



BURNSIDE

**Mattamy Lockhart Functional
Servicing and Stormwater
Management Report**

City of Barrie

**Mattamy Homes
7880 Keele Street, Unit 3, Suite 400
Vaughan ON L4K 4G7 CANADA**



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July 26, 2021

Table of Contents

1.0	Introduction.....	1
2.0	Site Description.....	2
3.0	Background Studies and Documentations	3
3.1	Existing Site Condition	4
3.1.1	Soil Conditions	4
3.1.2	Groundwater Conditions.....	5
3.1.3	Hewitt's Creek System	5
3.1.4	Environmental Features	6
4.0	Road Design.....	6
4.1	Utilities	6
5.0	Water Distribution.....	7
5.1	Existing Water Infrastructure.....	7
5.2	Water Design Criteria	7
5.3	Pressure Zone Boundaries	7
5.4	Proposed Water Distribution Layout.....	8
6.0	Wastewater Servicing.....	9
6.1	Existing Wastewater Infrastructure	9
6.2	Wastewater Design Criteria	9
6.3	Proposed Wastewater Servicing	10
7.0	Grading and Storm Drainage	11
7.1	Site Grading.....	11
7.1.1	GG (9 Mile) LTD.....	12
7.1.2	Lockhart Innisfil Investment LTD.	12
7.1.3	Rainsong Development Inc. Phase 2	12
7.1.4	Lockhart Road.....	13
8.0	Stormwater Management	14
8.1	Background	14
8.2	Existing Storm Drainage	14
8.3	Proposed Storm Drainage	14
8.3.1	Foundation Drain Collector Outlet System.....	15
8.4	Off-Site Stormwater Management Objectives	16
8.4.1	Quantity Control	16
8.4.2	Quality Control	16
8.5	On-Site Stormwater Management Objectives	16
8.5.1	Subsurface Infiltration Parameters	17
8.5.2	Water Balance	17
8.5.3	Volume Control	18
8.5.4	Phosphorous Budget.....	18
9.0	Timing & Phasing.....	19
10.0	Erosion & Sediment Control	20

July 26, 2021

11.0	SIS Recommendations	21
12.0	Conclusions and Recommendations	23

Tables

Table 1: Shallowest Groundwater Level Observed in Monitoring Wells

Table 2: Catchment Summary

Figures

Figure 1 - Site Location Plan

Figure 2 - Conformity Plan – Jones Consulting Group Ltd. (Concept 5 - April 29, 2021)

Figure 3 - Existing Condition Plan

Figure 4 - Grading Plan

Figure 5 - Watermain Distribution Plan

Figure 6 - Sanitary Drainage Area Plan

Figure 7 - Storm Drainage Area Plan

Figure 8 - Subsurface Infiltration Tank

Figure 9 - Servicing Details

Appendices

Appendix A Conformity Approval

Appendix B Preliminary Geotechnical Report

Appendix C Hydrogeological Report

Appendix D Background References

Appendix E PCSWMM Modelling Outputs

July 26, 2021

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July 26, 2021

1.0 Introduction

R.J. Burnside & Associates Limited (Burnside) has been retained by Mattamy Homes to prepare a Functional Servicing Report (FSR) in support of the proposed Mattamy Lockhart Development in the Hewitt's Creek Secondary Plan Area (HSPA) in the City of Barrie (City).

This Report will support the application for Draft Plan of Subdivision approval by demonstrating that the subject lands can be provided with municipal servicing in accordance with applicable regulatory requirements and criteria.

July 26, 2021

2.0 Site Description

The Mattamy Lockhart Subdivision is located at 620 Lockhart Road, approximately 900 m west of Yonge Street. The proposed development is 27.94 hectares (ha) and located within the limit of the City's boundary which borders with the Town of Innisfil to the south (Lockhart Road). The entirety of the site is developable land; the proposed draft plan consists of 630 residential units, a 2.52 ha park block and a 0.35 ha mixed use block. The site is located within the Hewitt's Creek Secondary Plan Area, Phase 2 of the Annexed Lands and within Lover's Creek Sub-watershed. It is bounded by Lockhart Road to the south, Lockhart Innisfil Investments Ltd. to the west, GG (9 Mile) Ltd. to the north and Rainsong Development Inc. to the east. Please refer to Figure 1 - Site Location Plan, showing the property location in the context of the surrounding area. This Figure is located within the "Figures" Appendix at the back of this Report in reference.

The Ontario Municipal Board (OMB) and the City have approved the Conformity Plan for Mattamy Lockhart, though correspondence provided in Appendix A. This plan includes 630 residential units (as noted above), a 0.35 ha Mixed Use Block consists of low and medium density unit types, as well as a 2.52 ha park block. The plan also provides for roadways, open space, and a small portion of the SWMF No. 3 (one of the overall stormwater management ponds proposed to service the Annexed Lands). Please refer to Figure 2 - Conformity Plan – Jones Consulting Group Ltd. (Concept 5 - April 29, 2021)

July 26, 2021

3.0 Background Studies and Documentations

The servicing concepts presented within this Report have been developed to comply with the infrastructure and stormwater management servicing framework that has been established for the Hewitt's Creek SPA. The Hewitt's Secondary Plan (O.P.A No.39) was adopted by the City on June 16, 2014.

The following documents, studies, and reports have been incorporated unless otherwise noted:

Document Title	Prepared By	Date
Preliminary Geotechnical Investigation	DS Consultants Limited	October 2020
City of Barrie, Secondary Plan, Background Studies and Infrastructure Master Plans Intensification and Annexed Lands (includes Drainage and Stormwater Management, Wastewater Collection, Wastewater Treatment, and Water Storage and Distribution)	AMEC	October 2013
MultiModal Active Transportation	GENIVAR	January 2014
Water Supply	GENIVAR	October 2013
Hewitt's Secondary Plan Area Subwatershed Impact Study Lover's, Hewitt's and Sandy Cove Creeks	RJ Burnside	September 2016
Hewitt's Secondary Plan Area Subwatershed Impact Study Lover's, Hewitt's and Sandy Cove Creeks Report Addendum No. 1	RJ Burnside	November 2017
Transportation Master Plan	City of Barrie	July 2019
Subdivision Conformity Review	RJ Burnside	December 2020

The current Report has been prepared in accordance with, and in consideration of, the information and recommendations provided in the following documents:

Document Title	Prepared By	Date
Development Manual	City of Barrie	2017
Sanitary Sewer Collection System Policies and Design Guideline	City of Barrie	2017
Lot Grading and Drainage Standards and Design Manual	City of Barrie	2019
Storm Drainage and Stormwater Management Policies and Design Guidelines	City of Barrie	October 2020

July 26, 2021

Stormwater Management Planning and Design Manual	Ministry of the Environment	March 2003
LSRCA Technical Guidelines for Stormwater Management Submissions	LSRCA	June 2016
Transportation Design Manual	City of Barrie	2020

3.1 Existing Site Condition

The existing site is primarily agricultural land (row crops/ hay) with a small wetland area located southwest of the subject property. Drainage runs from northeast at around an elevation of 274.0m to the southwest at an elevation of 255.0 m. The property is open agricultural land with some existing trees along the east and west fence lines. Please refer to Figure 3 - Existing Condition Plan.

The following section will discuss the existing soil conditions, groundwater conditions and environmental features of the subject site.

3.1.1 Soil Conditions

A preliminary geotechnical Investigation was completed by DS Consultants Ltd. (DS) on October 2, 2020 and can be found in Appendix B for reference. As part of the geotechnical investigation, a total of nine boreholes were drilled to depths ranging from 7.0 to 9.8 m. Three monitoring wells were installed per the preliminary investigation. Five additional wells were installed at a later date and will be concluded in the full geotechnical report.

Based on the finding from this report, the site is covered by a surficial layer of topsoil ranging in depths from 100 mm to 250 mm thick, underlain by strata of sandy silt to silty sand, with trace to some gravel, that extended to the maximum depth of the boreholes. In addition, a layer of firm to stiff silty clay was encountered in BH20-3, which is located at the southeast corner of the site. The top 1.0 m layer of the subgrade was found to be weathered or disturbed and contained organic material within.

In Boreholes BH20-3, BH20-6 and BH20-9 in the southern portion of the site, less competent soils were encountered at depth ranging from 2.0 to 3.8 m. Depending on the house foundation elevation in this portion of the site, where the less competent soil was encountered, the subgrade should either be sub-excavated and replaced with engineered fill or be consolidated through a field dynamic compaction programme. A further borehole investigation is recommended and will be carried out with detailed design of the site.

A perimeter and underfloor drainage system will be required around the exterior basement wall as recommended in the preliminary geotechnical report. This system will connect with the foundation drain and outlet to storm sewer.

July 26, 2021

3.1.2 Groundwater Conditions

A total of 8 groundwater monitoring wells were installed by DS Consultants in September and December 2020. A groundwater monitoring programme has been carried out by Burnside over the period of January to June 2021; the shallowest measurements recorded are presented in Table 1 below.

Table 1: Shallowest Groundwater Level Observed in Monitoring Wells

Well Number	Date	Water Level (mbgs)
MW1	April 29, 2021	0.48
MW2	April 29, 2021	8.96
MW3S	April 29, 2021	0.66
MW4	March 15, 2021	2.46
MW5	April 29, 2021	-0.12
BH20-3	April 29, 2021	-0.21
BH20-4	March 15, 2021	4.74

Note that MW3D is not included in this table as it is in the same location as MW3S and measurement in MW3S is more representative for this functional servicing design.

The result shows that some groundwater levels are very shallow at the west and south portion of the site. MW5 and BH20-3 are under artesian pressure hence the negative values. Overall, the water table ranges from -0.21 m to 8.96 m below ground surface. Groundwater has been interpreted to exist within the local supply aquifer with seasonal fluctuation.

Due to the potential for encountering the water table during construction, the dewatering of local aquifers may be required for services to be installed below the water table. Currently the MECP allows for construction dewatering of less than 400,000 L/d to proceed under the Environmental Activity Sector Registry (EASR) process. If dewatering is to be above this threshold, then the standard Permit to Take Water (PTTW) process applies. In both cases, a scientific study is required in support of EASR registration or PTTW application. The requirements for construction dewatering will be confirmed by geotechnical/ hydrogeological investigations completed in support of detailed design.

Please refer to the Hydrogeological Report for the complete results of the monitoring program and the well location plan located in Appendix C.

3.1.3 Hewitt's Creek System

The subject lands reside within the Hewitt's Creek Secondary Plan Area (SPA) and furthermore within the Lover's Creek Sub-watershed which is a tributary to Lake Simcoe. Natural Heritage System (NHS) limits and associated development buffers were defined in Section 3.0 of the Hewitt's SIS. There are no NHS lands designated specifically on the property, however on the adjacent lands to the west and south of Lockhart Road lies

July 26, 2021

Lover's Creek Swamp a provincially Significant Wetland (PSW) which is located approximately 100 m directly south of the site.

3.1.4 Environmental Features

The site is located within a Significant Groundwater Recharge Area (SGRA) and a Highly Vulnerable Aquifer (HVA) as designated on Ministry of the Environment, Climate Change and Park (MECP) Source water protection mapping. As such, the Lake Simcoe Protection Plan (LSPP) policies for Settlement Areas would apply to Significant Groundwater Recharge Areas (policies 6.36-DP and 6.40-DP). Burnside's Environmental team is concurrently working on a separate Environmental Impact Study (EIS) in support of the development demonstrating that the quality and quantity of groundwater in these areas and the function of the recharge areas will be protected, improved, or restored.

4.0 Road Design

As part of the Municipal Class Environmental Assessment (EA) completed with the SIS an 11 m road widening was provided along the northside of Lockhart Road for future development. The EA also assessed Lockhart Road as a future four-lane road and the landowners negotiated 31 m Right-of-Way (ROW) with the City.

Major Roadways within the SIS such as Madelaine Drive (north of the site) and Fenchurch Manor (internal to the site) are based on the City's 27 m Right-of-Way. Internally, Street A and Street C are based on the City of Barrie standards for a 24 m ROW (BSD-303). Street C however transitions from a 24 m to a 25 m ROW (BSD-304) for the first 50m (north) from Lockhart Drive. All minor roads have been designed using the City's standard 18 m ROW (BSD-301) except for a non-standard municipal ROW of 16 m that has been proposed on Street M and Street P in conjunction with the 11.0 m road widening on Lockhart. These two 16 m streets will be constructed as 'enhanced window streets' off Lockhart Road. Enhanced treatments for key intersections with the site will be applied at three main road connections, Lockhart Road and Street A, Street A and Street C, Street A and Street I/J.

4.1 Utilities

Utilities will be installed in a joint utility trench as shown on the City's ROWs and designed to meet the City's design standards. Design will be provided by the Utility companies Innpower (hydro), Enbridge (natural gas), Bell, Rogers and Canada Post. Through ongoing consultation with Innpower (hydro) and Enbridge (natural gas), adequate external utility supply has been confirmed.

July 26, 2021

5.0 Water Distribution

5.1 Existing Water Infrastructure

There are no existing watermain within the subject property. We assume that by the time the subject site is serviced all distribution watermain to the north of the property will be constructed and commissioned including the 300 mm watermain on Madeline Drive, which will serve as the main feed for the development. We assume that both the Lockhart Innisfil property to the west and Rainsong Phase 2 development to the east will be serviced on a similar time frame as the subject site.

5.2 Water Design Criteria

The proposed water distribution within the property will be designed and constructed to current City of Barrie and MECP criteria and specifications. The collector roads will have local trunk watermain installed and the local roads will have local watermain.

The following City of Barrie standards and MECP Design guidelines will be used to design the watermain system within the development:

- Residential Average Water Consumption Rate 225 Litres / Capita / Day
- Residential Population Densities:
 - Low Density (Single Detached Units) – 3.25 ppu
 - Medium Density (Townhouse Units) – 2.57 ppu
 - High Density (Apartment Dwellings) – 1.67 ppu
- Minimum Pipe Depth 1.7m
- Minimum Pipe Size 150mm Diameter
- Domestic Use Maximum Velocity will not exceed 1.5 m/s,
- Fire Flow Maximum Velocity will not exceed 5.0 m/s
- Maximum Hydrant Spacing 152m

It is understood that some of the existing infrastructure as part of the overall SIS watermain design for servicing the Annex Lands will need to be constructed prior to Mattamy Lockhart's watermain. Supporting watermain modeling will be completed as part of the detailed design by Schaeffer & Associates Ltd, who has been completing the water modeling for the Hewitt's Creek Secondary Plan Landowners group.

