOCHEN"
"          Company                            HP"
"          Date & Time last used:              2024-12-24 at 9:37:02 AM"
" 81      ADD COMMENT=====
"          1  Lines of comment"
"          501,1504,1604 10yr post"
" 31      TIME PARAMETERS"
"          5.000  Time Step"
"          180.000  Max. Storm length"
"          1500.000  Max. Hydrograph"
" 32      STORM Chicago storm"
"          1  Chicago storm"
"          2221.000  Coefficient A"
"          12.000  Constant B"
"          0.908  Exponent C"
"          0.400  Fraction R"
"          180.000  Duration"
"          1.000  Time step multiplier"
"          Maximum intensity          169.551  mm/hr"
"          Total depth                56.290  mm"
"          6  010hyd  Hydrograph extension used in this file"
" 33      CATCHMENT 1501"
"          1  Triangular SCS"
"          1  Equal length"
"          1  SCS method"
"          1501  rear yard "
"          24.000  % Impervious"
"          0.240  Total Area"
"          40.000  Flow length"
"          2.000  Overland Slope"
"          0.182  Pervious Area"
"          40.000  Pervious length"
"          2.000  Pervious slope"
"          0.058  Impervious Area"
"          40.000  Impervious length"
"          2.000  Impervious slope"
"          0.250  Pervious Manning 'n'"
"          77.000  Pervious SCS Curve No."
"          0.338  Pervious Runoff coefficient"
"          0.100  Pervious Ia/S coefficient"
"          7.587  Pervious Initial abstraction"
"          0.015  Impervious Manning 'n'"
"          98.000  Impervious SCS Curve No."

```

"	0.893	Impervious Runoff coefficient"			
"	0.100	Impervious Ia/S coefficient"			
"	0.518	Impervious Initial abstraction"			
"	0.023	0.000	0.000	0.000	c.m/sec"
"	Catchment 501	Pervious	Impervious	Total Area	"
"	Surface Area	0.182	0.058	0.240	hectare"
"	Time of concentration	18.233	2.165	10.924	minutes"
"	Time to Centroid	118.259	88.064	104.524	minutes"
"	Rainfall depth	56.290	56.290	56.290	mm"
"	Rainfall volume	102.67	32.42	135.10	c.m"
"	Rainfall losses	37.265	6.018	29.766	mm"
"	Runoff depth	19.025	50.272	26.524	mm"
"	Runoff volume	34.70	28.96	63.66	c.m"
"	Runoff coefficient	0.338	0.893	0.471	"
"	Maximum flow	0.013	0.021	0.023	c.m/sec"
" 40	HYDROGRAPH Add Runoff "				
"	4	Add Runoff "			
"	0.023	0.023	0.000	0.000"	
" 40	HYDROGRAPH Start - New Tributary"				
"	2	Start - New Tributary"			
"	0.023	0.000	0.000	0.000"	
" 33	CATCHMENT 1504"				
"	1	Triangular SCS"			
"	1	Equal length"			
"	1	SCS method"			
"	1504	To pond"			
"	63.000	% Impervious"			
"	0.090	Total Area"			
"	15.000	Flow length"			
"	3.000	Overland Slope"			
"	0.033	Pervious Area"			
"	15.000	Pervious length"			
"	2.000	Pervious slope"			
"	0.057	Impervious Area"			
"	15.000	Impervious length"			
"	2.000	Impervious slope"			
"	0.250	Pervious Manning 'n'"			
"	77.000	Pervious SCS Curve No."			
"	0.337	Pervious Runoff coefficient"			
"	0.100	Pervious Ia/S coefficient"			
"	7.587	Pervious Initial abstraction"			
"	0.015	Impervious Manning 'n'"			
"	98.000	Impervious SCS Curve No."			
"	0.887	Impervious Runoff coefficient"			
"	0.100	Impervious Ia/S coefficient"			
"	0.518	Impervious Initial abstraction"			
"	0.023	0.000	0.000	0.000	c.m/sec"
"	Catchment 1504	Pervious	Impervious	Total Area	"
"	Surface Area	0.033	0.057	0.090	hectare"
"	Time of concentration	10.122	1.202	2.828	minutes"

"	Time to Centroid	107.990	86.719	90.596	minutes"
"	Rainfall depth	56.290	56.290	56.290	mm"
"	Rainfall volume	18.74	31.92	50.66	c.m"
"	Rainfall losses	37.344	6.369	17.830	mm"
"	Runoff depth	18.946	49.921	38.460	mm"
"	Runoff volume	6.31	28.31	34.61	c.m"
"	Runoff coefficient	0.337	0.887	0.683	"
"	Maximum flow	0.003	0.022	0.023	c.m/sec"
" 40	HYDROGRAPH Add Runoff "				
"	4 Add Runoff "				
"	0.023 0.023 0.000 0.000"				
" 33	CATCHMENT 1604"				
"	1 Triangular SCS"				
"	1 Equal length"				
"	1 SCS method"				
"	1604 to pond"				
"	62.000 % Impervious"				
"	0.020 Total Area"				
"	30.000 Flow length"				
"	1.000 Overland Slope"				
"	0.008 Pervious Area"				
"	30.000 Pervious length"				
"	2.000 Pervious slope"				
"	0.012 Impervious Area"				
"	30.000 Impervious length"				
"	2.000 Impervious slope"				
"	0.250 Pervious Manning 'n' "				
"	68.000 Pervious SCS Curve No. "				
"	0.213 Pervious Runoff coefficient"				
"	0.100 Pervious Ia/S coefficient"				
"	11.953 Pervious Initial abstraction"				
"	0.015 Impervious Manning 'n' "				
"	98.000 Impervious SCS Curve No. "				
"	0.894 Impervious Runoff coefficient"				
"	0.100 Impervious Ia/S coefficient"				
"	0.518 Impervious Initial abstraction"				
"	0.005 0.023 0.000 0.000 c.m/sec"				
"	Catchment 1604 Pervious Impervious Total Area "				
"	Surface Area 0.008 0.012 0.020 hectare"				
"	Time of concentration 19.668 1.822 4.093 minutes"				
"	Time to Centroid 121.736 87.573 91.921 minutes"				
"	Rainfall depth 56.290 56.290 56.290 mm"				
"	Rainfall volume 4.28 6.98 11.26 c.m"				
"	Rainfall losses 44.311 5.945 20.524 mm"				
"	Runoff depth 11.979 50.345 35.766 mm"				
"	Runoff volume 0.91 6.24 7.15 c.m"				
"	Runoff coefficient 0.213 0.894 0.635 "				
"	Maximum flow 0.000 0.005 0.005 c.m/sec"				
" 40	HYDROGRAPH Add Runoff "				
"	4 Add Runoff "				

"	0.005	0.028	0.000	0.000"
" 38	START/RE-START TOTALS 1604"			
"	3 Runoff Totals on EXIT"			
"	Total Catchment area	0.350	hectare"	
"	Total Impervious area	0.127	hectare"	
"	Total % impervious	36.200"		
" 19	EXIT"			

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"          MIDUSS Output ----->"
"          MIDUSS version                      Version 2.25  rev. 473"
"          MIDUSS created                      February 7, 2010"
"          10  Units used:                      ie METRIC"
"          Job folder:                      C:\M\Meritech Engineering\PRJ - DOCS\4311\
"                                           60-Design\SWM\Miduss"
"          Output filename:                  4311.d100yrJan092025"
"          Licensee name:                    SusieC"
"          Company                          Meritech Engineering"
"          Date & Time last used:            2025-01-09 at 11:53:36 AM"
" 81      ADD COMMENT=====
"          1  Lines of comment"
"          100yr post development"
" 31      TIME PARAMETERS"
"          5.000  Time Step"
"          180.000 Max. Storm length"
"          1500.000 Max. Hydrograph"
" 32      STORM Chicago storm"
"          1  Chicago storm"
"          4688.000 Coefficient A"
"          17.000  Constant B"
"          0.962  Exponent C"
"          0.400  Fraction R"
"          180.000 Duration"
"          1.000  Time step multiplier"
"          Maximum intensity          239.650  mm/hr"
"          Total depth                87.263  mm"
"          6  100hyd  Hydrograph extension used in this file"
" 33      CATCHMENT 1601"
"          1  Triangular SCS"
"          1  Equal length"
"          1  SCS method"
"          1601  same 201"
"          0.000  % Impervious"
"          0.020  Total Area"
"          15.000  Flow length"
"          2.000  Overland Slope"
"          0.020  Pervious Area"
"          15.000  Pervious length"
"          2.000  Pervious slope"
"          0.000  Impervious Area"
"          15.000  Impervious length"
"          2.000  Impervious slope"
"          0.250  Pervious Manning 'n'"
"          68.000  Pervious SCS Curve No."
"          0.332  Pervious Runoff coefficient"
"          0.100  Pervious Ia/S coefficient"
"          11.953  Pervious Initial abstraction"
"          0.015  Impervious Manning 'n'"
"          98.000  Impervious SCS Curve No."

```

"	0.000	Impervious Runoff coefficient"			
"	0.100	Impervious Ia/S coefficient"			
"	0.518	Impervious Initial abstraction"			
"	0.003	0.000	0.000	0.000 c.m/sec"	
"		Catchment 1601	Pervious	Impervious	Total Area "
"		Surface Area	0.020	0.000	0.020 hectare"
"		Time of concentration	8.890	1.039	8.890 minutes"
"		Time to Centroid	105.473	85.361	105.473 minutes"
"		Rainfall depth	87.263	87.263	87.263 mm"
"		Rainfall volume	17.45	0.00	17.45 c.m"
"		Rainfall losses	58.307	7.853	58.307 mm"
"		Runoff depth	28.957	79.410	28.957 mm"
"		Runoff volume	5.79	0.00	5.79 c.m"
"		Runoff coefficient	0.332	0.000	0.332 "
"		Maximum flow	0.003	0.000	0.003 c.m/sec"
" 40		HYDROGRAPH Add Runoff "			
"	4	Add Runoff "			
"	0.003	0.003	0.000	0.000"	
" 33		CATCHMENT 1501"			
"	1	Triangular SCS"			
"	1	Equal length"			
"	1	SCS method"			
"	1501	overflow to king street"			
"	24.000	% Impervious"			
"	0.240	Total Area"			
"	40.000	Flow length"			
"	2.000	Overland Slope"			
"	0.182	Pervious Area"			
"	40.000	Pervious length"			
"	2.000	Pervious slope"			
"	0.058	Impervious Area"			
"	40.000	Impervious length"			
"	2.000	Impervious slope"			
"	0.250	Pervious Manning 'n'"			
"	77.000	Pervious SCS Curve No."			
"	0.467	Pervious Runoff coefficient"			
"	0.100	Pervious Ia/S coefficient"			
"	7.587	Pervious Initial abstraction"			
"	0.015	Impervious Manning 'n'"			
"	98.000	Impervious SCS Curve No."			
"	0.926	Impervious Runoff coefficient"			
"	0.100	Impervious Ia/S coefficient"			
"	0.518	Impervious Initial abstraction"			
"	0.048	0.003	0.000	0.000 c.m/sec"	
"		Catchment 1501	Pervious	Impervious	Total Area "
"		Surface Area	0.182	0.058	0.240 hectare"
"		Time of concentration	13.539	1.871	9.045 minutes"
"		Time to Centroid	109.428	86.432	100.570 minutes"
"		Rainfall depth	87.263	87.263	87.263 mm"
"		Rainfall volume	159.17	50.26	209.43 c.m"

"		Rainfall losses	46.540	6.470	36.924	mm"
"		Runoff depth	40.723	80.794	50.340	mm"
"		Runoff volume	74.28	46.54	120.82	c.m"
"		Runoff coefficient	0.467	0.926	0.577	"
"		Maximum flow	0.034	0.032	0.048	c.m/sec"
" 40		HYDROGRAPH Add Runoff "				
"	4	Add Runoff "				
"		0.048	0.051	0.000	0.000"	
" 56		DIVERSION"				
"	2	Node number"				
"	0.024	Overflow threshold"				
"	1.000	Required diverted fraction"				
"	0	Conduit type; 1=Pipe;2=Channel"				
"		Peak of diverted flow	0.027		c.m/sec"	
"		Volume of diverted flow	32.416		c.m"	
"		DIV00002.100hyd"				
"		Major flow at 2"				
"		0.048	0.051	0.024	0.000 c.m/sec"	
" 40		HYDROGRAPH Combine 100"				
"	6	Combine "				
"	100	Node #"				
"		post "				
"		Maximum flow	0.024		c.m/sec"	
"		Hydrograph volume	94.192		c.m"	
"		0.048	0.051	0.024	0.024"	
" 40		HYDROGRAPH Start - New Tributary"				
"	2	Start - New Tributary"				
"		0.048	0.000	0.024	0.024"	
" 33		CATCHMENT 1502"				
"	1	Triangular SCS"				
"	1	Equal length"				
"	1	SCS method"				
"	1502	To forest"				
"	26.000	% Impervious"				
"	0.210	Total Area"				
"	40.000	Flow length"				
"	2.000	Overland Slope"				
"	0.155	Pervious Area"				
"	40.000	Pervious length"				
"	2.000	Pervious slope"				
"	0.055	Impervious Area"				
"	40.000	Impervious length"				
"	2.000	Impervious slope"				
"	0.250	Pervious Manning 'n'"				
"	68.000	Pervious SCS Curve No."				
"	0.333	Pervious Runoff coefficient"				
"	0.100	Pervious Ia/S coefficient"				
"	11.953	Pervious Initial abstraction"				
"	0.015	Impervious Manning 'n'"				
"	98.000	Impervious SCS Curve No."				

"	0.926	Impervious Runoff coefficient"			
"	0.100	Impervious Ia/S coefficient"			
"	0.518	Impervious Initial abstraction"			
"		0.033	0.000	0.024	0.024 c.m/sec"
"		Catchment 1502	Pervious	Impervious	Total Area "
"		Surface Area	0.155	0.055	0.210 hectare"
"		Time of concentration	16.013	1.871	9.023 minutes"
"		Time to Centroid	114.186	86.432	100.467 minutes"
"		Rainfall depth	87.263	87.263	87.263 mm"
"		Rainfall volume	135.61	47.65	183.25 c.m"
"		Rainfall losses	58.220	6.470	44.765 mm"
"		Runoff depth	29.043	80.794	42.498 mm"
"		Runoff volume	45.13	44.11	89.25 c.m"
"		Runoff coefficient	0.333	0.926	0.487 "
"		Maximum flow	0.018	0.030	0.033 c.m/sec"
" 40		HYDROGRAPH Add Runoff "			
"	4	Add Runoff "			
"		0.033	0.033	0.024	0.024"
" 33		CATCHMENT 1603"			
"	1	Triangular SCS"			
"	1	Equal length"			
"	1	SCS method"			
"	1603	same as 203"			
"	0.000	% Impervious"			
"	0.150	Total Area"			
"	15.000	Flow length"			
"	3.000	Overland Slope"			
"	0.150	Pervious Area"			
"	15.000	Pervious length"			
"	3.000	Pervious slope"			
"	0.000	Impervious Area"			
"	15.000	Impervious length"			
"	3.000	Impervious slope"			
"	0.250	Pervious Manning 'n'"			
"	68.000	Pervious SCS Curve No."			
"	0.332	Pervious Runoff coefficient"			
"	0.100	Pervious Ia/S coefficient"			
"	11.953	Pervious Initial abstraction"			
"	0.015	Impervious Manning 'n'"			
"	98.000	Impervious SCS Curve No."			
"	0.000	Impervious Runoff coefficient"			
"	0.100	Impervious Ia/S coefficient"			
"	0.518	Impervious Initial abstraction"			
"		0.024	0.033	0.024	0.024 c.m/sec"
"		Catchment 1603	Pervious	Impervious	Total Area "
"		Surface Area	0.150	0.000	0.150 hectare"
"		Time of concentration	7.871	0.920	7.871 minutes"
"		Time to Centroid	104.280	85.207	104.280 minutes"
"		Rainfall depth	87.263	87.263	87.263 mm"
"		Rainfall volume	130.90	0.00	130.90 c.m"

"	Rainfall losses	58.265	8.642	58.265	mm"
"	Runoff depth	28.999	78.621	28.999	mm"
"	Runoff volume	43.50	0.00	43.50	c.m"
"	Runoff coefficient	0.332	0.000	0.332	"
"	Maximum flow	0.024	0.000	0.024	c.m/sec"
" 40	HYDROGRAPH Add Runoff "				
"	4 Add Runoff "				
"	0.024 0.055 0.024 0.024"				
" 33	CATCHMENT 1506"				
"	1 Triangular SCS"				
"	1 Equal length"				
"	1 SCS method"				
"	1506 7units rear yard"				
"	34.000 % Impervious"				
"	0.060 Total Area"				
"	33.000 Flow length"				
"	2.000 Overland Slope"				
"	0.040 Pervious Area"				
"	33.000 Pervious length"				
"	2.000 Pervious slope"				
"	0.020 Impervious Area"				
"	33.000 Impervious length"				
"	2.000 Impervious slope"				
"	0.250 Pervious Manning 'n' "				
"	77.000 Pervious SCS Curve No."				
"	0.466 Pervious Runoff coefficient"				
"	0.100 Pervious Ia/S coefficient"				
"	7.587 Pervious Initial abstraction"				
"	0.015 Impervious Manning 'n' "				
"	98.000 Impervious SCS Curve No."				
"	0.926 Impervious Runoff coefficient"				
"	0.100 Impervious Ia/S coefficient"				
"	0.518 Impervious Initial abstraction"				
"	0.015 0.055 0.024 0.024 c.m/sec"				
"	Catchment 1506 Pervious Impervious Total Area "				
"	Surface Area 0.040 0.020 0.060 hectare"				
"	Time of concentration 12.063 1.667 6.806 minutes"				
"	Time to Centroid 107.541 86.158 96.727 minutes"				
"	Rainfall depth 87.263 87.263 87.263 mm"				
"	Rainfall volume 34.56 17.80 52.36 c.m"				
"	Rainfall losses 46.578 6.452 32.935 mm"				
"	Runoff depth 40.686 80.811 54.328 mm"				
"	Runoff volume 16.11 16.49 32.60 c.m"				
"	Runoff coefficient 0.466 0.926 0.623 "				
"	Maximum flow 0.008 0.011 0.015 c.m/sec"				
" 40	HYDROGRAPH Add Runoff "				
"	4 Add Runoff "				
"	0.015 0.070 0.024 0.024"				
" 40	HYDROGRAPH Copy to Outflow"				
"	8 Copy to Outflow"				

"		0.015	0.070	0.070	0.024"
" 40	HYDROGRAPH	Combine	100"		
"	6	Combine "			
"	100	Node #"			
"		post "			
"		Maximum flow	0.094	c.m/sec"	
"		Hydrograph volume	259.533	c.m"	
"		0.015	0.070	0.070	0.094"
" 40	HYDROGRAPH	Start - New Tributary"			
"	2	Start - New Tributary"			
"		0.015	0.000	0.070	0.094"
" 33	CATCHMENT	1503"			
"	1	Triangular SCS"			
"	1	Equal length"			
"	1	SCS method"			
"	1503	To King Street"			
"	63.000	% Impervious"			
"	0.090	Total Area"			
"	15.000	Flow length"			
"	3.000	Overland Slope"			
"	0.033	Pervious Area"			
"	15.000	Pervious length"			
"	3.000	Pervious slope"			
"	0.057	Impervious Area"			
"	15.000	Impervious length"			
"	3.000	Impervious slope"			
"	0.250	Pervious Manning 'n'"			
"	77.000	Pervious SCS Curve No."			
"	0.463	Pervious Runoff coefficient"			
"	0.100	Pervious Ia/S coefficient"			
"	7.587	Pervious Initial abstraction"			
"	0.015	Impervious Manning 'n'"			
"	98.000	Impervious SCS Curve No."			
"	0.901	Impervious Runoff coefficient"			
"	0.100	Impervious Ia/S coefficient"			
"	0.518	Impervious Initial abstraction"			
"		0.036	0.000	0.070	0.094 c.m/sec"
"	Catchment 1503	Pervious	Impervious	Total Area	"
"	Surface Area	0.033	0.057	0.090	hectare"
"	Time of concentration	6.656	0.920	2.249	minutes"
"	Time to Centroid	100.831	85.207	88.829	minutes"
"	Rainfall depth	87.263	87.263	87.263	mm"
"	Rainfall volume	29.06	49.48	78.54	c.m"
"	Rainfall losses	46.869	8.642	22.786	mm"
"	Runoff depth	40.395	78.621	64.478	mm"
"	Runoff volume	13.45	44.58	58.03	c.m"
"	Runoff coefficient	0.463	0.901	0.739	"
"	Maximum flow	0.008	0.033	0.036	c.m/sec"
" 40	HYDROGRAPH	Add Runoff "			
"	4	Add Runoff "			

"		0.036	0.036	0.070	0.094"
" 33	CATCHMENT 1602"				
"	1	Triangular SCS"			
"	1	Equal length"			
"	1	SCS method"			
"	1602	same 202"			
"	0.000	% Impervious"			
"	0.040	Total Area"			
"	15.000	Flow length"			
"	2.000	Overland Slope"			
"	0.040	Pervious Area"			
"	15.000	Pervious length"			
"	2.000	Pervious slope"			
"	0.000	Impervious Area"			
"	15.000	Impervious length"			
"	2.000	Impervious slope"			
"	0.250	Pervious Manning 'n'"			
"	68.000	Pervious SCS Curve No."			
"	0.332	Pervious Runoff coefficient"			
"	0.100	Pervious Ia/S coefficient"			
"	11.953	Pervious Initial abstraction"			
"	0.015	Impervious Manning 'n'"			
"	98.000	Impervious SCS Curve No."			
"	0.000	Impervious Runoff coefficient"			
"	0.100	Impervious Ia/S coefficient"			
"	0.518	Impervious Initial abstraction"			
"		0.006	0.036	0.070	0.094 c.m/sec"
"	Catchment 1602	Pervious	Impervious	Total Area	"
"	Surface Area	0.040	0.000	0.040	hectare"
"	Time of concentration	8.890	1.039	8.890	minutes"
"	Time to Centroid	105.473	85.361	105.473	minutes"
"	Rainfall depth	87.263	87.263	87.263	mm"
"	Rainfall volume	34.91	0.00	34.91	c.m"
"	Rainfall losses	58.307	7.853	58.307	mm"
"	Runoff depth	28.957	79.410	28.957	mm"
"	Runoff volume	11.58	0.00	11.58	c.m"
"	Runoff coefficient	0.332	0.000	0.332	"
"	Maximum flow	0.006	0.000	0.006	c.m/sec"
" 40	HYDROGRAPH Add Runoff "				
"	4	Add Runoff "			
"		0.006	0.038	0.070	0.094"
" 40	HYDROGRAPH Copy to Outflow"				
"	8	Copy to Outflow"			
"		0.006	0.038	0.038	0.094"
" 40	HYDROGRAPH Combine 200"				
"	6	Combine "			
"	200	Node #"			
"	To King Street "				
"	Maximum flow	0.038	c.m/sec"		
"	Hydrograph volume	69.612	c.m"		

```

"          0.006      0.038      0.038      0.038"
" 47      FILEI_0 Read/Open DIV00001.100hyd"
"          1  1=read/open; 2=write/save"
"          2  1=rainfall; 2=hydrograph"
"          3  1=runoff; 2=inflow; 3=outflow; 4=junction"
"          DIV00001.100hyd"
"          Major flow at 1"
"          Total volume              7.859      c.m"
"          Maximum flow              0.017      c.m/sec"
"          0.006      0.038      0.017      0.038 c.m/sec"
" 40      HYDROGRAPH  Combine      200"
"          6  Combine "
"          200  Node #"
"          To King Street "
"          Maximum flow              0.055      c.m/sec"
"          Hydrograph volume        77.472      c.m"
"          0.006      0.038      0.017      0.055"
" 47      FILEI_0 Read/Open DIV00002.100hyd"
"          1  1=read/open; 2=write/save"
"          2  1=rainfall; 2=hydrograph"
"          3  1=runoff; 2=inflow; 3=outflow; 4=junction"
"          DIV00002.100hyd"
"          Major flow at 2"
"          Total volume              32.416      c.m"
"          Maximum flow              0.027      c.m/sec"
"          0.006      0.038      0.027      0.055 c.m/sec"
" 40      HYDROGRAPH  Combine      200"
"          6  Combine "
"          200  Node #"
"          To King Street "
"          Maximum flow              0.071      c.m/sec"
"          Hydrograph volume        109.887      c.m"
"          0.006      0.038      0.027      0.071"
" 40      HYDROGRAPH  Confluence    200"
"          7  Confluence "
"          200  Node #"
"          To King Street "
"          Maximum flow              0.071      c.m/sec"
"          Hydrograph volume        109.887      c.m"
"          0.006      0.071      0.027      0.000"
" 40      HYDROGRAPH Copy to Outflow"
"          8  Copy to Outflow"
"          0.006      0.071      0.071      0.000"
" 40      HYDROGRAPH  Combine      100"
"          6  Combine "
"          100  Node #"
"          post "
"          Maximum flow              0.164      c.m/sec"
"          Hydrograph volume        369.420      c.m"
"          0.006      0.071      0.071      0.164"

```

" 38	START/RE-START TOTALS 200"		
"	3 Runoff Totals on EXIT"		
"	Total Catchment area	0.810	hectare"
"	Total Impervious area	0.189	hectare"
"	Total % impervious	23.370"	
" 19	EXIT"		

Appendix D.3: Existing Pond Analysis



```

"          MIDUSS Output ----->"
"          MIDUSS version                      Version 2.25  rev. 473"
"          MIDUSS created                      February 7, 2010"
"          10  Units used:                      ie METRIC"
"          Job folder:          C:\M\Meritech Engineering\PRJ - DOCS\4311\"
"                                60-Design\SWM\Miduss\To Pond Analysis"
"          Output filename:          4311.4100d100yr2025-01-07.out"
"          Licensee name:                      SusieC"
"          Company                      Meritech Engineering"
"          Date & Time last used:          2025-01-09 at 1:49:23 PM"
" 31          TIME PARAMETERS"
"          5.000  Time Step"
"          180.000  Max. Storm length"
"          1500.000  Max. Hydrograph"
" 81          ADD COMMENT=====
"          4  Lines of comment"
"          Valleyview Heights Subdivision, St. Jacobs"
"          Final Stormwater Management Analysis"
"          Post-development Conditions for the 100-year, 3-hour Storm "
"          Event including future development of 1065 Old Scout Place"
" 32          STORM Chicago storm"
"          1  Chicago storm"
"          4692.000  Coefficient A"
"          17.437  Constant B"
"          0.956  Exponent C"
"          0.400  Fraction R"
"          180.000  Duration"
"          1.000  Time step multiplier"
"          Maximum intensity          239.793  mm/hr"
"          Total depth          89.960  mm"
"          8  100yrhyd  Hydrograph extension used in this file"
" 81          ADD COMMENT=====
"          1  Lines of comment"
"          Catchments draining directly to culvert under Printery Road"
" 33          CATCHMENT 506"
"          1  Triangular SCS"
"          1  Equal length"
"          1  SCS method"
"          506  Future development on 1065 Old Scout Place"
"          62.000  % Impervious"
"          0.180  Total Area"
"          15.000  Flow length"
"          2.500  Overland Slope"
"          0.068  Pervious Area"
"          15.000  Pervious length"
"          2.500  Pervious slope"
"          0.112  Impervious Area"
"          15.000  Impervious length"
"          2.500  Impervious slope"
"          0.250  Pervious Manning 'n'"

```

"	74.000	Pervious SCS Curve No."			
"	0.465	Pervious Runoff coefficient"			
"	0.045	Pervious Ia/S coefficient"			
"	4.016	Pervious Initial abstraction"			
"	0.015	Impervious Manning 'n'"			
"	98.000	Impervious SCS Curve No."			
"	0.907	Impervious Runoff coefficient"			
"	0.097	Impervious Ia/S coefficient"			
"	0.503	Impervious Initial abstraction"			
"		0.072	0.000	0.000	0.000 c.m/sec"
"		Catchment 506	Pervious	Impervious	Total Area "
"		Surface Area	0.068	0.112	0.180 hectare"
"		Time of concentration	7.047	0.971	2.424 minutes"
"		Time to Centroid	101.061	85.429	89.167 minutes"
"		Rainfall depth	89.960	89.960	89.960 mm"
"		Rainfall volume	61.53	100.40	161.93 c.m"
"		Rainfall losses	48.115	8.344	23.457 mm"
"		Runoff depth	41.845	81.616	66.503 mm"
"		Runoff volume	28.62	91.08	119.71 c.m"
"		Runoff coefficient	0.465	0.907	0.739 "
"		Maximum flow	0.017	0.065	0.072 c.m/sec"
" 40		HYDROGRAPH Add Runoff "			
"	4	Add Runoff "			
"		0.072	0.072	0.000	0.000"
" 33		CATCHMENT 602"			
"	1	Triangular SCS"			
"	1	Equal length"			
"	1	SCS method"			
"	602	Part of Township Road 42 right of way"			
"	95.000	% Impervious"			
"	0.180	Total Area"			
"	5.000	Flow length"			
"	4.000	Overland Slope"			
"	0.009	Pervious Area"			
"	5.000	Pervious length"			
"	4.000	Pervious slope"			
"	0.171	Impervious Area"			
"	5.000	Impervious length"			
"	4.000	Impervious slope"			
"	0.250	Pervious Manning 'n'"			
"	74.000	Pervious SCS Curve No."			
"	0.458	Pervious Runoff coefficient"			
"	0.045	Pervious Ia/S coefficient"			
"	4.016	Pervious Initial abstraction"			
"	0.015	Impervious Manning 'n'"			
"	98.000	Impervious SCS Curve No."			
"	0.829	Impervious Runoff coefficient"			
"	0.097	Impervious Ia/S coefficient"			
"	0.503	Impervious Initial abstraction"			
"		0.097	0.072	0.000	0.000 c.m/sec"

"	Catchment 602	Pervious	Impervious	Total Area	"
"	Surface Area	0.009	0.171	0.180	hectare"
"	Time of concentration	3.166	0.436	0.513	minutes"
"	Time to Centroid	96.040	84.966	85.278	minutes"
"	Rainfall depth	89.960	89.960	89.960	mm"
"	Rainfall volume	8.10	153.83	161.93	c.m"
"	Rainfall losses	48.773	15.410	17.078	mm"
"	Runoff depth	41.187	74.550	72.882	mm"
"	Runoff volume	3.71	127.48	131.19	c.m"
"	Runoff coefficient	0.458	0.829	0.810	"
"	Maximum flow	0.002	0.095	0.097	c.m/sec"
" 40	HYDROGRAPH Add Runoff "				
"	4 Add Runoff "				
"	0.097 0.169 0.000 0.000"				
" 33	CATCHMENT 501"				
"	1 Triangular SCS"				
"	1 Equal length"				
"	1 SCS method"				
"	501 Township Road 42 road widening area"				
"	10.000 % Impervious"				
"	0.070 Total Area"				
"	5.000 Flow length"				
"	33.000 Overland Slope"				
"	0.063 Pervious Area"				
"	5.000 Pervious length"				
"	33.000 Pervious slope"				
"	0.007 Impervious Area"				
"	5.000 Impervious length"				
"	33.000 Impervious slope"				
"	0.250 Pervious Manning 'n'"				
"	74.000 Pervious SCS Curve No."				
"	0.463 Pervious Runoff coefficient"				
"	0.045 Pervious Ia/S coefficient"				
"	4.016 Pervious Initial abstraction"				
"	0.015 Impervious Manning 'n'"				
"	98.000 Impervious SCS Curve No."				
"	0.808 Impervious Runoff coefficient"				
"	0.097 Impervious Ia/S coefficient"				
"	0.503 Impervious Initial abstraction"				
"	0.020 0.169 0.000 0.000 c.m/sec"				
"	Catchment 501	Pervious	Impervious	Total Area	"
"	Surface Area	0.063	0.007	0.070	hectare"
"	Time of concentration	1.681	0.232	1.445	minutes"
"	Time to Centroid	93.834	84.018	92.239	minutes"
"	Rainfall depth	89.960	89.960	89.960	mm"
"	Rainfall volume	56.67	6.30	62.97	c.m"
"	Rainfall losses	48.327	17.230	45.217	mm"
"	Runoff depth	41.633	72.730	44.743	mm"
"	Runoff volume	26.23	5.09	31.32	c.m"
"	Runoff coefficient	0.463	0.808	0.497	"

"		Maximum flow	0.016	0.004	0.020	c.m/sec"
" 40		HYDROGRAPH Add Runoff "				
"	4	Add Runoff "				
"		0.020 0.189 0.000 0.000"				
" 40		HYDROGRAPH Copy to Outflow"				
"	8	Copy to Outflow"				
"		0.020 0.189 0.189 0.000"				
" 40		HYDROGRAPH Combine 501"				
"	6	Combine "				
"	501	Node #"				
"		Culvert flow"				
"		Maximum flow	0.189			c.m/sec"
"		Hydrograph volume	282.213			c.m"
"		0.020 0.189 0.189 0.189"				
" 40		HYDROGRAPH Start - New Tributary"				
"	2	Start - New Tributary"				
"		0.020 0.000 0.189 0.189"				
" 81		ADD COMMENT=====				
"	2	Lines of comment"				
"		Catchments draining to proposed SWM facility from "				
"		Printery Road Development"				
" 33		CATCHMENT 1504"				
"	1	Triangular SCS"				
"	1	Equal length"				
"	1	SCS method"				
"	1504	Printery Road Additional Area "				
"	63.000	% Impervious"				
"	0.090	Total Area"				
"	15.000	Flow length"				
"	3.000	Overland Slope"				
"	0.033	Pervious Area"				
"	15.000	Pervious length"				
"	3.000	Pervious slope"				
"	0.057	Impervious Area"				
"	15.000	Impervious length"				
"	3.000	Impervious slope"				
"	0.250	Pervious Manning 'n'"				
"	77.000	Pervious SCS Curve No."				
"	0.516	Pervious Runoff coefficient"				
"	0.033	Pervious Ia/S coefficient"				
"	2.504	Pervious Initial abstraction"				
"	0.015	Impervious Manning 'n'"				
"	98.000	Impervious SCS Curve No."				
"	0.903	Impervious Runoff coefficient"				
"	0.097	Impervious Ia/S coefficient"				
"	0.503	Impervious Initial abstraction"				
"		0.038 0.000 0.189 0.189 c.m/sec"				
"		Catchment 1504 Pervious Impervious Total Area "				
"		Surface Area 0.033 0.057 0.090 hectare"				
"		Time of concentration 6.359 0.919 2.286 minutes"				

"	Time to Centroid	99.356	85.366	88.880	minutes"
"	Rainfall depth	89.960	89.960	89.960	mm"
"	Rainfall volume	29.96	51.01	80.96	c.m"
"	Rainfall losses	43.569	8.734	21.623	mm"
"	Runoff depth	46.391	81.226	68.337	mm"
"	Runoff volume	15.45	46.06	61.50	c.m"
"	Runoff coefficient	0.516	0.903	0.760	"
"	Maximum flow	0.009	0.033	0.038	c.m/sec"
" 40	HYDROGRAPH Add Runoff "				
"	4 Add Runoff "				
"	0.038 0.038 0.189 0.189"				
" 33	CATCHMENT 1604"				
"	1 Triangular SCS"				
"	1 Equal length"				
"	1 SCS method"				
"	1604 Printery Road Additional Area "				
"	62.000 % Impervious"				
"	0.020 Total Area"				
"	30.000 Flow length"				
"	1.000 Overland Slope"				
"	0.008 Pervious Area"				
"	30.000 Pervious length"				
"	1.000 Pervious slope"				
"	0.012 Impervious Area"				
"	30.000 Impervious length"				
"	1.000 Impervious slope"				
"	0.250 Pervious Manning 'n' "				
"	68.000 Pervious SCS Curve No."				
"	0.400 Pervious Runoff coefficient"				
"	0.033 Pervious Ia/S coefficient"				
"	3.944 Pervious Initial abstraction"				
"	0.015 Impervious Manning 'n' "				
"	98.000 Impervious SCS Curve No."				
"	0.927 Impervious Runoff coefficient"				
"	0.097 Impervious Ia/S coefficient"				
"	0.503 Impervious Initial abstraction"				
"	0.007 0.038 0.189 0.189 c.m/sec"				
"	Catchment 1604 Pervious Impervious Total Area "				
"	Surface Area 0.008 0.012 0.020 hectare"				
"	Time of concentration 15.149 1.937 4.698 minutes"				
"	Time to Centroid 111.864 86.690 91.951 minutes"				
"	Rainfall depth 89.960 89.960 89.960 mm"				
"	Rainfall volume 6.84 11.16 17.99 c.m"				
"	Rainfall losses 54.006 6.553 24.585 mm"				
"	Runoff depth 35.954 83.407 65.375 mm"				
"	Runoff volume 2.73 10.34 13.07 c.m"				
"	Runoff coefficient 0.400 0.927 0.727 "				
"	Maximum flow 0.001 0.007 0.007 c.m/sec"				
" 40	HYDROGRAPH Add Runoff "				
"	4 Add Runoff "				

"		0.007	0.045	0.189	0.189"
" 56	DIVERSION"				
"	1	Node number"			
"	0.028	Overflow threshold"			
"	1.000	Required diverted fraction"			
"	0	Conduit type; 1=Pipe;2=Channel"			
"		Peak of diverted flow	0.017	c.m/sec"	
"		Volume of diverted flow	7.859	c.m"	
"		DIV00001.100yrhyd"			
"		Major flow at 1"			
"		0.007	0.045	0.028	0.189 c.m/sec"
" 40	HYDROGRAPH	Combine	704"		
"	6	Combine "			
"	704	Node #"			
"		Culvert flow"			
"		Maximum flow	0.028	c.m/sec"	
"		Hydrograph volume	66.719	c.m"	
"		0.007	0.045	0.028	0.028"
" 40	HYDROGRAPH	Start - New Tributary"			
"	2	Start - New Tributary"			
"		0.007	0.000	0.028	0.028"
" 33	CATCHMENT 1505"				
"	1	Triangular SCS"			
"	1	Equal length"			
"	1	SCS method"			
"	1505	To Printery Road uncontrolled"			
"	22.000	% Impervious"			
"	0.040	Total Area"			
"	20.000	Flow length"			
"	2.000	Overland Slope"			
"	0.031	Pervious Area"			
"	20.000	Pervious length"			
"	2.000	Pervious slope"			
"	0.009	Impervious Area"			
"	20.000	Impervious length"			
"	2.000	Impervious slope"			
"	0.250	Pervious Manning 'n'"			
"	77.000	Pervious SCS Curve No."			
"	0.518	Pervious Runoff coefficient"			
"	0.033	Pervious Ia/S coefficient"			
"	2.504	Pervious Initial abstraction"			
"	0.015	Impervious Manning 'n'"			
"	98.000	Impervious SCS Curve No."			
"	0.921	Impervious Runoff coefficient"			
"	0.097	Impervious Ia/S coefficient"			
"	0.503	Impervious Initial abstraction"			
"		0.011	0.000	0.028	0.028 c.m/sec"
"		Catchment 1505	Pervious	Impervious	Total Area "
"		Surface Area	0.031	0.009	0.040 hectare"
"		Time of concentration	8.535	1.234	6.096 minutes"

"	Time to Centroid	102.088	85.752	96.631	minutes"
"	Rainfall depth	89.960	89.960	89.960	mm"
"	Rainfall volume	28.07	7.92	35.98	c.m"
"	Rainfall losses	43.355	7.079	35.375	mm"
"	Runoff depth	46.605	82.881	54.585	mm"
"	Runoff volume	14.54	7.29	21.83	c.m"
"	Runoff coefficient	0.518	0.921	0.607	"
"	Maximum flow	0.008	0.005	0.011	c.m/sec"
" 40	HYDROGRAPH Add Runoff "				
"	4 Add Runoff "				
"	0.011 0.011 0.028 0.028"				
" 40	HYDROGRAPH Copy to Outflow"				
"	8 Copy to Outflow"				
"	0.011 0.011 0.011 0.028"				
" 40	HYDROGRAPH Combine 704"				
"	6 Combine "				
"	704 Node #"				
"	Culvert flow"				
"	Maximum flow	0.039			c.m/sec"
"	Hydrograph volume	88.553			c.m"
"	0.011 0.011 0.011 0.039"				
" 40	HYDROGRAPH Start - New Tributary"				
"	2 Start - New Tributary"				
"	0.011 0.000 0.011 0.039"				
" 33	CATCHMENT 1701"				
"	1 Triangular SCS"				
"	1 Equal length"				
"	1 SCS method"				
"	1701 Printery Road controlled with ponding"				
"	80.000 % Impervious"				
"	0.260 Total Area"				
"	30.000 Flow length"				
"	1.000 Overland Slope"				
"	0.052 Pervious Area"				
"	30.000 Pervious length"				
"	1.000 Pervious slope"				
"	0.208 Impervious Area"				
"	30.000 Impervious length"				
"	1.000 Impervious slope"				
"	0.250 Pervious Manning 'n'"				
"	77.000 Pervious SCS Curve No."				
"	0.519 Pervious Runoff coefficient"				
"	0.033 Pervious Ia/S coefficient"				
"	2.504 Pervious Initial abstraction"				
"	0.015 Impervious Manning 'n'"				
"	98.000 Impervious SCS Curve No."				
"	0.927 Impervious Runoff coefficient"				
"	0.097 Impervious Ia/S coefficient"				
"	0.503 Impervious Initial abstraction"				
"	0.118 0.000 0.011 0.039 c.m/sec"				

	Catchment 1701	Pervious	Impervious	Total Area	
	Surface Area	0.052	0.208	0.260	hectare"
	Time of concentration	13.402	1.937	3.345	minutes"
	Time to Centroid	108.450	86.690	89.362	minutes"
	Rainfall depth	89.960	89.960	89.960	mm"
	Rainfall volume	46.78	187.12	233.90	c.m"
	Rainfall losses	43.255	6.553	13.894	mm"
	Runoff depth	46.705	83.407	76.067	mm"
	Runoff volume	24.29	173.49	197.77	c.m"
	Runoff coefficient	0.519	0.927	0.846	"
	Maximum flow	0.011	0.115	0.118	c.m/sec"
40	HYDROGRAPH Add Runoff "				
	4 Add Runoff "				
	0.118	0.118	0.011	0.039"	
54	POND DESIGN"				
	0.118	Current peak flow	c.m/sec"		
	0.066	Target outflow	c.m/sec"		
	197.8	Hydrograph volume	c.m"		
	15.	Number of stages"			
	342.900	Minimum water level	metre"		
	344.800	Maximum water level	metre"		
	342.900	Starting water level	metre"		
	0	Keep Design Data: 1 = True; 0 = False"			
		Level Discharge	Volume"		
	342.900	0.000	0.000"		
	343.036	0.00362	1.00E-07"		
	343.171	0.00580	1.00E-07"		
	343.307	0.00737	1.00E-07"		
	343.443	0.00866	1.00E-07"		
	343.579	0.00978	1.00E-07"		
	343.714	0.01078	1.00E-07"		
	343.850	0.01170	1.00E-07"		
	343.986	0.01255	1.00E-07"		
	344.121	0.01334	19.360"		
	344.257	0.01409	41.118"		
	344.393	0.01481	62.881"		
	344.529	0.01549	85.413"		
	344.664	0.01614	121.632"		
	344.800	0.01677	188.935"		
	1.	ORIFICES"			
		Orifice	Orifice	Orifice	Number of"
		invert	coefficie	diameter	orifices"
		342.900	0.630	0.0750	1.000"
	1.	LAYERS"			
		Bottom	Aspect	Bottom	Top
		area	ratio	elevation	elevation
		160.000	1.000	344.000	344.760
					0.000"
	1.	WEDGES"			
		Wedge	Grade 1	Grade 2	Angle
		invert	g1H:1V	g2H:1V	Number"
				subtended	of wedges"

"	344.450	50.000	30.000	90.000	4.000"
"	Peak outflow		0.016	c.m/sec"	
"	Maximum level		344.625	metre"	
"	Maximum storage		111.297	c.m"	
"	Centroidal lag		2.632	hours"	
"	0.118	0.118	0.016	0.039	c.m/sec"
" 40	HYDROGRAPH	Combine	704"		
"	6	Combine "			
"	704	Node #"			
"		Culvert flow"			
"	Maximum flow		0.054	c.m/sec"	
"	Hydrograph volume		286.225	c.m"	
"	0.118	0.118	0.016	0.054"	
" 40	HYDROGRAPH	Start - New Tributary"			
"	2	Start - New Tributary"			
"	0.118	0.000	0.016	0.054"	
" 33	CATCHMENT	802"			
"	1	Triangular SCS"			
"	1	Equal length"			
"	1	SCS method"			
"	802	Rear yards of existing homes along King Stree"			
"	37.000	% Impervious"			
"	0.560	Total Area"			
"	30.000	Flow length"			
"	3.000	Overland Slope"			
"	0.353	Pervious Area"			
"	30.000	Pervious length"			
"	3.000	Pervious slope"			
"	0.207	Impervious Area"			
"	30.000	Impervious length"			
"	3.000	Impervious slope"			
"	0.250	Pervious Manning 'n'"			
"	68.000	Pervious SCS Curve No."			
"	0.399	Pervious Runoff coefficient"			
"	0.033	Pervious Ia/S coefficient"			
"	3.944	Pervious Initial abstraction"			
"	0.015	Impervious Manning 'n'"			
"	98.000	Impervious SCS Curve No."			
"	0.925	Impervious Runoff coefficient"			
"	0.097	Impervious Ia/S coefficient"			
"	0.503	Impervious Initial abstraction"			
"	0.139	0.000	0.016	0.054	c.m/sec"
"	Catchment 802	Pervious	Impervious	Total Area	"
"	Surface Area	0.353	0.207	0.560	hectare"
"	Time of concentration	10.896	1.393	5.418	minutes"
"	Time to Centroid	106.438	85.931	94.618	minutes"
"	Rainfall depth	89.960	89.960	89.960	mm"
"	Rainfall volume	317.38	186.40	503.78	c.m"
"	Rainfall losses	54.038	6.737	36.536	mm"
"	Runoff depth	35.922	83.223	53.424	mm"

"	Runoff volume	126.73	172.44	299.17	c.m"
"	Runoff coefficient	0.399	0.925	0.594	"
"	Maximum flow	0.062	0.119	0.139	c.m/sec"
" 40	HYDROGRAPH Add Runoff "				
"	4 Add Runoff "				
"	0.139	0.139	0.016	0.054"	
" 33	CATCHMENT 701"				
"	1 Triangular SCS"				
"	1 Equal length"				
"	1 SCS method"				
"	701 Subdivision lands draining south"				
"	70.000 % Impervious"				
"	0.770 Total Area"				
"	36.500 Flow length"				
"	2.500 Overland Slope"				
"	0.231 Pervious Area"				
"	36.500 Pervious length"				
"	2.000 Pervious slope"				
"	0.539 Impervious Area"				
"	36.500 Impervious length"				
"	2.000 Impervious slope"				
"	0.250 Pervious Manning 'n'"				
"	61.000 Pervious SCS Curve No."				
"	0.330 Pervious Runoff coefficient"				
"	0.025 Pervious Ia/S coefficient"				
"	4.060 Pervious Initial abstraction"				
"	0.015 Impervious Manning 'n'"				
"	98.000 Impervious SCS Curve No."				
"	0.928 Impervious Runoff coefficient"				
"	0.097 Impervious Ia/S coefficient"				
"	0.503 Impervious Initial abstraction"				
"	0.309	0.139	0.016	0.054 c.m/sec"	
"	Catchment 701	Pervious	Impervious	Total Area	"
"	Surface Area	0.231	0.539	0.770	hectare"
"	Time of concentration	15.120	1.770	3.534	minutes"
"	Time to Centroid	112.352	86.456	89.879	minutes"
"	Rainfall depth	89.960	89.960	89.960	mm"
"	Rainfall volume	207.81	484.88	692.69	c.m"
"	Rainfall losses	60.295	6.484	22.627	mm"
"	Runoff depth	29.665	83.477	67.333	mm"
"	Runoff volume	68.53	449.94	518.46	c.m"
"	Runoff coefficient	0.330	0.928	0.748	"
"	Maximum flow	0.029	0.303	0.309	c.m/sec"
" 40	HYDROGRAPH Add Runoff "				
"	4 Add Runoff "				
"	0.309	0.446	0.016	0.054"	
" 33	CATCHMENT 702"				
"	1 Triangular SCS"				
"	1 Equal length"				
"	1 SCS method"				

"	702	ID number"				
"	48.000	% Impervious"				
"	1.310	Total Area"				
"	26.000	Flow length"				
"	2.500	Overland Slope"				
"	0.681	Pervious Area"				
"	26.000	Pervious length"				
"	2.500	Pervious slope"				
"	0.629	Impervious Area"				
"	26.000	Impervious length"				
"	2.500	Impervious slope"				
"	0.250	Pervious Manning 'n'"				
"	61.000	Pervious SCS Curve No."				
"	0.330	Pervious Runoff coefficient"				
"	0.025	Pervious Ia/S coefficient"				
"	4.060	Pervious Initial abstraction"				
"	0.015	Impervious Manning 'n'"				
"	98.000	Impervious SCS Curve No."				
"	0.924	Impervious Runoff coefficient"				
"	0.097	Impervious Ia/S coefficient"				
"	0.503	Impervious Initial abstraction"				
"		0.387	0.446	0.016	0.054 c.m/sec"	
"		Catchment 702	Pervious	Impervious	Total Area	"
"		Surface Area	0.681	0.629	1.310	hectare"
"		Time of concentration	11.537	1.350	4.188	minutes"
"		Time to Centroid	107.826	85.875	91.991	minutes"
"		Rainfall depth	89.960	89.960	89.960	mm"
"		Rainfall volume	612.81	565.67	1178.48	c.m"
"		Rainfall losses	60.317	6.808	34.633	mm"
"		Runoff depth	29.643	83.152	55.327	mm"
"		Runoff volume	201.93	522.86	724.79	c.m"
"		Runoff coefficient	0.330	0.924	0.615	"
"		Maximum flow	0.094	0.362	0.387	c.m/sec"
" 40		HYDROGRAPH Add Runoff "				
"	4	Add Runoff "				
"		0.387	0.833	0.016	0.054"	
" 33		CATCHMENT 703"				
"	1	Triangular SCS"				
"	1	Equal length"				
"	1	SCS method"				
"	703	ID number"				
"	58.000	% Impervious"				
"	1.220	Total Area"				
"	41.500	Flow length"				
"	2.500	Overland Slope"				
"	0.512	Pervious Area"				
"	41.500	Pervious length"				
"	2.500	Pervious slope"				
"	0.708	Impervious Area"				
"	41.500	Impervious length"				

"	2.500	Impervious slope"				
"	0.250	Pervious Manning 'n'"				
"	61.000	Pervious SCS Curve No."				
"	0.330	Pervious Runoff coefficient"				
"	0.025	Pervious Ia/S coefficient"				
"	4.060	Pervious Initial abstraction"				
"	0.015	Impervious Manning 'n'"				
"	98.000	Impervious SCS Curve No."				
"	0.928	Impervious Runoff coefficient"				
"	0.097	Impervious Ia/S coefficient"				
"	0.503	Impervious Initial abstraction"				
"		0.409	0.833	0.016	0.054 c.m/sec"	
"		Catchment 703	Pervious	Impervious	Total Area	"
"		Surface Area	0.512	0.708	1.220	hectare"
"		Time of concentration	15.274	1.788	4.549	minutes"
"		Time to Centroid	112.551	86.478	91.816	minutes"
"		Rainfall depth	89.960	89.960	89.960	mm"
"		Rainfall volume	460.96	636.56	1097.51	c.m"
"		Rainfall losses	60.288	6.492	29.086	mm"
"		Runoff depth	29.672	83.469	60.874	mm"
"		Runoff volume	152.04	590.62	742.66	c.m"
"		Runoff coefficient	0.330	0.928	0.677	"
"		Maximum flow	0.063	0.397	0.409	c.m/sec"
" 40		HYDROGRAPH Add Runoff "				
"	4	Add Runoff "				
"		0.409	1.242	0.016	0.054"	
" 33		CATCHMENT 704"				
"	1	Triangular SCS"				
"	1	Equal length"				
"	1	SCS method"				
"	704	ID number"				
"	41.000	% Impervious"				
"	2.910	Total Area"				
"	40.000	Flow length"				
"	2.500	Overland Slope"				
"	1.717	Pervious Area"				
"	40.000	Pervious length"				
"	2.500	Pervious slope"				
"	1.193	Impervious Area"				
"	40.000	Impervious length"				
"	2.500	Impervious slope"				
"	0.250	Pervious Manning 'n'"				
"	61.000	Pervious SCS Curve No."				
"	0.330	Pervious Runoff coefficient"				
"	0.025	Pervious Ia/S coefficient"				
"	4.060	Pervious Initial abstraction"				
"	0.015	Impervious Manning 'n'"				
"	98.000	Impervious SCS Curve No."				
"	0.928	Impervious Runoff coefficient"				
"	0.097	Impervious Ia/S coefficient"				

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"      0.503  Impervious Initial abstraction"
"          0.713      1.242      0.016      0.054 c.m/sec"
"      Catchment 704      Pervious      Impervious      Total Area  "
"      Surface Area      1.717      1.193      2.910      hectare"
"      Time of concentration 14.940      1.749      6.211      minutes"
"      Time to Centroid 112.141      86.428      95.126      minutes"
"      Rainfall depth      89.960      89.960      89.960      mm"
"      Rainfall volume      1544.52      1073.31      2617.84      c.m"
"      Rainfall losses      60.304      6.480      38.236      mm"
"      Runoff depth      29.656      83.480      51.724      mm"
"      Runoff volume      509.16      996.00      1505.16      c.m"
"      Runoff coefficient      0.330      0.928      0.575      "
"      Maximum flow      0.221      0.672      0.713      c.m/sec"
" 40      HYDROGRAPH Add Runoff "
"      4      Add Runoff "
"          0.713      1.955      0.016      0.054"
" 40      HYDROGRAPH Copy to Outflow"
"      8      Copy to Outflow"
"          0.713      1.955      1.955      0.054"
" 40      HYDROGRAPH  Combine      704"
"      6      Combine "
" 704      Node #"
"      Culvert flow"
"      Maximum flow      2.005      c.m/sec"
"      Hydrograph volume      4076.471      c.m"
"          0.713      1.955      1.955      2.005"
" 40      HYDROGRAPH Start - New Tributary"
"      2      Start - New Tributary"
"          0.713      0.000      1.955      2.005"
" 81      ADD COMMENT=====
"      1      Lines of comment"
"      Minor flows to Printery Road, major flows to Water Street"
" 33      CATCHMENT 706"
"      1      Triangular SCS"
"      1      Equal length"
"      1      SCS method"
"      706      Water Street lots"
" 44.000      % Impervious"
"      0.470      Total Area"
" 31.600      Flow length"
"      2.500      Overland Slope"
"      0.263      Pervious Area"
" 31.600      Pervious length"
"      2.500      Pervious slope"
"      0.207      Impervious Area"
" 31.600      Impervious length"
"      2.500      Impervious slope"
"      0.250      Pervious Manning 'n'"
" 61.000      Pervious SCS Curve No."
"      0.329      Pervious Runoff coefficient"

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"      0.025   Pervious Ia/S coefficient"
"      4.060   Pervious Initial abstraction"
"      0.015   Impervious Manning 'n'"
"  98.000   Impervious SCS Curve No."
"      0.927   Impervious Runoff coefficient"
"      0.097   Impervious Ia/S coefficient"
"      0.503   Impervious Initial abstraction"
"           0.126      0.000      1.955      2.005 c.m/sec"
"      Catchment 706      Pervious      Impervious      Total Area "
"      Surface Area      0.263      0.207      0.470      hectare"
"      Time of concentration 12.970      1.518      5.082      minutes"
"      Time to Centroid      109.659      86.097      93.430      minutes"
"      Rainfall depth      89.960      89.960      89.960      mm"
"      Rainfall volume      236.77      186.04      422.81      c.m"
"      Rainfall losses      60.351      6.557      36.681      mm"
"      Runoff depth      29.609      83.403      53.279      mm"
"      Runoff volume      77.93      172.48      250.41      c.m"
"      Runoff coefficient      0.329      0.927      0.592      "
"      Maximum flow      0.035      0.118      0.126      c.m/sec"
"  40      HYDROGRAPH Add Runoff "
"      4      Add Runoff "
"           0.126      0.126      1.955      2.005"
"  56      DIVERSION"
"      706      Node number"
"      0.063      Overflow threshold"
"      1.000      Required diverted fraction"
"      0      Conduit type; 1=Pipe;2=Channel"
"      Peak of diverted flow      0.063      c.m/sec"
"      Volume of diverted flow      45.136      c.m"
"      DIV00706.100yrhyd"
"      Major flow at 706"
"           0.126      0.126      0.063      2.005 c.m/sec"
"  40      HYDROGRAPH Next link "
"      5      Next link "
"           0.126      0.063      0.063      2.005"
"  81      ADD COMMENT=====
"      1      Lines of comment"
"      Minor and major flows to Printery Road"
"  33      CATCHMENT 711"
"      1      Triangular SCS"
"      1      Equal length"
"      1      SCS method"
"      711      ID number"
"      5.000      % Impervious"
"      0.240      Total Area"
"      15.000      Flow length"
"      2.000      Overland Slope"
"      0.228      Pervious Area"
"      15.000      Pervious length"
"      2.000      Pervious slope"

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"	0.012	Impervious Area"				
"	15.000	Impervious length"				
"	2.000	Impervious slope"				
"	0.250	Pervious Manning 'n'"				
"	61.000	Pervious SCS Curve No."				
"	0.329	Pervious Runoff coefficient"				
"	0.025	Pervious Ia/S coefficient"				
"	4.060	Pervious Initial abstraction"				
"	0.015	Impervious Manning 'n'"				
"	98.000	Impervious SCS Curve No."				
"	0.912	Impervious Runoff coefficient"				
"	0.097	Impervious Ia/S coefficient"				
"	0.503	Impervious Initial abstraction"				
"		0.039	0.063	0.063	2.005 c.m/sec"	
"		Catchment 711	Pervious	Impervious	Total Area	"
"		Surface Area	0.228	0.012	0.240	hectare"
"		Time of concentration	8.868	1.038	7.871	minutes"
"		Time to Centroid	104.468	85.517	102.053	minutes"
"		Rainfall depth	89.960	89.960	89.960	mm"
"		Rainfall volume	205.11	10.80	215.90	c.m"
"		Rainfall losses	60.395	7.926	57.771	mm"
"		Runoff depth	29.565	82.034	32.189	mm"
"		Runoff volume	67.41	9.84	77.25	c.m"
"		Runoff coefficient	0.329	0.912	0.358	"
"		Maximum flow	0.036	0.007	0.039	c.m/sec"
" 40		HYDROGRAPH Add Runoff "				
"	4	Add Runoff "				
"		0.039	0.102	0.063	2.005"	
" 33		CATCHMENT 705"				
"	1	Triangular SCS"				
"	1	Equal length"				
"	1	SCS method"				
"	705	ID number"				
"	75.000	% Impervious"				
"	0.580	Total Area"				
"	27.200	Flow length"				
"	2.500	Overland Slope"				
"	0.145	Pervious Area"				
"	27.200	Pervious length"				
"	2.500	Pervious slope"				
"	0.435	Impervious Area"				
"	27.200	Impervious length"				
"	2.500	Impervious slope"				
"	0.250	Pervious Manning 'n'"				
"	61.000	Pervious SCS Curve No."				
"	0.329	Pervious Runoff coefficient"				
"	0.025	Pervious Ia/S coefficient"				
"	4.060	Pervious Initial abstraction"				
"	0.015	Impervious Manning 'n'"				
"	98.000	Impervious SCS Curve No."				