5.3 Pressure Zone Boundaries

The City is currently divided into five major pressure zones. The southern half is serviced with two southern zones (2S and 3S) which use surface water sources. The northern half of the City is serviced by groundwater sources in three northern zones (1, 2N and 3N). The Hewitt's SPA including Mattamy Lockhart is located within 2S which

July 26, 2021

will be serviced by the Surface Treatment Water Plan located at 20 Royal Parkside Drive.

During the detailed design of the project, water distribution modeling will be complete to confirm the watermain sizing and pressures to support the development.

5.4 Proposed Water Distribution Layout

The preliminary design for the proposed water distribution layout for the Mattamy Lockhart Subdivision can be found on Figure 5 - Watermain Distribution Plan. This plan indicates connection points, as well as layout and routing for the proposed watermain within the development area. The overall layout conforms with the Hewitt's SIS Figure 12. Local water infrastructure will be comprised of 150 to 200 mm watermains as specified in previous studies. It will be designed to loop through the development area and maintain sufficient pressure and flows for both domestic and fire usage.

The proposed watermain layout for the Mattamy Lockhart development (as shown on Figure 5) has a local truck sewer on Street A connecting Madelaine Drive at the north to Lockhart Road at the south. Since there is no existing watermain south of the site on Lockhart Road, a hydrant and auto flusher will be installed. Street C (Lower Street) will connect the internal local watermains with another local trunk watermain running across the site from either side, connecting Rainsong Development Land (east) to Lockhart Innisfil (west). Fenchurch Manor is designed to have a local trunk watermain as well, which connects the existing 300 mm local trunk watermain on Madelaine Drive with the Lockhart Innisfil development. Minor changes to the local road network layout though detail design will have no adverse impact on the water distribution.

The 0.35 ha Mixed-Use block will be serviced off Street A and the required domestic and firefighting services will be sized and detailed as part of the detailed design of the block.

July 26, 2021

6.0 Wastewater Servicing

6.1 Existing Wastewater Infrastructure

There is no existing wastewater infrastructure within the subject property. The site is reliant on the downstream sewer construction within Lockhart Innisfil, GG (9 Mile), and the Bemp 2 developments in order to outlet to the proposed E3 connection point as shown on Figure 13 of the SIS found in Appendix D.

Outlet E3 is located on the west side of Bemp 2 lands, just north of SWMF No. 4 which outlets to Partrick Drive to the west. The sanitary drainage from their travels north on Stunden Lane, passing over Mapleview Drive which then connects to the County's lands north of Mapleview. Eventually the sanitary drainage makes its way downtown and is treated at the City's Sewage Treatment Plant located at 1000 Dixie Road in downtown Barrie.

6.2 Wastewater Design Criteria

The proposed wastewater sewers will be designed and constructed to current City of Barrie and MOECC criteria and specifications. The following summary of applicable City of Barrie criteria will be applied in generating average and peak design flows:

- Residential Flow Rate – 255 L/capacity/day
- Commercial Flow Rate – 28 m³/day/ha (0.324 L/sec/ha)
- Infiltration Flow Rate – 0.1 L/sec/ha
- Peaking Factor – Harmon Peaking Factor Formula or Babbit Peaking Factor, whichever is higher.
- Population Densities:
 - Low Density (Single Detached Units) – 3.13 ppu
 - Medium Density (Townhouse Units) – 2.34 ppu
 - High Density (Apartment Dwellings) – 1.67 ppu
- Design Minimums:
 - Pipe Diameter: (200 mm Residential/250 mm ICI)
 - Flow Velocity: 0.60 m/s, excluding extraneous flows.
 - Slopes: 0.4% where minimum velocity is achieved, 2.0% for first run dead ends.

It should be noted that at a functional design level, some of these design details have not yet been integrated. Sanitary Design Sheets will be prepared during the detailed design stage and will confirm that the above parameters are within acceptable limits per City of Barrie Standards.

July 26, 2021

6.3 Proposed Wastewater Servicing

The wastewater collection for the Mattamy Lockhart Development can be seen on Figure 6 - Sanitary Drainage Area Plan. Sanitary sewers generally drain from east to west and south to north, to the Lockhart Innisfil Development collector road (Fenchurch Manor) and conveyed north to Madelaine Drive and ultimately to connection outlet point E3 at the pre-2010 City Boundary on Patrick Drive. Figure 6 also shows the proposed sub-drainage areas to each local connection point (both to proposed and existing infrastructure), as well as layout and routing for the proposed sanitary sewers within the development area. Please refer to Figure 6 - Sanitary Drainage Area Plan in reference.

City of Barrie stipulates the maximum riser height and service slope therefore no sanitary services shall be installed on a sewer deeper than 7.5m. Due to grading constraints of the site, a portion of the sanitary sewer, near the west edge of Street C, is anticipated to be deeper than the maximum allowed depth and will require stocked sewer. The stocked sewer allows service connections to be installed at ideal depth on an upper local sewer, with a trunk sewer below to convey flows by gravity.

The SIS summarizes that the connection point E3 has a surplus capacity of 156.2 L/s while the projected flow is at 79.7 L/s. (Refer to Background References in Appendix D, which shows the Proposed Sanitary Flows for the SIS discharge points) Minor modifications have since been made on the sanitary route to allow the north portion of the site to be independent of the neighbouring development. The overall revised design has been reviewed by the City through the conformity review and no adverse impacts have been found.

The sanitary layout generally conforms to Figure 15 of the SIS with minor changes which includes 630 residential units as well as the 0.35m Mixed-Use block which will be serviced by a sanitary sewer connection off Street A.

July 26, 2021

7.0 Grading and Storm Drainage

The grading of the subject site has been proposed to match into the adjacent development designs while conforming to the drainage boundaries presented in the SIS. The adjacent developers have deviated from the SIS grading elevations for a variety of reasons but have generally maintained the SIS drainage patterns. The following section will provide background summary of grading design in relation to each adjacent property and the plan for the proposed development in relation to this.

7.1 Site Grading

The preliminary site grading design provided as Figure 4 - Grading Plan has been developed in consideration of the following requirements and constraints:

- Conformance to the City of Barrie grading and drainage criteria.
- Matching of existing boundary grades where applicable.
- Consideration for future full urban cross section for Lockhart Road.
- Coordination of grading at the interface with the adjacent landowners to the north, east and west.
- Optimization of earthworks (i.e., minimizing fill export).
- Provision for adequate cover on proposed services.
- Provision for overland flow conveyance on the roadways to the proposed stormwater facilities (i.e., major system storm drainage and emergency overland flow).

Overall, the site grading design generally corresponds to the grading depicted in Hewitt's SIS Figure 8 which can be found in Appendix D.

The majority of the lots on the plan will be split draining lots (SP) and front draining lots (FD) as depicted on Figure 4 - Grading Plan. Units fronting along Street A will be FD and drain towards the road. A small portion of walkout units (WO) will back onto the north part of the Park Block and internally along Street C (Lower Street). Another small portion of units will be lookout lots (LO) along Street K central to the site and Street C on the west side. The lots fronting Madelaine Drive will be FD and be serviced off Madelaine Drive. Along the southern limits of the property, window streets (Street M and Street P) will run parallel to Lockhart Road and adequate room for road widening has been provided for the future road expansions of Lockhart Road.

Grading of the subject site has been proposed to match into the adjacent development designs while conforming to the drainage boundaries presented in the SIS. The adjacent sites grading designs has deviated from the SIS grading elevations for a variety of reasons but maintaining the SIS drainage patterns. The following sections provide background and summary of grading design in relation to each adjacent property.

July 26, 2021

7.1.1 GG (9 Mile) LTD.

GG (9 Mile) development, previously known as Lockmaple Innisfil before change of landowner, is located along the entirety of the northern boundary of the Mattamy Lockhart Subdivision. Madelaine Drive is a collector road within the GG (9 Mile) development and lies along the south limits of the property. Street A, B and D from Mattamy Lockhart will ultimately intersect with Madelaine Drive. As part of the GG (9 Mile) design, Madelaine was lowered 2-3 m below the grading elevations included in the SIS. The storm drainage along Madelaine flows from east to west draining to SWMF No.4. This development has been pre-graded for site servicing at the time of preparing this report. The proposed grading of Mattamy Lockhart subdivision is matching the current design of Madelaine Drive.

7.1.2 Lockhart Innisfil Investment LTD.

The Lockhart Innisfil development is located across the entirety of the western property boundary of the Mattamy Lockhart Subdivision. The development has completed the preliminary grading design at the time of preparing this report. This development includes SWMF No.3 and SWMF No.4 which Mattamy Lockhart will be dependent on for stormwater management. The north half of the Mattamy Lockhart drains to SWMF No.4 and the south half drains to SWMF No.3. The design of SWMF No.3 has been modified from the SIS by the Lockhart Innisfil Development's consultant to provide a greater separation from the groundwater table. The top of pond elevation included in the SIS is 255.53 and the revised design concept has raised it to 256.70. A hydrogeological assessment has been completed across both Mattamy Lockhart and Lockhart Innisfil property which has confirmed the high ground water levels and the need to raise SWMF3 above the SIS grading. The preliminary grading of Mattamy Lockhart has been designed to maintain the drainage catchment divide between the two SWM facilities.

SWMF No.4 been designed as a segmented facility which accounts for upstream drainage areas from both Madeline Drive and from Street E. the preliminary grading and drainage from the subject site has been designed to match the SIS SWMF No.4 catchment area. It is understood that SWMF4 is to be subdivided into 3 interconnected ponds. At this time, the full details of the SWMF No.4 ponds are not available, and for simplicity it is assumed as a single pond for this report. Refer to the stormwater management section for more details.

7.1.3 Rainsong Development Inc. Phase 2

The second phase of the Rainsong Development is located to the east of the Mattamy Lockhart Subdivision. This development has conceptual grading prepared for earthworks purposes but has not made a conformity submission to the City at the time of preparing this report. This development is reliant on the municipal servicing of the Mattamy Lockhart site to service the property. All wastewater and stormwater will flow

July 26, 2021

west from the Rainsong Development through the Mattamy Lockhart development to the Lockhart Innisfil development. The conceptual grading design provided by Rainsong is significantly lower than the SIS along Street C at the property line; it is understood that the change is to help balance earthworks between Rainsong Phase 1 and Phase 2. After review of the groundwater conditions found within the Mattamy Lockhart monitoring wells, grading of Street C within the development has been raised to maintain a closer elevation to the design of the SIS. The specified road grading is required to allow for the construction of the LID within the park while maintaining cover on the storm sewer. For the Street J/Street O road connection between Mattamy Lockhart and Rainsong, the grading has been prepared to match at property line.

7.1.4 Lockhart Road

There was a Municipal Class Environmental Assessment (EA) completed to prepare the design for the widening of Lockhart Road in the Hewitt's Secondary Plan Area. The EA determined that a 4-lane road shall be constructed on a 34 m Right-of-Way (ROW). After the completion of the EA, the landowners group negotiated a reduction in the ROW section to 31 m, which includes an 11 m widening on the northside of the road, across the frontage of the subject development.

July 26, 2021

8.0 Stormwater Management

8.1 Background

The proposed development is within the Hewitt's SIS boundary and conveys drainage from the north half of the land to SWM Facility 4, and the South half to SWM Facility 3 on the neighbouring landowners property Lockhart Innisfil. There is a small area labelled as '3a' adjacent to Lockhart Road that will drain to Lover's Creek via Lockhart Road as it is unable to drain to SWM Facility 3 due to the grading. The catchment areas are generally matching the SIS design. Due to elevation adjustments of SWM Facility 3 in Lockhart Innisfil, drainage to Lockhart Road (area 3a and 3-EXT) is increased slightly from what was assumed in the SIS. For reference, a summary of the catchment areas is provided in Table 2 below.

8.2 Existing Storm Drainage

The topography generally falls from east to west towards Lover's Creek. There is appreciable grade across the site with average slopes of 3-4%. The site does not have a specific drainage outlet, but rather sheet flows through adjacent lands to Lover's Creek. Please see Figure 3 - Existing Condition Plan, for reference. Similarly, external drainage from east of the development drains through the subject lands in the direction of Lover's Creek. All of this has been outlined in the SIS and can be referenced there.

As per the SIS, all the stormwater quantity and quality control for the site will be achieved through SWMF Nos.3 and 4, which are external to the site. Therefore, establishing baseline existing conditions targets for quantity control was not required. Stormwater volume control, water balance and phosphorus budget are the responsibility of the landowner as discussed below.

8.3 Proposed Storm Drainage

Under proposed conditions, the site is to be developed into a residential subdivision, consisting of a variety of lot sizes. The drainage will continue to be conveyed in a westerly direction, to the lands adjacent to Lover's Creek. The following table summarizes the SIS catchments, refined per the FSR grading, and outlets over this site:

Table 2: Catchment Summary

Catchment ID	Catchment Area (ha)	Catchment Outlet
3	20.2	SWMF No.3
3a	1.6	Lockhart Road
3-EXT	1.21	SWMF No.3
4	9.4	SWMF No.4

These areas are depicted on Figure 7 - Storm Drainage Area Plan. It is understood that SWMF4 is to be subdivided into 3 interconnected ponds. The site will contribute

July 26, 2021

drainage to SWMF No. 4B and 4C. At this time, the full details of SWMF No.4 ponds are not available, and for simplicity it was assumed as a single pond. At detailed design, the drainage areas will be further delineated to conform to the requirements of the downstream SWM facility, based on the final pond design.

Runoff up to the 5-year design storm will be conveyed via catch basins to internal storm sewers. The storm sewers will connect to sewers on the neighbouring properties, or directly into the ultimate ponds. Major system design storms up to the 100-year storm will be conveyed overland within the road section, to the adjoining roads and directed to the ponds as well.

An external drainage area approximately 15.8 ha in size exists to the east of the Mattamy Lockhart development. This drainage area represents the proposed Rainsong Phase 2 development. Minor system drainage from this catchment will be conveyed through storm sewers into the subject site's storm sewers at 'Lower Street'. Similarly, the major system will be conveyed overland at this location, with all external flows ultimately reaching SWMF No.3.