"	0.925	Impervious Runoff coefficient"			
"	0.097	Impervious Ia/S coefficient"			
"	0.503	Impervious Initial abstraction"			
"	0.255	0.102	0.063	2.005	c.m/sec"
"	Catchment 705	Pervious	Impervious	Total Area	"
"	Surface Area	0.145	0.435	0.580	hectare"
"	Time of concentration	11.854	1.387	2.498	minutes"
"	Time to Centroid	108.231	85.923	88.290	minutes"
"	Rainfall depth	89.960	89.960	89.960	mm"
"	Rainfall volume	130.44	391.33	521.77	c.m"
"	Rainfall losses	60.331	6.744	20.141	mm"
"	Runoff depth	29.629	83.216	69.819	mm"
"	Runoff volume	42.96	361.99	404.95	c.m"
"	Runoff coefficient	0.329	0.925	0.776	"
"	Maximum flow	0.020	0.250	0.255	c.m/sec"
" 40	HYDROGRAPH Add Runoff "				
"	4	Add Runoff "			
"	0.255	0.337	0.063	2.005"	
" 40	HYDROGRAPH Copy to Outflow"				
"	8	Copy to Outflow"			
"	0.255	0.337	0.337	2.005"	
" 40	HYDROGRAPH Combine 704"				
"	6	Combine "			
"	704	Node #"			
"	Culvert flow"				
"	Maximum flow		2.343	c.m/sec"	
"	Hydrograph volume		4763.948	c.m"	
"	0.255	0.337	0.337	2.343"	
" 40	HYDROGRAPH Confluence 704"				
"	7	Confluence "			
"	704	Node #"			
"	Culvert flow"				
"	Maximum flow		2.343	c.m/sec"	
"	Hydrograph volume		4763.949	c.m"	
"	0.255	2.343	0.337	0.000"	
" 33	CATCHMENT 6011"				
"	1	Triangular SCS"			
"	1	Equal length"			
"	1	SCS method"			
"	6011	Back part of development at 1065 Old Scout"			
"	30.000	% Impervious"			
"	0.210	Total Area"			
"	15.000	Flow length"			
"	3.500	Overland Slope"			
"	0.147	Pervious Area"			
"	15.000	Pervious length"			
"	3.500	Pervious slope"			
"	0.063	Impervious Area"			
"	15.000	Impervious length"			
"	3.500	Impervious slope"			

"	0.250	Pervious Manning 'n'"			
"	74.000	Pervious SCS Curve No."			
"	0.479	Pervious Runoff coefficient"			
"	0.025	Pervious Ia/S coefficient"			
"	2.231	Pervious Initial abstraction"			
"	0.015	Impervious Manning 'n'"			
"	98.000	Impervious SCS Curve No."			
"	0.899	Impervious Runoff coefficient"			
"	0.097	Impervious Ia/S coefficient"			
"	0.503	Impervious Initial abstraction"			
"		0.062	2.343	0.337	0.000 c.m/sec"
"		Catchment 6011	Pervious	Impervious	Total Area "
"		Surface Area	0.147	0.063	0.210 hectare"
"		Time of concentration	6.290	0.878	3.877 minutes"
"		Time to Centroid	99.570	85.314	93.213 minutes"
"		Rainfall depth	89.960	89.960	89.960 mm"
"		Rainfall volume	132.24	56.67	188.92 c.m"
"		Rainfall losses	46.886	9.077	35.543 mm"
"		Runoff depth	43.074	80.883	54.417 mm"
"		Runoff volume	63.32	50.96	114.28 c.m"
"		Runoff coefficient	0.479	0.899	0.605 "
"		Maximum flow	0.038	0.036	0.062 c.m/sec"
" 40		HYDROGRAPH Add Runoff "			
"	4	Add Runoff "			
"		0.062	2.399	0.337	0.000"
" 33		CATCHMENT 707"			
"	1	Triangular SCS"			
"	1	Equal length"			
"	1	SCS method"			
"	707	Medium density block"			
"	80.000	% Impervious"			
"	1.400	Total Area"			
"	10.000	Flow length"			
"	2.000	Overland Slope"			
"	0.280	Pervious Area"			
"	10.000	Pervious length"			
"	2.000	Pervious slope"			
"	1.120	Impervious Area"			
"	10.000	Impervious length"			
"	2.000	Impervious slope"			
"	0.250	Pervious Manning 'n'"			
"	61.000	Pervious SCS Curve No."			
"	0.328	Pervious Runoff coefficient"			
"	0.025	Pervious Ia/S coefficient"			
"	4.060	Pervious Initial abstraction"			
"	0.015	Impervious Manning 'n'"			
"	98.000	Impervious SCS Curve No."			
"	0.892	Impervious Runoff coefficient"			
"	0.097	Impervious Ia/S coefficient"			
"	0.503	Impervious Initial abstraction"			

"	0.664	2.399	0.337	0.000 c.m/sec"	
"	Catchment 707	Pervious	Impervious	Total Area	"
"	Surface Area	0.280	1.120	1.400	hectare"
"	Time of concentration	6.953	0.814	1.330	minutes"
"	Time to Centroid	102.178	85.247	86.671	minutes"
"	Rainfall depth	89.960	89.960	89.960	mm"
"	Rainfall volume	251.89	1007.55	1259.44	c.m"
"	Rainfall losses	60.489	9.682	19.843	mm"
"	Runoff depth	29.471	80.278	70.117	mm"
"	Runoff volume	82.52	899.11	981.63	c.m"
"	Runoff coefficient	0.328	0.892	0.779	"
"	Maximum flow	0.048	0.646	0.664	c.m/sec"

" 40 HYDROGRAPH Add Runoff "

" 4 Add Runoff "

"	0.664	3.063	0.337	0.000"
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" 33 CATCHMENT 708"

"	1	Triangular SCS"
"	1	Equal length"
"	1	SCS method"
"	708	ID number"
"	49.000	% Impervious"
"	0.350	Total Area"
"	41.000	Flow length"
"	2.500	Overland Slope"
"	0.178	Pervious Area"
"	41.000	Pervious length"
"	2.500	Pervious slope"
"	0.171	Impervious Area"
"	41.000	Impervious length"
"	2.500	Impervious slope"
"	0.250	Pervious Manning 'n'"
"	61.000	Pervious SCS Curve No."
"	0.330	Pervious Runoff coefficient"
"	0.025	Pervious Ia/S coefficient"
"	4.060	Pervious Initial abstraction"
"	0.015	Impervious Manning 'n'"
"	98.000	Impervious SCS Curve No."
"	0.928	Impervious Runoff coefficient"
"	0.097	Impervious Ia/S coefficient"
"	0.503	Impervious Initial abstraction"

"	0.101	3.063	0.337	0.000 c.m/sec"
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"	Catchment 708	Pervious	Impervious	Total Area	"
"	Surface Area	0.178	0.171	0.350	hectare"
"	Time of concentration	15.163	1.775	5.390	minutes"
"	Time to Centroid	112.408	86.463	93.469	minutes"
"	Rainfall depth	89.960	89.960	89.960	mm"
"	Rainfall volume	160.58	154.28	314.86	c.m"
"	Rainfall losses	60.293	6.485	33.927	mm"
"	Runoff depth	29.667	83.475	56.033	mm"
"	Runoff volume	52.96	143.16	196.12	c.m"

"	Runoff coefficient	0.330	0.928	0.623	"
"	Maximum flow	0.022	0.096	0.101	c.m/sec"
" 40	HYDROGRAPH Add Runoff "				
"	4 Add Runoff "				
"	0.101 3.164 0.337 0.000"				
" 33	CATCHMENT 709"				
"	1 Triangular SCS"				
"	1 Equal length"				
"	1 SCS method"				
"	709 New lots on old Printery Road"				
"	53.000 % Impervious"				
"	0.860 Total Area"				
"	45.400 Flow length"				
"	2.500 Overland Slope"				
"	0.404 Pervious Area"				
"	45.400 Pervious length"				
"	2.500 Pervious slope"				
"	0.456 Impervious Area"				
"	45.400 Impervious length"				
"	2.500 Impervious slope"				
"	0.250 Pervious Manning 'n'"				
"	61.000 Pervious SCS Curve No."				
"	0.330 Pervious Runoff coefficient"				
"	0.025 Pervious Ia/S coefficient"				
"	4.060 Pervious Initial abstraction"				
"	0.015 Impervious Manning 'n'"				
"	98.000 Impervious SCS Curve No."				
"	0.928 Impervious Runoff coefficient"				
"	0.097 Impervious Ia/S coefficient"				
"	0.503 Impervious Initial abstraction"				
"	0.263 3.164 0.337 0.000 c.m/sec"				
"	Catchment 709 Pervious Impervious Total Area "				
"	Surface Area 0.404 0.456 0.860 hectare"				
"	Time of concentration 16.119 1.887 5.296 minutes"				
"	Time to Centroid 113.648 86.623 93.097 minutes"				
"	Rainfall depth 89.960 89.960 89.960 mm"				
"	Rainfall volume 363.62 410.04 773.66 c.m"				
"	Rainfall losses 60.313 6.504 31.794 mm"				
"	Runoff depth 29.647 83.456 58.166 mm"				
"	Runoff volume 119.83 380.39 500.23 c.m"				
"	Runoff coefficient 0.330 0.928 0.647 "				
"	Maximum flow 0.048 0.254 0.263 c.m/sec"				
" 40	HYDROGRAPH Add Runoff "				
"	4 Add Runoff "				
"	0.263 3.426 0.337 0.000"				
" 33	CATCHMENT 801"				
"	1 Triangular SCS"				
"	1 Equal length"				
"	1 SCS method"				
"	801 ID number"				

"	30.000	% Impervious"				
"	0.460	Total Area"				
"	17.000	Flow length"				
"	2.000	Overland Slope"				
"	0.322	Pervious Area"				
"	17.000	Pervious length"				
"	2.000	Pervious slope"				
"	0.138	Impervious Area"				
"	17.000	Impervious length"				
"	2.000	Impervious slope"				
"	0.250	Pervious Manning 'n'"				
"	68.000	Pervious SCS Curve No."				
"	0.397	Pervious Runoff coefficient"				
"	0.034	Pervious Ia/S coefficient"				
"	4.064	Pervious Initial abstraction"				
"	0.015	Impervious Manning 'n'"				
"	98.000	Impervious SCS Curve No."				
"	0.917	Impervious Runoff coefficient"				
"	0.097	Impervious Ia/S coefficient"				
"	0.503	Impervious Initial abstraction"				
"		0.111	3.426	0.337	0.000 c.m/sec"	
"		Catchment 801	Pervious	Impervious	Total Area	"
"		Surface Area	0.322	0.138	0.460	hectare"
"		Time of concentration	8.760	1.119	4.961	minutes"
"		Time to Centroid	103.751	85.619	94.737	minutes"
"		Rainfall depth	89.960	89.960	89.960	mm"
"		Rainfall volume	289.67	124.14	413.82	c.m"
"		Rainfall losses	54.218	7.502	40.203	mm"
"		Runoff depth	35.742	82.459	49.757	mm"
"		Runoff volume	115.09	113.79	228.88	c.m"
"		Runoff coefficient	0.397	0.917	0.553	"
"		Maximum flow	0.062	0.080	0.111	c.m/sec"
" 40		HYDROGRAPH Add Runoff "				
"		4 Add Runoff "				
"		0.111	3.528	0.337	0.000"	
" 33		CATCHMENT 710"				
"		1 Triangular SCS"				
"		1 Equal length"				
"		1 SCS method"				
"		710 SWM block"				
"		30.000 % Impervious"				
"		0.660 Total Area"				
"		12.000 Flow length"				
"		20.000 Overland Slope"				
"		0.462 Pervious Area"				
"		12.000 Pervious length"				
"		20.000 Pervious slope"				
"		0.198 Impervious Area"				
"		12.000 Impervious length"				
"		20.000 Impervious slope"				

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"      0.250  Pervious Manning 'n'"
"    61.000  Pervious SCS Curve No."
"      0.325  Pervious Runoff coefficient"
"      0.025  Pervious Ia/S coefficient"
"      4.060  Pervious Initial abstraction"
"      0.015  Impervious Manning 'n'"
"    98.000  Impervious SCS Curve No."
"      0.832  Impervious Runoff coefficient"
"      0.097  Impervious Ia/S coefficient"
"      0.503  Impervious Initial abstraction"
"          0.170      3.528      0.337      0.000 c.m/sec"
"      Catchment 710      Pervious      Impervious Total Area "
"      Surface Area      0.462      0.198      0.660      hectare"
"      Time of concentration 3.888      0.455      2.091      minutes"
"      Time to Centroid 98.326      85.010      91.356      minutes"
"      Rainfall depth      89.960      89.960      89.960      mm"
"      Rainfall volume      415.62      178.12      593.74      c.m"
"      Rainfall losses      60.744      15.078      47.044      mm"
"      Runoff depth      29.216      74.882      42.916      mm"
"      Runoff volume      134.98      148.27      283.24      c.m"
"      Runoff coefficient      0.325      0.832      0.477      "
"      Maximum flow      0.087      0.110      0.170      c.m/sec"
" 40      HYDROGRAPH Add Runoff "
"      4      Add Runoff "
"          0.170      3.698      0.337      0.000"
" 54      POND DESIGN"
"      3.698      Current peak flow      c.m/sec"
"      1.800      Target outflow      c.m/sec"
"      7068.3      Hydrograph volume      c.m"
"      7.      Number of stages"
"      340.000      Minimum water level      metre"
"      342.100      Maximum water level      metre"
"      340.000      Starting water level      metre"
"      0      Keep Design Data: 1 = True; 0 = False"
"          Level Discharge      Volume"
"      340.000      0.000      0.000"
"      340.500      0.01800      882.000"
"      341.000      0.06200      2202.000"
"      341.200      0.07200      2885.000"
"      341.500      0.08600      4003.000"
"      341.800      0.4350      5237.000"
"      342.100      1.151      6614.000"
"      Peak outflow      0.437      c.m/sec"
"      Maximum level      341.801      metre"
"      Maximum storage      5242.553      c.m"
"      Centroidal lag      9.937      hours"
"          0.170      3.698      0.437      0.000 c.m/sec"
" 40      HYDROGRAPH      Combine      501"
"      6      Combine "
"      501      Node #"

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"          Culvert flow"
"          Maximum flow          0.453      c.m/sec"
"          Hydrograph volume      6666.472    c.m"
"              0.170      3.698      0.437      0.453"
" 40      HYDROGRAPH Start - New Tributary"
"          2      Start - New Tributary"
"              0.170      0.000      0.437      0.453"
" 81      ADD COMMENT=====
"          1      Lines of comment"
"              Catchments discharging uncontrolled"
" 33      CATCHMENT 502"
"          1      Triangular SCS"
"          1      Equal length"
"          1      SCS method"
"          502      ID number"
"          0.000      % Impervious"
"          0.390      Total Area"
"          22.200      Flow length"
"          2.000      Overland Slope"
"          0.390      Pervious Area"
"          22.200      Pervious length"
"          2.000      Pervious slope"
"          0.000      Impervious Area"
"          22.200      Impervious length"
"          2.000      Impervious slope"
"          0.250      Pervious Manning 'n'"
"          61.000      Pervious SCS Curve No."
"          0.330      Pervious Runoff coefficient"
"          0.025      Pervious Ia/S coefficient"
"          4.060      Pervious Initial abstraction"
"          0.015      Impervious Manning 'n'"
"          98.000      Impervious SCS Curve No."
"          0.000      Impervious Runoff coefficient"
"          0.097      Impervious Ia/S coefficient"
"          0.503      Impervious Initial abstraction"
"              0.055      0.000      0.437      0.453 c.m/sec"
"          Catchment 502      Pervious      Impervious      Total Area      "
"          Surface Area      0.390      0.000      0.390      hectare"
"          Time of concentration      11.220      1.313      11.220      minutes"
"          Time to Centroid      107.424      85.836      107.424      minutes"
"          Rainfall depth      89.960      89.960      89.960      mm"
"          Rainfall volume      350.84      0.00      350.84      c.m"
"          Rainfall losses      60.296      6.875      60.296      mm"
"          Runoff depth      29.664      83.085      29.664      mm"
"          Runoff volume      115.69      0.00      115.69      c.m"
"          Runoff coefficient      0.330      0.000      0.330      "
"          Maximum flow      0.055      0.000      0.055      c.m/sec"
" 40      HYDROGRAPH Add Runoff "
"          4      Add Runoff "
"              0.055      0.055      0.437      0.453"

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" 33      CATCHMENT 503"
"          1    Triangular SCS"
"          1    Equal length"
"          1    SCS method"
"          503  ID number"
"          0.000 % Impervious"
"          0.320 Total Area"
"          22.500 Flow length"
"          2.500 Overland Slope"
"          0.320 Pervious Area"
"          22.500 Pervious length"
"          2.500 Pervious slope"
"          0.000 Impervious Area"
"          22.500 Impervious length"
"          2.500 Impervious slope"
"          0.250 Pervious Manning 'n'"
"          61.000 Pervious SCS Curve No."
"          0.329 Pervious Runoff coefficient"
"          0.025 Pervious Ia/S coefficient"
"          4.060 Pervious Initial abstraction"
"          0.015 Impervious Manning 'n'"
"          98.000 Impervious SCS Curve No."
"          0.000 Impervious Runoff coefficient"
"          0.097 Impervious Ia/S coefficient"
"          0.503 Impervious Initial abstraction"
"              0.046      0.055      0.437      0.453 c.m/sec"
"          Catchment 503      Pervious      Impervious      Total Area "
"          Surface Area      0.320      0.000      0.320      hectare"
"          Time of concentration 10.579      1.238      10.578      minutes"
"          Time to Centroid 106.636      85.756      106.636      minutes"
"          Rainfall depth 89.960      89.960      89.960      mm"
"          Rainfall volume 287.87      0.00      287.87      c.m"
"          Rainfall losses 60.325      7.066      60.325      mm"
"          Runoff depth 29.635      82.894      29.635      mm"
"          Runoff volume 94.83      0.00      94.83      c.m"
"          Runoff coefficient 0.329      0.000      0.329      "
"          Maximum flow 0.046      0.000      0.046      c.m/sec"
" 40      HYDROGRAPH Add Runoff "
"          4    Add Runoff "
"              0.046      0.101      0.437      0.453"
" 33      CATCHMENT 504"
"          1    Triangular SCS"
"          1    Equal length"
"          1    SCS method"
"          504  ID number"
"          45.000 % Impervious"
"          0.270 Total Area"
"          30.000 Flow length"
"          2.500 Overland Slope"
"          0.148 Pervious Area"

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"	30.000	Pervious length"				
"	2.500	Pervious slope"				
"	0.122	Impervious Area"				
"	30.000	Impervious length"				
"	2.500	Impervious slope"				
"	0.250	Pervious Manning 'n'"				
"	61.000	Pervious SCS Curve No."				
"	0.329	Pervious Runoff coefficient"				
"	0.025	Pervious Ia/S coefficient"				
"	4.060	Pervious Initial abstraction"				
"	0.015	Impervious Manning 'n'"				
"	98.000	Impervious SCS Curve No."				
"	0.926	Impervious Runoff coefficient"				
"	0.097	Impervious Ia/S coefficient"				
"	0.503	Impervious Initial abstraction"				
"		0.074	0.101	0.437	0.453	c.m/sec"
"		Catchment 504	Pervious	Impervious	Total Area	"
"		Surface Area	0.148	0.122	0.270	hectare"
"		Time of concentration	12.572	1.472	4.833	minutes"
"		Time to Centroid	109.154	86.029	93.032	minutes"
"		Rainfall depth	89.960	89.960	89.960	mm"
"		Rainfall volume	133.59	109.30	242.89	c.m"
"		Rainfall losses	60.340	6.617	36.165	mm"
"		Runoff depth	29.620	83.343	53.795	mm"
"		Runoff volume	43.99	101.26	145.25	c.m"
"		Runoff coefficient	0.329	0.926	0.598	"
"		Maximum flow	0.019	0.070	0.074	c.m/sec"
" 40		HYDROGRAPH Add Runoff "				
"	4	Add Runoff "				
"		0.074	0.154	0.437	0.453"	
" 33		CATCHMENT 505"				
"	1	Triangular SCS"				
"	1	Equal length"				
"	1	SCS method"				
"	505	ID number"				
"	36.000	% Impervious"				
"	0.720	Total Area"				
"	45.500	Flow length"				
"	2.500	Overland Slope"				
"	0.461	Pervious Area"				
"	45.500	Pervious length"				
"	2.000	Pervious slope"				
"	0.259	Impervious Area"				
"	45.500	Impervious length"				
"	2.000	Impervious slope"				
"	0.250	Pervious Manning 'n'"				
"	61.000	Pervious SCS Curve No."				
"	0.330	Pervious Runoff coefficient"				
"	0.025	Pervious Ia/S coefficient"				
"	4.060	Pervious Initial abstraction"				

```

"      0.015  Impervious Manning 'n'"
"  98.000  Impervious SCS Curve No."
"      0.926  Impervious Runoff coefficient"
"      0.097  Impervious Ia/S coefficient"
"      0.503  Impervious Initial abstraction"
"          0.151      0.154      0.437      0.453 c.m/sec"
"      Catchment 505      Pervious      Impervious      Total Area  "
"      Surface Area      0.461      0.259      0.720      hectare"
"      Time of concentration 17.258      2.020      7.926      minutes"
"      Time to Centroid 115.032      86.807      97.747      minutes"
"      Rainfall depth 89.960      89.960      89.960      mm"
"      Rainfall volume 414.54      233.18      647.71      c.m"
"      Rainfall losses 60.305      6.661      40.993      mm"
"      Runoff depth 29.655      83.299      48.967      mm"
"      Runoff volume 136.65      215.91      352.56      c.m"
"      Runoff coefficient 0.330      0.926      0.544      "
"      Maximum flow 0.053      0.143      0.151      c.m/sec"
" 40      HYDROGRAPH Add Runoff "
"      4      Add Runoff "
"          0.151      0.292      0.437      0.453"
" 47      FILEI_0 Read/Open div00706.100yrhyd"
"      1      1=read/open; 2=write/save"
"      2      1=rainfall; 2=hydrograph"
"      1      1=runoff; 2=inflow; 3=outflow; 4=junction"
"      div00706.100yrhyd"
"      Major flow at 706"
"      Total volume      45.136      c.m"
"      Maximum flow      0.063      c.m/sec"
"          0.063      0.292      0.437      0.453 c.m/sec"
" 40      HYDROGRAPH Add Runoff "
"      4      Add Runoff "
"          0.063      0.343      0.437      0.453"
" 40      HYDROGRAPH Copy to Outflow"
"      8      Copy to Outflow"
"          0.063      0.343      0.343      0.453"
" 40      HYDROGRAPH Combine 501"
"      6      Combine "
" 501      Node #"
"      Culvert flow"
"      Maximum flow      0.552      c.m/sec"
"      Hydrograph volume 7419.938      c.m"
"          0.063      0.343      0.343      0.552"
" 38      START/RE-START TOTALS 505"
"      3      Runoff Totals on EXIT"
"      Total Catchment area      14.540      hectare"
"      Total Impervious area      7.032      hectare"
"      Total % impervious      48.363"
" 19      EXIT"

```

Appendix E: Agency Comments



Sarah Kerr

From: Norm Litchfield
Sent: October 25, 2024 11:35 AM
To: Sarah Kerr
Subject: FW: Preapplication 2024 - 014 - 1128 and 1138 Printery Road JQ4311 COM
Attachments: cp21306h.pdf

Sarah,
Please save the email comments in External Docs. Thanks.

Sincerely,
MERITECH ENGINEERING

Norm B. Litchfield, P. Eng., MBA
Director of Engineering

From: Brandon Flewwelling <brandonf@gspgroup.ca>
Sent: Wednesday, August 14, 2024 2:50 PM
To: Sherwin Meloney <smeloney@woolwich.ca>
Cc: Kevin Smith <kevin.smith@willohomes.com>
Subject: RE: Preapplication 2024 - 014 - 1128 and 1138 Printery Road

Hi Sherwin,
Further to our meeting last week please find attached a revised development concept.
If you could please review and provide a high level summary of initial thoughts that would be appreciated.

The revised plan:

- provides for a turning circle
- breaks the plan into two parts (left side – free hold street townhouse dwellings / right side townhouse condominium)
- This plan would require a Plan of Subdivision application to create the street townhouse lots and the condominium block
- We no longer have 'back lotting' along King St.
- The condominium plan provide for a common amenity space.
- The condo would have private garbage collection and snow removal

Please let me know your thoughts and if you have any comments on the revised plan.

Thanks,
Brandon

Brandon Flewwelling
MCIP, RPP
Development Planning Manager

office: 519.569.8883
direct: 226.243.6521



72 Victoria Street South
Suite 201
Kitchener, ON N2G 4Y9



This communication is intended solely for the named addressee(s) and may contain information that is privileged, confidential, protected or otherwise exempt from disclosure. If you are not the intended recipient of this communication, please advise us immediately and delete this email without reading, copying or forwarding it to anyone.

From: Sherwin Meloney <smeloney@woolwich.ca>
Sent: Friday, July 26, 2024 11:21 AM
To: Brandon Flewwelling <brandonf@gspgroup.ca>
Subject: Preapplication 2024 - 014 - 1128 and 1138 Printery Road

Morning

The Township and respective agencies have reviewed the information provided for the preapplication zone change proposal located at 1128 and 1134 Printery Road. Both properties are zoned Residential (R-1). The property at 1128 Printery Road is 925 square metres in size with 19 metres of frontage. The abutting property at 1134 Printery Road is 9072 square metres in size with frontages along Printery Road and King Street North. The proposed zone change is to facilitate the future development of a plan of condominium containing 22 bungalow townhouse dwellings.

Township Planning Staff notes the following for a complete application:

1. The Township will require a Planning Justification Report (PJR). As part of the PJR, indicate what the new proposed zoning is, how it represents appropriate development and is consistent with Provincial Policy Statement (PPS), Regional Official Plan (ROP) and Township Official Plan (OP) policies with respect to the St. Jacobs Settlement. In addition, the PJR should address the following:
 - Layout with respect to:
 - Dead end streets. Turning circles will have to be provided for required truck and vehicle turning movements.
 - Pedestrian circulation. To promote walkability and connectivity sidewalks will need to be continuous and on both sides of the road
 - Street network. The proposed configuration of the two roads creates a disjointed development. It is recommended that the roads connect which will create a more unified development and allow for continuous circulation of vehicles and pedestrians.
 - How will the development not impact the existing neighbouring properties or prevent future development on adjacent lands.
 - Provide opportunity for accessory dwelling units and affordable housing.
 - Parking for the proposed development that includes designated spaces for visitor parking. Provide a full Parking Plan.
 - Outdoor amenity spaces, common areas and open spaces for residents within the proposed development.
 - Compatibility with respect to road noise, rail noise / vibration and nearby industrial uses.
 - Urban and Sustainable green building design.
 - Conformity with the Zoning Bylaw.
2. Parkland dedication or Cash in lieu required.
3. Provide a Traffic Impact Study (TIS) and management plan.
4. Prepare a draft Zoning by-law Amendment (ZBA).
5. Units abutting King Street North and Printery Road, facades must face the street to provide integration with exiting .

6. Formal ZBA submission must include a complete Site Plan drawing to demonstrate functionality of the development proposal.
7. Prepare an Urban Design Brief to demonstrate how the proposed development meets the Township Urban Design Guidelines.
8. Hydrogeological and Geotechnical reports will be required in support of the development as well as a Lot Grading and Drainage plan.
9. The current parcel configuration being two separate parcels must be addressed prior to the consideration of a Plan of Condominium.
10. Provide a Noise and Vibration Study, which addresses the noise from road traffic, rail, rail vibration and the nearby industrial uses.
11. The proposed development abuts an Environmental Core Feature to the east. What measures will be taken to mitigate impact. Provide an Environmental Impact Study (EIS) and a Tree Management Plan. Appropriate buffers maybe required.
12. Prepare a Functional Servicing Report (FSR) to demonstrate that the site can be supported on full municipal services. This will need to include information demonstrating adequate fire flow as per Fire Code requirements. Storm Water Management (SWM) must also be addressed in terms of quality and quantity control and overall site design. Sanitary servicing is allocated by Township Council where the proposed infilling development will be subject to staging policies and associated servicing capacity at the time of a formal complete application being received.
13. If the zoning approval is granted, the proposed development will be subject to Site Plan Control and a future Site Plan Agreement (SPA) prior to finalization of any Plan of Condominium.

Township Development Engineering Section notes the following.

- i. Please ensure the Township Engineering Development and Infrastructure Manual (EDIM), Region specifications (DGSSMS) and other engineering standards / manuals are followed.
- ii. Provide a Functional Servicing Report / Brief demonstrating that there is sufficient water (domestic and fire) and sanitary sewer capacity for the proposed development. Please note the township has an updated sanitary model that a 3rd party consultant manages. The consultant can review the sanitary capacity from the site for a fee plus 15% Township administration. Note that this property is located between the high and low water pressure zones and a pressure reducing valve and backflow protection will be required. Above ground bulk water meter is required. Only one connection to watermain per lot / property.

Provide a preliminary SWM Report / Brief which provides for quality control and quantity control for 2, 5, 10, 25, 50 and 100-year storm events. Quality Control is to meet 80% Total Suspended Solid (TSS) removal. As the Grand River Conservation Authority (GRCA) is not reviewing water quality anymore as per Reg 686/21. Municipalities are to provide full review and have adopted the GRCA standard approach that only a 50% credit for Oil and Grit Separators (OGS) and TSS removal applies. Treatment train approach must be followed. Quantity control to be post development peak flows to equal pre-development flows and or outlet capacity, are stringent to apply. Please identify the legal outlet for the site. The Township encourages Low Impact Development (LID) through the development process. Please provide LID features throughout the proposed development where applicable. The property is located within the Brubacher Drain watershed, commonly referred to as the Old Scout Drain.

- i. Provide a scoped TIS. See EDIM for more detail. Intersections at Maplelawn Drive and the east entrance must line up. Region may not want the first entrance so close to a regional road. Please confirm with them. Sight line analysis for entrance to sites is required.
- ii. Provide a fire flow analysis to demonstrate that there is sufficient volume and pressure to meet FUS requirements for the property.
- iii. The south side of Printery Road is to be urbanized including a sidewalk from King Street to the east limit of the proposed plan. Any relocation of existing utilities to accommodate the urbanization is the responsibility of the applicant.
- iv. No servicing easement allowed in the 3m road widening.

Based on the review of the submitted preliminary information, engineering staff have provided the following comments to be addressed at the time of SPA:

- i. The applicant is to review the service connection records to see if there are any outstanding service connection costs.
- ii. Road widenings are needed along the frontage of Printery Road. Schedule 2 of the Official Plan prescribes an 18-metre required road width for Printery Road.
- iii. The following engineering plans will be required with the Site Plan application:
 - Existing / Removal Conditions Plan, which includes servicing and grades.
 - Detail grading drainage and servicing plan. Existing drainage patterns are to be maintained and development of the site is not to impact adjacent properties.
 - Erosion and sediment control plan.
 - SWM Report.
 - Any existing trees that are being removed and / or proposed trees being installed need to be indicated on the plan. Trees within right-of-way are Township property and ownership. Township / 3rd party arborist to determine value of trees and future discussion on cost recovery and determine value to be put into future planting program.
 - Site lighting photometric plan. Site lighting is not to encroach onto adjacent properties.
 - Identify truck turning movements on a plan.
 - Verify that the existing driveway entrance is in accordance with Township standards and adjust where necessary.
- iv. If a foundation is proposed for the new building, the underside of footings is required to be a minimum 0.6 metres above the seasonally high groundwater table. Hydrogeology report to identify seasonally high groundwater table. Please see EDIM for requirements. Confirm wells in the area won't be affected.
- v. The major overland stormwater flow exiting the site is not to pass through existing adjacent properties.
- vi. Please provide statement on grading plan stating:

The Engineer / Designer hereby certifies that the proposed lot drainage and / or grading plan(s) have been designed in accordance with drainage common law in Ontario, sound engineering principles and the Ontario Building Code Articles such as but not limited to 9.14.6.1 & 9.15.4.6. The Engineer / Designer ensures artificially collected and / or surface drainage will not adversely affect adjacent properties.
- vii. Roadwork permit is required for any works within road allowance including any adjustments to the entrance.
- viii. Provide a detail engineer cost estimate for works to be performed within the road allowance and external to the site.
- ix. The Developer will be required to post 100% securities for works within the road allowance.
- x. Township fees to apply as per fees and charges bylaw and as per agreements. Right of way and private works deposits as per agreement

Township Building Section has no comments at this time but will comment at the site plan stage.

Township Fire Department has no issues with the proposed zone change.

Region of Waterloo notes the following, for additional comments please see attached.

- a. PJR is required to analyze how the proposed ZBA is consistent with provincial policies and conforms to the ROP, including Regional Official Plan Amendment 6.
- b. The proposed 22 residential units would contribute an additional 72 people to the St. Jacobs Wastewater Treatment Plant (SJWWTP). The available capacity at the plant as of year end 2023 is approximately 1000 people. Therefore, while the SJWWTP has capacity for this application in isolation, Staff must review it within the context of other development applications located in the St. Jacobs WWTP Service Area. Currently, this area has seen multiple other large development applications that may use up most of the available capacity as well and may restrict development in other parts of the service area. There is a planned update to the Regional Wastewater Master Plan scheduled to commence in 2025 and planned expansion of SJWWTP in 2029/2030. The

proposed application must account for these factors and servicing limits. A Functional Servicing Report is required as part of a complete application.