The 2.52 ha park block located at the eastern edge of the site has been proposed with a centralized subsurface system to infiltrate stormwater. The sewer along Street C draining stormwater from the east will be utilized to achieve volume control and water balance objectives as discussed below. External flows that exceed the infiltration tank capacity will overflow back into the storm sewer network and will be conveyed to SWMF No.3.

A servicing detail has been prepared to demonstrate the typical layout of sanitary, watermain, and storm services connecting to a building. Please refer to Figure 9 - Servicing Details.

8.3.1 Foundation Drain Collector Outlet System

An assessment has been completed to compare the preliminary subdivision grading and the high groundwater elevations shown in the hydrogeological report. The result indicates that, due to the shallow groundwater condition, foundation situated within 0.5m of the high groundwater level is not avoidable in some area. Per the City of Barrie standards, installation of foundation drain collector outlet system will be needed to meet the stormwater management requirements.

Based on City of Barrie Standard BSD-75B, a foundation drain outlet system with a gravity outlet connects directly to the foundation weepers and sump pump pit has been proposed. This design allows the groundwater around the building to be drawn down in heavy precipitation and/or thaw season even if the sump pump fail to function. A back flow preventor has been specified to prevent water in storm sewer backing up into the basement during a major storm event. A sump pump to surface has also been specified

July 26, 2021

as a secondary system to empty the sump pit in case of an emergency or system failure. Float of sump pit pump shall be installed above the gravity outlet to ensure that the pump will not run needlessly. Please see RJB 1.01 on Figure 7 for detail.

8.4 Off-Site Stormwater Management Objectives

8.4.1.1 Quantity Control

As prescribed in the SIS, quantity control is required to reduce post development peak flows, to predevelopment levels, for the 2 through 100-year design storm events for the overall subcatchment. However, none of the proposed ponds fall within the site area. As a result, the north catchments of about 9.4ha will drain through the adjoining subdivision to SWMF No.4, where it is accounted for in the quantity control calculations. Similarly, the southern catchments of 20.2ha will drain to SWMF No.3, where quantity control will be achieved. SWMF No.3 is to also overcontrol for approximately 1.6ha of the subject site that discharges directly to Lockhart Road due to grading constraints.

Therefore, no quantity control calculations are required for this site's application.

8.4.1.2 Quality Control

As per the SIS, and local standards, enhanced level quality control will be required for all drainage from the subject site. This requires 80% total suspended solids (TSS) removal prior to discharging to Lover's Creek. Similar to the Quantity control requirement, this will be achieved through SWMF No.3 and SWMF No.4 offsite, with no quality control onsite required.

8.5 On-Site Stormwater Management Objectives

As per the SIS, Low Impact Development (LID) measures are to be implemented throughout the development in accordance with the LSRCA Stormwater Management Design Guidelines, to help achieve the following 3 objectives:

- Water Balance – As per LSRCA standards post development infiltration is to match or exceed pre-development infiltration.
- Volume control up to 25mm – As noted in the SIS, the soils in the majority of catchments 3 and 4 consist of silty clay material with low infiltration rates, thus volume control is to be on a 'best efforts' basis for this site.
- Phosphorus Budget – As per LSRCA standards there is to be an 80% reduction in phosphorus load for the development area.

The SIS also recommended a topsoil depth of 300 mm on all lots. In addition to the above objectives there are significant groundwater recharge areas delineated across most of the Mattamy Lockhart Development.

July 26, 2021

8.5.1 Subsurface Infiltration Parameters

Infiltration opportunities will be confined to the Park Block located along the east property line. The City of Barrie typically does not support infiltration practices in the boulevard due to maintenance concerns, limiting available land for LIDs to the park block. Additionally, this area of the site provides some of the better groundwater and soils parameters to promote groundwater recharge.

A Preliminary Geotechnical Investigation was prepared by DS Consultants Ltd. in October 2020, with boreholes advanced throughout the site. Borehole 20-8 was in the vicinity of the proposed park block. This borehole was found to have small layers of topsoil and sandy silt, overlaying 6.7 m of Silty Sand Till. The infiltration tank would fall within the Silty Sand Till. There were 4 soil samples taken from the Silty Sand Till layer throughout the site. These samples noted a soil breakdown as follows: Gravel/Sand comprising 52-63% of the sample, silt comprising 29-37% of the sample and clay comprising 8-11% of the sample. Utilizing a Soil Texture Calculator (Natural Resources Conservation Service, USDA), these soil samples generally fall within the Sandy Loam soil type. Sandy Loam has a saturated hydraulic conductivity of 21.8 mm/hr (Handbook of Hydrology, 1993), as per the Low Impact Development Stormwater Management Planning and Design Guide a factor of safety of 3 was applied resulting in a design infiltration rate for the infiltration tank of 7.3 mm/hr. This rate will be confirmed through infiltration testing at the detailed design stage.

The proposed infiltration tank has been situated a minimum of 1m above the high groundwater level that was established by the Hydrogeological evaluation.

8.5.2 Water Balance

Reviewing the above objectives, it was found that the water balance component would produce the highest infiltration volume requirement and was determined to be the limiting factor. Initial calculations were completed to determine the volume of water required to achieve a water balance.

In the hydrogeological report completed by Burnside (2021) the Thornwaithe Method was applied to determine the pre and post development infiltration over a year. It was found that under pre-development conditions, approximately 56,930 m³ of stormwater would infiltrate through the year. Under proposed conditions, without any mitigation, only 27,876 m³ of infiltration is expected a year, resulting in a deficit of 29,054m³/yr.

Continuous simulation modeling was completed in PCSWMM to determine the required mitigation measures. As discussed above, the Rainsong Phase 2 development will be infiltrated in-lieu of the site's water but will equate to the volume of water required for the subject site. Since the Rainsong Phase 2 design has not been advanced at this stage, the SIS Continuous model was used.

July 26, 2021

Within the SIS a Continuous model was developed to compare predevelopment and post development infiltration over the course of a year. The Rainsong Phase 2 lands (15.8ha) were extracted from the SIS model which incorporates the necessary climate data and a year's worth of rainfall data (average representative year from June 1, 2005 to May 31, 2006 totalling 984.3mm). Please refer to the SIS for complete details of the hydrology data. The Rainsong Phase 2 catchment of 15.8ha is shown in Appendix E.

As shown in the model, by diverting the yearly runoff to a 6500 m² subsurface infiltration tank, that is 1m deep, 31,865 m³ of runoff is infiltrating over the year, exceeding the target of 29,054m³/yr. This will achieve the water balance target required for site.

An additional 20% was added to the infiltration tank footprint for the FSR stage. The figures show a 7800 m² area to account for further refinement at detailed design stage. Please refer to Figure 8 - Subsurface Infiltration Tank.

8.5.3 Volume Control

As per the SIS, catchments 3 and 4 are within areas that are poor for infiltration due to soil types and ground water elevations. As such, the SIS only required Best Efforts to achieving volume control (25mm infiltration) as outlined in the LSRCA standards. Due to the pocket of suitable soils and groundwater in the park block, efforts were made to achieve up to 25mm volume control. Similar to the water balance, it was not possible to divert site drainage to the infiltration tank. Instead the drainage from Rainsong Phase 2 will be diverted into the infiltration tank. The proposed infiltration tank contains 6,500m³ of storage. The total Mattamy Lockhart development is 31.1 ha in size. Twenty millimetres of rain over the site area would equate to a total volume of 6,220 m³, which is less than the 6,500 m³ available in the infiltration tank. This conservatively excludes infiltration and demonstrates that 20mm volume control can be achieved, far exceeding the 'Best Efforts' requirement set out in the SIS.

8.5.4 Phosphorous Budget

LSRCA guidelines stipulate that post development phosphorous loads need to be reduced by 80% of the development load, and a 'best effort' target of an additional 20% reduction beyond this level.

The only downstream water quality controls are off site, at SWMF No.3 and SWMF No.4. Downstream the flow will be conveyed through a Jellyfish unit as per the City of Barrie Standards, and then through the wet ponds. The Jellyfish units provide 59% removal of phosphorus and the wet ponds provide 63% removal of total phosphorus (LSRCA, 2016). In a treatment train configuration, the removal will be as follows:

- Total 100% of Phosphorus minus 59% (Jellyfish) = 41% of phosphorus remaining
- 41% of remaining phosphorus minus 63% (Wet Pond) = 26% of phosphorus remaining.

July 26, 2021

Therefore, 74% of the phosphorus will be removed downstream prior to discharging to Lover's Creek. Complete pre to post development phosphorus loading summaries will be completed at detailed design. The LSRCA Phosphorus Offsetting Policy will be applied where necessary to make up any difference in phosphorus load that cannot be mitigated on site.

9.0 Timing & Phasing

As part of detailed design, timing of work required for the development and construction staging will be reviewed and prioritized based on functionality. Burnside will review the projects entirety and strategize efficiencies. Given the size of the site; it will likely be staged in two construction phases based on the timing of construction for SWMF No. 3 and No. 4 on Lockhart Innisfil's lands.

July 26, 2021

10.0 Erosion & Sediment Control

The erosion and sediment control plan for the site will be developed in accordance with the City of Barrie and LSRCA guidelines. The plan will be completed at the detailed design stage prior to undertaking any grading activity on the site.

Erosion and sediment control will be implemented for all construction activities including topsoil stripping, foundation excavation and stockpiling of material. The following erosion and sediment control measures will be implemented:

- A temporary sediment control fence will be placed around the perimeter of all areas to be disturbed prior to grading. The installation of double row fencing may be appropriate adjacent to sensitive natural areas.
- Appropriately designed sediment control ponds will be provided to support drainage from the site.
- Temporary sedimentation control measure on site and adjacent to storm sewer inlets including sediment traps in existing catchbasin will be provided.
- Check dams, etc., for erosion / velocity control will be provided.
- Gravel mud mats will be provided at all construction access points to minimize offsite tracking of sediments.

All temporary erosion and sediment control measures will be routinely inspected, monitored and repaired during construction. Temporary controls will not be removed until the areas they serve have been restored and stabilized.

Connection to LID measures will not be completed until the contributing area is stabilized with vegetation to minimize sediment accumulation and maintenance issues.

All reasonable measures will be taken to ensure that sediment loading is minimized both during and following construction. Additional details will be provided as part of the detailed design.

July 26, 2021

11.0 SIS Recommendations

The following is a list of the recommendations from the Hewitt's Sub-watershed Impact Study (SIS) Lover's, Hewitt's and Sandy Cove Creeks (2016) that need to be applied to the Mattamy Lockhart Development:

1. Post to pre-quantity control for the 2 to 100year storm events (inclusive) and provide safe conveyance for the Regional Storm event.
2. Stormwater quality controls to a minimum of the MOECC 'Enhanced' level of treatment (80% TSS Removal for the 4 hour 25 mm Chicago Storm).
3. A minimum of 80% total Phosphorous removal (with a 'best efforts' target of 100% removal) as per the LSRCA June 2016 SWM Guidelines.
4. Efforts to provide temperature mitigation on all stormwater discharged to Lover's, Hewitt's and Sandy Cove Creeks.
5. Filtration of runoff for the equivalent of 25 mm of runoff from all new impervious areas.
6. Infiltration of runoff for the equivalent of 25 mm of runoff from all new impervious areas, unless evidence can be provided that indicates that 25 mm is not possible. In the case where 25 mm is not possible, 12.5 mm shall be applied. Where 12.5 mm cannot be achieved, 5 mm shall be applied. Where 5 mm cannot be achieved, 'best efforts' or offsite compensation shall be provided in negotiation with the LSRCA and City of Barrie.
7. LID principles should be applied where possible as per the LSRCA guidelines and City of Barrie including LIDs within the R.O.W., open spaces, Park Blocks, School Blocks, and use of NHS buffer zones for passive or structural LID where feasible.
8. Additional topsoil depth (minimum 300 mm) on all pervious areas (regardless of underlying soil type) could be implemented to reach infiltration targets. LSRCA, City and MOECC pre-consultation required to confirm credit for LID on private lots.
9. Constructed wetlands should be implemented where end-of-pipe controls are required to provide the highest level of TP removal and mitigate temperature of discharge.
10. Catchment 3/3A/3EXT
 - a. Provide an end-of-pipe SWMF within Catchment 3 to provide quality and quantity controls for Catchments 3 & 3EXT as per LSRCA and City standards. Specific SWMF characteristics and precise location to be

July 26, 2021

determined at Draft Plan and detailed design stage. Design of SWMF No.3 to provide overcompensation for Catchment 3A.

- b. Best efforts towards a 5 mm infiltration target, with filtration/attenuation for the remainder of the 25 mm target.
- c. LID's to be implemented within school block, recreation centre block, ROW and on private lots where possible.
- d. External drainage area (3-EXT) to provide stand-alone TP removal measures and infiltration/filtration LID to LSRCA standards.

11. Catchment 4

- a. Provide an end-of-pipe SWMF within Catchment 4 to provide quality and quantity controls as per LSRCA and City standards. Specific SWMF characteristics and precise location to be determined at Draft Plan and detailed design stage. Design of SWMF No.4 to accommodate boundary between Phase 1 and Phase 2 works.
- b. Best efforts towards a 5 mm infiltration target, with filtration/attenuation for the remainder of the 25 mm target.
- c. Infiltration/Filtration LID to be provided within park blocks, school block, NHS Buffers and within the ROW.

This Report demonstrates how all the above recommendations from the SIS can be achieved for the Mattamy Lockhart Development. Using the subsurface filtration tank as a LID measure, filtration and infiltration targets have been met throughout the site. The additional required quality and quantity control has been achieved through the use of the external infiltration basins, SWMF Nos. 3 and 4. As per the recommendations noted above, the infiltration basins will eliminate phosphorus migration from the site and the need for temperature mitigation. These wetlands will provide the highest level of TP removal and temperature mitigation of discharge. **Therefore, the proposed design within this FSR is in compliance with the SIS.**

July 26, 2021

12.0 Conclusions and Recommendations

This Report addresses the requirements for submission of a Functional Servicing Report to support the current Draft Plan Applications for the Mattamy Lockhart Development.

The following summary conclusions are presented:

This Functional Servicing Report demonstrates that the Mattamy Lockhart Development can be developed on full municipal services. Stormwater management measures can be implemented to meet all required runoff and surface water quality criteria of the governing agencies. The proposed Draft Plan accommodates the functional servicing and stormwater management concepts presented in this Report.

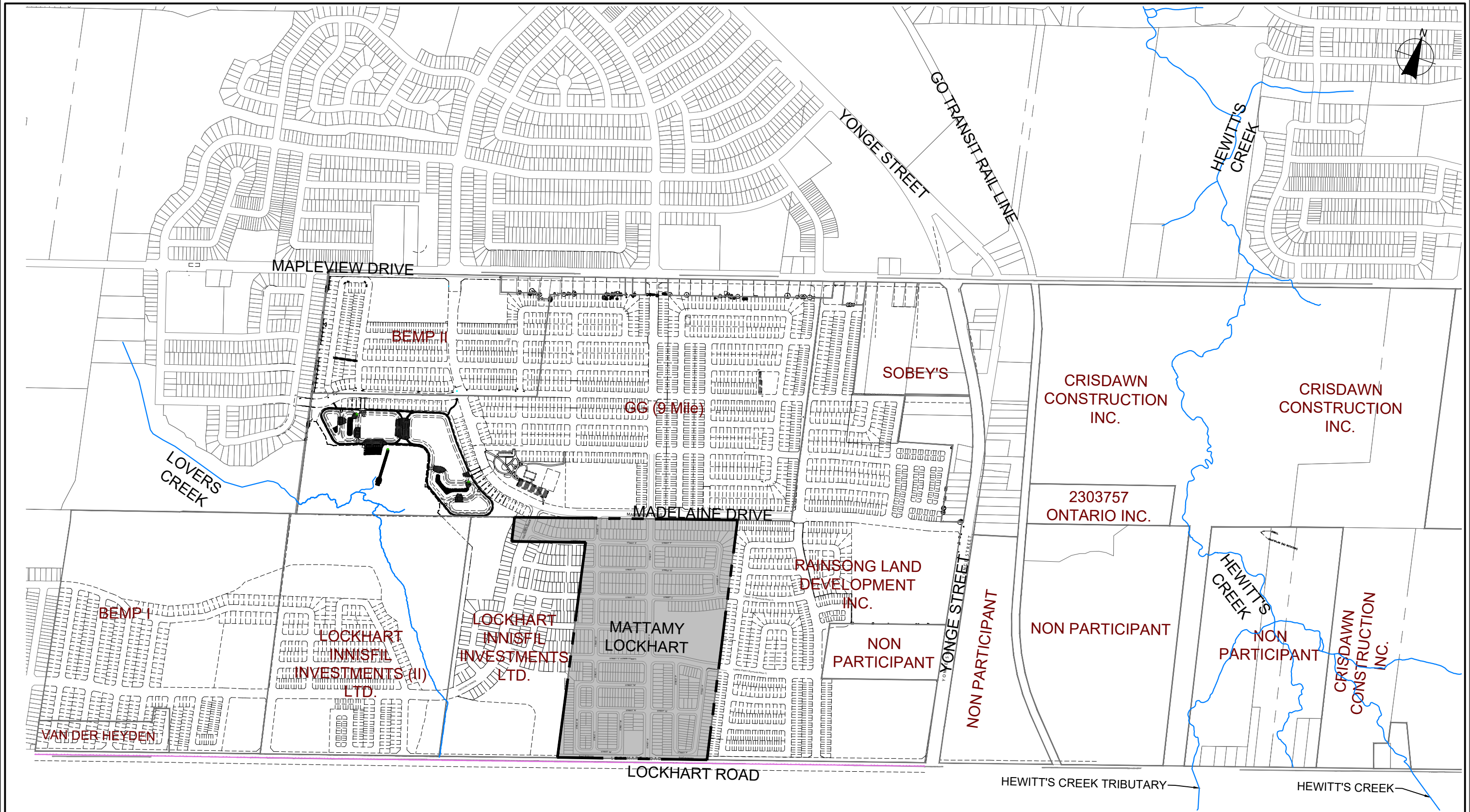


BURNSIDE

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Figures



LIMIT OF SUBJECT SITE



BURNSIDE

Figure Title

MATTAMY LOCKHART FSR

SITE LOCATION PLAN

Client

MATTAMY LOCKHART

Drawn

LP

Checked

PH

Date

21/06/23

Scale

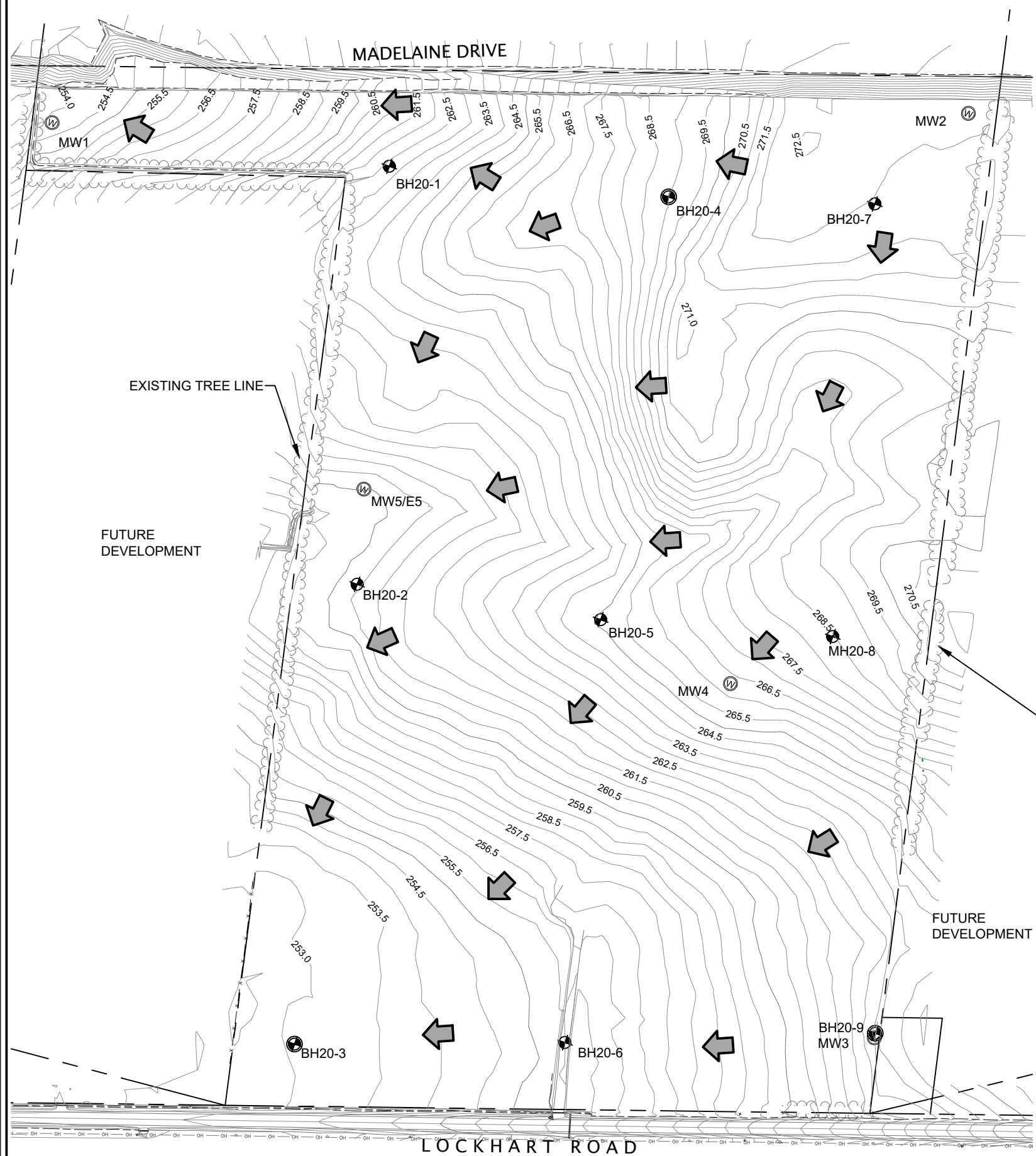
N.T.S

Project No.

300052092

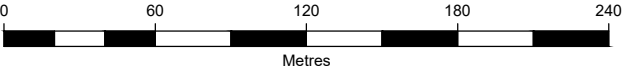
Figure No.

FIG 1

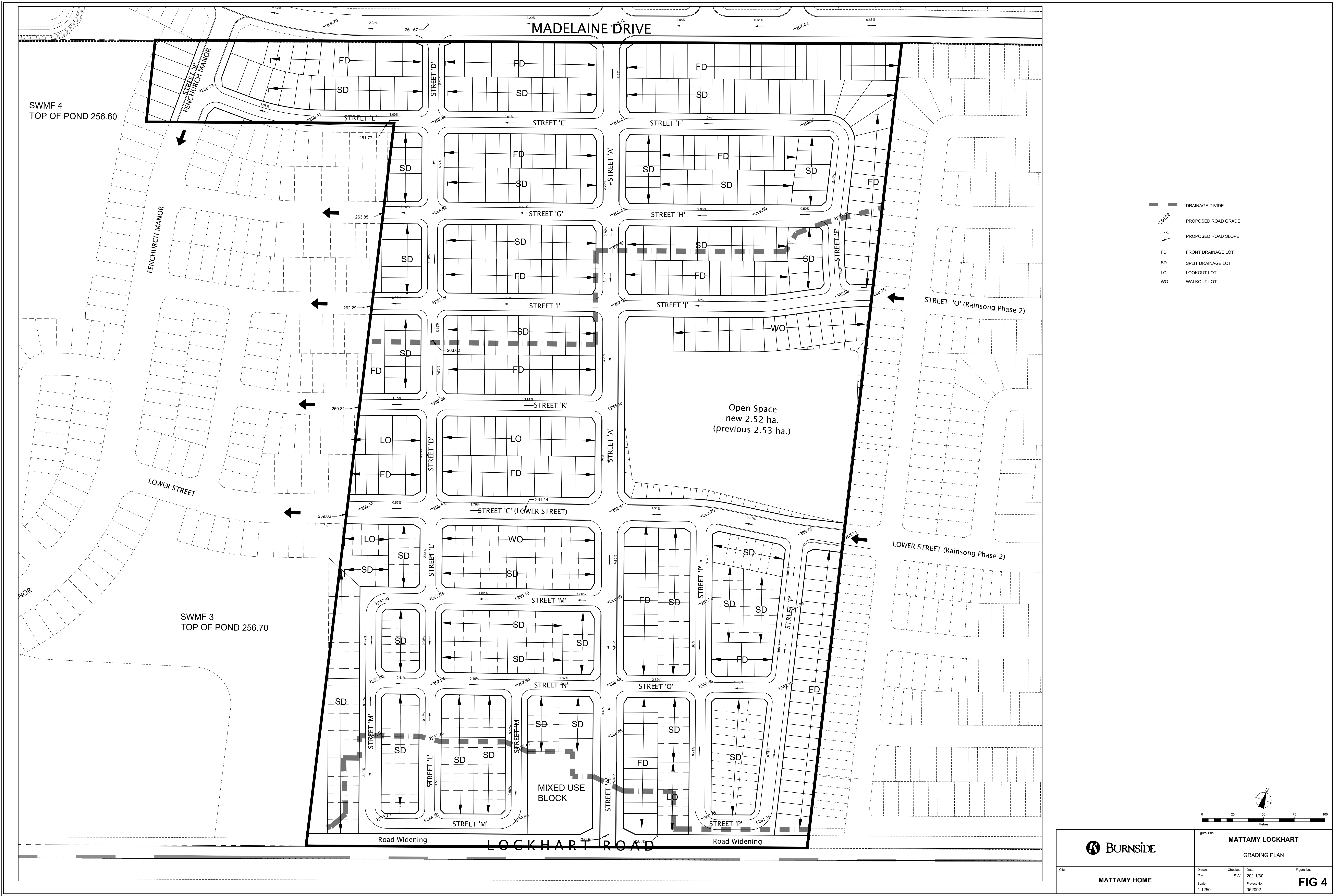


LEGEND

- OVERHEAD HYDRO LINES
- TREE LINES
- EX. CHAIN LINK FENCE
- EX. CULVERT
- EX. BOREHOLE
- EX. WELL
- OVERLAND FLOW DIRECTIONS
- TOP OF SLOPE OF BANK
- BOTTOM OF SLOPE OF BANK
- DITCH



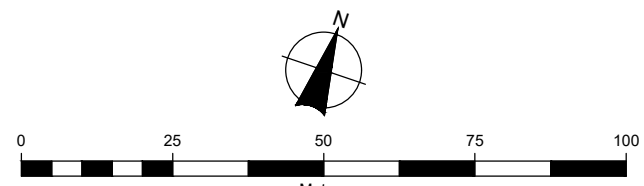
 BURNSIDE		Figure Title MATTAMY LOCKHART FSR EXISTING CONDITION PLAN			
Client	MATTAMY LOCKHART	Drawn	Checked	Date	Figure No. FIG 3
		LP	PH	21/06/23	
		Scale	Project No.		
		1:3000	300052092		





LEGEND

- Area ID (Residential)**: A10 (0.34 9.4)
- Proposed Unit (Single + Town Unit)**: A10 (0.34 9.4)
- Area in Hectares**: A10 (0.34 9.4)
- Area ID (Mixed Use)**: M10 (0.34 0.3)
- Flow Rate (L/sec/ha)**: M10 (0.34 0.3)
- Area in Hectares**: M10 (0.34 0.3)
- External Area ID**: EXT 1 (0.82 1.05)
- External Population**: EXT 1 (0.82 1.05)
- External Area in Hectares**: EXT 1 (0.82 1.05)
- Future Area in Hectares**: 2.36
- Future Proposed Population**: 3
- Contributing Units**: 10.5
- Flow Rate (L/s/ha)**: 0.32
- Total Flow (L/s)**: 0.10
- Park/School Area in Hectares**: 0.30
- Sanitary Manhole/Sewer**: (Symbol)
- Sanitary Sewer with Secondary Pipe**: (Symbol)
- Sanitary Sewer Tributary Boundary**: (Symbol)