- c. Regional Staff confirm that based on the Environmental Site Screening Questionnaire that a heating fuel tank was located on the subject lands at one time. Regional Staff have requested written confirmation from the owner/applicant as to whether the fuel tank was located above ground. Upon receipt of this confirmation the Region will have no further comments on site contamination. If the fuel storage tank was located underground, then the Region may require a Record of Site Condition and Ministry Acknowledgement Letter as part of a complete application to ensure the subject lands are cleared of any environmental contamination concerns. The owner/applicant is required to provide this confirmation as soon as possible to Regional Staff.
- d. An Environmental Impact Statement (EIS) will be required to demonstrate that the proposed development will not be within the limits of the Significant Woodland, and that no adverse environmental impacts to the Significant Woodland (feature limits or functionally) will result. If an EIS is completed as part of a complete application, please note that the study will be subject to peer review at the owner/applicant's expense. The cost for this peer review is \$5198.00 and the fee must be provided at time of complete application, with the completed study. The cheque is to be made payable to the Region of Waterloo.
- e. Regional Staff note that based on the road geometry and layout of the proposed site that waste collection and disposal would fall under the responsibility of a future condo board or site property management team to resolve independently and at their own expense.
- f. An Environmental Noise Study is required due to King Street North (RR #8), and the Region's Waterloo Spur Line railway. Please note that there is a \$500 fee for the preparation of the traffic forecasts and review of the Environmental Noise Study.
- g. An Archaeological Assessment and Ministry Acknowledgement will be required as part of a complete application due to the proximity of historical structures, features, and resources. A Heritage Impact assessment may also be required for the existing barn located on 1134 Printery Road.
- h. A Salt Management Plan is required at Site Plan control and implemented thorough a Plan of Condominium application.
- i. The expansion of the existing transit stop (#3808) along King Street North is required.
- j. Connection of the existing sidewalk on King Street North to Printery Road is required.
- k. A private stormwater connection to any storm sewer on King Street North will be discouraged where an alternate stormwater connection is available, including infiltration if soil conditions and Source Protection under the Clean Water Act permit, or if it is determined that the King Street North storm sewer does not have the sufficiency (condition and capacity) to accommodate private stormwater flows from this site.
- l. The applicant must submit a detailed site grading and drainage control plan(s) and site servicing plan(s) along with a SWM report (including an electronic copy) to the commissioner of Planning, Development and Legislative Services, Region of Waterloo for approval.

Region of Waterloo Risk Management notes the following.

The property at 1128 & 1138 Printery Rd, St Jacobs is not in a source protection area under the 2022 Grand River Source Protection Plan. A Notice of Source Protection Plan Compliance (Section 59 Notice) is not required.

GRCA has no comments.

Enova Power has no new comments.

Bell Canada please see attached comments.

Please review and address the comments provided. If you would like to have a formal meeting to review comments, please let me know.

- For a complete future Site Plan Agreement application, the following is required:
 - Township Planning fees
 - Pre-Application \$1500

- Review for Completion fee \$200
- Development Agreement Application fee \$5100
- Pre-Application form
- Completed SPA application form
- Storm water management
- Parking plan
- Servicing plan
- Salt management plan
- Tree management plan
- Lighting and photometric plan
- Truck turning movements plan
- Traffic control and signage details
- Erosion and sediment control plan
- Detailed grading and drainage plan
- Existing conditions and removals plan
- Landscape plan and landscape cost estimate
- Engineering cost estimate for external works including within requested road widening.
- Site plan identifying:
 - Fire routes
 - Visitor parking
 - Snow storage area
 - Parkland dedication
 - Garbage storage/pick up
 - Provision of Street trees
 - Dedicated road widening
 - Existing and proposed services
 - Truck turning and vehicle movements
 - Site lighting and a photometric detail

Zone Change Application Requirements:

- Prior to moving to a complete zone change application, the Township will require a second pre-application at which time the following draft reports and plans are to be submitted:
 - Planning justification report
 - Storm water management
 - Functional servicing report
 - Hydrogeological and geotechnical
 - Lot grading and drainage plan
 - Environmental impact study
 - Scoped traffic impact study
 - Fire flow analysis
 - Archeological study
 - Environmental noise study/railway vibration study
 - Response document to comments provided
 - Site plan
 - The Township Planning review fee for this process is \$2500.00.
- For a complete zone change application, the following is required:
 - Township Planning fees
 - Complete Application Review fee \$500
 - Advertising fee \$1500
 - Application fee \$2600

- Development Engineering Fees
 - Zoning application review fee \$200.
- Region of Waterloo Fees
 - Draft Plan of Condominium fee \$3150 + \$100/unit (to a maximum fee of \$6150)
 - Zoning by-law amendment fee \$3000.
- Draft zoning bylaw
- Completed ZBA application form
- Planning justification report to the satisfaction of the Township and Region
- Functional servicing report to the satisfaction of the Township and Region
- Storm water management report to the satisfaction of the Township and Region
- Fire flow analysis to the satisfaction of the Township
- Hydrogeological and geotechnical reports to the satisfaction of the Township
- Lot grading and drainage Plan to the satisfaction of the Township
- Urban design brief to the satisfaction of the Township
- Tree management plan to the satisfaction of the Township
- Scoped traffic impact study to the satisfaction of the Township
- Scaled site plan drawing to demonstrate functionality of the development proposal in conformity with the proposed zoning
- Record of site condition and ministry acknowledgement letter (dependent on written confirmation from the owner/applicant on the fuel tank)
- Environmental impact statement with peer review fee of \$5198.00 (unless addressed as per the Region comments) and to the satisfaction of the Township
- Archaeological assessment and Ministry acknowledgement letter
- Environmental noise study/railway vibration study
- Provide 1 electronic copy and 2 hard copies of the above.

Notes:

1. The above conditions of site plan approval are separate and independent of any review under the Ontario Building Code (OBC) as part of the Building Permit review process. If a building permit application does not comply with the OBC, a letter outlining the deficiencies or areas of non-compliance will be issued to the owner and/or agent. Site plan review and building permit review are separate and independent processes.
2. Please note that in the event a building permit for the proposed development has not been issued within one (1) year from the date of conditional site plan approval, the approval shall lapse. Prior to the approval lapsing, a request for an extension for a period up to, but not exceeding a one (1) year period, may be made directly to the Township, with written justification. The applicant is responsible for making this request and ensuring that any conditional site plan approval does not lapse.
3. Comments and requirements are based on the information provided and does not preclude additional requirements in the future by the Township.
4. Development Charges in effect at the time of Building Permit will apply.
5. Fees and Charges are subject to change annually.

If you have any questions, please feel free to contact us.

Sincerely,

Sherwin Meloney
Planner – Department of Development Services
 Town of Woolwich
 24 Church Street West, P.O. Box 158
 Elmira, ON N3B 2Z6



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Web: www.woolwich.ca

Appendix F: Geotechnical Data



GEOTECHNICAL INVESTIGATION

**PROPOSED TOWNHOUSE DEVELOPMENT
1134 PRINTERY ROAD
ST. JACOBS, ONTARIO**

CMT Project 24-811.R01

Prepared for:

Will-O Homes

December 19, 2024





CMT Engineering Inc.
1011 Industrial Crescent, Unit 1
St. Clements, Ontario N0B 2M0
Tel: 519-699-5775
Fax: 519-699-4664
www.cmtinc.net

December 19, 2024

24-811.R01

Will-O Homes
55 Reinhart Place
P.O. Box 187
Petersburg, ON
N0B 2H0

Attention: Mr. Kevin Smith

Dear Kevin:

**Re: Geotechnical Investigation
Proposed Townhouse Development
1134 Printery Road
St. Jacobs, Ontario**

As requested, CMT Engineering Inc. conducted a geotechnical investigation at the above-referenced site, and we are pleased to present the enclosed report.

We trust that this information meets your present requirements, and we thank you for allowing us to undertake this project. Should you have any questions, please do not hesitate to contact our office.

Yours truly,

A handwritten signature in black ink that reads 'Jake Feeney'. The signature is written in a cursive, flowing style.

Jake Feeney, P. Eng

tb

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1.0 INTRODUCTION

The services of CMT Engineering Inc. (CMT Inc.) were retained by Mr. Kevin Smith of Will-O-Homes to conduct a geotechnical investigation for the proposed townhouses to be located at 1134 Printery Road in St. Jacobs, Ontario. The location of the site is shown on Drawing 1.

It is understood that the project will comprise the construction of five (5) 2 storey townhouse blocks with an access road and parking. The geotechnical investigation was carried out in conjunction with a Hydrogeological Study, the results of which will be provided under separate cover by Hydrogeology Consulting Services (HCS).

The purpose of the geotechnical investigation was to assess the existing soil and groundwater conditions encountered in the boreholes. Included in the assessment are the soil classification and groundwater observations, as well as comments and recommendations regarding the estimated geotechnical resistance (bearing capacity); estimated serviceability limit states (anticipated settlement); dewatering considerations; site classification for seismic site response; recommendations for site grading, site servicing, excavations and backfilling; recommendations for slab-on-grade construction; pavement design/drainage; soil design properties; and a summary of the laboratory results.

The recommendations in this report are solely based on the soil conditions encountered in the boreholes advanced on the subject site.

2.0 EXISTING SITE CONDITIONS

Currently, the subject site comprises an existing farmhouse, a barn and agricultural land used for crop production. In general, the topography of the site slopes down towards the south throughout the proposed construction area. The subject site is bounded by existing residential properties in all directions. The St. Jacobs Printery is located to the north and additional agricultural land to the south and west.

3.0 FIELD AND LABORATORY PROCEDURES

The field investigation was conducted on November 20, 2024 and November 22, 2024 and comprised the advancement of seven (7) boreholes (referenced as Boreholes 1 to 7) utilizing a Geoprobe 7822DT drillrig operated by employees of CMT Drilling Inc. Boreholes 1, 3, 4, 5 and 7 were advanced to depths of approximately 7.62 m (25.00 ft) below the existing ground surface. Boreholes 2 and 6 were advanced to a depth of approximately 5.18 m (17.00 ft) below the existing ground surface.

Standard penetration testing (SPT) and sampling was carried out in the boreholes using 38 mm inside diameter split spoon sampling equipment and an automatic hammer, in accordance with ASTM D 1586 "Standard Test Method for Standard Penetration Test (SPT) and Split-Barrel Sampling of Soils". SPT soil sampling was generally conducted at 0.76 m (2.5 ft) intervals to

approximately 3.05 m (10.00 ft) and every 1.52 m (5.00 ft) thereafter to borehole termination. Macro core (MC5) direct push sampling in accordance with ASTM D6282/D6282M-14 "Standard Guide for Direct Push Soil Sampling" was generally conducted between the SPT samples below 3.05 m (10.00 ft) in the boreholes.

Boreholes 1, 3, 4, 5 and 7 were equipped with 38 mm diameter PVC monitoring wells comprising 1.0 m, 1.5 m and 3.0 m long screens backfilled with filter sand and then riser pipes, backfilled with bentonite. Boreholes 3 and 4 were equipped with both shallow (1.5 m and 2.7 m) and deep (7.6 m) wells to assess both upper perched water conditions as well as deeper water conditions. All monitoring wells were installed according with the Ontario Water Resources Act, Regulation 903 (O.Reg. 903) by well technicians licensed by the Ministry of the Environment, Conservation and Parks (MECP), working for a contractor also licensed by the MECP. The boreholes that were not instrumented with monitoring wells were backfilled with bentonite in accordance with O.Reg. 903. The monitoring wells are registered with the MECP and must be decommissioned in accordance with O.Reg. 903 prior to future construction.

Technical staff from CMT Inc. observed the drilling operation and collected and logged the recovered soil samples. A small portion of each sample was placed in a sealed, marked jar for moisture content determinations. Four (4) representative soil samples from the boreholes at the following depth were submitted to the CMT Inc. laboratory in St. Clements, Ontario for grain size analyses:

- Borehole 1 – depth 2.29 m to 2.90 m (7.50 ft to 9.50 ft),
- Borehole 3 – depth 1.52 m to 2.13 m (5.00 ft to 7.00 ft),
- Borehole 4 – depth 6.10 m to 7.62 m (20.00 ft to 25.00 ft),
- Borehole 5 – depth 5.18 m to 6.10 m (17.00 ft to 20.00 ft), and
- Borehole 7 - depth 3.05 m to 3.66 m (10.00 ft to 12.00 ft).

The borehole logs are provided in Appendix A and the grain size analyses are provided in Appendix B.

The ground surface elevations at the borehole locations were surveyed by CMT Inc. The storm sewer grate, located to the west of 1128 Printery Road at the south road edge of Printery Road, was utilized as a benchmark with an assumed elevation of 100.00 m. The ground surface elevations at the borehole locations ranged from approximately 97.87 m at Borehole 4 to 100.21 m at Borehole 1. The locations of the boreholes are shown on Drawing 2.

4.0 SUBSOIL CONDITIONS

The soils encountered in the boreholes are described briefly below and a more detailed stratigraphic description is provided on the borehole logs in Appendix A. The following paragraphs have been simplified into terms of major soil strata. The soil boundaries indicated have been inferred from non-continuous samples and observations of sampling and drilling resistance and typically represent transitions from one soil type to another rather than exact

planes of geological change. Further, the subsurface conditions are anticipated to vary between and beyond the borehole locations.

4.1. Topsoil

Loose, dark brown, silty, organic topsoil in a moist state was encountered at the surface of the boreholes. The thickness of the topsoil was observed to range from about 300 mm to 610 mm (average 344 mm) at the borehole locations, however the thickness of the topsoil is anticipated to vary throughout the site. Materials noted as topsoil in this report were classified based on visual and textural evidence. Testing of organic content or for other nutrients was not carried out.

4.2. Sand

Brown sand with trace to some gravel, trace to some silt and trace clay was encountered underlying the topsoil at the borehole locations and underlying the clay and silt at Boreholes 3, 6 and 7. The sand soils were observed to extend to the termination depth of Borehole 3. The sand soils were considered to be very loose to dense, with SPT N-values ranging from approximately 2 to 33 blows per 0.3 m (average 14 blows per 0.3 m). The sand was considered to be moist to saturated, with moisture contents ranging from about 1.9% to 23.4% (average 14.9%).

4.3. Silty Sand

Brown silty sand with trace to some clay and trace to no gravel was encountered underlying the clay and silt at Boreholes 4 and 7 and underlying the sand at Boreholes 5 and 6. The silty sand was observed to extend to the termination depth of Boreholes 4, 6 and 7. The silty sand soils were considered to be compact to dense, with SPT N-values ranging from approximately 12 to 35 blows per 0.3 m (average 24 blows per 0.3 m). The silty sand was considered to be wet, with moisture contents ranging from about 16.9% to 25.4% (average 20.4%).

4.4. Clay and Silt

Brown to grey clay and silt with trace sand was encountered underlying the sand at Boreholes 1 to 4 and 6 and 7, and underlying the silty sand at Borehole 5. The clay and silt soils were considered to be stiff to very stiff, with SPT N-values ranging from approximately 10 to 31 blows per 0.3 m (average 20 blows per 0.3 m). The clay and silt was observed to extend to the termination depth of Boreholes 1, 2 and 5. The clay and silt was considered to be moist to wet, with moisture contents ranging from about 10.4% to 26.2% (average 20.0%).

4.5. Groundwater

Monitoring wells were installed in Boreholes 1, 3 to 5 and 7 to measure the static water levels. The water levels were measured by HCS Inc. personnel on November 25, 2024. Two (2) wells each were installed at Boreholes 3 and 4 noted as 3S, 3D, 4S and 4D. The 'S' wells were installed shallower than the 'D' wells (shallow and deep). The purpose of the shallower wells was to assess the perched groundwater conditions on-site.

The measured elevations of water in the monitoring wells, the estimated wet to saturated zones, as well as the ground surface and bottom of borehole elevations, are provided in the following table:

Borehole No.	Ground Surface Elevation (m)	Measured Elevation of Water in Monitoring Well March 8, 2021 (m)	Estimated Wet to Saturated Zones (m)	Bottom of Borehole Elevation (m)
1	100.21	97.35 (2.86)	97.16 to 95.94	92.59
2	98.80	--	98.04 to 96.51	93.62
3S (Shallow)	98.07	96.62 (1.45)	96.55 to 95.78 and 90.91 to 90.45 (termination)	90.45
3D (Deep)		93.37 (4.70)		
4S (Shallow)	97.87	97.03 (0.84)	97.11 to 96.65 and 91.16 to 90.25 (termination)	90.25
4D (Deep)		93.80 (4.07)		
5	98.99	96.79 (2.20)	97.47 to 92.89	91.37
6	98.63	--	97.11 to 93.45 (termination)	93.45
7	98.95	94.67 (4.28)	94.07 to 92.24	91.33

Wet to saturated zones were observed in all boreholes. It should be noted that the monitoring wells were installed on November 20, 2024 and November 22, 2024. The typically finer grained clay and silt soils have the potential to create perched water conditions in any overlying soils. Perched water conditions were observed in the upper sand soils in most of the boreholes advanced for this investigation. Groundwater conditions are generally dependent on the amount of precipitation, control of surface water, as well as the time of year, and can fluctuate significantly in elevation and volume.

Recommendations with respect to dewatering conditions are provided in Section 5.8 of this report, and recommendations regarding waterproofing and drainage are presented in Section 5.10.

5.0 DISCUSSION AND RECOMMENDATIONS

The following sections of the report provide an interpretation of the factual geotechnical data obtained during the investigation and is intended for the guidance of the design engineer. Where comments are made on construction, they are provided only to highlight those aspects which could affect the design of the project. Contractors bidding on or undertaking the work should make their own independent interpretation of the factual subsurface information provided as it affects their proposed construction means and methods, equipment selection, scheduling, pricing, and the like.

Utilizing the information gathered during the geotechnical investigation and assuming that the borehole information is representative of the subsoil conditions throughout the site, the following comments and recommendations are provided.

5.1. Serviceability and Ultimate Limit Pressure

Based on the information obtained from the boreholes, the following table provides the estimated geotechnical reaction at the Serviceability Limit State (SLS) and the factored geotechnical resistance at the Ultimate Limit State (ULS) pressures at the various elevations, including soil types:

Borehole No.	Ground Surface Elevation (m)	SLS kPa (psf)	ULS kPa (psf)	Estimated Highest Founding Elevation (m)	Estimated Depth to Founding Elevation (m)	Soil Type
1	100.21	150 (3,000)	225 (4,500)	99.45 to 92.59 (termination)	0.76	Sand/Clay and Silt
2	98.80	150 (3,000)	225 (4,500)	98.04 to 93.62 (termination)	0.76	Sand/Clay and Silt
3S/3D	98.07	150 (3,000)	225 (4,500)	97.31 to 90.45 (termination)	0.76	Sand/Clay and Silt
4	97.87	150 (3,000)	225 (4,500)	97.11 to 90.25 (termination)	0.76	Sand/Clay and Silt/Silty Sand
5	98.99	150 (3,000)	225 (4,500)	98.23 to 91.37 (termination)	0.76	Sand/Silty Sand/Clay and Silt
6	98.63	150 (3,000)	225 (4,500)	97.87 to 93.45 (termination)	0.76	Clay and Silt/Sand/Silty Sand
7	98.95	150 (3,00)	225 (4,500)	98.34 to 91.33 (termination)	0.61	Sand/Clay and Silt/Sand/Silty Sand

Based on the information obtained from the geotechnical investigation and summarized in the table above, suitable founding soils capable of supporting conventional foundations designed with a bearing capacity of at least 150 kPa (3,000 psf) at SLS were generally encountered within the native soils at depths of approximately 0.61 m to 0.76 m below the ground surface.

With respect to the Serviceability Limit State (SLS), the total and differential footing settlements are not expected to exceed the generally acceptable limits of 25 mm (1") and 19 mm (3/4") respectively.

Should footings be designed to be constructed at elevations higher than the elevations indicated in the table above, then structural fill will be required in order to achieve the design grades for the proposed foundations. The serviceability limit pressure for good quality granular fill (OPSS Granular 'A' or 'B') placed on suitable subgrade soils and compacted in accordance with Section 5.4.2 of this report is estimated to be at least 150 kPa (3,000 psf) at SLS and 225 kPa (4,500 psf) at ULS. Alternatively, lean mix concrete fill could be used, or footings could be stepped down to bear on approved undisturbed founding soils. It is imperative that the founding soils be assessed at the time of construction by qualified geotechnical personnel in order to confirm their founding suitability.

It is expected that saturated soil conditions will be encountered at the interface between the sand and the clay and silt soils which may cause the soils to become unstable when excavating. Seepage and sloughing/caving of the excavation walls should be expected if the excavation extends into the wet to saturated soils.

Should wet to saturated soils be encountered during excavation, it is recommended that widened footings are considered for the support of the structure. It may be necessary to install a granular drainage layer to provide a suitable base for the foundations. This will depend on the bearing capacity required for the founding strata. If required, the granular drainage layer must conform to the requirements listed in Section 9.14.4 of the OBC 2012.

Footings founded on soil may be placed at a higher elevation relative to another footing provided that the slope between the outside face of the footings is separated by a minimum slope of 10 horizontal to 7 vertical (10H:7V) with an imaginary line projected from the underside of the footings.

It is recommended that structural foundation drawings be cross-referenced with site servicing drawings to ensure that service pipes do not conflict with building foundations (including the zone of influence down and away from the footings).

All exterior footings must be provided with a minimum of 1.2 m of soil cover or equivalent thermal insulation (sufficient thermal insulation is required to protect all footings and slab-on-grades during construction until such a time that the structure is heated) in order to provide protection against frost action.

5.2. Seismic Site Classification

The site classification for seismic response in Table 4.1.8.4 of the 2012 Ontario Building Code relates to the average properties of the upper 30.0 m of strata. The information obtained in the geotechnical field investigation was gathered from the upper 7.62 m (25.00 ft) of strata. Based on the information gathered in the geotechnical field investigation, the site classification for seismic site response would be considered Site Class D (stiff soils) for structures founded on the native soils at the recommended founding elevations provided in Section 5.1 of this report as well as structures founded on structural fill placed in accordance with Section 5.4.2 of this report. The structural engineer responsible for the design of the structure should review the earthquake loads and effects.

Mean seismic hazard values were determined for the 2 percent in 50-year (0.000404 per annum) probability of exceedance for the standard base condition assuming "firm ground" (NBCC 2015 Soil Class C, average V_{s30} shear wave velocity 450 m/s). The 5 percent damped spectral acceleration (S_a) values for the location of the site (as multiples of gravitational acceleration, 9.81 m/s^2) are: $S_a(0.2) = 0.113$; $S_a(0.5) = 0.074$; $S_a(1.0) = 0.044$; and $S_a(2) = 0.022$. The peak ground acceleration (PGA) value for the site is 0.58 m/s^2 with a peak ground velocity (PGV) of 0.068 m/s . Acceleration-based (F_a) and velocity-based (F_v) site coefficients of 1.3 and 1.4, respectively, should be applied to account for the Site Class D designation.

5.3. Soil Design Parameters

The following table provides estimated soil design parameters for imported granular fill, as well as the native soils encountered on the subject site. It should be noted that earth pressure coefficients (K_a , K_p , K_o) provided are for flat ground surface conditions and will differ for areas with slopes or embankments.

The estimated soil design parameters can be utilized for the design of perimeter shoring, foundations and retaining walls, as required:

Soil Type	Soil Density (kg/m ³)	Friction Angle (Degree)	Coefficient of Active Pressure (K_a)	Coefficient of Passive Pressure (K_p)	Coefficient of At-Rest Pressure (K_o)	Coefficient of Friction (μ)	Cohesion (Undrained) (kPa)
Imported Granular 'A' (OPSS 1010)	2,100	34°	0.28	3.54	0.44	0.45	0
Imported Granular 'B' (OPSS 1010)	2,050	33°	0.29	3.39	0.46	0.43	0
Sand	1,850	33°	0.29	3.39	0.46	0.43	0

Soil Type	Soil Density (kg/m ³)	Friction Angle (Degree)	Coefficient of Active Pressure (K _a)	Coefficient of Passive Pressure (K _p)	Coefficient of At-Rest Pressure (K _o)	Coefficient of Friction (μ)	Cohesion (Undrained) (kPa)
Silty Sand	1,850	32°	0.31	3.25	0.47	0.41	0
Clay and Silt	1,800	28°	0.36	2.77	0.53	0.35	0

5.4. Site Preparation

The site preparation for the proposed development is anticipated to consist of the demolition of the existing residence, sub-excavation of any loose/soft fill or native soils deemed not capable of supporting the design bearing capacity, removal or relocation of any existing services and buried piping (including any drainage tiles), followed by the placement of structural fill or lean mix concrete (as required) and site grading to achieve the proposed grades.

5.4.1. Removal/Relocation of Existing Services and Buried Piping

Any existing services and buried pipes (including drainage tiles) that may be located within the proposed building envelope must be removed/relocated. Any piping that is left in place that is no longer active must be completely sealed with watertight mechanical covers, concrete, or grout at termination points to prevent the migration of soils into pipe voids, which may result in potential settlement. All existing trench backfill material associated with any existing buried pipes must be subexcavated and the subsequent excavation must be backfilled with approved soils placed in accordance with Section 5.4.2 of this report.

5.4.2. Site Grading and Structural Fill Placement

Following the removal of all unsuitable soils, the exposed subgrade soils must be proof-rolled, and any soft or unstable areas must be subexcavated and replaced with approved fill materials. Any fill materials required to achieve the design site grades should be placed according to the following procedures:

- Prior to placement of any structural fill or bulk fill, the subgrade for the proposed building and any associated parking areas and driveways must be prepared large enough to accommodate a 1:1 slope commencing a distance of 1.0 m beyond the outside edge of the proposed foundations or pavement/concrete edge down to the approved competent founding soils,

- Soils approved for use as structural fill must be placed in loose lifts not exceeding 0.3 m (12") in depth for granular soils (recommended fill material) and 0.2 m (8") in depth for silts and clays (not recommended for this application), or the capacity of the compactor (whichever is less),
- Approved imported granular fill materials (OPSS 1010 Type II or Type III Granular 'B' recommended for this application) can be compacted utilizing adequate heavy vibratory smooth drum or padfoot compaction equipment,
- Fine-grained silt and clay soils (not recommended) must be compacted utilizing adequate heavy padfoot vibratory compaction equipment. It should be noted that the existing native soils were typically very stiff with depth. It is imperative that if the dense soils are utilized for structural fill, the material must be broken down (pulverized) to minimize voids and reduce the potential for settlement,
- Approved fill materials must be at suitable moisture contents (at or near to the optimum moisture content as determined by laboratory Proctor testing) to achieve the specified compaction. Soil moisture will also be dependent on weather conditions at the time of construction. Granular soils may require the addition of water in order to achieve the specified compaction,
- Approved structural fill materials that will support structures as well as slab-on-grades that will be subject to heavy loads or point loading (including any entrance slabs, concrete loading areas and other large expansive slabs) must be compacted to 100% standard Proctor maximum dry density (SPMDD),
- Approved bulk fill (foundation wall backfill, bulk fill under slab-on-grades that will not support footings or heavy point loading, bulk fill for driveways or surface-level parking areas) must be compacted to a minimum 95% SPMDD. It would be expected that the existing on-site soils, free of any deleterious materials, would be suitable for use as bulk fill; however, depending on the time of year and weather conditions when construction takes place, soils may require air-drying in order to achieve the specified density, and
- Granular 'B' subbase and Granular 'A' base materials for the driveways and paved areas must be compacted to 100% SPMDD.

Any wet soils (if encountered) will require significant air-drying along with working of the soils in order to achieve the specified compaction of 100% SPMDD in the building envelope (including 1:1 as required) and 95% SPMDD for bulk fill for any driveways and surface-level parking areas. Utilizing the existing soils during site grading may be more achievable if work is completed during the generally drier summer months. It should be noted, however, that due to the nature of some soils, during hot dry weather, the addition

of water may be required in order to achieve the specified compaction. Reuse of excavated soils on-site will be subject to approval from qualified geotechnical personnel.

It is imperative that if any very stiff cohesive soils are utilized as fill, the material must be broken down (pulverized) to minimize void space and reduce the potential for settlement. Problems associated with compacting very stiff cohesive soils include the potential for long-term settlement due to excessive void space caused by the generally blocky structure of the excavated soils. As such, any dense, blocky material should not be used as structural fill. The contractor must have equipment on-site that can effectively break down (pulverize) the very stiff excavated soil into workable sizes (as required). Backfilling utilizing this material must be performed in thin lifts with considerable compactive effort applied, thereby reducing the void space, and minimizing long-term settlement. This process could be difficult and time-consuming.

The native soils can be easily disturbed and subject to strength losses, making travel on this material somewhat difficult with conventional rubber-tired construction equipment such as dump trucks and compactors. Conditions should be expected to worsen if the subgrade soils are in a wet to saturated state. Therefore, it is recommended that construction traffic be minimized, where possible, from driving on the native subgrade soils. Depending on the time of year, it may be required to construct a haul road utilizing a Granular 'B' base.

5.4.3. Fill Removal

Any existing fill (including any existing trench backfill), as well as any native soil that has inadequate bearing capacity or has been disturbed by demolition/construction processes and is deemed unsuitable to support foundations or slab-on-grades, must be sub-excavated from within the proposed building envelopes, exterior entranceways, perimeter sidewalks and perimeter concrete slab areas to expose approved competent subgrade soils. It would also be sound construction practice to subexcavate all existing unsuitable fill from the paved driveway areas; however, this may not be cost-effective. At a minimum, thorough inspection will be required at the time of construction to assess the existing fill to ensure there is no buried topsoil or other deleterious materials within the subgrade. Remedial action will also be required to further consolidate the existing fill if it is decided to leave it in place. If the existing fill is left in place, provisions for the alterations to the design of the pavement structure should be included in the tender documents. Review of the subgrade and potential changes to the design of the pavement structure, as required, will be addressed at the time of construction.

Prior to reusing excavated material on-site as potential bulk fill, thorough field inspection and approval by qualified geotechnical personnel would be required to

ensure that existing fill materials are not comprised of organics, topsoil, or other deleterious materials.

5.4.3. Building Demolition

Currently, an existing residence and a barn building are located on the subject site. The buildings are expected to be removed/demolished prior to proceeding with development of the site. All above-grade structures as well as all foundations, concrete slabs and loose backfill must be removed from within the proposed building envelope, driveways and surface parking lot areas.

It should be noted that there was previously a barn located off the west side of the existing residence that has been demolished. As such it is possible that the building foundations and potential slabs still exist below grade. If encountered during excavating, all existing foundation walls, footings, slab-on-grades and other construction materials (if present), as well as all relatively loose backfill material, must be removed from within the proposed building envelopes, driveways and surface parking lot areas.

All excavations must be inspected and then backfilled as required according to the procedures outlined in Section 5.4.5 of this report. It is recommended that good quality imported granular material (OPSS 1010 Type II or Type III Granular 'B' or an approved alternative) be placed as structural fill as required. Provided any concrete from former building foundations and slab-on-grades, as well as any other concrete on-site (if encountered) is reduced to a maximum size of 100 mm, and all reinforcing steel and any deleterious materials are removed, the reduced concrete material may be combined with imported granular fill to be utilized as fill on-site. The reuse of this material will be subject to approval from qualified geotechnical personnel.

5.5. Foundation Subgrade Preparation

The soil encountered in the boreholes is sensitive to changes in moisture content and can become loose/soft if the soils are subjected to additional water or precipitation, as well as severe drying conditions. The soil could also be easily disturbed if traveled on during construction. Once they become disturbed, they are no longer considered adequate for the support of foundations.

To ensure and protect the integrity of the founding soils during construction operations, the following is recommended:

- During construction, the subgrade should be sloped/ditched to a sump (as required) located outside the structure footprints (if feasible) in the excavations to promote surface drainage of rainwater or seepage and the collected water should be pumped out of the excavation. It is critical that all water be

controlled (not allowed to pond) and that the subgrade and foundation preparation commence in dry conditions,

- Should the native soils at the design founding elevation in the proposed building envelopes be comprised of wet/saturated soils, then a granular drainage layer, constructed in accordance with Section 9.14.4 of the current Ontario Building Code (OBC) may be required. Alternatively, a lean mix concrete mud mat may be placed over top of the subgrade soils to provide a stable base,
- Construction equipment travel and foot traffic on the founding soils should be minimized,
- If construction is to be undertaken during subzero weather conditions, the founding native soils and any potential fill materials must be maintained above freezing,
- Prior to placing concrete for the footings, the footing area must be cleaned of all disturbed or caved materials,
- The foundation formwork and concrete should be installed as soon as practical following the excavation, inspection, and approval of the founding soils. The longer that the excavated soils remain open to weather conditions and groundwater seepage, the greater the potential for construction problems to occur,
- If it is expected that the founding soils will be left open to exposure for an extended period of time, it is recommended that a 75 mm concrete mud slab be placed in order to protect the structural integrity of the founding soils.