BURNSIDE	FIGURE TITLE		
	MATTAMY LOCKHART SANITARY DRAINAGE AREA PLAN		
Client	Drawn	Checked	Date
MATTAMY HOME	PH	SW	20/11/30
	Scale	Project No.	052092
	1:1250		

FIG 6

File: MattamyLockhart_Visual_Area052092 - Mattamy/04 - Preliminary/002 - Sanitary Drainage Area Plan - 20/11/30 - 2:34 PM

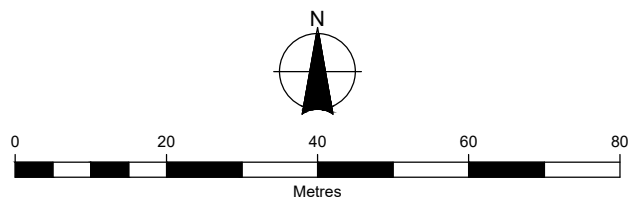
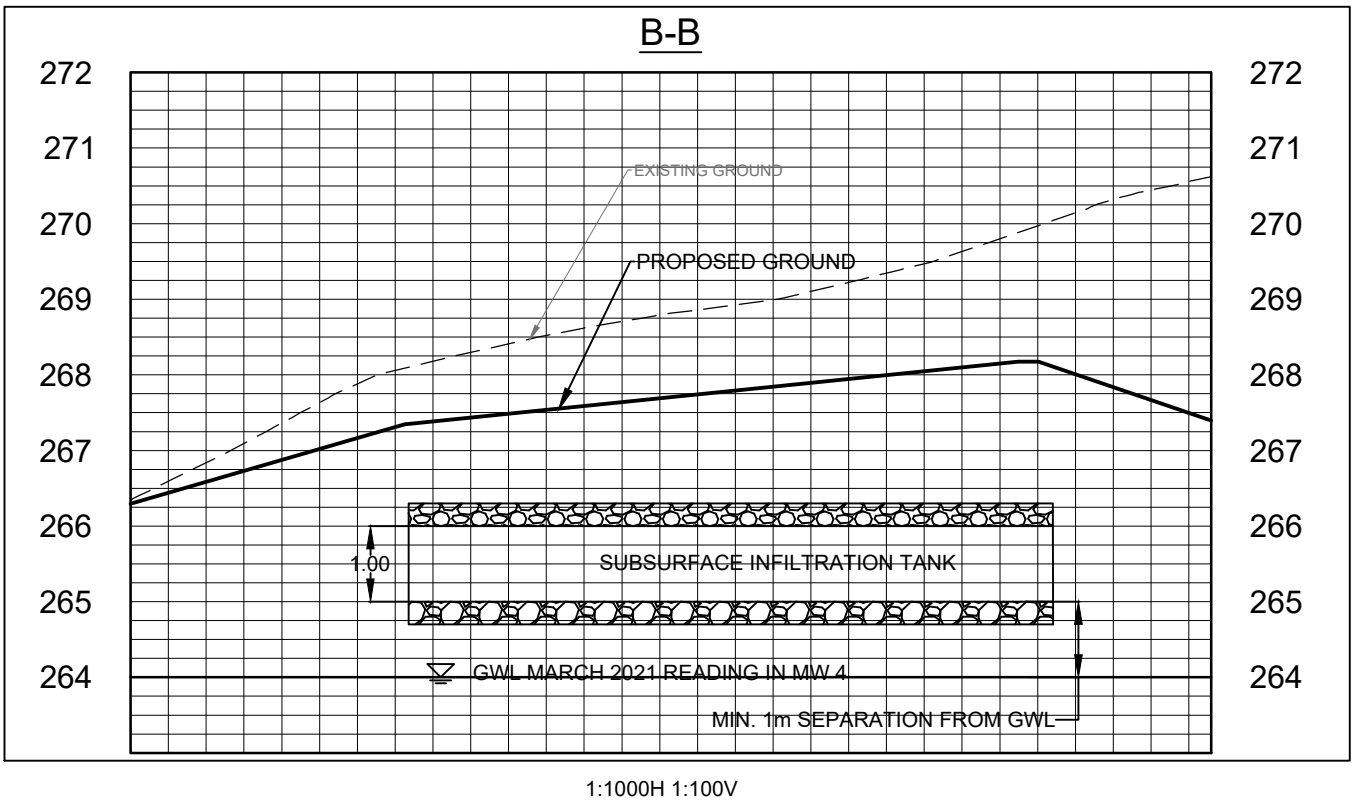
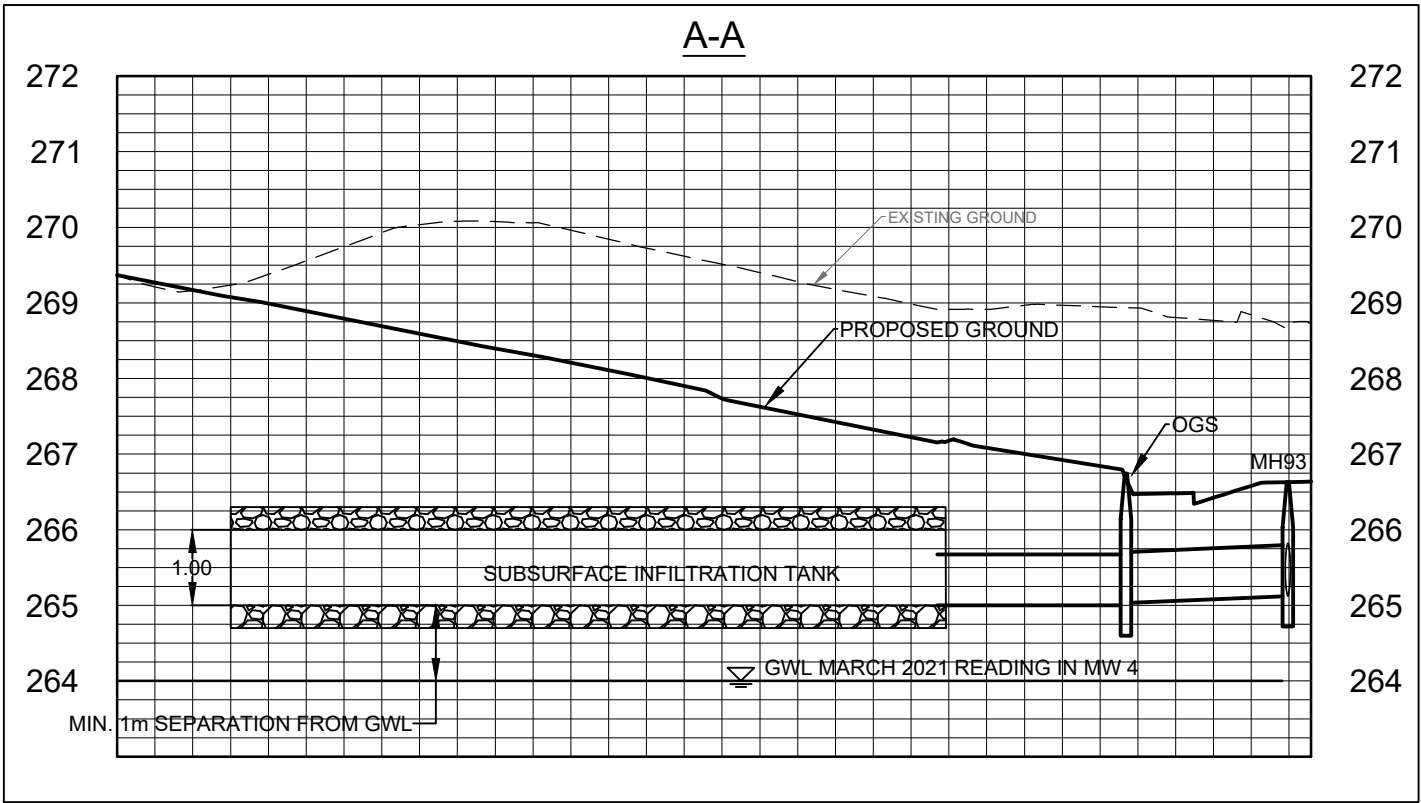
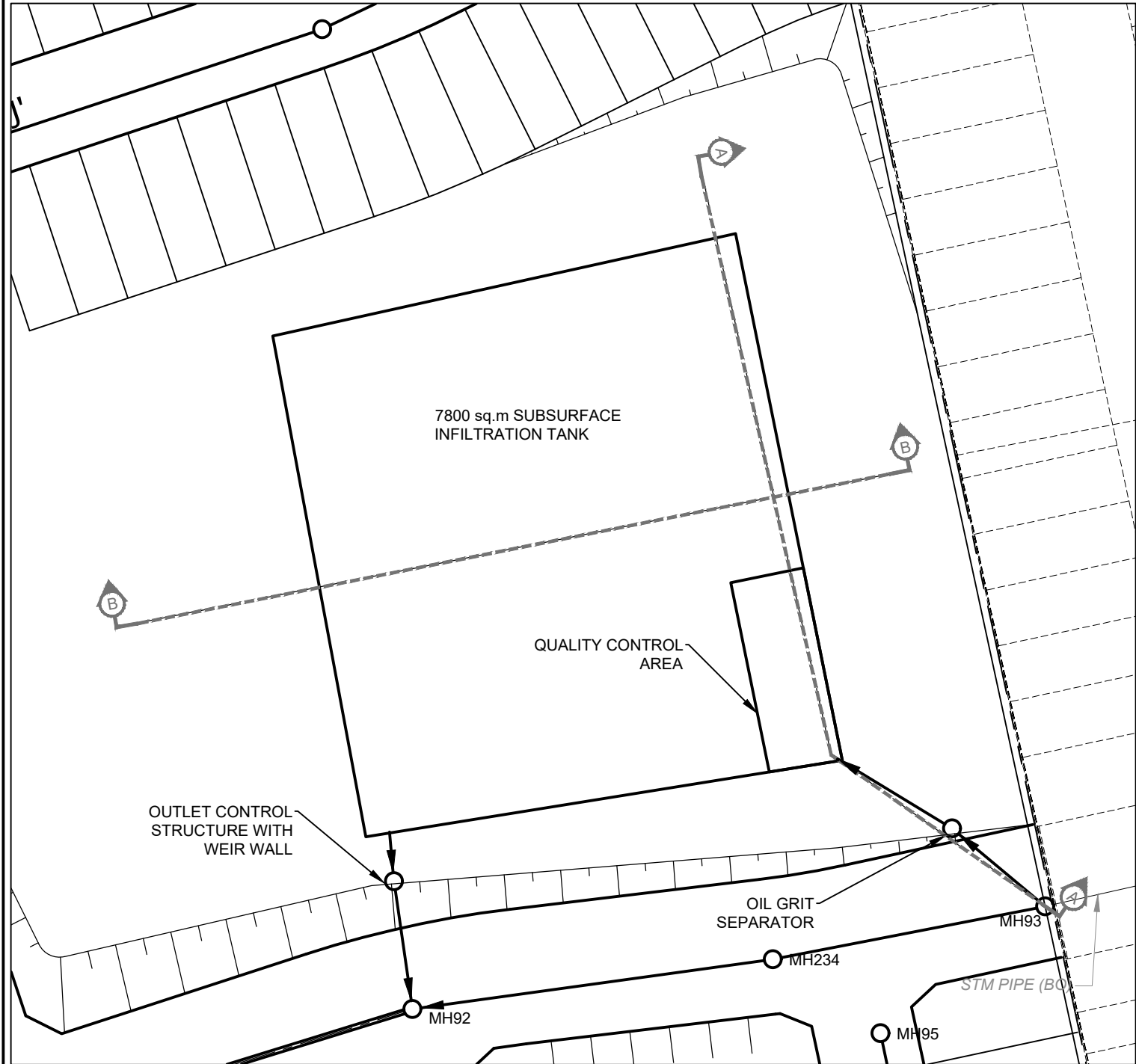


		Figure Title		
		MATTAMY LOCKHART SUBSURFACE INFILTRATION TANK		
Client		Drawn	Checked	Date
		PH	SW	20/11/30
MATTAMY HOME		Scale	Project No.	
		1:1000	052092	
				Figure No.
				FIG 8



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Appendix A

Conformity Approval

CITY HALL
70 COLLIER STREET
TEL. (705) 739-4208
FAX (705) 739-4270



P.O. BOX 400
BARRIE, ONTARIO
L4M 4T5

THE CORPORATION OF THE CITY OF BARRIE
DEVELOPMENT SERVICES DEPARTMENT
"Committed to Service Excellence"

April 26, 2021

File: D28-006-2021

Ray Duhamel, RPP, Partner
Jones Consulting Group Ltd.
229 Mapleview Drive, Unit 1
Barrie, Ontario L4N 0W5
(T:) 705-734-2538 ext. 226
(E:) rduhamel@jonesconsulting.com

Dear Mr. Duhamel,

**RE: CONFORMITY REVIEW – ZONING BY-LAW AMENDMENT & DRAFT PLAN OF SUBDIVISION
620 Lockhart Road (Mattamy Homes Canada), Hewitt's Secondary Plan Area, City of Barrie**

Please be advised that the Conformity Review Plan dated May 3, 2021 (see Appendix "A"), submitted by The Jones Consulting Group Ltd. on behalf of Mattamy Homes Canada for lands known municipally as 620 Lockhart Road, Barrie, has been deemed to generally conform to the Hewitt's Secondary Plan, subject to the following conditions:

- 1) The Applicant/Owner shall address any technical review comments provided through the Conformity Review process, as identified in Appendix "B".
- 2) The formal Zoning By-law Amendment and Draft Plan of Subdivision application(s) shall be accompanied by a Concept Plan which demonstrates that the proposed Mixed Use Block can accommodate a viable commercial development, in accordance with the 'Neighbourhood Mixed Use' (NMU) Zone provisions. In this regard, the Concept Plan shall identify a building footprint, parking area and driveway access.
- 3) The Planning Justification Report (PJR) submitted in support of the formal Zoning By-law Amendment and Draft Plan of Subdivision application(s) shall discuss the Mixed Use Policies of the Hewitt's Secondary Plan and provide justification for the size and configuration of the Mixed Use Block, as it relates to accommodating a viable commercial development to service the surrounding neighbourhood(s).
- 4) The Applicant/Owner shall participate in a Design Charette with the Lake Simcoe Region Conservation Authority (LSRCA) prior to the submission of a formal *Planning Act* application for the subject lands.