If wet soils are encountered at the founding elevations, pumping from properly constructed and filtered sumps located in the base of the excavation and outside of the bearing areas of any footings may be required to remove water from the excavation.

5.6. Slab-on-Grade/Modulus of Subgrade Reaction

Prior to the placement of the granular base material for any slab-on-grade construction, the subgrade soils should be proof-rolled. Any soft or weak zones, as well as the unsuitable fill in the subgrade, should be subexcavated and backfilled with approved fill materials (see Sections 5.4.2 and 5.10 of this report).

The following table provides the estimated modulus of subgrade reaction (k) for imported granular fill, as well as the native soils encountered on-site:

Soil Type	Estimated Modulus of Subgrade Reaction (k)
Imported Sand and Gravel (OPSS 1010)	81,000 kN/m ³ (300 lb/in ³)
Sand	61,100 kN/m ³ (225 lb/in ³)
Silty Sand	40,700 kN/m ³ (150 lb/in ³)
Clay and Silt	34,000 kN/m ³ (125 lb/in ³)

In dry conditions, floor slabs can be founded on a minimum thickness of 150 mm (6") of Granular 'A' (OPSS 1010) and compacted to 100% SPMDD. Given the potential for wet to saturated conditions, it would be recommended that for any basement floor slabs, 150 mm (6") of 19 mm clear crushed stone (OPSS 1004) should be used instead of Granular 'A'. Utilizing clear crushed stone for the slab-on-grade base can assist in providing a moisture barrier by reducing the potential for capillary rise of moisture from the subgrade soils. Compactive effort is required to consolidate the clear stone. The 19 mm clear crushed stone should meet the physical property and gradation requirements of OPSS 1004.

It is recommended that areas of extensive exterior slab-on-grade (sidewalks and accessibility ramps) be constructed with a Granular 'B' subbase (450 mm) and a Granular 'A' base (150 mm), as well as incorporating subdrains, to promote rapid drainage and reduce the effects of frost heaving. This is particularly critical at barrier-free access points. Alternatively, structural frost slabs could be designed and constructed, or sufficient thermal insulation could be provided, at all door entrances and areas of barrier-free access.

5.7. Excavations

All excavations must be carried out in accordance with Ontario Regulation 213/91 (Reg 213/91) of the Occupational Health and Safety Act and Regulations for Construction Projects.

Type 2 Soils – In general the native clay and silt soils, in a drained state, encountered in the boreholes are considered to be Type 2 soils under the regulation and if trenched, must be sloped from the bottom of the excavation having a minimum gradient of 1 horizontal to 1 vertical. Soils underlain by Type 3 or 4 soils that are exposed in the excavation must be treated as Type 3 or 4 soils (see below).

Type 3 Soils – In general the native sand and silty sand soils, in a drained state, encountered in the boreholes are considered to be Type 3 soils under the regulation and if trenched, must be sloped from the bottom of the excavation having a minimum gradient of 1 horizontal to 1 vertical. Soils underlain by Type 4 soils that are exposed in the excavation must be treated as Type 4 soils (see below).

Type 4 Soils - In general, any wet to saturated soils (if encountered) would be classified as Type 4 soils under Reg 213/91. Type 4 soils must be sloped from the bottom of the excavation at a minimum gradient of 3 horizontal to 1 vertical.

If it is not practical to excavate according to the above requirements, then a trench support system (designed in accordance with the Ontario Health and Safety Act Regulations) may be utilized. When using a temporary trench support system consisting of trench boxes to reduce the lateral extent of the excavations, it should be noted that the support system is intended primarily to protect workers as opposed to controlling lateral soil movement. Any voids between the excavation walls and the support system should be immediately filled to reduce the potential for loss of ground and to provide support to existing adjacent utilities and structures, and it is recommended that the excavation be carried out in short sections, with the support system installed immediately upon excavation completion. If the excavation is not a trench, no worker should be required to be closer to a wall of the excavation than the height of the excavated wall.

Sloughing/caving of the excavation walls should be expected when excavating into wet to saturated soils, if encountered. As such, it may be necessary to increase the width of the excavation to accommodate sloughing/caving soils.

5.8. Construction Dewatering Considerations

Wet to saturated conditions were observed in all boreholes upon completion. As noted previously, perched water conditions were observed in the boreholes and it is expected that saturated soil conditions may be encountered at the interface between the sand and the clay and silt soils which, may cause these soils to become prone to instability during excavation. It should be noted that groundwater conditions (particularly perched water) are generally dependent on the amount of precipitation, control of surface water, as well as the time of year, and can fluctuate significantly in elevation and volume. As such, provisions for site dewatering should be part of the site development and construction process.

Seepage control requirements during construction will depend upon the area of work on the site, the depth of the excavations, the time of year, the amount of precipitation and the control of surface water. As required, seepage should generally be adequately controlled using conventional construction dewatering techniques such as pumping from sump pits. However, if heavy seepage occurs, it may be necessary to increase the number of pumps during construction.

Dewatering should be performed in accordance with OPSS 517 and the control of water must be in accordance with OPSS 518. It is the responsibility of the contractor to propose a suitable dewatering system based on the groundwater elevation at the time of construction. Collected water should discharge a sufficient distance away from the excavation to prevent re-entry. Sediment control measures must be installed at the discharge point of the dewatering system to avoid any potential adverse impacts on the environment.

5.9. Service Pipe Bedding

The native soils encountered in the geotechnical investigation are generally considered suitable for indirect support of the site service pipes. There is the potential for instability due to wet soil conditions to be encountered, and as such it may be necessary to increase the thickness of the granular base and utilize 19 mm clear stone to create an adequate supporting base for the service pipes and/or manholes. Pipe embedment, cover, and backfill for both flexible and rigid pipes should be in accordance with all current and applicable OPSD, OPSS and OBC standards and guidelines and as follows.

Flexible Pipes – The pipe bedding should be shaped to receive the bottom of the pipe. If necessary, pipe culvert frost treatment should be undertaken in accordance with OPSD-803.031. The trench excavations should be symmetrical with respect to the centreline of the pipe. The granular material placed under the haunches of the pipe must be compacted to 95% SPMDD prior to the continued placement and compaction of the embedment material. The homogeneous granular material used for embedment should be placed and compacted uniformly around the pipe. Should wet conditions be encountered at the base of the trench, then the pipe bedding should consist of 19 mm clear stone (meeting OPS Specifications) wrapped completely in a geotextile fabric such as Terrafix 270 or equivalent.

Rigid Pipes - In general, the pipe installation recommendations for rigid pipes are the same as those for flexible pipes, except that the minimum bedding depth below a rigid pipe should be $0.15D$ (where D is the pipe diameter). In no case should this dimension be less than 150 mm or greater than 300 mm.

Any service pipes that are not provided with sufficient frost coverage must be protected with the necessary equivalent thermal insulation. The general contractor is responsible for protecting service piping from damage by heavy equipment.

5.10. Perimeter Building Drainage, Foundation Wall Backfill and Trench Backfill

Accumulated groundwater and wet to saturated soils were observed within the boreholes. It should be noted that groundwater elevations (perched and regional water tables) are typically dependent on weather and seasonal conditions and should be expected to fluctuate. Foundations constructed within wet to saturated soils (if encountered) could be subject to flooding in the event of a power failure or equipment malfunction.

If applicable, it would be recommended that foundations be constructed at least one footing width (minimum 0.5 m) above the static water level.

Depending on the design founding elevations and groundwater conditions at the time of construction, it may be necessary to install a granular drainage layer to provide a suitable base for the foundations as well as the slab-on-grade. If required, the granular drainage layer must conform to the requirements listed in Section 9.14.4 of the OBC 2012.

In order to assist in maintaining dry buildings with respect to surface water seepage, it is recommended that exterior grades around the buildings be sloped down and away at a 2% gradient or more, for a distance of at least 1.5 m. Any surface discharge rainwater leaders must be constructed with solid piping that discharges with positive drainage at least 1.5 m away from the building foundations and/or beyond external slab-on-grades such as loading areas, sidewalks and accessibility ramps to a drainage swale or appropriate storm drainage system.

It is anticipated that the proposed townhouses will have basements. Should a basement or underground parking be installed, a perimeter drainage system will be required. The drainage system should be installed at the founding elevation and be constructed with positive drainage into a sump pit or other suitable outlet that provides positive drainage away from the structure. Perforated subdrains should be installed around both the exterior and interior perimeter, throughout the interior, and non-perforated pipe should be installed to direct the collected exterior water to a sump pit with a good quality sump pump(s). It is recommended that sump pumps be equipped with a battery backup (in the event of a power outage). It is also recommended that a capped cleanout port(s) be extended up to the ground surface elevation to provide future access (if required). Rainwater leaders must not be connected to the perimeter drainage system.

If a basement/underground-parking is to be installed a foundation wall and slab-on-grade waterproofing system should be designed for the site by a qualified installer and must conform to current OBC regulations (as required).

In order to reduce the effects of surficial frost heave in areas that will be hard surfaced, it is recommended that the exterior foundation backfill consist of free-draining granular material such as imported sand or Granular 'B' Type I, or Type III (OPSS 1010), with a maximum aggregate size not exceeding 100 mm, and that it extend a minimum lateral distance of 600 mm out from the foundation walls and/or beyond perimeter sidewalks and entranceway slabs. It is critical that particles greater than 100 mm in diameter are not in contact with the foundation wall to prevent point loading and overstressing. The backfill material used against the foundation walls must be placed so that the allowable lateral capacities of the foundation walls are not exceeded. Where only one side of a foundation wall will be backfilled, and the height of the wall is such that lateral support is required, or where the concrete strength has not been achieved, the wall must be braced or laterally supported prior to backfilling. In situations where both sides of the wall are backfilled, the backfill should be placed in equal lifts, not exceeding 200 mm

differential on each side during backfill operations and the backfill should be compacted to a minimum of 98% SPMDD.

It is recommended that frost tapers be constructed (refer to OPSD 3101.150 for typical details) in order to minimize differential frost action between the foundation wall backfill and the granular base of any adjacent paved areas. The frost taper must be constructed utilizing the OPSS 1010 granular material that is used for the foundation wall backfill.

The native soils are generally considered suitable for reuse as trench backfill and bulk fill in the driveways and surface-level parking areas; however, any wet soils encountered may require air-drying in order to achieve the specified compaction. Air-drying cannot typically be achieved during winter construction; therefore, depending on the time of year that construction takes place, it may be more feasible to utilize an imported granular fill for this project (keeping in mind that frost tapers, as noted above, would be recommended to minimize differential frost heave).

Backfilling operations should be carried out with the following minimum requirements:

- Adequate heavy padfoot (cohesive soils) or smooth drum (non-cohesive soils) vibratory compaction equipment should be used for the compaction and to break down any large blocky pieces of soil,
- Loose lift thicknesses should not exceed 0.3 m (12") for sand and gravel soils (non-cohesive) or 0.2 m (8") for clay and silt soils (cohesive) or the capacity of the compactor (whichever is less),
- The soils must be at suitable moisture contents to achieve compaction to a minimum 95% SPMDD in non-structural bulk fill areas. Service trenches excavated within the zone of influence of footings for structures must be compacted to a minimum of 100% SPMDD,
- It is recommended that inspection and testing be carried out during construction to confirm backfill quality, thickness and to ensure that compaction requirements are achieved,
- Service trench backfill materials may consist of approved excavated soils with no particles greater than 100 mm and no topsoil or other deleterious materials,
- If construction operations are undertaken in the winter, strict consideration should be given to the condition of the backfill material to make certain that frozen material is not used.

It is imperative that if any very stiff soils are utilized for backfilling of service trenches, the material must be broken down (pulverized) to minimize voids and reduce the potential for settlement.

5.11. Pavement Design/Drainage

Any soils containing organics or other deleterious material must be subexcavated from within the proposed parking areas and entrances. It is recommended to either subexcavate any existing loose subgrade materials or provide further consolidation with vibratory compaction equipment in order to prepare a proper, stable subgrade. Prior to placement of the granular base, the subgrade must be proof-rolled, and any soft or unstable areas should be subexcavated and replaced with suitable approved materials. The subgrade should be graded smooth (free of depressions) and properly crowned to ensure positive drainage, with a minimum grade of 3% toward the drainage outlet or curb line. When service pipes are installed, pipe bedding and backfilling should be undertaken as indicated in Sections 5.9 and 5.10 of this report.

Rapid drainage of the pavement structure is critical to ensure long-term performance. As such, it is recommended to install subdrains for this project (provided gravity drainage to a suitable outlet can be provided). Subdrains should be designed and installed in accordance with OPSS 405 and OPSD 216.021. If Granular 'A' bedding (OPSS 1010) is utilized, the subdrains should be equipped with a factory installed filter sock. If 19 mm clear stone (OPSS 1004) is utilized as bedding for the subdrain (recommended for this application), then the bedding must be wrapped completely with geotextile filter fabric such as Terrafix 270R (or equivalent). Installation of rigid subdrains allows for better grade control and less potential for damage during installation or service. Positive drainage through grade control of subdrains is critical, as improperly installed subdrains can turn drainage systems into reservoirs, which can fuel frost action. The subdrains will hasten the removal of water, thereby reducing the risk and effects of frost heaving and load transfer in saturated conditions. It is suggested that subdrains be installed at regular intervals (to be designed based on layout of catch basins and storm sewers) through paved driveways and parking areas.

It is also recommended to install subdrains through any areas that cannot tolerate differential frost heave such as accessibility ramps/sidewalks. The subdrains should be installed in a 0.3 m (1.0 ft) by 0.3 m (1.0 ft) trench in the subgrade and bedded approximately 50 mm (2") above the bottom of the trench. The subgrade must be prepared with positive drainage to the subdrains and the subdrains must be installed with positive drainage into a catch basin structure or other suitable outlet.

The native subgrade soils are highly sensitive to changes in moisture content and can become loose or soft if the soils are subject to inclement weather and seepage or severe drying. Furthermore, the subgrade soil could be easily disturbed if traveled on during construction. As such, where this material will be exposed, it is recommended that the granular subbase be placed immediately upon completion of the subgrade preparation to protect the integrity of the subgrade soils.

Should wet conditions be encountered during construction, site assessments may be required to determine what options can be undertaken to construct a modified pavement base. These options may include subexcavation of loose/soft soils, increasing the

thickness of the granular base, the use of reinforcing geotextiles or geogrids, or a combination of all.

It is expected that the roadway will experience both light traffic (personal vehicles) and some heavy traffic (moving trucks, delivery trucks, maintenance, and emergency vehicles). Based on the anticipated vehicle loading and frost-susceptibility of the subgrade soils, the following pavement design is provided:

Material	Recommended Thickness For New Pavement	
	Light Traffic	Heavy Traffic
Asphaltic Concrete	HL3 – 50 mm (2.0") HL4 or HL8 – 50 mm (2.0")	HL3 – 50 mm (2.0") HL8 – 75 mm (3.0")
Granular 'A' Base	150 mm (6.0")	150 mm (6.0")
Granular 'B' Subbase	400 mm (16.0")	450 mm (18.0")

Construction joints in the surface and binder asphalt must be offset a minimum of 150 mm to 300 mm (6" to 12") from construction joints in the binder asphalt so that longitudinal joints do not coincide.

Should any new asphalt be joined into existing asphalt, it is recommended that the existing asphalt be sawcut in a straight line prior to being milled to a depth of 80 mm and a width of 300 mm as per OPSD 509.010. It is recommended that a tack coat in conformance with OPSS 308 be applied to the edge and surface of all milled asphalt prior to placement of new asphalt.

The granular base and subbase materials must conform to the physical property and gradation requirements of OPSS 1010 and must be compacted to 100% SPMDD. Asphaltic concrete should be supplied, placed, and compacted to a minimum 92.0% Marshall maximum relative density, in accordance with OPSS 1150 and OPSS 310.

The pavement should be designed to ensure that water will not pond on the pavement surface. If the surface asphalt is not placed within a reasonable time following placement of the binder asphalt, it is recommended that the catch basin lids are set at a lower elevation, or apertures provided to allow surface water to drain into the catch basins and not accumulate around the catch basins. The strength of the pavement structure relies on all of the components to be in place in order to provide the design strength; therefore, it is strongly recommended that the surface asphalt be placed shortly after placement of the binder asphalt so as to avoid undue stress on the binder asphalt by not having the complete pavement structure in place.

It should be noted that, currently, asphalt mixes tend to be more flexible and, as such, there is a tendency for damage to occur from vehicles turning their steering wheels or

applying excessive brake pressure. The condition is further intensified during hot weather. In high traffic areas or areas subjected to frequent turning of heavy vehicles, it is recommended that rigid Portland cement pavement be considered.

5.12. Radon

According to information provided by Health Canada, radon is a radioactive gas that is naturally formed through the breakdown of uranium in soil, rock, and water. When radon escapes the earth in the outdoors, it mixes with fresh air, resulting in concentrations that are too low to be of concern. However, when radon enters an enclosed space, such as a building, high concentration of radon can accumulate and become a health concern. Health Canada indicates that most buildings and homes have some level of radon in them. Unfortunately, it is not possible to predict before construction whether or not a new building will have high radon levels as radon can only be detected by radon measurement devices, which would be installed in a building, post construction. Section 9.13.4.1 Soil Gas Control of the current 2012 Ontario Building Code (OBC) states that “Where methane or radon gases are known to be a problem, construction shall comply with the requirements for soil gas control in MMAH Supplementary Standard SB-9, Requirements for Soil Gas Control”.

5.13. Chemical Analysis/Excess Soil Management

As requested, CMT Engineering Inc. has obtained two (2) soil samples from 1134 Printery Road in St. Jacob’s, Ontario. The samples were obtained on November 20, 2024 and November 22, 2024 and submitted to the ALS Environmental Laboratory in Waterloo, Ontario for chemical analysis on November 25, 2024.

Sampling was undertaken following the Ministry of Environment, Conservation and Parks “Guideline on Sampling and Analytical Methods for Use at Contaminated Sites in Ontario” protocol. One soil sample was tested for the corrosivity package of tests and the other soil sample was tested for Sodium Adsorption Ratio (SAR).

The following table presents the results of the corrosivity testing completed by ALS for Borehole 1 Sample 3:

Parameter	Sample 1 Results
Chlorides	23.4 ppm
Sulphates	<20 ppm
Resistivity	9,430 Ω/cm
pH	8.18

The following table presents the results of the SAR testing completed by ALS for Borehole 7 Sample 2:

Parameter	Sample 1 Results
Calcium	9.64 mg/L
Magnesium	3.23 mg/L
Sodium	28.9 mg/L
SAR	2.06

The results of the chemical analysis are attached for your reference. Please note, the units shown on the analysis results for chlorides and sulphates is mg/kg which is equal to ppm.

We trust this information meets with your present requirements. CMT Inc. recommends that an environmental consultant be contacted for further recommendations when exceedances are found. Should you have any questions or require additional testing, please do not hesitate to contact our office.

6.0 SITE INSPECTION

Qualified geotechnical personnel should supervise excavation inspections as well as compaction testing for any structural filling, site grading, and site servicing. This will ensure that footings are founded in the proper strata and that proper material, and techniques are used, and the specified compaction is achieved. CMT Engineering Inc. would be pleased to review the design drawings and provide an inspection and testing program for the construction of the proposed new building.

7.0 LIMITATIONS OF THE INVESTIGATION

This report is intended for the Client named herein and for their Client. The report should be read in its entirety, and no portion of this report may be used as a separate entity. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties.

The recommendations made in this report are in accordance with our present understanding of the project. We request that we be permitted to review our recommendations when the drawings and specifications are complete, or if the proposed construction should differ from that mentioned in this report.

It is important to emphasize that a soil investigation is, in fact, a random sampling of a site and the comments are based on the results obtained at the test locations only. It is therefore assumed that these results are representative of the subsoil conditions across the site. Should any conditions at the site be encountered which differ from those found at the test locations, we request that we be notified immediately in order to permit a reassessment of our recommendations.

It should be noted that this report specifically addresses geotechnical aspects of the project and does not include any investigations or assessments relating to potential subsurface contamination. As such, there should be no assumptions or conclusions derived from this report with respect to potential soil or water contamination.

The samples obtained during the geotechnical investigation will be stored for a period of three months, after which time they will be disposed of unless alternative arrangements are made.

We trust that this report meets with your present requirements. Should you have any questions, please do not hesitate to contact our office.

Prepared by:



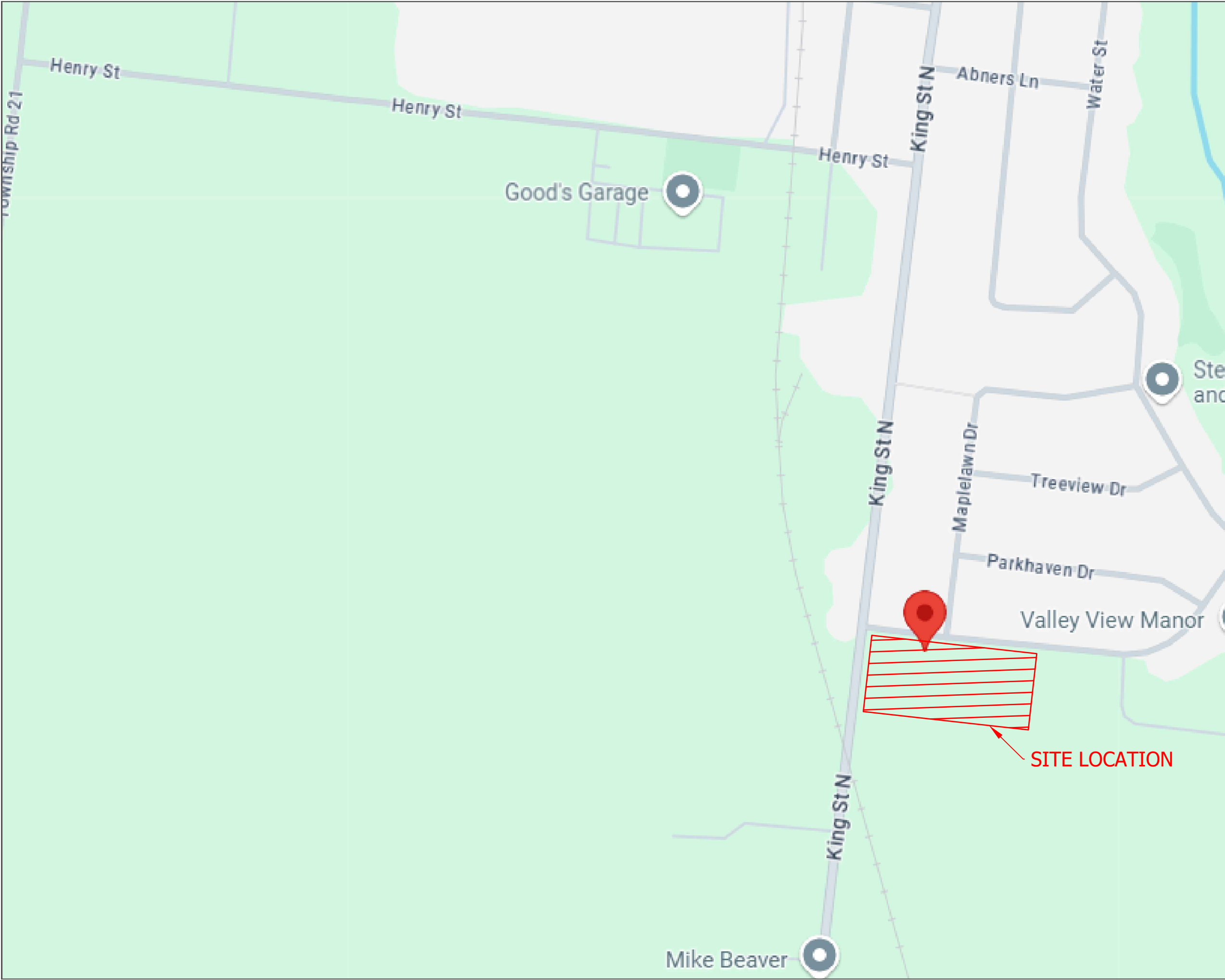
Jake Feeney, P.Eng.

Reviewed by:



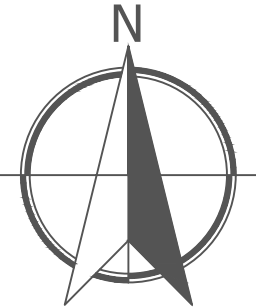
Nathan Chortos, P.Eng.
Senior Geotechnical Engineer

tb



NOTES:

1. BASE MAP PROVIDED BY GOOGLE MAPS



NO.	DESCRIPTION	DATE

REVISIONS



CMT ENGINEERING INC.
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www.cmtinc.net

PROJECT:
PROPOSED TOWNHOUSE
DEVELOPMENT
1134 Printery Road
St. Jacobs, Ontario

DRAWING TITLE:

SITE LOCATION MAP

PROJECT NO.:	DATE:
24-811	November 25, 2024
SCALE:	DRAWING NO.
N.T.S.	1



NOTES:

1. DRAWING PROVIDED BY GSP Group

Legend



CMT Borehole (2024)



CMT Monitoring Well (2024)



Temporary Benchmark - Catchbasin on
Printery Street (Elevation: 100.00 m)



NO.	DESCRIPTION	DATE
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REVISIONS



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PROJECT:

PROPOSED TOWNHOUSE
DEVELOPMENT
1134 Printery Road
St. Jacobs, Ontario

DRAWING TITLE:

SITE DRAWING SHOWING
BOREHOLE LOCATIONS

PROJECT NO.:

24-811

DATE:

November 25, 2024

SCALE:

N.T.S.

DRAWING NO.

2

APPENDIX A

BOREHOLE LOGS



CMT Engineering Inc.
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BOREHOLE NUMBER 1

PAGE 1 OF 1

PROJECT: Proposed Townhouse Development

PROJECT ADDRESS: 1134 Printery Road

PROJECT LOCATION: St. Jacobs, Ontario

PROJECT NUMBER: 24-811

DRILLING DATE: 24-11-20

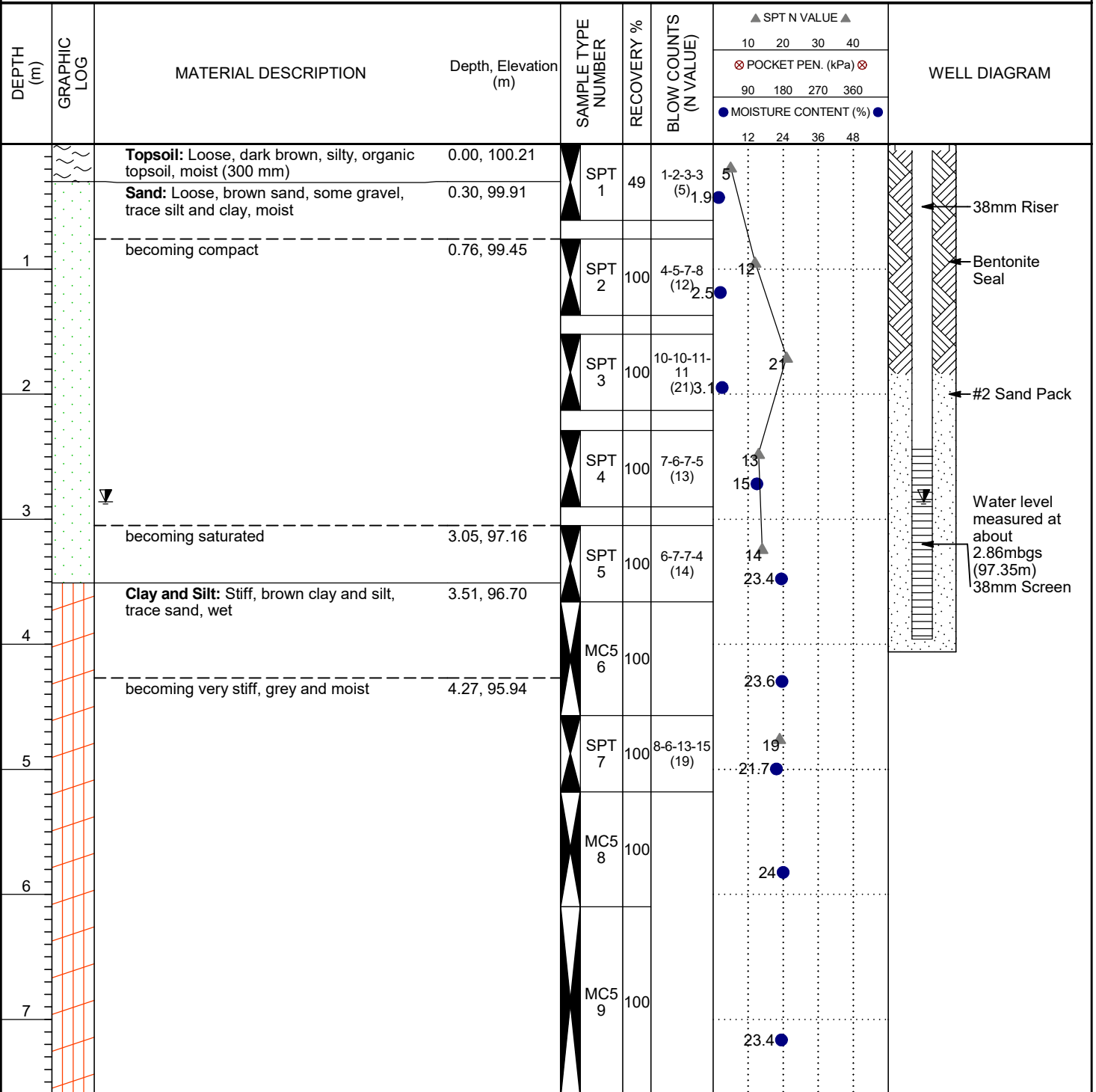
DRILLING CONTRACTOR: CMT Drilling Inc.

DRILLING EQUIPMENT: Geoprobe 7822DT

GROUND ELEVATION: 100.21 m

LOGGED BY: J. Feeney

SAMPLING METHOD: SPT/MC5



BOREHOLE LOG WITH WELL2 24-811.GPJ CMT_TEMPLATE_2020-05-15.GDT 24-12-13



CMT Engineering Inc.
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BOREHOLE NUMBER 2

PAGE 1 OF 1

PROJECT: Proposed Townhouse Development

PROJECT ADDRESS: 1134 Printery Road

PROJECT LOCATION: St. Jacobs, Ontario

PROJECT NUMBER: 24-811

DRILLING DATE: 24-11-20

DRILLING CONTRACTOR: CMT Drilling Inc.

DRILLING EQUIPMENT: Geoprobe 7822DT

GROUND ELEVATION: 98.80 m

LOGGED BY: J. Feeney

SAMPLING METHOD: SPT/MC5

DEPTH (m)	GRAPHIC LOG	MATERIAL DESCRIPTION	Depth, Elevation (m)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	▲ SPT N VALUE ▲				WELL DIAGRAM	
							10	20	30	40		
							⊗ POCKET PEN. (kPa) ⊗					
							90	180	270	360		
							● MOISTURE CONTENT (%) ●					
							12	24	36	48		
1		Topsoil: Loose, dark brown, silty, organic topsoil, moist (300 mm)	0.00, 98.80	SPT 1	74	2-1-2-2 (3)	3	10	17.8	18	17	21.7
		Sand: Very loose, brown sand, some gravel, trace silt and clay, moist	0.30, 98.50									
		becoming compact and wet to saturated	0.76, 98.04	SPT 2	100	6-9-9-12 (18)						
2				SPT 3	100	12-9-8-8 (17)						
3		Clay and Silt: Very stiff, brown clay and silt, trace sand, moist	2.29, 96.51	SPT 4	49	6-10-13-16 (23)	19	23	22	15.5	23.4	19.2
		becoming grey	3.05, 95.75									
4				SPT 5	100	5-9-13-20 (22)						
				MC5 6	100							
5				SPT 7	100	9-12-12-16 (24)						

Borehole caved at about 1.63 m below the ground surface. No accumulated groundwater or seepage observed upon completion.

Bottom of borehole at 5.18 m, Elevation 93.62 m.



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BOREHOLE NUMBER 3D

PAGE 1 OF 1

PROJECT: Proposed Townhouse Development

PROJECT ADDRESS: 1134 Printery Road

PROJECT LOCATION: St. Jacobs, Ontario

PROJECT NUMBER: 24-811

DRILLING DATE: 24-11-22

DRILLING CONTRACTOR: CMT Drilling Inc.

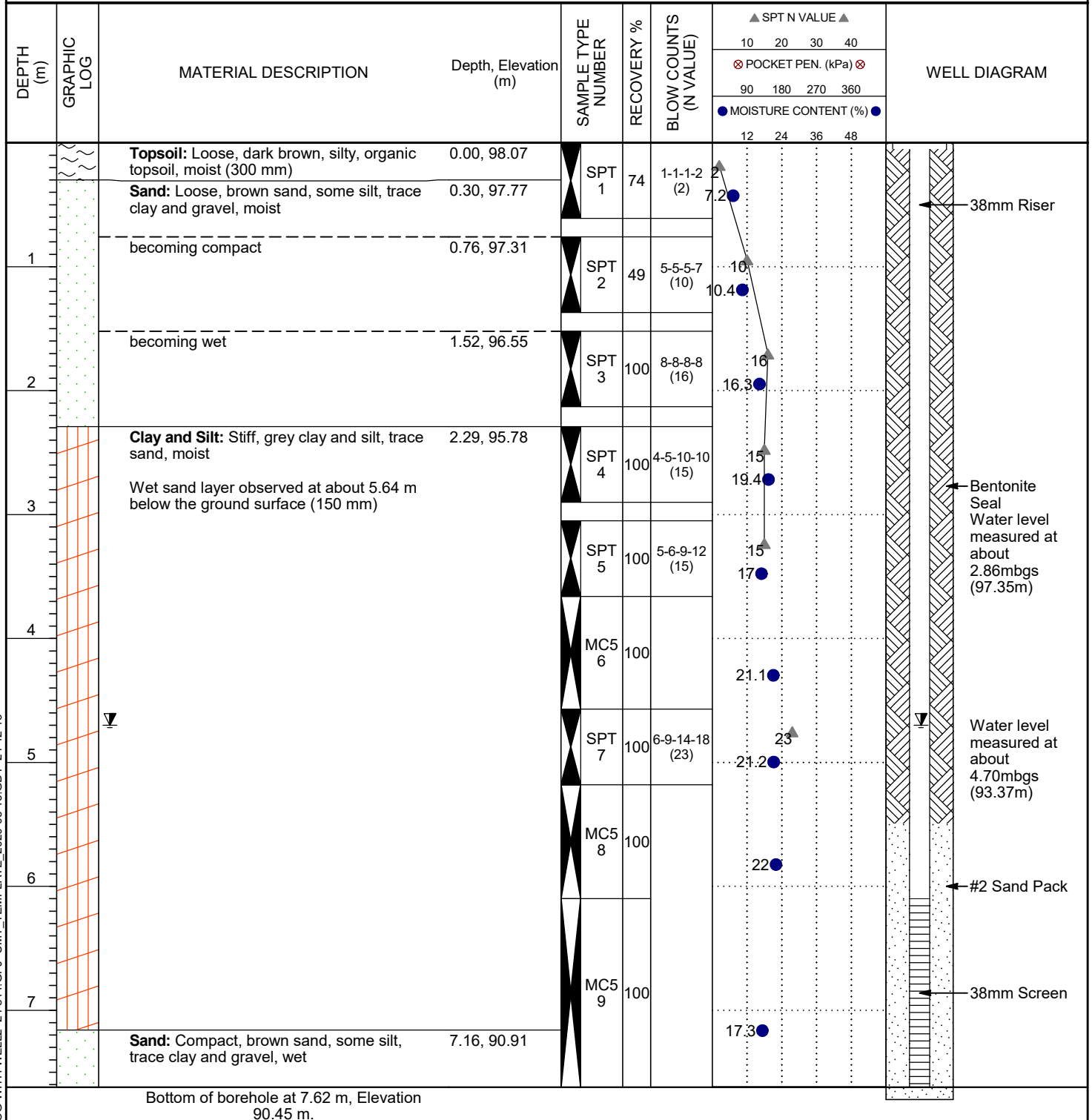
DRILLING EQUIPMENT: Geoprobe 7822DT

GROUND ELEVATION: 98.07 m

LOGGED BY: J. Feeney

SAMPLING METHOD: SPT/MC5

BOREHOLE LOG WITH WELL2 24-811.GPJ CMT_TEMPLATE_2020-05-15.GDT 24-12-13





CMT Engineering Inc.
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BOREHOLE NUMBER 3S

PAGE 1 OF 1

PROJECT: Proposed Townhouse Development

PROJECT ADDRESS: 1134 Printery Road

PROJECT LOCATION: St. Jacobs, Ontario

PROJECT NUMBER: 24-811

DRILLING DATE: 24-11-22

DRILLING CONTRACTOR: CMT DRILLING INC.

DRILLING EQUIPMENT: Geoprobe 7822DT

GROUND ELEVATION: 98.07 m

LOGGED BY: J. Feeney

SAMPLING METHOD: SPT/MC5

DEPTH (m)	GRAPHIC LOG	MATERIAL DESCRIPTION	Depth, Elevation (m)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	▲ SPT N VALUE ▲				WELL DIAGRAM	
							10	20	30	40		
							⊗ POCKET PEN. (kPa) ⊗					
							90	180	270	360		
							● MOISTURE CONTENT (%) ●					
							12	24	36	48		
1		Topsoil: Loose, dark brown, silty, organic topsoil, moist (300 mm)	0.00, 98.07	SPT 1	74	1-1-1-2 (2)	7.2	10.4	16.3	19.4	21.1	23
		Sand: Loose, brown sand, some silt, trace clay and gravel, moist	0.30, 97.77									
		becoming compact	0.76, 97.31									
2		becoming wet	1.52, 96.55	SPT 2	49	5-5-5-7 (10)	10.4	16.3	19.4	21.1	23	23
3		Clay and Silt: Stiff, grey clay and silt, trace sand, moist	2.29, 95.78	SPT 3	100	8-8-8-8 (16)	16.3	19.4	21.1	23	23	23
4		Wet sand layer observed at about 5.64 m below the ground surface (150 mm)		SPT 4	100	4-5-10-10 (15)	15	17	21.1	23	23	23
5				SPT 5	100	5-6-9-12 (15)	15	17	21.1	23	23	23
6				MC5 6	100							
7				SPT 7	100	6-9-14-18 (23)	23	21.2	22	17.3		
8				MC5 8	100							
9				MC5 9	100							
10		Sand: Compact, brown sand, some silt, trace clay and gravel, wet	7.16, 90.91									

Bottom of borehole at 7.62 m, Elevation 90.45 m.

BOREHOLE LOG WITH WELL2 24-811.GPJ CMT_TEMPLATE_2020-05-15.GDT 24-12-13



CMT Engineering Inc.
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BOREHOLE NUMBER 4D

PAGE 1 OF 1

PROJECT: Proposed Townhouse Development

PROJECT ADDRESS: 1134 Printery Road

PROJECT LOCATION: St. Jacobs, Ontario

PROJECT NUMBER: 24-811

DRILLING DATE: 24-11-20

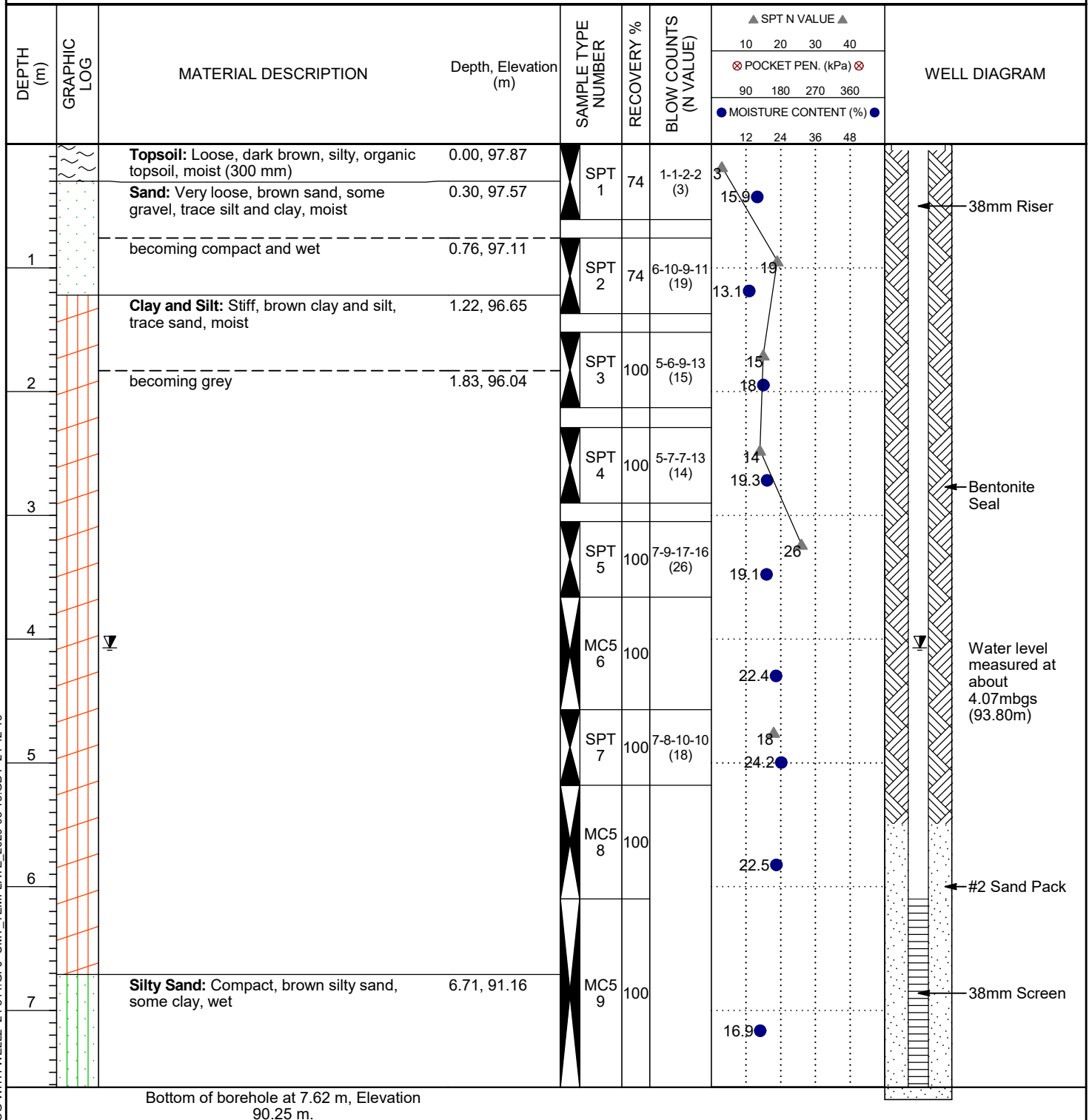
DRILLING CONTRACTOR: CMT Drilling Inc.

DRILLING EQUIPMENT: Geoprobe 7822DT

GROUND ELEVATION: 97.87 m

LOGGED BY: J. Feeney

SAMPLING METHOD: SPT/MC5



BOREHOLE LOG WITH WELL2 24-811.GPJ CMT_TEMPLATE_2020-05-15.GDT 24-12-13

PROJECT: Proposed Townhouse Development

PROJECT ADDRESS: 1134 Printery Road

PROJECT LOCATION: St. Jacobs, Ontario

GROUND ELEVATION: 97.87 m

LOGGED BY: J. Feeney

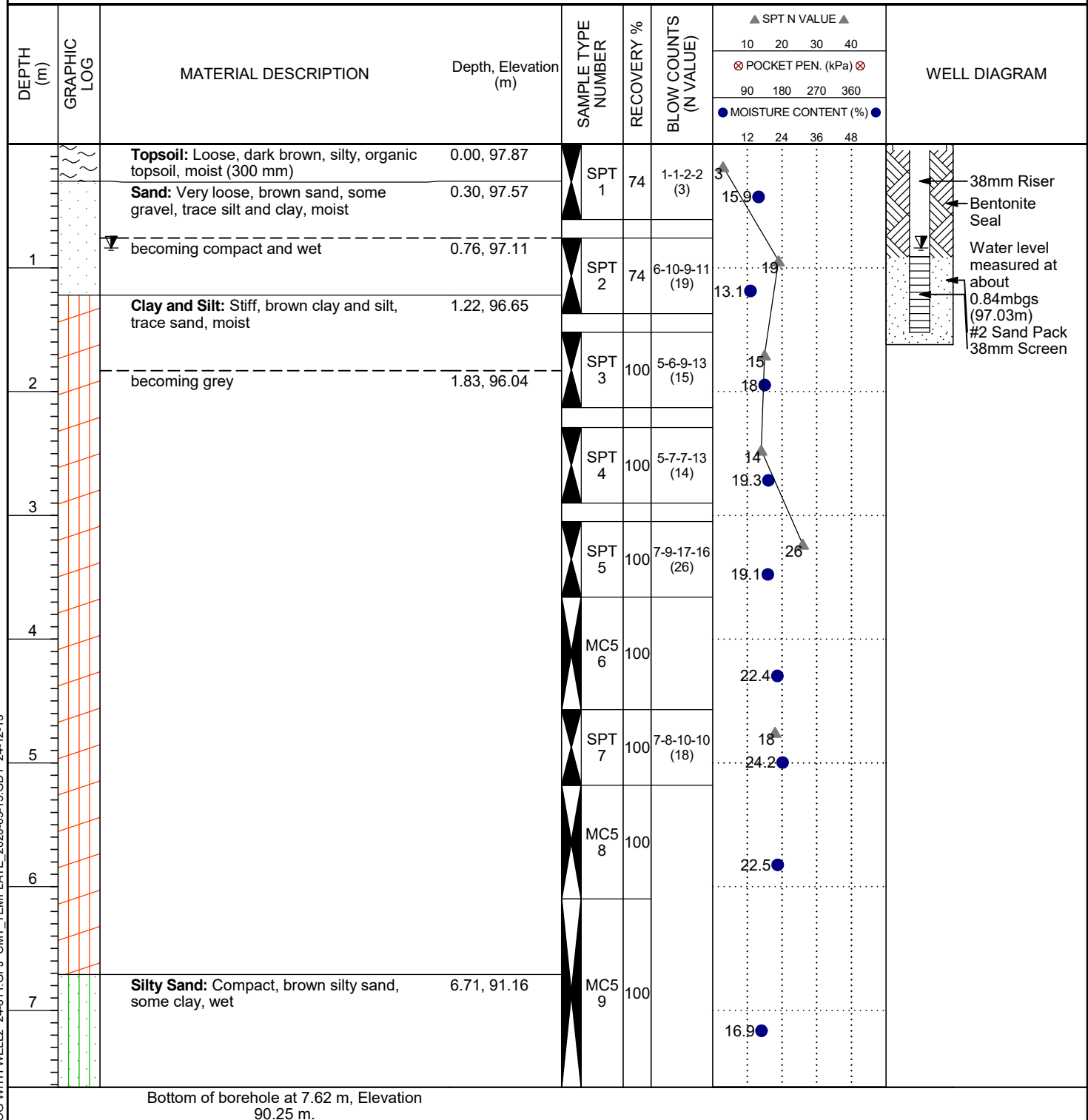
SAMPLING METHOD: SPT/MC5

PROJECT NUMBER: 24-811

DRILLING DATE: 24-11-20

DRILLING CONTRACTOR: CMT DRILLING INC.

DRILLING EQUIPMENT: Geoprobe 7822DT





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BOREHOLE NUMBER 5

PAGE 1 OF 1

PROJECT: Proposed Townhouse Development

PROJECT ADDRESS: 1134 Printery Road

PROJECT LOCATION: St. Jacobs, Ontario

PROJECT NUMBER: 24-811

DRILLING DATE: 24-11-22

DRILLING CONTRACTOR: CMT Drilling Inc.

DRILLING EQUIPMENT: Geoprobe 7822DT

GROUND ELEVATION: 98.99 m

LOGGED BY: J. Feeney

SAMPLING METHOD: SPT/MC5

DEPTH (m)	GRAPHIC LOG	MATERIAL DESCRIPTION	Depth, Elevation (m)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	▲ SPT N VALUE ▲				WELL DIAGRAM
							10	20	30	40	
							⊗ POCKET PEN. (kPa) ⊗				
							90	180	270	360	
							● MOISTURE CONTENT (%) ●				
							12	24	36	48	
1		Topsoil: Loose, dark brown, silty, organic topsoil, moist (300 mm)	0.00, 98.99	SPT 1	49	1-1-1-2 (2)	7.5	2	2	2	
		Sand: Very loose, brown sand, some gravel, trace silt and clay, moist	0.30, 98.69								
		becoming compact	0.76, 98.23								
2		becoming saturated	1.52, 97.47	SPT 2	100	10-11-10-13 (21)	8.1	2	2	2	
3				SPT 3	100	11-9-10-12 (19)	19	2	2	2	
4				SPT 4	100	14-11-10-12 (21)	23.5	2	2	2	
5				SPT 5	100	13-10-9-9 (19)	21.4	19	2	2	
6				MC5 6	100		18.9				
7				SPT 7	100	3-6-6-6 (12)	25.4	12	2	2	
8				MC5 8	100		20.7				
9				MC5 9	100		17				

Bottom of borehole at 7.62 m, Elevation 91.37 m.

BOREHOLE LOG WITH WELL2 24-811.GPJ CMT_TEMPLATE_2020-05-15.GDT 24-12-13



CMT Engineering Inc.
1011 Industrial Crescent
St. Clements, Ontario, N0B 2M0
Telephone: 519-699-5775
Fax: 519-699-4664

BOREHOLE NUMBER 6

PAGE 1 OF 1

PROJECT: Proposed Townhouse Development

PROJECT ADDRESS: 1134 Printery Road

PROJECT LOCATION: St. Jacobs, Ontario

PROJECT NUMBER: 24-811

DRILLING DATE: 24-11-20

DRILLING CONTRACTOR: CMT Drilling Inc.

DRILLING EQUIPMENT: Geoprobe 7822DT

GROUND ELEVATION: 98.63 m

LOGGED BY: J. Feeney

SAMPLING METHOD: SPT/MC5

DEPTH (m)	GRAPHIC LOG	MATERIAL DESCRIPTION	Depth, Elevation (m)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	▲ SPT N VALUE ▲				WELL DIAGRAM								
							10	20	30	40									
							⊗ POCKET PEN. (kPa) ⊗												
							90	180	270	360									
							● MOISTURE CONTENT (%) ●												
							12	24	36	48									
1		Topsoil: Loose, dark brown, silty, organic topsoil, moist (300 mm)	0.00, 98.63	SPT 1	74	1-2-5-9 (7)	6.8	7	13	10.4	18	18.2	19	18.4	33	22	20	17.6	35
		Sand: Loose, brown sand, some gravel, trace silt and clay, moist	0.30, 98.33																
2		Clay and Silt: Stiff, brown clay and silt, trace sand, moist	0.76, 97.87	SPT 2	100	6-6-7-9 (13)													
		Sand: Compact, brown sand, some silt, trace clay and gravel, wet	1.52, 97.11	SPT 3	100	9-9-9-10 (18)													
3		becoming saturated	2.29, 96.34	SPT 4	100	11-9-10-8 (19)													
		becoming dense	3.05, 95.58	SPT 5	100	4-16-17-16 (33)													
4				MC5 6	100														
		Silty Sand: Dense, brown silty sand, some clay, trace gravel, wet	4.42, 94.21	SPT 7	100	6-16-19-21 (35)													

Borehole caved at about 2.16 m below the ground surface. No accumulated groundwater or seepage observed upon completion.

Bottom of borehole at 5.18 m, Elevation 93.45 m.



CMT Engineering Inc.
1011 Industrial Crescent
St. Clements, Ontario, N0B 2M0
Telephone: 519-699-5775
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BOREHOLE NUMBER 7

PAGE 1 OF 1

PROJECT: Proposed Townhouse Development

PROJECT ADDRESS: 1134 Printery Road

PROJECT LOCATION: St. Jacobs, Ontario

PROJECT NUMBER: 24-811

DRILLING DATE: 24-11-22

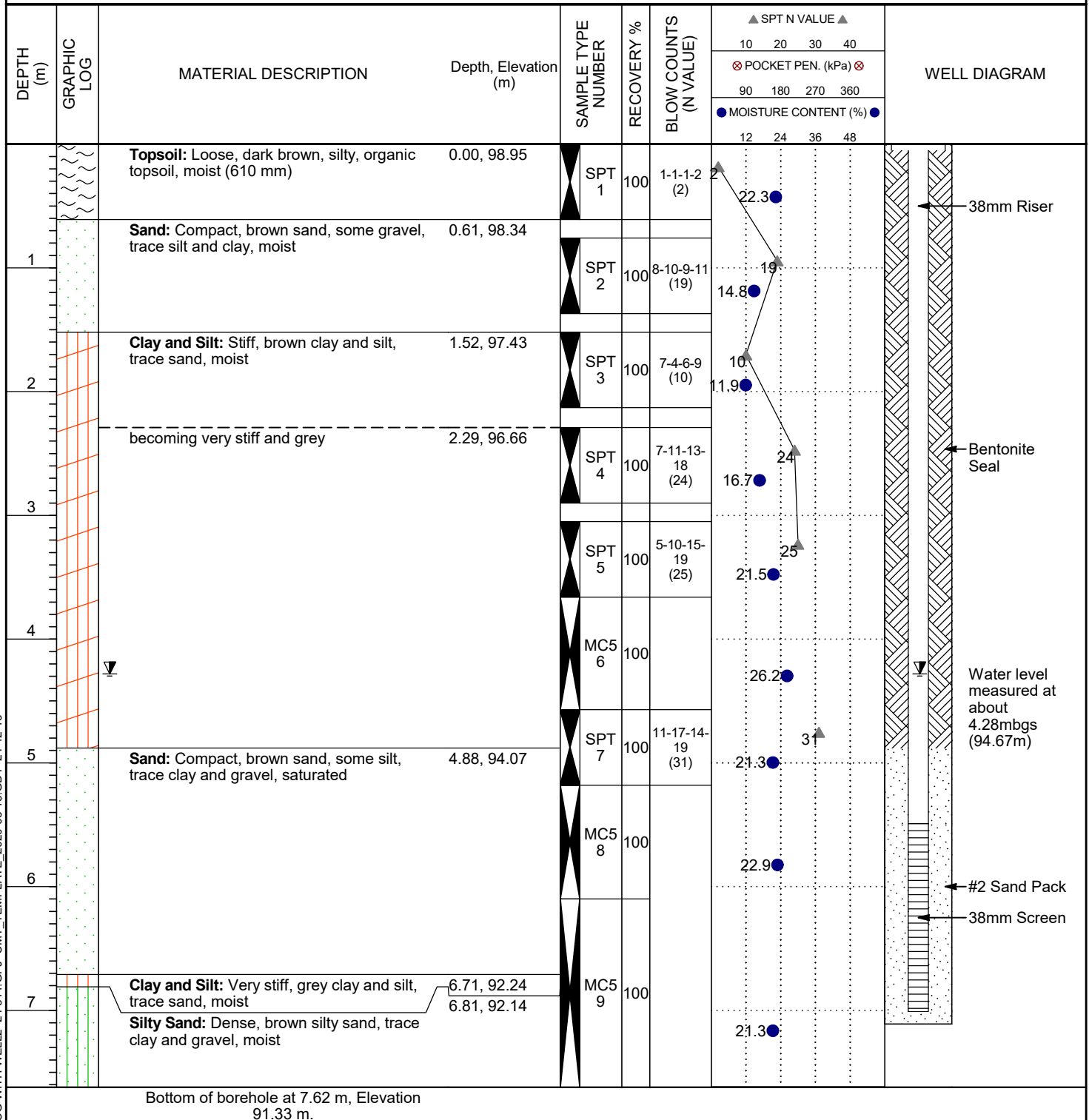
DRILLING CONTRACTOR: CMT Drilling Inc.

DRILLING EQUIPMENT: Geoprobe 7822DT

GROUND ELEVATION: 98.95 m

LOGGED BY: J. Feeney

SAMPLING METHOD: SPT/MC5

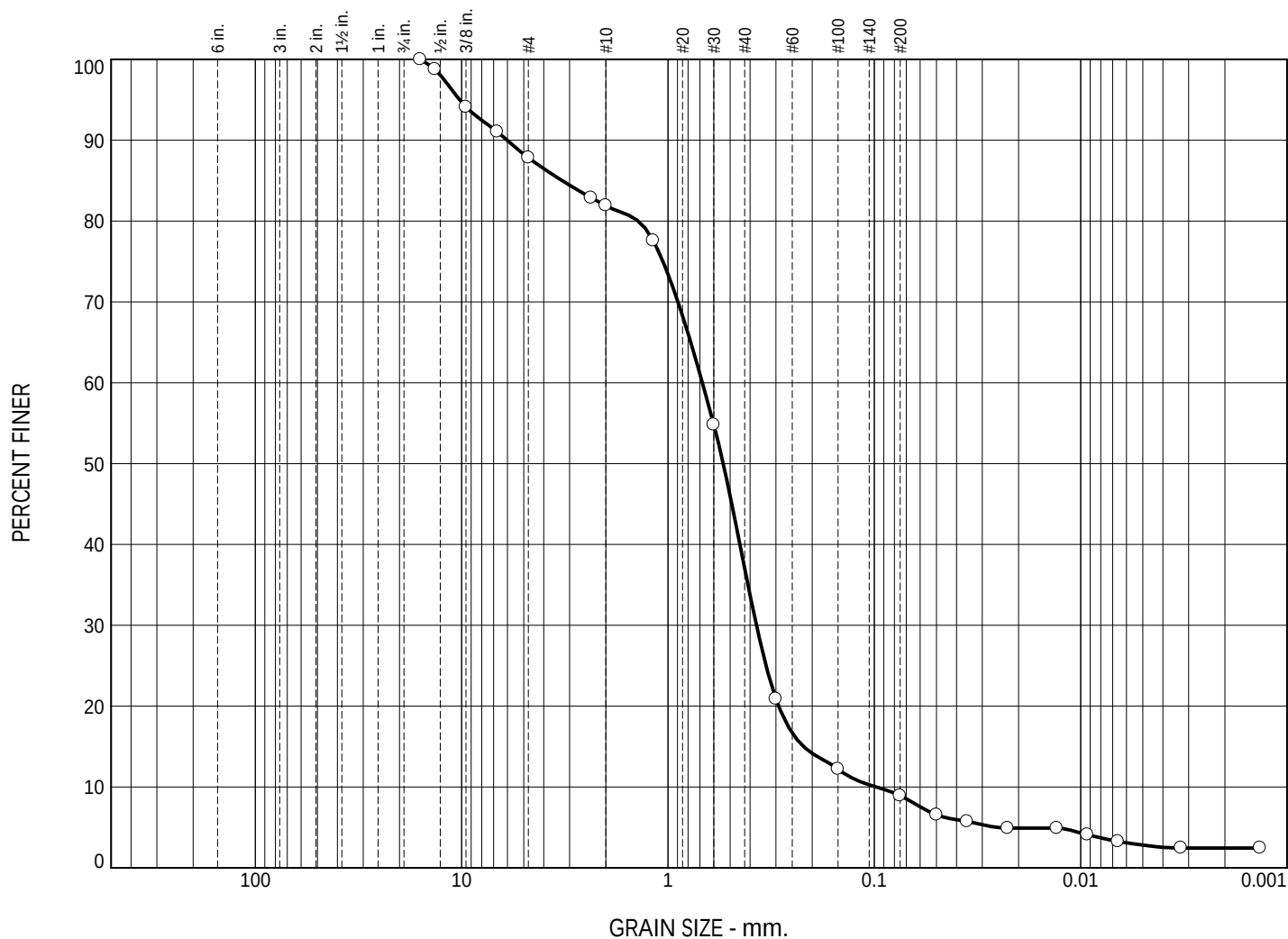


BOREHOLE LOG WITH WELL2 24-811.GPJ CMT_TEMPLATE_2020-05-15.GDT 24-12-13

APPENDIX B

GRAIN SIZE ANALYSES

Particle Size Distribution Report



GRAIN SIZE - mm.

	% Cobbles	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	12.2	5.9	44.9	28.1	6.4	2.5

SOIL DATA

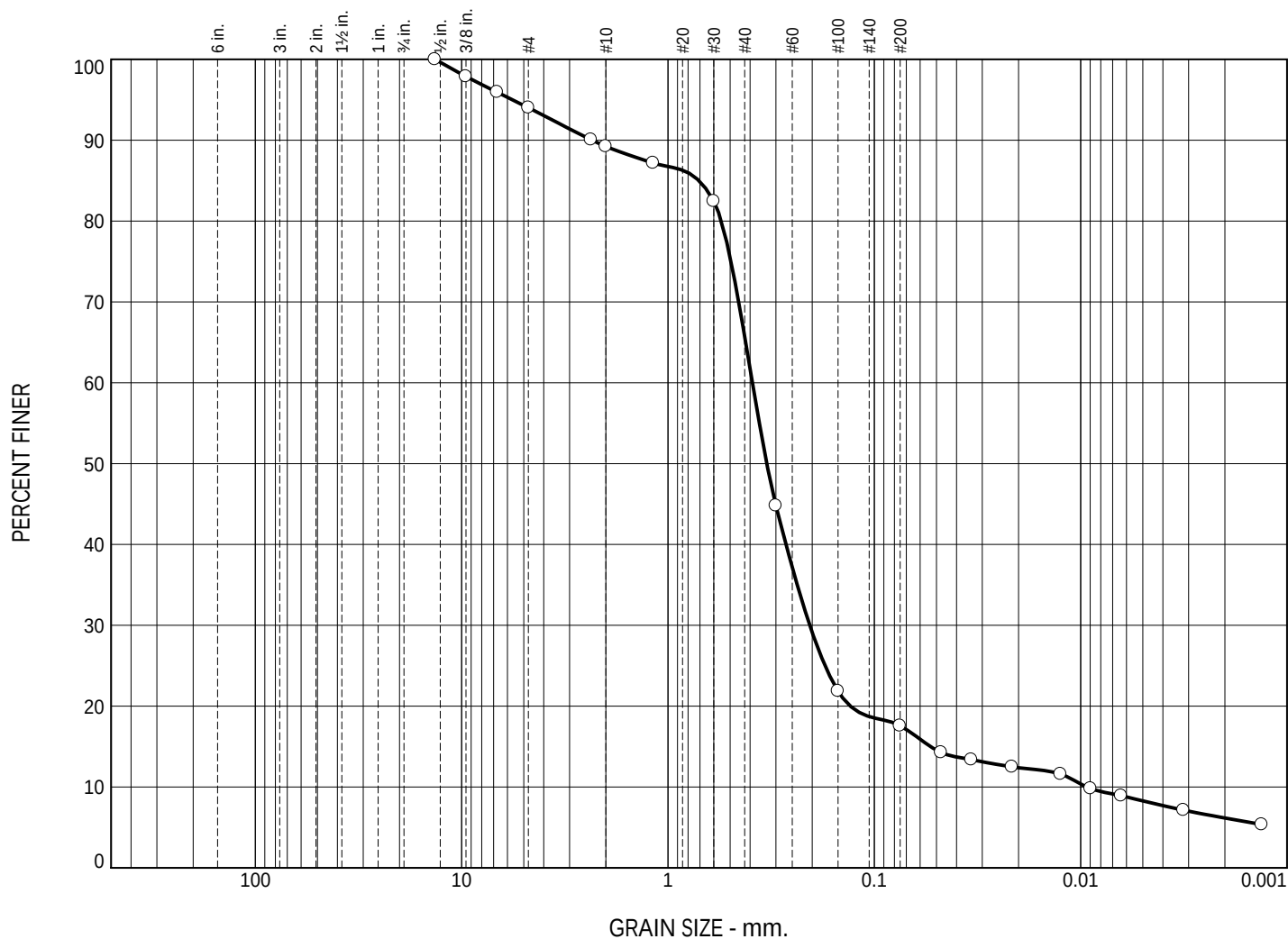
	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	BH1	4	2.29-2.90m	sand, some gravel, trace silt and clay	SW-SM
				Sampled by JF of CMT Engineering Inc. November 20, 2024	
				Tested by JM of CMT Engineering Inc. November 26, 2024	

CMT Engineering Inc.