While the plan has been deemed to generally conform to the policies and schedules of the Hewitt's Secondary Plan, formal applications will be reviewed in greater detail and revisions may be required. Further to Condition No. 1 above, please see the technical comments attached as Appendix "B" to this letter which identify matters that shall be addressed through the formal application submission.

This conformity letter is valid for a period of two (2) years, expiring on **April 26, 2023**. Should the development proposal change or if a formal application is not received by the date noted above, the applicant may be required to submit a new conformity application.

If you have any questions or concerns, please contact the Planning File Manager, Andrew Gameiro, at 705-739-4220 ext. 5038 or andrew.gameiro@barrie.ca.

Sincerely,



Michelle Banfield, RPP
Director of Development Services

cc: Frank Palka, Senior Manager of Development Services
Tiffany Thompson, Manager of Growth and Development
Carlissa McLaren, Supervisor of Planning
Barb Perreault, Manager of Approvals
Kevin Bradley, Manager of Parks Planning
Brett Gratrix, Transportation Planning Lead
Marc Villeneuve, Supervisor of Development Charges
Melinda Bessey, Lake Simcoe Region Conservation Authority

MATTAMY HOMES-LOCKHART
CITY OF BARRIE

LOCKHART ROAD
TOWN OF INNISFIL

CONFORMITY REVIEW PLAN
620 Lockhart Road, Barrie
Mattamy Homes Canada
2021

KEY PLAN
SCALE 1:25,000

Legend:

- Subject Lands (Boundary is subject to confirmation by an Ontario Land Surveyor, areas are approximate)
 - Total Site Area: 27.94 ha.
 - Net Developable: 27.94 ha.
- City of Barrie Phasing Line
- City of Barrie Settlement Area Boundary (2031)
- Entrance Location
- Mixed Use Proposed (NMU) (0.35 ha.)
- Mixed Use as per City of Barrie Secondary Plan (2.20 ha.)
- Stormwater Management Ponds/Drainage (0.14 ha.)
- Open Space (2.52 ha.)
- Enhanced Landscaping & Dual Sidewalks
- Enhanced Window Street
- Key Intersections (Enhanced treatments)
- Parcels with this symbol are Partial Lots/Blocks.

NOTES:

- Blue Dimensions are taken at the 3m Front Yard Setback.
- Black Dimensions (on lots) are taken at the 7m Front Yard Setback on regular pie lots, or for reverse pie lots at the 5m Rear Yard Setback.
- Corner Lot Driveways are in accordance with the City of Barrie Transportation Design Manual.
- All neighborhood Mixed Use (NMU) units are required to have 12m² of Private Amenity Area. Building footprints are required to confirm compliance.

Preliminary Statistics

	No. of Units	% of Total Units	Lot/Block Numbers
11.0m Single Unit (S1)	111	39%	1-346
13.0m Single Unit (S2)	89	32%	1-346
15.0m Single Unit (S3)	89	32%	1-346
Street Townhomes (2 Storey) (T1)	172	28%	Blocks 347-371
Back to Back Townhomes (16.0m) (T2)	89	31%	Blocks 372-379
Partial Lots/Blocks (Approx.)	26	3%	-
Total	624	100%	

Roads Breakdown:

- Major Collector Road 27.0m – STREET 'B' (Fenchurch Manor)
- Minor Collector Roads 24.0m – STREETS 'A' and STREETS 'C' (Lower Street)
- Local Roads 18.0m – STREET 'D' – STREET 'P'

Scale: SCALE 1 : 1500 (A1)

MATTAMY HOMES CANADA
– LOCKHART –
CONFORMITY REVIEW PLAN

SCHEDULE OF REVISIONS

DATE	DESCRIPTION	DRAWN

Date Issued: MAY 3, 2021
Checked By: RD
Project No.: MAT-20542
Drawn By: m.c.r.
Drawing Name: MAT-20542-CP-6.dwg

JONES CONSULTING GROUP LTD.
PLANNERS & ENGINEERS
275 Sheppard Ave East, Suite 100, Toronto, Ontario M4M 1B7
Phone: (416) 461-1000 Fax: (416) 461-1001 Email: info@jonescg.com Website: www.jonescg.com

APPENDIX “B” – TECHNICAL REVIEW COMMENTS

City Hall
70 COLLIER STREET
TEL (705) 726-4242
FAX (705) 739-4270



P.O. Box 400
BARRIE, ON
L4M 4T5

THE CORPORATION OF THE CITY OF BARRIE
DEVELOPMENT SERVICES DEPARTMENT

CONFORMITY REVIEW PLANNING COMMENTS

File: D28-006-2021

To: Ray Duhamel, RPP, MCIP, The Jones Consulting Group Ltd.

From: Andrew Gameiro, RPP, Planner

Date: March 8, 2021

Subject: Conformity Review – 620 Lockhart Road – 630 unit Draft Plan of Subdivision

Technical Meeting Date: Thursday March 11, 2021 – 9:00 am to 10:30 am (via Microsoft Teams)

The Development Services Department has completed a preliminary review of the policy implications of the proposed Zoning By-law Amendment and Draft Plan of Subdivision application(s) to implement the concept plan submitted. The following comments are for consideration only and do not represent a full technical review of a formal application under the *Planning Act*.

Please note that these comments are valid for one year from the date of issuance and Planning staff reserves the opportunity to provide further comments on any revised submissions.

Comments

1.	Official Plan Designation	'Residential Area' and 'Neighbourhood Mixed Use Node'
2.	Zoning	Existing: 'Agriculture General' in Innisfil Zoning By-law 2004-054. Proposed: 'Neighbourhood Residential' (R5), 'Neighbourhood Mixed Use' (NMU) and 'Open Space' (OS)
3.	Applications required:	
	OPA	☐
	Zoning	☒
	Consent/Minor Variance	☐
	Site Plan	☐
	Deeming By-law	☐
	Plan of Subdivision	☒
	Part Lot Control	☐
	Condominium Exemption	☐
	Holding Provision	☐
	Other	☐

4.	Official Plan Conformity	The applicant will be required to submit a Planning Justification Report, prepared by a Registered Professional Planner, which demonstrates how the development proposal and any requested site-specific provisions conform to the policies of the Official Plan and the Hewitt's Secondary Plan, including but not limited to: City of Barrie Official Plan 3.1 – Growth Management 3.3 – Housing (including Affordable Housing Policies) 3.5 – Natural Heritage, Natural Hazards and Resources 3.7 – Energy Conservation and Renewable Energy Systems 3.9 – Lake Simcoe Protection Plan 5.0 – Servicing and Transportation Hewitt's Secondary Plan 9.2 – Community Vision and Structure 9.3 – Natural Heritage System 9.4 – Community and Sustainable Design Strategy 9.5 – Land Use Strategy 9.5.4 – Mixed Use Nodes and Corridors 9.5.6 – Neighbourhood Mixed Use Nodes 9.5.7 – Residential Area 9.5.10 – Neighbourhood Park (designation not present, but a park is proposed) 9.6 – Community Services Strategy 9.7 Development Review and Growth Management
5.	Community Form – Section 9.4.2 Hewitt's Secondary Plan	The Hewitt's Master Plan in Appendix 9B is intended to illustrate graphically the design of the Hewitt's Secondary Plan Area, and how the policies and Schedules of the Plan are to be implemented. Planning staff are generally satisfied with the conceptual design and layout of the proposed draft plan of subdivision, as it relates to the street network and the provision of residential uses within the 'Residential Area' designation, as well as a park/open space to service the neighbourhood. Planning staff have concerns with the location of and built form proposed within the 'mixed use block'. Additionally, the mixed-use block appears to have been omitted from the plan, having been replaced with townhouse lotting and a municipal street network, which is contrary to the Hewitt's Master Plan in Appendix 9B of the Secondary Plan. The mixed-use block is simply identified as an overlay on the plan – a mixed use block is not proposed. In the absence of a Market Study, staff are not supportive of the current design, layout and built form proposed within the 'Neighbourhood Mixed Use Node' (NMU) designation. As noted in sections 6 and 7 below, the current design, layout and built form proposed within the NMU designation is not consistent with the City's goals and policies. Planning staff are concerned that the conversion of mixed-use blocks for the purposes of providing residential development may erode the fabric of the neighbourhood(s) in the Hewitt's Secondary Plan Area. The Secondary Plan Area is to be designed as a complete and walkable community including a

		mix of uses, a variety of housing types and public facilities such as parks and schools, with an emphasis on public transit and active transportation. The applicant shall consider the impact that the omission of commercial uses may have not only on this site but on the secondary plan area as a whole. The conversion of mixed-use blocks would result in future residents having to travel longer distances – likely by car – to access commercial uses elsewhere in the City, such as Mapleview Drive and Yonge Street. This is contrary the City's vision for creating complete and walkable communities. The applicant is strongly encouraged to modify the conformity plan to incorporate a mixed-use block at the intersection of Lockhart Road and Street "A". The mixed-use block may be reduced in size to accommodate convenience commercial uses, with the balance of the lands being developed with townhouse dwelling units. Should the applicant choose to move forward with the current concept, the formal Zoning By-law Amendment/Draft Plan of Subdivision application(s) shall be accompanied by a Market Study to demonstrate the demand, or lack thereof, for commercial development within the proposed Plan of Subdivision and the Hewitt's Secondary Plan as a whole. The Study shall evaluate the anticipated impact that the omission of commercial uses will have on existing and planned developments within the Hewitt's Secondary Plan Area, particularly along Lockhart Road between Huronia Road and Yonge Street. In their Planning Justification Report, the applicant shall also address how the omission of a mixed-use block and commercial uses will impact the development of complete and walkable communities within the Hewitt's Secondary Plan, as mixed-use blocks are expected to function as focal points and meetings places for residents.
6.	Community Design – Section 9.4.4 Hewitt's Secondary Plan	Policy 9.4.4.2(a) states that all development, particularly in the Mixed-Use Nodes and Corridors identified on Schedule 9A, shall be designed to be compact and have a pedestrian and transit oriented built form. Building densities and land uses shall be designed at densities which are transit supportive. While townhouse units represent a higher density built-form and a more affordable/attainable form of housing than single and semi-detached dwelling units, they still represent ground-oriented development which is dependent on the private automobile. The proposed townhouse units do not have frontage on an arterial or collector road, as they are located internal to the subdivision with private driveways on local roads. Higher density mixed-use buildings are encouraged in the mixed-use nodes and corridors, particularly at the intersection of arterial and collector roads. Currently, single detached dwelling units are proposed at the intersection Lockhart Road and Street "A".
7.	Mixed Use Nodes and Corridors – Sections 9.5.4 and 9.5.6 Hewitt's Secondary Plan	Lands in the Neighbourhood Mixed Use Node designation shall be developed in accordance with the policies of Section 9.5.4. As noted in Section 9.5.4 of the Hewitt's Secondary Plan, development in the Mixed-Use Nodes and Corridors identified

		on Schedule 9A is intended to provide primarily for mixed-use development. The goals for the Mixed-Use Nodes include: - To create mixed use nodes and corridors with medium and high density residential, special needs housing, institutional and commercial facilities as a focus of community and neighbourhood activity; and - To create a meeting place for residents, which is designed to be pedestrian friendly and maximize the use of public transit. According to Section 9.5.4.2 of the Hewitt's Secondary Plan, the main uses permitted in the mixed-use nodes shall include a variety of residential, institutional and office uses and community facilities in single use and mixed-use buildings, including single use commercial buildings. The current design does not provide any commercial uses within the mixed-use node. As a result, the mixed-use node area is not designed to maximize the use of public transit and will not function as a focal point of community and neighbourhood activity. As noted above, this may reduce the walkability of the neighbourhood as residents would need to travel greater distances – likely by car – to access commercial uses on Mapleview Drive and Yonge Street. The applicant is encouraged to revise the plan to incorporate a mixed-use block at the intersection of Lockhart Road and Street "A" to accommodate future convenience commercial uses to service the neighbourhood Policy 9.5.4.3(f) states that buildings should be located on or close to the street line and massed at intersections to establish a strong street edge. The current plan does not accomplish this as a mixed-use block is not being proposed. As noted previously, street townhouses and a municipal street network are proposed with an overlay identifying said lands as a mixed-use block. This layout is not contributing to providing buildings that are located on or close to the street line and massed at intersections to establish a strong street edge. Planning staff understand that the townhouse units could be designed to create an interface between the building(s) and the street, however the units front onto local roads which are internal to the plan of subdivision. The built form and building location(s) do not frame the intersection of Lockhart Road and Street "A", thereby not creating a strong street edge. The provision of a mixed-use block at the intersection of Lockhart Road and Street "A" would facilitate the future development of mixed-use building or a stand-alone commercial building which could be massed at the intersection and located close to the street line to establish a strong street edge. Policy 9.5.4.3(g) states that provision shall be made in the design of development to encourage pedestrian traffic generating activities, wherever feasible, particularly retail commercial uses and restaurants, at grade level, with
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		residential, office and similar uses encouraged in upper storey locations, throughout nodes and corridors, but particularly at key intersections of arterial roads and other arterial streets and collector streets. The proposed plan, in its current configuration, does not satisfy this policy for the reasons noted above. Should a mixed-use block be omitted from the plan, the applicant shall provide justification in their PJR and Market Study.
8.	City of Barrie Draft Official Plan	For the applicant's reference, the City's Draft Official Plan, identifies the subject lands as 'Neighborhood Area'. Neighbourhood Areas permit some low-impact intensification along with urbanization and a broad range of uses to transition these areas from single-use (e.g. only residential) to mixed-use (e.g. residential units together with neighbourhood commercial/office uses). Neighbourhood Areas are intended to be a supportive part of a complete community. Commercial/retail uses are permitted in the Neighbourhood Area, provided the use is located on a collector or arterial road, and shall be limited to a maximum of 2,000.0 square metres on the ground floor. Small-scale convenience commercial uses would be encouraged at the intersection of Lockhart Road and Street "A" to service the plan of subdivision and the surrounding area. The provision of convenience commercial uses would contribute to creating a more complete and walkable community.
9.	Affordable Housing	The City's Official Plan policy 3.3.2.2(a) targets a minimum of 10% of all new housing units to be affordable. The Planning Justification Report shall include information on how the proposed development addresses the provision of affordable housing. For example, if a portion of the proposed units provided are to be affordable, how will these units be maintained as affordable in the long term.
10.	Development Limits – EP Conveyance(s) and/or Boundary Trees	The development limits of the site, as it relates to protecting natural heritage resources and/or shared boundary trees shall be established to the satisfaction of the City. Approval from adjacent landowners shall be required to remove/impact shared boundary vegetation. In this regard, written consent to harm and/or remove shared boundary trees shall be provided. Otherwise, boundary trees are required to be protected in accordance with City standards. This includes tree protection fencing at the drip line of any shared boundary tree, with an additional 5 metre development setback. The applicant shall submit a Tree Inventory, Assessment, Removals and Preservation Plan. An Endangered Species Survey/Clearance shall also be provided.
11.	Design Charette - LSRCA	The applicant shall contact the Lake Simcoe Region Conservation Authority (LSRCA) to schedule a design charette prior to the submission of a formal application.
11.	Comments/Response Matrix	The formal application submission shall be accompanied by a comment/response matrix which clearly identifies how each City/Agency comment has been addressed. Applications shall be submitted digitally through the City's APLI Portal.

Attachments

Comments received from departments:

Department	Date Received
Development Services Planning	March 8, 2021 (A. Gameiro)
Development Services Approvals Landscape* Transportation Planning	March 5, 2021 (G. Matthie) – gary.matthie@barrie.ca March 5, 2021 (B. McGregor) – No comments or concerns* March 4, 2021 (J. MacDonald) – justin.macdonald@barrie.ca
Building	No comments or concerns.
Fire	February 2, 2021 (D. Lalonde) – David.lalonde@barrie.ca
Finance	March 1, 2021 (N. Myers) – Nicole.myers@barrie.ca
LSRCA	February 11, 2021 (M. Bessey) – m.bessey@lsrca.on.ca - Based on a review of current environmental mapping, the southern part of the site is within an area governed by Ontario Regulation 179/06 as made by the Conservation Authorities Act. This is representative of the lands being within 120 metres of a Provincially Significant Wetland (Lover's Creek Swamp). A permit from LSRCA will be required prior to any site alteration or development within the regulated area. - Per the Hewitt's SIS a full site-specific hydrogeological assessment is required. The assessment is to take into account that mapping on the property indicates both an SGRA and ESGA are present on site and that LSPP 6.40-DP is applicable. - The provided Planning Justification report (Jones Consulting) notes that the application will be prepared to satisfy DP-6.40 of the LSPP. Please note that as the proposed development constitutes "Major Development" as defined by the LSPP, the application will be required to satisfy 4.8-DP as well. - The application will be subject to the Lake Simcoe Phosphorus Offsetting Policy and Lake Simcoe Protection Plan Water Budget Offsetting Policy for LSPP 4.8-DP and 6.40-DP. - We encourage the Applicant to contact LSRCA staff to schedule a design charrette for this site



MEMORANDUM

TO: Andrew Gameiro
Planner

DATE: March 5, 2021

FROM: Gary Matthie
Senior Development Services Technologist

RE: **Conformity Review Submission Comments**
620 Lockhart Road

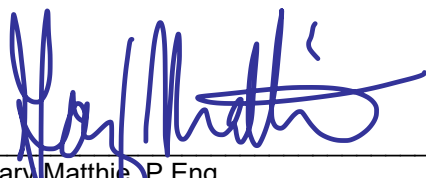
File: D28-006-2021

Please be advised that the Development Services Department – Approvals, has completed a preliminary review of the submitted Conformity Review Plans and other documents and can confirm that the plans appear to be in general conformance. However, we do offer the following comments, for consideration. Detailed review comments will be provided upon formal Plan of Subdivision submission.

Engineering Approvals

1. In accordance with the City of Barrie OP, a 34 m wide road allowance is required for Lockhart Road. In this regard, the owner will be required to dedicate to the City of Barrie any road allowance widenings needed to mitigate for deficiencies between existing road allowance and that which is required.
2. Servicing to the proposed development (stormwater, water, sanitary) is contingent on the development of the infrastructure in the surrounding area.

Prepared by:



Gary Matthie, P.Eng.
Senior Development Services Technologist

GM



Transportation Planning Conformity Application

To: A. Gameiro, RPP, Planner

From: J. MacDonald C.E.T., Senior Transportation Operations Technologist (Ext. 5178)

Date: May 4, 2021

Re: D28-006-2021 – 620 Lockhart Road

Development Stage: Conformity Review

Introductory Statement:

Staff reviewed the proposed site plan (D28-006-2021) for 620 Lockhart Road submitted to the City as part of the pre-consultation process.

Professionals completing the site design and traffic impact study must adhere to the following City guidelines.

- Urban Design Guideline ([Link](#))
- Transportation Development Manual ([link](#))
- Transportation Association of Canada Geometric Design Guide
- Relevant Ontario Traffic Manuals
- ITE

Transportation Design Manual – Conformity Review

1. The Transportation Design Manual – Conformity Review Memorandum prepared by JD Engineering dated December 21, 2020 shall be signed and stamped by the preparing engineer.

Property Conveyance / Corridor Protection:

2. In accordance with City of Barrie standards and guidelines, the Owner shall dedicate the following:
 - a. A 3m x 3m daylighting triangle at the intersections of all local streets;
 - b. A 3m x 5m daylighting triangle at the intersection of all local streets and minor collector road (Lower Street and Street 'A');
 - c. A 3m x 7m daylighting triangle at the intersection of all local streets and major collector road (Fenchurch Manor);
 - d. A 5m x 5m daylighting triangle at the intersection of minor collector road (Lower Street) and minor collector road (Street 'A');
 - e. A 5m x 10m daylighting triangle at the intersection of minor collector road (Street 'A') and arterial road (Lockhart Road);
3. According to a right of way Map developed by the City in 2017 for the Salem & Hewitt's Secondary Plan Mid-Block Right of Ways, a 34 metre right of way is required for Lockhart Road. Through discussion with the Landowners Groups the City agreed in 2018 to reduce the widening requirement for a portion of Lockhart Road between Huronia Road and Yonge Street to 31 metres providing that the roadway drainage is accommodated within the development lands. In

this regard, the owner will be responsible to dedicate a right of way widening to the City of Barrie across the full frontage of Lockhart Road of 11.00 metres to achieve the 31.0 metre width.

Improvements within the Municipal ROW:

4. The applicant shall be required to implement a temporary eastbound left turn lane on Lockhart Road at Street 'A'; this shall be designed in accordance with TAC based on a design speed of 100 km/h.

Roadway Configuration and Circulation:

5. According to Amendment No.39 to the City of Barrie's Official Plan (Schedule 9D-2) Transportation Master Plan, Fenchurch Manor shall be classified as a major collector with a road allowance width of 27.0 metres to support two (2) vehicular lanes with a centre turn lane, and two (2) buffered bicycle lanes.
6. According to Amendment No.39 to the City of Barrie's Official Plan (Schedule 9D-2) and Transportation Master Plan, Lower Street and Street 'A', shall be classified as a minor collector with a road allowance width of 24.0 metres to support two (2) vehicular lanes and two (2) bicycle lanes.

Traffic Calming:

7. A Neighbourhood Traffic Calming Management Plan is required to identify locations and potential applications for permanent traffic calming measures to the satisfaction of the Director of Development Services.

Active Transportation:

8. The design and location of sidewalks, access blocks/walkways and major pedestrian linkages associated with transit routes, schools, parks and valley lands shall be generally consistent with the Pedestrian Circulation Plan to the satisfaction of the Director of Development Services.

General Development Plan Comments:

9. Staff will be prohibiting on-street parking to one side of all local roadways. The applicant is to ensure all reasonable efforts are taken to maximize on-street parking spacing; this is to include driveway spacing and placement of fire hydrants.
10. A Pavement Marking and Signing Plan (PMSP) is required for the proposed Plan of Subdivision. The PMSP provides details and specifications for all traffic signs and pavement markings. The PMSP is to also identify sign mounting heights clearly, sign orientation and dimensions.



Justin MacDonald, C.E.T.
Senior Transportation Operations Technologist

Andrew Gameiro

From: Melinda Bessey <M.Bessey@lsrca.on.ca>
Sent: Thursday, February 11, 2021 10:10 AM
To: Andrew Gameiro
Subject: 620 Lockhart Road -Conformity Review CP-402913-120220 (D28-006-2021)

Good morning Andrew,

Thank you for circulating the conformity package for the captioned site to LSRCA for review and comment. Based on our review, we provide the following:

- Based on a review of current environmental mapping, the southern part of the site is within an area governed by Ontario Regulation 179/06 as made by the Conservation Authorities Act. This is representative of the lands being within 120 metres of a Provincially Significant Wetland (Lover's Creek Swamp). A permit from LSRCA will be required prior to any site alteration or development within the regulated area.
- Per the Hewitt's SIS a full site-specific hydrogeological assessment is required. The assessment is to take into account that mapping on the property indicates both an SGRA and ESGA are present on site and that LSPP 6.40-DP is applicable.
- The provided Planning Justification report (Jones Consulting) notes that the application will be prepared to satisfy DP-6.40 of the LSPP. Please note that as the proposed development constitutes "Major Development" as defined by the LSPP, the application will be required to satisfy 4.8-DP as well.
- The application will be subject to the Lake Simcoe Phosphorus Offsetting Policy and Lake Simcoe Protection Plan Water Budget Offsetting Policy for LSPP 4.8-DP and 6.40-DP
- We encourage the Applicant to contact LSRCA staff to schedule a design charrette for this site

Should you have any questions concerning the above, please do not hesitate to contact me.

Kind regards,

Melinda Bessey, MSc., MCIP, RPP

Director, Planning

Lake Simcoe Region Conservation Authority

120 Bayview Parkway,

Newmarket, Ontario L3Y 3W3

905-895-1281, ext. 151 | 1-800-465-0437 | Mobile- 905-955-3730

m.bessey@lsrca.on.ca | www.lsrca.on.ca

Please note: the LSRCA Board of Directors approved a change to our Fee Policy. The new fees will take effect on January 1, 2021. Please click [here](#) for the new fee schedule.

Twitter: @LSRCA

Facebook: LakeSimcoeConservation

The information in this message (including attachments) is directed in confidence solely to the person(s) named above and may not be otherwise distributed, copied or disclosed. The message may contain information that is privileged, confidential and exempt from disclosure under the Municipal Freedom of Information and Protection of Privacy Act and by the Personal Information Protection Electronic Documents Act. If you have received this message in error, please notify the sender immediately and delete the message without making a copy. Thank you.



M E M O R A N D U M

TO: Andrew Gameiro

FROM: David Lalonde

DATE: Feb 2 2021

FILE: D28-006-2021

SUBJECT: ZBA pre consult, 620 Lockhart Rd.

- If the development will occur in phases, the phasing plan will require approval from BFES to ensure adequate fire fighting access.
- A fire break plan will be required for this development.
- The municipal addressing scheme will need BFES approval.

**David Lalonde - Fire Prevention Officer
Barrie Fire & Emergency Service
705 728 3199 ext 3236**



To: Andrew Gameiro,
Planner

From: Nicole Myers,
Development Charges Administrator

Date: March 1, 2021

Re: D28-006-2021 – 620 Lockhart Road – Phase 2 – Owner: Thomas William Edward Irving

In response to your invitation to provide comments, please be advised of the following from the Development Charges Division of the Finance Department.

It is our understanding that the owner is proposing a rezoning and Draft Plan of Subdivision for a proposed subdivision consisting of 630 residential units, an open space block and a mixed-use area.

Please be advised of the following development fees (amounts are subject to change):

1) Current development charge rates are as follows:

Development Charges for a single/semi dwelling unit are \$69,932. The Development Charges outlined in By-Law 2019-055, Section 8(d) are \$55,448 (Internally DC1) and all other DC's are \$14,484 per unit (Internally DC 2 & 3).

Development Charges for a townhouse unit are \$55,357. The Development Charges outlined in By-Law 2019-055, Section 8(d) are \$43,892 (Internally DC1) and all other DC's are \$11,465 per unit (Internally DC 2 & 3).

2) The following applies to complete Site Plan applications and Zoning By-law Amendment applications accepted by the City on/after January 1, 2020. The amount of development charges is determined on:

- a) the day an application for an approval of development in a site plan control area;
- b) if clause a) does not apply, the day an application for an amendment to the zoning by-law was made.
- c) If neither clause a) nor clause b) applies, the day before the first building permit is issued.

If a) or b) applies, development charge amounts will remain crystallized for a maximum of two years. The crystallized development charge amount will be indexed and become payable at the time development charges are due. The indexing amount will accrue from the date of complete application.

The indexing rate is determined using the City's weighted average cost of capital (WACC). WACC is unique to each organization and considers both internal and external factors to evaluate the cost of delaying the receipt of funds. The City updates its WACC semi-annually or may do so at any other time should conditions so warrant. The current rate in effect is 3.84%. The applicable WACC rate will ultimately be the rate in effect at the time of complete application.

Complete Application Date: January 25, 2021

Development charges that are not crystallized are subject to an annual inflationary adjustment on January 1st of each year.

- 3) Hard services (referred to internally as DC 1) would be paid at the time of execution of the subdivision/site plan agreement.
- 4) As per the Memorandum of Understanding (MOU) with the Secondary Plan Area Owners, soft services (referred to internally as DC 2 and DC 3) are to be paid at the time of execution of the subdivision/site plan agreement for the first 2000 residential units registered within the secondary plan areas.

If registered after the first 2000 residential units have been registered, DC 2 and DC 3 will be payable at building permit issuance.
- 5) Before DC credits are applied to any development, the applicable trustee shall provide written notice as to the distribution of such DC credits amongst the Owners within their applicable Secondary Plan Area.
- 6) Final determination whether to include part lots in unit counts will occur at subdivision registration.
- 7) Potential for deferral of development charge payments for any of the following types of development:

Deferral of Development Charge Payments

For Rental Housing that is Not Non-Profit Housing (minimum 4 units - all of which are intended for Rental use): DCs will be due in 6 equal annual payments plus interest commencing on the earlier of the date of the issuance of an occupancy permit or the date the building is first occupied. The person required to pay development charges is required to notify the City within 5 business days of the building first being occupied. Failure to notify the City will result in the development charge, including any interest payable becoming due and payable immediately.