St. Clements, ON

Client: Will-O Homes
Project: Townhouse Development
1134 Printery Road, St. Jacobs, Ontario
Project No.: 24-811

Particle Size Distribution Report



	% Cobbles	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	6.0	4.8	23.5	48.1	11.4	6.2

SOIL DATA					
	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	BH3	3	1.52-2.13m	sand, some silt, trace clay and gravel	SM
				Sampled by JF of CMT Engineering Inc. November 20, 2024	
				Tested by JM of CMT Engineering Inc. November 26, 2024	

CMT Engineering Inc.

St. Clements, ON

Client: Will-O Homes
Project: Townhouse Development
1134 Printery Road, St. Jacobs, Ontario
Project No.: 24-811

Particle Size Distribution Report



GRAIN SIZE - mm.

	% Cobbles	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.4	0.3	46.4	34.8	18.1

SOIL DATA

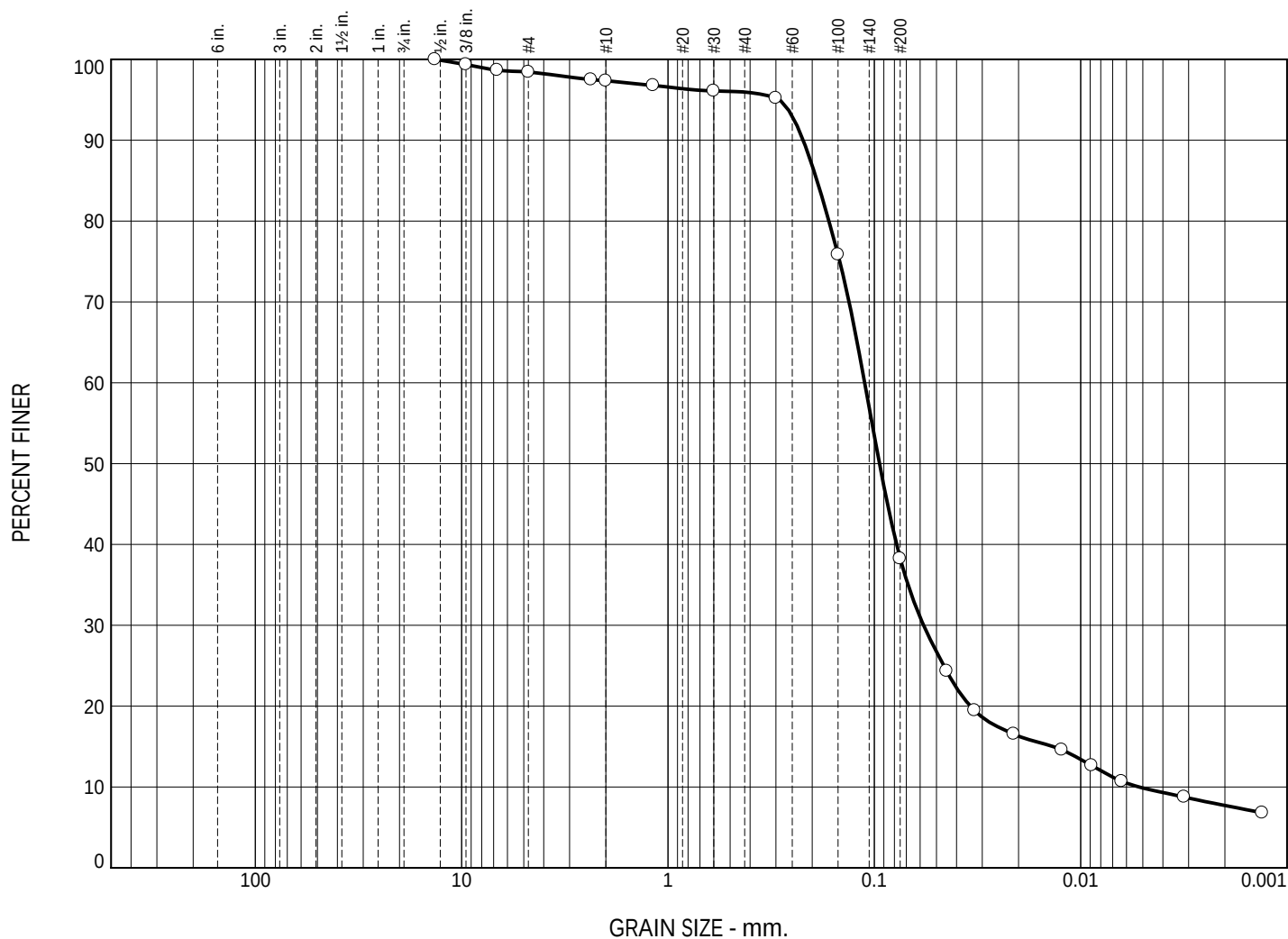
	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	BH4	9	6.10-7.62m	silty sand, some clay	ML
				Sampled by JF of CMT Engineering Inc. November 20, 2024	
				Tested by JM of CMT Engineering Inc. November 26, 2024	

CMT Engineering Inc.

St. Clements, ON

Client: Will-O Homes
Project: Townhouse Development
1134 Printery Road, St. Jacobs, Ontario
Project No.: 24-811

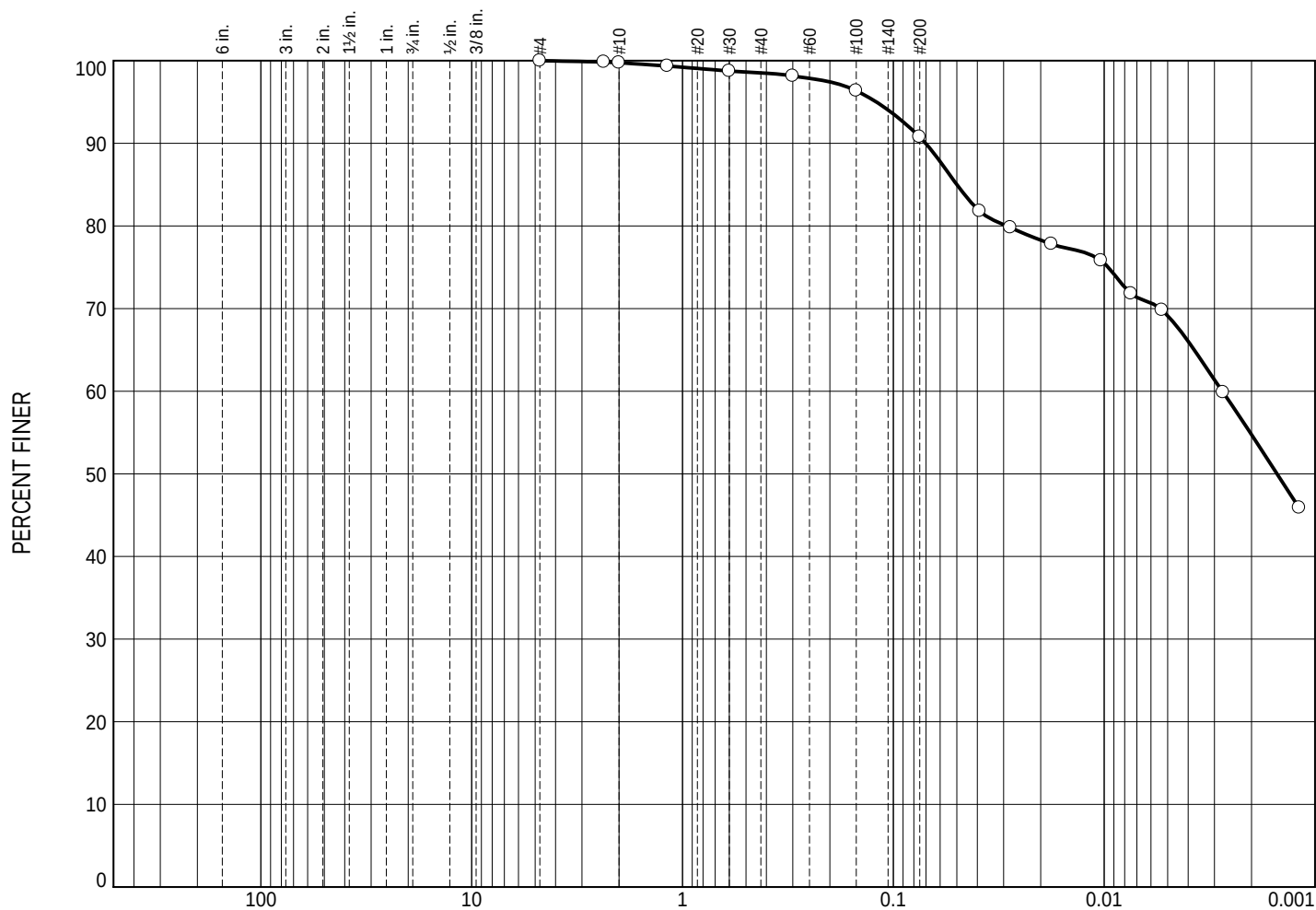
Particle Size Distribution Report



	% Cobbles	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	1.6	1.0	1.4	57.7	30.6	7.7

SOIL DATA					
	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	BH5	8	5.18-6.10m	silty sand, trace clay and gravel	SM
				Sampled by JF of CMT Engineering Inc. November 20, 2024	
				Tested by JM of CMT Engineering Inc. November 26, 2024	

Particle Size Distribution Report



GRAIN SIZE - mm.

	% Cobbles	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.3	1.2	7.7	36.1	54.7

SOIL DATA

	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	BH7	7	3.05-3.66m	clay and silt, trace sand	ML
				Sampled by JF of CMT Engineering Inc. November 20, 2024	
				Tested by JM of CMT Engineering Inc. November 26, 2024	

CMT Engineering Inc.

St. Clements, ON

Client: Will-O Homes
Project: Townhouse Development
1134 Printery Road, St. Jacobs, Ontario
Project No.: 24-811

APPENDIX C

CHEMICAL ANALYSIS RESULTS



CERTIFICATE OF ANALYSIS (GUIDELINE EVALUATION)

Work Order	: WT2435102	Page	: 1 of 4
Client	: CMT Engineering Inc.	Laboratory	: ALS Environmental - Waterloo
Contact	: Jake Feeney	Account Manager	: Mathy Mahadeva
Address	: 1011 Industrial Crescent Unit 1 St. Clements ON Canada N0B 2M0	Address	: 60 Northland Road, Unit 1 Waterloo, Ontario Canada N2V 2B8
Telephone	: 519 699 5775	Telephone	: +1 519 886 6910
Project	: 24-811 1134 PRINTERY ROAD, ST. JACOBS, ON	Date Samples Received	: 25-Nov-2024 17:20
PO	: ----	Date Analysis Commenced	: 28-Nov-2024
C-O-C number	: ----	Issue Date	: 06-Dec-2024 18:30
Sampler	: Jake Feeney		
Site	: ----		
Quote number	: Standing Offer 2024 Pricing		
No. of samples received	: 2		
No. of samples analysed	: 2		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Guideline Comparison

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QC Interpretive report to assist with Quality Review and Sample Receipt Notification (SRN).

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	Position	Laboratory Department
Jon Fisher	Production Manager, Environmental	Inorganics, Waterloo, Ontario
Josphin Masihi	Analyst	Centralized Prep, Waterloo, Ontario
Nik Perkio	Senior Analyst	Inorganics, Waterloo, Ontario
Nik Perkio	Senior Analyst	Metals, Waterloo, Ontario



No Breaches Found

General Comments

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Refer to the ALS Quality Control Interpretive report (QCI) for applicable references and methodology summaries. Reference methods may incorporate modifications to improve performance.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Application of guidelines is provided "as is" without warranty of any kind, either expressed or implied, including, but not limited to fitness for a particular purpose, or non-infringement. ALS assumes no responsibility for errors or omissions in the information. Guidelines are not adjusted for the hardness, pH or temperature of the sample (the most conservative values are used). Measurement uncertainty is not applied to test results prior to comparison with specified criteria values.

Key : LOR: Limit of Reporting (detection limit).

Unit	Description
-	no units
%	percent
µS/cm	microsiemens per centimetre
mg/kg	milligrams per kilogram
mg/L	milligrams per litre
mV	millivolts
ohm cm	ohm centimetres (resistivity)
pH units	pH units

>: greater than.

<: less than.

Red shading is applied where the result or the LOR is greater than the Guideline Upper Limit (or lower than the Guideline Lower Limit, if applicable).

For drinking water samples, Red shading is applied where the result for E.coli, fecal or total coliforms is greater than or equal to the Guideline Upper Limit.

Analytical Results Evaluation

Matrix: Soil				Client sample ID	BH1S3	BH7S2	----	----	----	----	----
				Sampling date/time	22-Nov-2024 00:00	22-Nov-2024 00:00	----	----	----	----	----
				Sub-Matrix	Soil	Soil	----	----	----	----	----
Analyte	CAS Number	Method/Lab	Unit	WT2435102-001	WT2435102-002	-----	-----	-----	-----	-----	-----
Physical Tests											
Conductivity (1:2 leachate)	----	E100-L/WT	µS/cm	106	----	----	----	----	----	----	----
Moisture	----	E144/WT	%	2.33	----	----	----	----	----	----	----
Oxidation-reduction potential [ORP]	----	E125/WT	mV	328	----	----	----	----	----	----	----
pH (1:2 soil:CaCl2-aq)	----	E108A/WT	pH units	8.18	----	----	----	----	----	----	----
Resistivity	----	EC100R/WT	ohm cm	9430	----	----	----	----	----	----	----
Inorganics											
Sulfides, acid volatile	----	E396-L/WT	mg/kg	<0.21	----	----	----	----	----	----	----
Metals											
Calcium, soluble ion content	7440-70-2	E484/WT	mg/L	----	9.64	----	----	----	----	----	----
Magnesium, soluble ion content	7439-95-4	E484/WT	mg/L	----	3.23	----	----	----	----	----	----
Sodium, soluble ion content	17341-25-2	E484/WT	mg/L	----	28.9	----	----	----	----	----	----
Sodium adsorption ratio [SAR]	----	E484/WT	-	----	2.06	----	----	----	----	----	----
Leachable Anions & Nutrients											
Chloride, soluble ion content	16887-00-6	E236.Cl/WT	mg/kg	23.4	----	----	----	----	----	----	----
Sulfate, soluble ion content	14808-79-8	E236.SO4/WT	mg/kg	<20	----	----	----	----	----	----	----

Please refer to the General Comments section for an explanation of any result qualifiers detected.

Please refer to the Accreditation section for an explanation of analyte accreditations.



Summary of Guideline Limits

Analyte	CAS Number	Unit	ON153/04 T1-RPIICC	ON153/04 T2-ICC-C	ON153/04 T2-ICC-F	ON153/04 T2-RPI-C	ON153/04 T2-RPI-F		
Physical Tests									
Conductivity (1:2 leachate)	----	µS/cm	570 µS/cm	1400 µS/cm	1400 µS/cm	700 µS/cm	700 µS/cm		
Moisture	----	%	--	--	--	--	--		
Oxidation-reduction potential [ORP]	----	mV	--	--	--	--	--		
pH (1:2 soil:CaCl2-aq)	----	pH units	--	--	--	--	--		
Resistivity	----	ohm cm	--	--	--	--	--		
Inorganics									
Sulfides, acid volatile	----	mg/kg	--	--	--	--	--		
Metals									
Calcium, soluble ion content	7440-70-2	mg/L	--	--	--	--	--		
Magnesium, soluble ion content	7439-95-4	mg/L	--	--	--	--	--		
Sodium adsorption ratio [SAR]	----	-	2.4 -	12 -	12 -	5 -	5 -		
Sodium, soluble ion content	17341-25-2	mg/L	--	--	--	--	--		
Leachable Anions & Nutrients									
Chloride, soluble ion content	16887-00-6	mg/kg	--	--	--	--	--		
Sulfate, soluble ion content	14808-79-8	mg/kg	--	--	--	--	--		

Please refer to the General Comments section for an explanation of any qualifiers detected.

Key:

ON153/04	Ontario Regulation 153/04 - April 15, 2011 Standards (JUL, 2011)
T1-RPIICC	153 T1-Soil-Res/Park/Inst/Ind/Com/Commu Property Use
T2-ICC-C	153 T2-Soil-Ind/Com/Commu Property Use (Coarse)
T2-ICC-F	153 T2-Soil-Ind/Com/Commu Property Use (Fine)
T2-RPI-C	153 T2-Soil-Res/Park/Inst. Property Use (Coarse)
T2-RPI-F	153 T2-Soil-Res/Park/Inst. Property Use (Fine)

QUALITY CONTROL INTERPRETIVE REPORT

Work Order	: WT2435102	Page	: 1 of 7
Client	: CMT Engineering Inc.	Laboratory	: ALS Environmental - Waterloo
Contact	: Jake Feeney	Account Manager	: Mathy Mahadeva
Address	: 1011 Industrial Crescent Unit 1 St. Clements ON Canada N0B 2M0	Address	: 60 Northland Road, Unit 1 Waterloo, Ontario Canada N2V 2B8
Telephone	: 519 699 5775	Telephone	: +1 519 886 6910
Project	: 24-811 1134 PRINTERY ROAD, ST. JACOBS, ON	Date Samples Received	: 25-Nov-2024 17:20
PO	: ----	Issue Date	: 06-Dec-2024 18:30
C-O-C number	: ----		
Sampler	: Jake Feeney		
Site	: ----		
Quote number	: Standing Offer 2024 Pricing		
No. of samples received	: 2		
No. of samples analysed	: 2		

This report is automatically generated by the ALS LIMS (Laboratory Information Management System) through evaluation of Quality Control (QC) results and other QA parameters associated with this submission, and is intended to facilitate rapid data validation by auditors or reviewers. The report highlights any exceptions and outliers to ALS Data Quality Objectives, provides holding time details and exceptions, summarizes QC sample frequencies, and lists applicable methodology references and summaries.

Key

Anonymous: Refers to samples which are not part of this work order, but which formed part of the QC process lot.

CAS Number: Chemical Abstracts Service number is a unique identifier assigned to discrete substances.

DQO: Data Quality Objective.

LOR: Limit of Reporting (detection limit).

RPD: Relative Percent Difference.

Workorder Comments

Holding times are displayed as "----" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Summary of Outliers

Outliers : Quality Control Samples

- No Method Blank value outliers occur.
- No Duplicate outliers occur.
- No Laboratory Control Sample (LCS) outliers occur
- No Test sample Surrogate recovery outliers exist.

Outliers: Reference Material (RM) Samples

- No Reference Material (RM) Sample outliers occur.

Outliers : Analysis Holding Time Compliance (Breaches)

- No Analysis Holding Time Outliers exist.

Outliers : Frequency of Quality Control Samples

- No Quality Control Sample Frequency Outliers occur.



Analysis Holding Time Compliance

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times, which are selected to meet known provincial and /or federal requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by organizations such as CCME, US EPA, APHA Standard Methods, ASTM, or Environment Canada (where available). Dates and holding times reported below represent the first dates of extraction or analysis. If subsequent tests or dilutions exceeded holding times, qualifiers are added (refer to COA).

If samples are identified below as having been analyzed or extracted outside of recommended holding times, measurement uncertainties may be increased, and this should be taken into consideration when interpreting results.

Where actual sampling date is not provided on the chain of custody, the date of receipt with time at 00:00 is used for calculation purposes.

Where only the sample date without time is provided on the chain of custody, the sampling date at 00:00 is used for calculation purposes.

Matrix: **Soil/Solid**

Evaluation: ✖ = Holding time exceedance ; ✔ = Within Holding Time

Analyte Group : Analytical Method	Method	Sampling Date	Extraction / Preparation				Analysis			
Container / Client Sample ID(s)			Preparation Date	Holding Times		Eval	Analysis Date	Holding Times		Eval
				Rec	Actual			Rec	Actual	
Inorganics : Acid Volatile Sulfide in Soil by Colourimetry (0.2 mg/kg)										
Glass soil jar/Teflon lined cap [ON MECP] BH1S3	E396-L	22-Nov-2024	02-Dec-2024	14 days	11 days	✓	02-Dec-2024	7 days	0 days	✓
Leachable Anions & Nutrients : Water Extractable Chloride by IC										
Glass soil jar/Teflon lined cap [ON MECP] BH1S3	E236.Cl	22-Nov-2024	03-Dec-2024	30 days	12 days	✓	03-Dec-2024	28 days	0 days	✓
Leachable Anions & Nutrients : Water Extractable Sulfate by IC										
Glass soil jar/Teflon lined cap [ON MECP] BH1S3	E236.SO4	22-Nov-2024	03-Dec-2024	30 days	12 days	✓	03-Dec-2024	28 days	0 days	✓
Metals : Sodium Adsorption Ratio (SAR) - 1:2 Soil:Water (Dry)										
Glass soil jar/Teflon lined cap [ON MECP] BH7S2	E484	22-Nov-2024	06-Dec-2024	180 days	15 days	✓	06-Dec-2024	180 days	0 days	✓
Physical Tests : Conductivity in Soil (1:2 Soil:Water Extraction) (Low Level)										
Glass soil jar/Teflon lined cap [ON MECP] BH1S3	E100-L	22-Nov-2024	03-Dec-2024	30 days	11 days	✓	03-Dec-2024	30 days	11 days	✓
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap [ON MECP] BH1S3	E144	22-Nov-2024	----	----	----		28-Nov-2024	----	7 days	
Physical Tests : ORP by Electrode										
Glass soil jar/Teflon lined cap [ON MECP] BH1S3	E125	22-Nov-2024	28-Nov-2024	180 days	7 days	✓	29-Nov-2024	180 days	8 days	✓

Page : 4 of 7
 Work Order : WT2435102
 Client : CMT Engineering Inc.
 Project : 24-811 1134 PRINTERY ROAD, ST. JACOBS, ON



Matrix: **Soil/Solid**

Evaluation: ✖ = Holding time exceedance ; ✔ = Within Holding Time

Analyte Group : Analytical Method		Method	Sampling Date	Extraction / Preparation			Analysis				
Container / Client Sample ID(s)				Preparation Date	Holding Times		Eval	Analysis Date	Holding Times		Eval
					Rec	Actual			Rec	Actual	
Physical Tests : pH by Meter (1:2 Soil:0.01M CaCl2 Extraction) - As Received											
Glass soil jar/Teflon lined cap [ON MECP] BH1S3		E108A	22-Nov-2024	28-Nov-2024	30 days	7 days	✔	02-Dec-2024	30 days	11 days	✔

Legend & Qualifier Definitions

Rec. HT: ALS recommended hold time (see units).



Quality Control Parameter Frequency Compliance

The following report summarizes the frequency of laboratory QC samples analyzed within the analytical batches (QC lots) in which the submitted samples were processed. The actual frequency should be greater than or equal to the expected frequency.

Matrix: **Soil/Solid**

Evaluation: ✖ = QC frequency outside specification; ✔ = QC frequency within specification.

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	Method	QC Lot #	QC	Regular	Actual	Expected	Evaluation
Laboratory Duplicates (DUP)							
Acid Volatile Sulfide in Soil by Colourimetry (0.2 mg/kg)	E396-L	1791834	1	14	7.1	4.7	✔
Conductivity in Soil (1:2 Soil:Water Extraction) (Low Level)	E100-L	1787672	1	15	6.6	5.0	✔
Moisture Content by Gravimetry	E144	1787682	1	18	5.5	5.0	✔
ORP by Electrode	E125	1787678	1	20	5.0	5.0	✔
pH by Meter (1:2 Soil:0.01M CaCl ₂ Extraction) - As Received	E108A	1787676	1	20	5.0	5.0	✔
Sodium Adsorption Ratio (SAR) - 1:2 Soil:Water (Dry)	E484	1793258	1	3	33.3	5.0	✔
Water Extractable Chloride by IC	E236.Cl	1793717	1	14	7.1	5.0	✔
Water Extractable Sulfate by IC	E236.SO ₄	1793716	1	14	7.1	5.0	✔
Laboratory Control Samples (LCS)							
Acid Volatile Sulfide in Soil by Colourimetry (0.2 mg/kg)	E396-L	1791834	1	14	7.1	4.7	✔
Conductivity in Soil (1:2 Soil:Water Extraction) (Low Level)	E100-L	1787672	2	15	13.3	10.0	✔
Moisture Content by Gravimetry	E144	1787682	1	18	5.5	5.0	✔
ORP by Electrode	E125	1787678	1	20	5.0	5.0	✔
pH by Meter (1:2 Soil:0.01M CaCl ₂ Extraction) - As Received	E108A	1787676	1	20	5.0	5.0	✔
Sodium Adsorption Ratio (SAR) - 1:2 Soil:Water (Dry)	E484	1793258	2	3	66.6	10.0	✔
Water Extractable Chloride by IC	E236.Cl	1793717	2	14	14.2	10.0	✔
Water Extractable Sulfate by IC	E236.SO ₄	1793716	2	14	14.2	10.0	✔
Method Blanks (MB)							
Acid Volatile Sulfide in Soil by Colourimetry (0.2 mg/kg)	E396-L	1791834	1	14	7.1	4.7	✔
Conductivity in Soil (1:2 Soil:Water Extraction) (Low Level)	E100-L	1787672	1	15	6.6	5.0	✔
Moisture Content by Gravimetry	E144	1787682	1	18	5.5	5.0	✔
Sodium Adsorption Ratio (SAR) - 1:2 Soil:Water (Dry)	E484	1793258	1	3	33.3	5.0	✔
Water Extractable Chloride by IC	E236.Cl	1793717	1	14	7.1	5.0	✔
Water Extractable Sulfate by IC	E236.SO ₄	1793716	1	14	7.1	5.0	✔



Methodology References and Summaries

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Reference methods may incorporate modifications to improve performance (indicated by "mod").

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Conductivity in Soil (1:2 Soil:Water Extraction) (Low Level)	E100-L ALS Environmental - Waterloo	Soil/Solid	CSSS Ch. 15 (mod)/APHA 2510 (mod)	Conductivity, also known as Electrical Conductivity (EC) or Specific Conductance, is measured by immersion of a conductivity cell with platinum electrodes into a soil sample that has been added in a defined ratio of soil to deionized water, then shaken well and allowed to settle. Conductance is measured in the fluid that is observed in the upper layer.
pH by Meter (1:2 Soil:0.01M CaCl ₂ Extraction) - As Received	E108A ALS Environmental - Waterloo	Soil/Solid	MECP E3530	pH is determined by potentiometric measurement with a pH electrode, and is conducted at ambient laboratory temperature (normally 20 ± 5°C) and is carried out in accordance with procedures described in the Analytical Protocol (prescriptive method). A minimum 10g portion of the sample, as received, is extracted with 20mL of 0.01M calcium chloride solution by shaking for at least 30 minutes. The aqueous layer is separated from the soil by centrifuging, settling, or decanting and then analyzed using a pH meter and electrode. This method is equivalent to ASTM D4972 and is acceptable for topsoil analysis.
ORP by Electrode	E125 ALS Environmental - Waterloo	Soil/Solid	APHA 2580 (mod)	Oxidation Reduction Potential (ORP) is reported as the oxidation-reduction potential of the platinum metal-reference electrode employed in the analysis, measured in mV.
Moisture Content by Gravimetry	E144 ALS Environmental - Waterloo	Soil/Solid	CCME PHC in Soil - Tier 1	Moisture is measured gravimetrically by drying the sample at 105°C. Moisture content is calculated as the weight loss (due to water) divided by the wet weight of the sample, expressed as a percentage.
Water Extractable Chloride by IC	E236.Cl ALS Environmental - Waterloo	Soil/Solid	EPA 300.1	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection using a soil sample that has been added in a defined ratio of soil to deionized water, then shaken well and allowed to settle. Anions are measured in the fluid that is observed in the upper layer.
Water Extractable Sulfate by IC	E236.SO ₄ ALS Environmental - Waterloo	Soil/Solid	EPA 300.1	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection using a soil sample that has been added in a defined ratio of soil to deionized water, then shaken well and allowed to settle. Anions are measured in the fluid that is observed in the upper layer.
Acid Volatile Sulfide in Soil by Colourimetry (0.2 mg/kg)	E396-L ALS Environmental - Waterloo	Soil/Solid	APHA 4500S2J	This analysis is carried out in accordance with the method described in APHA 4500 S2-J. After extraction the Acid Volatile Sulphide is determined colourimetrically.
Sodium Adsorption Ratio (SAR) - 1:2 Soil:Water (Dry)	E484 ALS Environmental - Waterloo	Soil/Solid	SW846 6010C	A dried, disaggregated solid sample is extracted with deionized water, the aqueous extract is separated from the solid, acidified and then analyzed using a ICP/OES. The concentrations of Na, Ca and Mg are reported as per CALA requirements for calculated parameters. These individual parameters are not for comparison to any guideline.



Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Resistivity Calculation for Soil Using E100-L	EC100R ALS Environmental - Waterloo	Soil/Solid	APHA 2510 B	Soil Resistivity (calculated) is determined as the inverse of the conductivity of a 2:1 water:soil leachate (dry weight). This method is intended as a rapid approximation for Soil Resistivity. Where high accuracy results are required, direct measurement of Soil Resistivity by the Wenner Four-Electrode Method (ASTM G57) is recommended.
Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Leach 1:2 Soil:Water for pH/EC	EP108 ALS Environmental - Waterloo	Soil/Solid	BC WLAP METHOD: PH, ELECTROMETRIC, SOIL	The procedure involves mixing the dried (at <60°C) and sieved (No. 10 / 2mm) sample with deionized/distilled water at a 1:2 ratio of sediment to water.
Leach 1:2 Soil : 0.01CaCl ₂ - As Received for pH	EP108A ALS Environmental - Waterloo	Soil/Solid	MOEE E3137A	A minimum 10g portion of the sample, as received, is extracted with 20mL of 0.01M calcium chloride solution by shaking for at least 30 minutes. The aqueous layer is separated from the soil by centrifuging, settling or decanting and then analyzed using a pH meter and electrode.
Preparation of ORP by Electrode	EP125 ALS Environmental - Waterloo	Soil/Solid	APHA 2580 (mod)	Field-moist sample is extracted in a 1:2 ratio with DI water and then analyzed by ORP meter.
Anions Leach 1:10 Soil:Water (Dry)	EP236 ALS Environmental - Waterloo	Soil/Solid	EPA 300.1	5 grams of dried soil is mixed with 50 grams of distilled water for a minimum of 30 minutes. The extract is filtered and analyzed by ion chromatography.
Distillation for Acid Volatile Sulfide in Soil	EP396-L ALS Environmental - Waterloo	Soil/Solid	APHA 4500S2J	Acid Volatile Sulfide is determined by colourimetric measurement on a sediment sample that has been treated with hydrochloric acid within a purge and trap system, where the evolved hydrogen sulfide gas is carried into a basic solution by argon gas for analysis.

QUALITY CONTROL REPORT

Work Order	: WT2435102	Page	: 1 of 6
Client	: CMT Engineering Inc.	Laboratory	: ALS Environmental - Waterloo
Contact	: Jake Feeney	Account Manager	: Mathy Mahadeva
Address	: 1011 Industrial Crescent Unit 1 St. Clements ON Canada N0B 2M0	Address	: 60 Northland Road, Unit 1 Waterloo, Ontario Canada N2V 2B8
Telephone	: 519 699 5775	Telephone	: +1 519 886 6910
Project	: 24-811 1134 PRINTERY ROAD, ST. JACOBS, ON	Date Samples Received	: 25-Nov-2024 17:20
PO	: ----	Date Analysis Commenced	: 28-Nov-2024
C-O-C number	: ----	Issue Date	: 06-Dec-2024 18:30
Sampler	: Jake Feeney		
Site	: ----		
Quote number	: Standing Offer 2024 Pricing		
No. of samples received	: 2		
No. of samples analysed	: 2		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percent Difference (RPD) and Data Quality Objectives
- Reference Material (RM) Report; Recovery and Data Quality Objectives
- Method Blank (MB) Report; Recovery and Data Quality Objectives
- Laboratory Control Sample (LCS) Report; Recovery and Data Quality Objectives

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	Position	Laboratory Department
Jon Fisher	Production Manager, Environmental	Waterloo Inorganics, Waterloo, Ontario
Josphin Masihi	Analyst	Waterloo Centralized Prep, Waterloo, Ontario
Nik Perkio	Senior Analyst	Waterloo Inorganics, Waterloo, Ontario
Nik Perkio	Senior Analyst	Waterloo Metals, Waterloo, Ontario

Page : 2 of 6
Work Order : WT2435102
Client : CMT Engineering Inc.
Project : 24-811 1134 PRINTER ROAD, ST. JACOBS, ON



General Comments

The ALS Quality Control (QC) report is optionally provided to ALS clients upon request. ALS test methods include comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against predetermined Data Quality Objectives (DQOs) to provide confidence in the accuracy of associated test results. This report contains detailed results for all QC results applicable to this sample submission. Please refer to the ALS Quality Control Interpretation report (QCI) for applicable method references and methodology summaries.

Key :

Anonymous = Refers to samples which are not part of this work order, but which formed part of the QC process lot.

CAS Number = Chemical Abstracts Service number is a unique identifier assigned to discrete substances.

DQO = Data Quality Objective.

LOR = Limit of Reporting (detection limit).

RPD = Relative Percent Difference

= Indicates a QC result that did not meet the ALS DQO.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.



Laboratory Duplicate (DUP) Report

A Laboratory Duplicate (DUP) is a randomly selected intralaboratory replicate sample. Laboratory Duplicates provide information regarding method precision and sample heterogeneity. ALS DQOs for Laboratory Duplicates are expressed as test-specific limits for Relative Percent Difference (RPD), or as an absolute difference limit of 2 times the LOR for low concentration duplicates within ~ 4-10 times the LOR (cut-off is test-specific).

Sub-Matrix: Soil/Solid					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
Physical Tests (QC Lot: 1787672)											
WT2435238-002	Anonymous	Conductivity (1:2 leachate)	----	E100-L	5.00	µS/cm	0.0983 mS/cm	104	5.25%	20%	----
Physical Tests (QC Lot: 1787676)											
WT2435102-001	BH1S3	pH (1:2 soil:CaCl2-aq)	----	E108A	0.10	pH units	8.18	8.18	0.00%	5%	----
Physical Tests (QC Lot: 1787678)											
WT2435128-002	Anonymous	Oxidation-reduction potential [ORP]	----	E125	0.10	mV	264	252	4.65%	25%	----
Physical Tests (QC Lot: 1787682)											
WT2435128-001	Anonymous	Moisture	----	E144	0.25	%	19.5	19.6	0.279%	20%	----
Inorganics (QC Lot: 1791834)											
KS2405011-002	Anonymous	Sulfides, acid volatile	----	E396-L	0.22	mg/kg	<0.22	<0.22	0	Diff <2x LOR	----
Metals (QC Lot: 1793258)											
WT2435581-021	Anonymous	Calcium, soluble ion content	7440-70-2	E484	0.50	mg/L	16.8	16.9	0.593%	30%	----
		Magnesium, soluble ion content	7439-95-4	E484	0.50	mg/L	12.1	12.5	3.25%	30%	----
		Sodium, soluble ion content	17341-25-2	E484	0.50	mg/L	7.14	7.17	0.419%	30%	----
Leachable Anions & Nutrients (QC Lot: 1793716)											
WT2435005-004	Anonymous	Sulfate, soluble ion content	14808-79-8	E236.SO4	20	mg/kg	148	150	1.57%	30%	----
Leachable Anions & Nutrients (QC Lot: 1793717)											
WT2435005-004	Anonymous	Chloride, soluble ion content	16887-00-6	E236.Cl	5.0	mg/kg	149	151	1.10%	30%	----



Method Blank (MB) Report

A Method Blank is an analyte-free matrix that undergoes sample processing identical to that carried out for test samples. Method Blank results are used to monitor and control for potential contamination from the laboratory environment and reagents. For most tests, the DQO for Method Blanks is for the result to be < LOR.

Sub-Matrix: Soil/Solid

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Physical Tests (QCLot: 1787672)						
Conductivity (1:2 leachate)	----	E100-L	5	µS/cm	<5.00	----
Physical Tests (QCLot: 1787682)						
Moisture	----	E144	0.25	%	<0.25	----
Inorganics (QCLot: 1791834)						
Sulfides, acid volatile	----	E396-L	0.2	mg/kg	<0.20	----
Metals (QCLot: 1793258)						
Calcium, soluble ion content	7440-70-2	E484	0.5	mg/L	<0.50	----
Magnesium, soluble ion content	7439-95-4	E484	0.5	mg/L	<0.50	----
Sodium, soluble ion content	17341-25-2	E484	0.5	mg/L	<0.50	----
Leachable Anions & Nutrients (QCLot: 1793716)						
Sulfate, soluble ion content	14808-79-8	E236.SO4	20	mg/kg	<20	----
Leachable Anions & Nutrients (QCLot: 1793717)						
Chloride, soluble ion content	16887-00-6	E236.Cl	5	mg/kg	<5.0	----



Laboratory Control Sample (LCS) Report

A Laboratory Control Sample (LCS) is an analyte-free matrix that has been fortified (spiked) with test analytes at known concentration and processed in an identical manner to test samples. LCS results are expressed as percent recovery, and are used to monitor and control test method accuracy and precision, independent of test sample matrix.

Sub-Matrix: Soil/Solid

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Target Concentration	LCS	Low	High	Qualifier
Physical Tests (QCLot: 1787672)									
Conductivity (1:2 leachate)	----	E100-L	5	µS/cm	1410 µS/cm	97.3	90.0	110	----
Physical Tests (QCLot: 1787676)									
pH (1:2 soil:CaCl2-aq)	----	E108A	----	pH units	7 pH units	101	98.0	102	----
Physical Tests (QCLot: 1787682)									
Moisture	----	E144	0.25	%	50 %	100	90.0	110	----
Inorganics (QCLot: 1791834)									
Sulfides, acid volatile	----	E396-L	0.2	mg/kg	100 mg/kg	78.0	70.0	130	----
Metals (QCLot: 1793258)									
Calcium, soluble ion content	7440-70-2	E484	0.5	mg/L	300 mg/L	104	80.0	120	----
Magnesium, soluble ion content	7439-95-4	E484	0.5	mg/L	50 mg/L	101	80.0	120	----
Sodium, soluble ion content	17341-25-2	E484	0.5	mg/L	50 mg/L	104	80.0	120	----
Leachable Anions & Nutrients (QCLot: 1793716)									
Sulfate, soluble ion content	14808-79-8	E236.SO4	20	mg/kg	1000 mg/kg	95.8	80.0	120	----
Leachable Anions & Nutrients (QCLot: 1793717)									
Chloride, soluble ion content	16887-00-6	E236.Cl	5	mg/kg	1000 mg/kg	99.2	80.0	120	----



Reference Material (RM) Report

A Reference Material (RM) is a homogenous material with known and well-established analyte concentrations. RMs are processed in an identical manner to test samples, and are used to monitor and control the accuracy and precision of a test method for a typical sample matrix. RM results are expressed as percent recovery of the target analyte concentration. RM targets may be certified target concentrations provided by the RM supplier, or may be ALS long-term mean values (for empirical test methods).

Sub-Matrix:

Sub-Matrix:					Reference Material (RM) Report				
					RM Target Concentration	Recovery (%) RM	Recovery Limits (%)		
Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method			Low	High	Qualifier
Physical Tests (QCLot: 1787672)									
QC-1787672-003	RM	Conductivity (1:2 leachate)	----	E100-L	3310 µS/cm	98.9	70.0	130	----
Physical Tests (QCLot: 1787678)									
QC-1787678-001	RM	Oxidation-reduction potential [ORP]	----	E125	475 mV	101	90.0	110	----
Metals (QCLot: 1793258)									
QC-1793258-003	RM	Calcium, soluble ion content	7440-70-2	E484	174 mg/L	104	70.0	130	----
QC-1793258-003	RM	Magnesium, soluble ion content	7439-95-4	E484	63.5 mg/L	106	70.0	130	----
QC-1793258-003	RM	Sodium, soluble ion content	17341-25-2	E484	113 mg/L	107	70.0	130	----
Leachable Anions & Nutrients (QCLot: 1793716)									
QC-1793716-003	RM	Sulfate, soluble ion content	14808-79-8	E236.SO4	170 mg/kg	82.2	70.0	130	----
Leachable Anions & Nutrients (QCLot: 1793717)									
QC-1793717-003	RM	Chloride, soluble ion content	16887-00-6	E236.Cl	402 mg/kg	83.0	70.0	130	----



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Report To Contact and company name below will appear on the final report Company: CMT Engineering Inc. Contact: J. Feeney Phone: 519-699-5775 (ext. 307) Company address below will appear on the final report Street: 1011 Industrial Cres. Unit 1 City/Province: St. Clements, Ontario Postal Code: N0B 2M0		Reports / Recipients Select Report Format: ☒ PDF ☐ EXCEL ☐ EDO (DIGITAL) Merge QC/QCI Reports with COA ☒ YES ☐ NO ☐ N/A ☒ Compare Results to Criteria on Report - provide details below if box checked Select Distribution: ☒ EMAIL ☐ MAIL ☐ FAX Email 1 or Fax: nchoros@cmfinc.net Email 2: jfeeney@cmfinc.net Email 3:		Turnaround Time (TAT) Requested ☒ Routine [R] if received by 3pm M-F - no surcharges apply ☐ 4 day [P4] if received by 3pm M-F - 20% rush surcharge minimum ☐ 3 day [P3] if received by 3pm M-F - 25% rush surcharge minimum ☐ 2 day [P2] if received by 3pm M-F - 50% rush surcharge minimum ☐ 1 day [E] if received by 3pm M-F - 100% rush surcharge minimum ☐ Same day [E2] if received by 10am M-S - 200% rush surcharge. AC fees may apply to rush requests on weekends, statutory holidays and routine tests																																																																												
Project Information ALS Account # / Quote #: Job #: 24-811 1134 Printery Road, St. Jacobs, ON PO / AFE: LSD:		Oil and Gas Required Fields (client use) AFE/Cost Center: PO# Major/Minor Code: Routing Code: Requisitioner: Location:																																																																														
Shipping Information ALS Lab Work Order # (lab use only): W12135102 Sample identification and/or Coordinates (This description will appear on the report) BH1S3 BH7S2		Invoice Recipients Select Invoice Distribution: ☒ EMAIL ☐ MAIL ☐ FAX Email 1 or Fax: egibbs@cmfinc.net Email 2: jfeeney@cmfinc.net																																																																														
Shipping Details Shipping Method: ☐ NONE ☐ ICE ☒ ICE PACKS ☐ FROZEN ☐ COOLING INITIATED Submission Comments identified on Sample Receipt Notification: ☐ YES ☐ NO Cooler Custody Seals Intact: ☐ YES ☐ N/A Sample Custody Seals Intact: ☐ YES ☐ N/A INITIAL COOLER TEMPERATURES °C: FINAL COOLER TEMPERATURES °C:		Analysis Request Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below <table border="1" style="width:100%; border-collapse: collapse;"> <thead> <tr> <th rowspan="2">SAR</th> <th colspan="12">NUMBER OF CONTAINERS</th> </tr> <tr> <th>1</th><th>2</th><th>3</th><th>4</th><th>5</th><th>6</th><th>7</th><th>8</th><th>9</th><th>10</th><th>11</th><th>12</th> </tr> </thead> <tbody> <tr> <td>Corrosivity</td> <td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td> </tr> <tr> <td>Flammability</td> <td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td> </tr> <tr> <td>Reactivity</td> <td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td> </tr> <tr> <td>Other</td> <td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td> </tr> </tbody> </table>		SAR	NUMBER OF CONTAINERS												1	2	3	4	5	6	7	8	9	10	11	12	Corrosivity													Flammability													Reactivity													Other												
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REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION
 Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.
 1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form**.

Appendix G: Reference Project Info – Old Scout Place



previously proposed to decrease the clearance requirement by passively lowering the groundwater table (by draining it by gravity to the storm sewer), but the additional cost is prohibitive. Additionally, multiple easements would be required, which is undesirable.

Stormwater Management

The stormwater management design for the earlier phases of the subdivision to the west (known as the Valleyview Heights Subdivision) included 0.28ha of land in catchment 601 at 95% impervious (see Catchment 601 in Figure 10 and Table 6 in the attached Valleyview Heights Subdivision Pond, both in Appendix E). The allowable "A x C" impervious area is thus $0.28\text{ha} \times 0.95\% = 2660\text{m}^2$.

This catchment 601 is uncontrolled, and the figure shows that the lands are meant to drain to Old Scout Place and then to the low point at the existing SWM facility outlet. The property at 1065 Old Scout Place comprises most of the catchment.

The requirement for stormwater management control on the property is thus to limit the product of the imperviousness and area of what will drain to Old Scout Place to $2,660\text{m}^2$. The figure attached in Appendix E shows Catchment 506 draining to the road; its total area is 1900m^2 , and thus the area requirement is easily accomplished. The landowner opposite Old Scout Place has expressed concern regarding the amount of stormwater being directed by the storm sewers in the roadway and the outfall from the pond through his property. In order to reduce the drainage area, the grading on the lots has been designed to be split front-and-rear as much as possible.

The increased drainage area to Old Scout Place is accounted for in the updated modelling for the rear of the properties that drains to the pond by a rear-yard swale. Attached in Appendix E are two pages from the 2002 report, showing the original modeling input parameters and modeling results, as well as the catchment plan showing the location of the site. Catchment 601a has been added to the original MIDUSS modeling (attached in Appendix E); a summary of the results for the worst-case 100-year storm event are shown below in Table 2, and a catchment plan has been included.

The imperviousness for catchment 601a was rounded up to allow for up to 100ft^2 of additional hard surfaces such as decks, patios, sheds, etc. in addition to the imperviousness of the houses themselves.

	Peak outflow (m^3/s)	Storage volume (m^3)	Ponding elevation
Allowable	0.476	5,237	341.80
2002 modeling post-development	0.398	5,107	341.77
Update including rear yards and roofs of 1065 Old Scout Place	0.415	5,167	341.78

Table 2: 100-year Pond Performance Comparison (Existing SWM Facility)

In summary, the existing SWM facility can accommodate the small amount of additional drainage from the rear yards and roofs of 1065 Old Scout Place without any modifications to the facility.

The front portion of the site has been accounted for in the storm sewer design for the reconstruction of Old Scout Place (Environmental Compliance Approval #7689-AMFQVU). This approval indicating the locations of the storm sewers, along with the associated storm sewer design sheet and catchment area drawing are also attached in Appendix E. As the area draining to the road will be reduced, there is no negative impact on the storm sewers.

As this site is sufficiently managed in both the existing stormwater management pond to the west, and the right-of-way drainage to the south, no further stormwater management quality or quantity control measures are proposed or required.

Utilities

Enova Power Corp. have finalized their design to service the proposed development. Their drawing is attached in Appendix B.

The following utility companies are required to confirm their ability to service the development:

- Bell Canada
 - Design is underway; pedestal locations have been determined
- Rogers Cable
 - Design is complete
- Enbridge (formerly Union Gas)
 - A line was previously installed along the flankage of 246 Water Street to service this development. The design is underway; the proposed running line location has been determined

Grading and Drainage

Grading for the existing site is generally to the west to the existing stormwater management pond. Proposed grading involves a 3:1 berm to raise the buildings in order to ensure frost cover on the building foundation and adequate separation to groundwater as shown on the Site Grading Plan in Appendix B. Grading will comprise generally of a split lot configuration with rear yards directed to a swale for conveyance to the west, and the front of lots graded to discharge directly to the Old Scout Place right-of-way.

Recommendation

Approval agencies shall review and approve this document for both re-zoning and Draft Plan approval.

recommended ranges within the MIDUSS software. For the impervious areas, an initial abstraction value of 0.5mm was used.

Catchment	Area (ha)			Slope Length (m)	Slope Gradient (%)	Impervious (%)	IA (mm) (pervious)	SCS CN (pervious)	Uncontrolled Peak Flow (m³/s)	
	Controlled	Uncontrolled	Total						5-year	100-year
Internal										
501		0.07	0.07	5.0	33.0	10.0	4.0	74	0.007	0.020
502		0.39	0.39	22.2	2.0	0.0	4.0	61	0.013	0.055
503		0.32	0.32	22.5	2.5	0.0	4.0	61	0.011	0.047
504		0.27	0.27	30.0	2.5	45.0	4.0	61	0.037	0.074
505		0.72	0.72	45.5	2.5	36.0	4.0	61	0.075	0.152
701	0.77		0.77	36.5	2.5	70.0	4.0	61	0.159	0.309
702	1.31		1.31	26.0	2.5	48.0	4.0	61	0.194	0.387
703	1.22		1.22	41.5	2.5	58.0	4.0	61	0.209	0.409
704	2.91		2.91	40.0	2.5	41.0	4.0	61	0.356	0.713
705	0.58		0.58	27.2	2.5	75.0	4.0	61	0.132	0.255
706	0.47		0.47	31.6	2.5	44.0	4.0	61	0.063	0.126
707	1.40		1.40	10.0	2.0	80.0	4.0	61	0.359	0.664
708	0.35		0.35	41.0	2.5	49.0	4.0	61	0.051	0.101
709	0.86		0.86	45.4	2.5	53.0	4.0	61	0.133	0.263
710	0.66		0.66	12.0	20.0	30.0	4.0	61	0.071	0.170
711	0.24		0.24	15.0	2.0	5.0	4.0	61	0.010	0.039
Subtotal:	10.77	1.77	12.54							
External										
601		0.28	0.28	45.0	2.0	95.0	4.0	74	0.076	0.147
602		0.18	0.18	5.0	4.0	95.0	4.0	74	0.054	0.097
* 801	0.46		0.46	17.0	2.0	30.0	4.0	68	0.048	0.111
802	0.56		0.56	30.0	3.0	37.0	4.0	68	0.065	0.139
Subtotal:	1.09	0.46	1.55							
Total	11.86	2.23	14.09							

Table 6: Proposed Condition Modelling Parameters

The resultant peak flows from each catchment are summarized in Table 6. Refer to the MIDUSS modelling results in Appendix D.2 for further information. Table 7 shows that the unattenuated post development peak flows are greater than the predevelopment flows. As a result, attenuation measures in the form of a controlled outlet pond are proposed.

Event/Condition	5-year (m³/s)	25-year (m³/s)	100-year (m³/s)
Predevelopment	0.216	0.324	0.476
Unattenuated Post development	1.842	2.672	3.600

Table 7: Peak Flow Comparison

* 801 Catchment is reduced since some of this catchment area is included in site modeling catchments for subject lands. 801 is reduced to only included remaining area outside of subject site.

rise due to the restriction on the outlet. Eventually, the water will be "backed up" until it reaches a maximum elevation of 340.782 metres, which means that the sediment forebay will be slightly inundated as well. After the storm has ended, the pond will continue to "trickle down" over a period of at least 24 hours and will eventually return to the permanent pool elevation.

The facility will operate in a similar fashion during the 5-year storm event, except that the maximum elevation of ponding will be 341.112 metres, which is 0.612 metres above the invert of the inlet pipe. The resulting surcharged sewers are shown in Figure 7. At this elevation, outflow is only through the restriction pipe.

Finally, during a 100-year storm event, runoff from the subdivision will be a combination of pipe flow and overland flow. In some areas, overland flow will pond at low points in the road before overflowing, however, this "lag time" has been ignored in the modelling. The maximum ponding elevation is 341.768 metres. The discharge from the pond will be predominantly overland from the v-notch weir. Table 10 presents the total peak flow for all lands draining south.

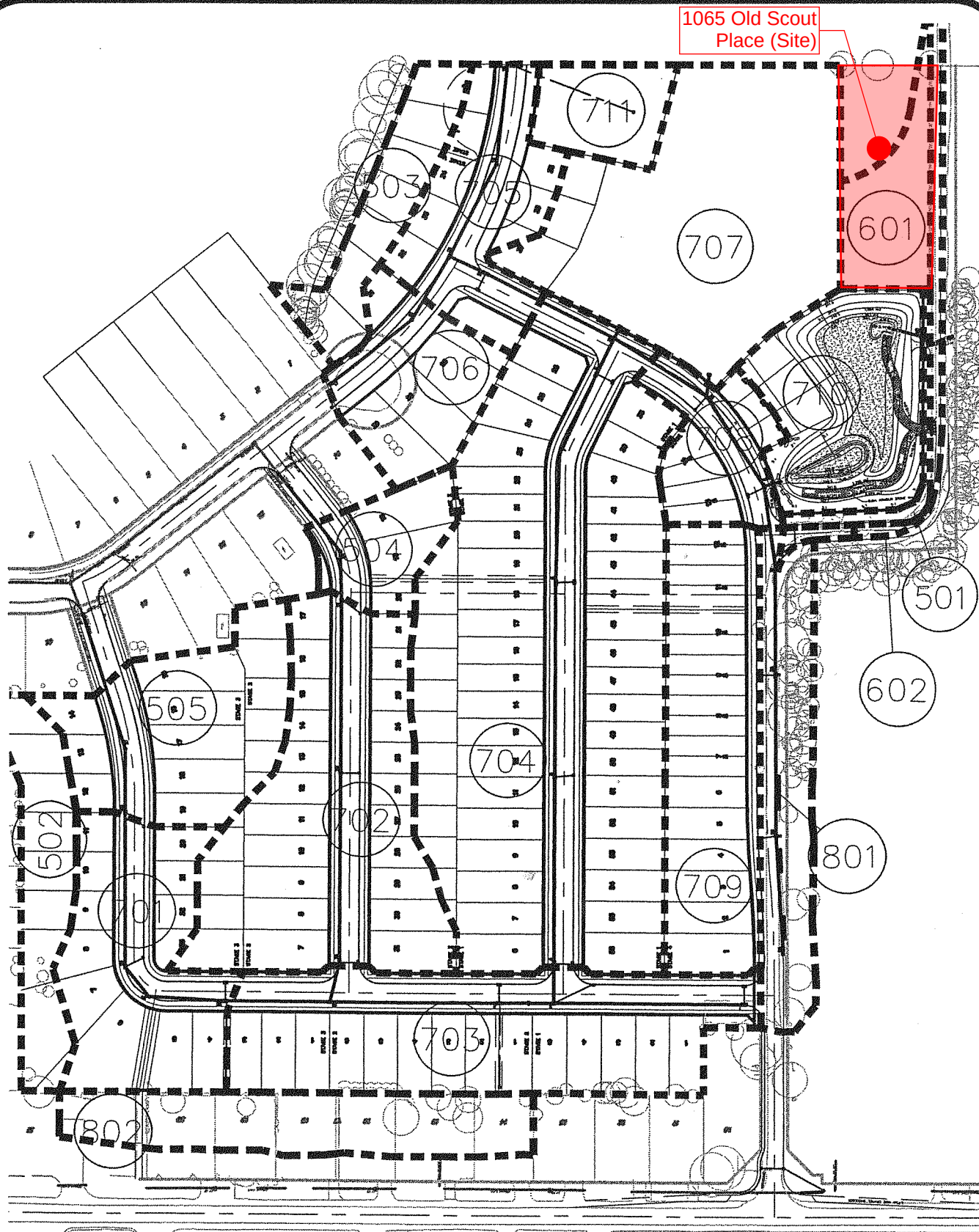
Event/Condition	5-year (m ³ /s)	25-year (m ³ /s)	100-year (m ³ /s)
Predevelopment	0.216	0.324	0.476
Attenuated Post-development	0.068	0.127	0.398

Table 10: Comparison of Attenuated Peak Flows

Table 11 summarizes the overall performance of the pond, including volume of the permanent pool and peak discharge.

Description	Elevation (m)	Depth (m)	Volume (m ³)	Discharge (m ³ /s)
Wet pond bottom	339.700	-0.300	0	0
Forebay bottom	339.000	-1.500	0	0
Wet pond permanent pool	340.000	0.000	391	0
Control Pipe Invert	340.000	0.000	391	0
Forebay permanent pool	340.500	0.000	421	0.000
Extended detention ponding	340.782	0.782	1626	0.043
Sewer invert into forebay	340.500	0.500	882	0.018
5-year ponding	341.112	1.112	2583	0.068
Invert of V-notch weir	341.200	1.200	2885	0.072
25-year ponding	341.535	1.535	4147	0.127
100-year ponding	341.768	1.768	5106	0.398

Table 11: Pond Performance Table



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**Post-Development Catchments
Valleyview Heights Subdivisions**

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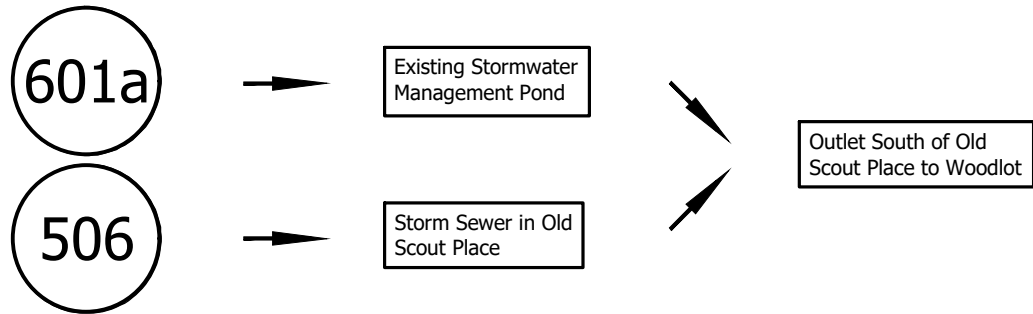
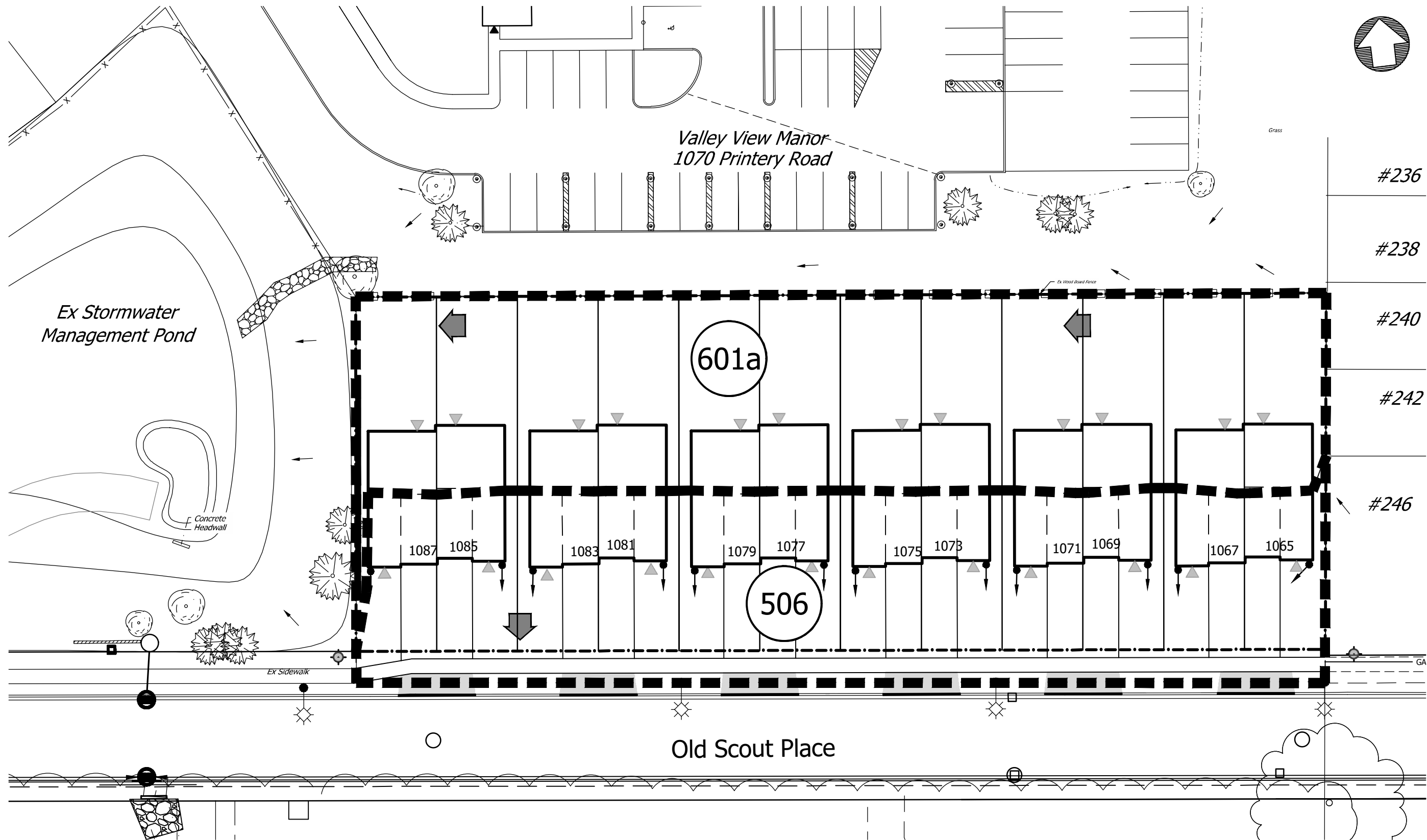
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