For Institutional Development: DCs will be due in 6 equal annual payments plus interest commencing on the earlier of the date of the issuance of an occupancy permit or the date the building is first occupied. The person required to pay development charges is required to notify the City within 5 business days of the building first being occupied. Failure to notify the City will result in the development charge, including any interest payable becoming due and payable immediately.

For Non-Profit Housing Development: DCs will be due in 21 equal annual payments plus interest commencing on the earlier of the date of the issuance of an occupancy permit or the date the building is first occupied. Interest is waived during the first 5 years of the deferral. The person required to pay development charges is required to notify the City within 5 business days of the building first being occupied. Failure to notify the City will result in the development charge, including any interest payable becoming due and payable immediately.

Interest is determined using the City's weighted average cost of capital (WACC).

WACC is unique to each organization and considers both internal and external factors to evaluate the cost of delaying the receipt of funds. The City updates its WACC semi-annually or may do so at any other time should conditions so warrant. The current rate in effect is 3.84% The applicable WACC rate will ultimately be the rate in effect at the time of complete application.

The deferral of Development Charge payments does not apply to Education Levies, Cash in Lieu of Parkland, or the Finance Administration Fees.

- 8) Education Levies will be calculated and collected at the time of issuance of the building permit. The current fee is \$3,559 per unit.
- 9) A cash in lieu of parkland contribution will be required prior to registration of the plan of subdivision. The amount is currently \$5,726 per residential unit.

The Residential Cash in Lieu of Parkland fees are subject to an annual inflationary adjustment on January 1st of each year.

- 10) A Finance Administration Fee of \$77.50 per dwelling unit will be calculated and collected at the time of issuance of the building permit.

While every effort is made to provide accurate information, please be advised that the foregoing is an estimate only based on our understanding of the development, current By-laws, agreements, and rates in effect as of the date of these comments. Development Charges are subject to an annual inflationary adjustment on January 1st of each year.



Technical Meeting Required Reports
ZONING BY-LAW AMENDMENT & DRAFT PLAN OF SUBDIVISION

Meeting Date: March 11th, 2021

Application Type: ZBA/DPS

File Manager: Andrew Gameiro

File Number(s): D28-006-2021

Site Address: 620 Lockhart Road, Barrie

Legend:

The letter **Y** indicates that the study or plan is required with submission

The letter **N** indicates that the study or plan is not currently required with submission

***Please Provide Digital Copy of Plans**

Please be advised that it is the applicant's responsibility to review the Technical Review Comments to ensure that all required reports/studies/plans are submitted, including the level of detail required by the City or External Agency.

Y/N	REQUIREMENTS	NOTES
PLANNING		
Y	Planning Justification Report (PJR)	
	Aggregate Potential Assessment and/or Aggregate License Compatibility Assessment	
Y	Affordable Housing Report	May be included in PJR
Y	Archaeological Study/Assessment	
	Architectural/Cultural Heritage Report (built heritage and cultural heritage landscapes)	
	Heritage Impact Assessment/Evaluation	
	Odour/Dust/Nuisance Impact Analysis	
Y	Conceptual Site Plan for Mixed Use Block	
	Noise Impact Study	
Y	Urban Design Report/Brief	May be included in the PJR
	Shadow Impact Study (For buildings over 3-storeys in height)	
	Block Plan/Context Plan	
	Microclimatic Report	
	Site Sections, Building Elevations/3D Visualizations	
	Parking Justification Study	
ENGINEERING		
Y	Functional Servicing Report	
Y	Civil Engineering Plans	
Y	Hydrogeological/Hydrology Study (incl. Water Balance)	
Y	Stormwater Management Report	
Y	Phosphorous Budget	
	Formal Design Brief for Site Alteration	
	Electrical Site Plan (hydro transformer location)	
Y	Geotechnical Report	
	Photometric Plan	



Technical Meeting Required Reports
ZONING BY-LAW AMENDMENT & DRAFT PLAN OF SUBDIVISION

Y/N	REQUIREMENTS	NOTES
Y	Neighbourhood Traffic Calming Management Plan	Please contact Transportation Planning to confirm. May only be required at detailed design.
	Pavement Marking and Signage Plan	
Y	Transportation Design Manual – Conformity Review Memorandum/Brief	
Y	Pedestrian Circulation Plan	
	Civil Works Cost Estimate	
ENVIRONMENTAL		
	Agricultural Assessment	
	Coastal Engineering Studies along the Lake Simcoe Shoreline	
	Energy Conservation and Efficiency Evaluation	
	Scoped Environmental Impact Study	
	Hazards Lands/Slope and Soil Stability Report	
Y	Endangered Species Survey/Clearance (in accordance with the ESA)	
	Fisheries Impact Study	
Y	Tree Inventory/Assessment	
Y	Tree Preservation & Removal Plan	
Y	Park Facility Fit/Concept Plan(s)	Please contact Parks Planning to confirm. May only be required at detailed design.
	Complete Landscape Submission & Details	
	Record of Site Condition (RSC)	
	A Site Risk Assessment	
Y	LSRCA Review Fee	Shall be paid directly to the LSRCA
SOURCE WATER PROTECTION QUALITY AND QUANTITY RISKS		
	Completed Screening form for Source Water Protection for properties within Drinking Water Vulnerable Areas identified on Schedule "G" to the Official Plan (Source Water Information Form)	To be confirmed with Engineering/Risk Management Official
ADDITIONAL ITEMS / STUDIES		
Y	Topographic Survey of existing conditions	
NOTES		

Terms of Reference for required reports and studies are available online on the City's website under **Development Review Process - Complete Application**: <https://www.barrie.ca/City%20Hall/Planning-and-Development/Pages/Development-Review-Process.aspx>

It is important to note that the need for additional studies and plans may result during application review. If following the submission of your application, it is determined that material that is not identified in this checklist is required to



Technical Meeting Required Reports
ZONING BY-LAW AMENDMENT & DRAFT PLAN OF SUBDIVISION

achieve complete application status, in accordance with the Planning Act and Official Plan requirements, City of Barrie Planning staff will notify you of outstanding material required within the required 30-day period. Mandatory pre-consultation application will not shorten the City's standard processing timelines, or guarantee that an application will be approved. It is intended to help educate and inform the applicant about submission requirements as well as municipal processes, policies, and key issues in advance of submitting a formal development application. This list is valid for one year following the above noted meeting date.



BURNSIDE

[THE DIFFERENCE IS OUR PEOPLE]

Appendix B

Preliminary Geotechnical Report

REPORT ON
Preliminary Geotechnical Investigation
Proposed Residential Development
620 Lockhart Road
Barrie, Ontario

PREPARED FOR:
Mattamy Homes

DS Project No: 20-231-400
Date: October 2, 2020



DS CONSULTANTS LTD.
6221 Highway 7, Unit 16
Vaughan, Ontario, L4H 0K8
Telephone: (905) 264-9393
www.dsconsultants.ca

Table of Contents

1. INTRODUCTION	1
2. FIELD AND LABORATORY WORK	1
3. SUBSURFACE CONDITIONS.....	2
3.1 Soil Conditions	2
3.2 Groundwater Conditions	3
4. DISCUSSION AND RECOMMENDATIONS.....	4
4.1 SITE GRADING AND ENGINEERED FILL	4
4.2 ROADS	6
4.2.1 STRIPPING, SUB-EXCAVATION AND GRADING	7
4.2.2 ROAD CONSTRUCTION	7
4.2.3 DRAINAGE	8
4.3 SEWERS	8
4.3.1 TRENCHING	8
4.3.2 BEDDING	9
4.3.3 BACKFILLING OF TRENCHES	9
4.4 FOUNDATION CONDITIONS	10
4.5 EARTH PRESSURES	12
4.6 FLOOR SLAB AND PERMANENT DRAINAGE	12
4.7 STORMWATER MANAGEMENT POND	12
5. GENERAL COMMENTS AND LIMITATIONS OF REPORT	12

Drawings	Nos.
BOREHOLE LOCATION PLAN	1
GENERAL NOTES ON SAMPLES DESCRIPTIONS	1A
BOREHOLE LOGS	2-10
A GENERALIZED SUB-SURFACE PROFILE	11
GRADATION CURVES	12
DRAINAGE RECOMMENDATIONS	13

APPENDIX A: ENGINEERED FILL GUIDELINES

1. INTRODUCTION

DS Consultants Ltd. (DS) was retained by Mattamy Homes to undertake a preliminary geotechnical investigation for the proposed residential development located at 620 Lockhart Road in Barrie, Ontario.

It is understood that the proposed development will consist of construction of detached homes and townhouse units throughout the existing land. All townhouses and detached homes are assumed to have one level of basement.

The purpose of this geotechnical investigation was to obtain information about the subsurface conditions at boreholes locations and from the findings in the boreholes to make preliminary engineering recommendations pertaining to the geotechnical design of underground utilities, roads and to comment on the foundation conditions for the building construction.

This geotechnical investigation is preliminary, based on a limited number of boreholes. More boreholes are recommended for the final design of the proposed development.

This report is provided on the basis of the terms of reference presented above and, on the assumption, that the design will be in accordance with the applicable codes and standards. If there are any changes in the design features relevant to the geotechnical analyses, or if any questions arise concerning the geotechnical aspects of the codes and standards, this office should be contacted to review the design. It may then be necessary to carry out additional borings and reporting before the recommendations of this office can be relied upon.

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

This report has been prepared for Mattamy Homes and its architect and designers. Third party use of this report without DS consent is prohibited.

2. FIELD AND LABORATORY WORK

A total of nine (9) boreholes (BH20-1 to BH20-9, see **Drawing 1** for borehole location plan) were drilled to depths ranging from 7.0 to 9.8m. The boreholes were drilled with solid stem augers by a drilling sub-contractor under the direction and supervision of DS Consultants Ltd. personnel. Samples were retrieved at regular intervals with a 50 mm O.D. split-barrel sampler driven with a hammer weighing 624 N and dropping 760 mm in accordance with the Standard Penetration Test (SPT) method. The samples

were logged in the field and returned to the DS Consultants Ltd. laboratory for detailed examination by the project engineer and for laboratory testing.

As well as visual examination in the laboratory, all soil samples from geotechnical boreholes were tested for moisture contents. Grain size analyses of five (5) soil samples (BH20-1/SS4, BH20-3/SS3, BH20-5/SS3, BH20-6/SS3 and BH20-9/SS5) conducted and the results are presented in **Drawing 12**.

Water level observations were made during drilling and in the open boreholes at the completion of the drilling operations. Three (3) monitoring wells of 50mm diameter were installed in Boreholes BH20-3, BH20-4 and BH20-9 for the long-term groundwater levels monitoring. The elevation surveying of the boreholes was undertaken by DS Consultants Ltd. personnel, using the differential GPS unit.

3. SUBSURFACE CONDITIONS

The subject site is located on the north side of Lockhart Road in Barrie. At the time of our drilling work and surveying, the land was active farmland. There is a wetland area to the southwest of the subject property.

The borehole location plan is shown on **Drawing 1**. General notes on sample description are provided on **Drawing 1A**. The subsurface conditions in the boreholes by DS are presented in the individual borehole logs presented on **Drawings 2 to 10**. Generalized sub-surface profiles are presented on **Drawing 11**.

3.1 Soil Conditions

Topsoil/Fill Material:

A surficial topsoil layer, ranging in thickness from 100 to 250mm was encountered at all borehole locations. In the area of Borehole BH 20-6, this topsoil layer was overlain by compact granular fill, consisting of sand and gravel materials, which was approximately 1.3 m thick. This granular fill was placed as gravel driveway in the subject property.

It should be noted that the thickness of the topsoil explored at the borehole locations may not be representative for the site and should not be relied on to calculate the amount of topsoil at the site. Shallow test pits should be carried out to explore the thickness of topsoil across the site.

The type/quantity and extent of the existing fill layers must be explored by further test pit investigation prior to/during excavation.

Silt, Sand, Sandy Silt to Silty Sand Till:

Sandy silt silty sand/till, silt and sand deposits extended below the topsoil to the maximum explored depth of all the boreholes. The cohesionless deposit contained clay, gravel and cobbles.

These deposits were present in a loose to very dense state, with SPT 'N' values ranging from 4 to over 100 blows per 300 mm of penetration. Occasional cobbles/boulders were inferred within the till deposits during drilling. The top 1.0 m of the subgrade was disturbed/weathered and contained some to trace of organics. The moisture content of the sandy silt to silty sand (till) varied from 6 to 21% and the sand layer from 2 to 15%.

Grain size analyses of four (4) soil samples from this cohesionless deposit/till (BH20-1/SS4, BH20-5/SS3, BH20-6/SS3, BH20-9/SS5) were conducted and the results are presented on Drawing 12, with the following fractions:

Clay: 8 to 11%
Silt: 29 to 37%
Sand: 46 to 57%
Gravel: 3 to 12%

In addition, at the south portion of the subject site, this deposit contained a layer of firm to stiff silty clay in the area of BH20-3 between approximate depths of 1.1 and 2.1 m, with SPT 'N' values ranging from 6 to 12 blows per 300 mm of penetration. The moisture content of this clayey layer ranged from 18 to 30%

Grain size analyses of one (1) soil samples from this clayey layer (BH20-3/SS3) was conducted and the results are presented on Drawing 12, with the following fractions:

Clay: 66%
Silt: 32%
Sand: 2%

It should be noted that this deposit also contained less competent soils at the south end of the site in the areas of BH20-6 and BH20-9, with SPT 'N' values ranging from 4 to 8 blows per 300 mm of penetration.

The thickness/depth and extent of this clayey and less competent sandy silt/silty sand layers in BH 20-6 and BH 20-9 should be confirmed by further borehole investigation.

3.2 Groundwater Conditions

Upon completion of drilling, groundwater was observed in the boreholes at depths ranging from 1.5 to 4.6 m, however, BH20-7 remained dry. The groundwater levels in the monitoring wells were measured on September 30, 2020 and are presented in Table 1.

Table 1: Groundwater Levels Observed in Monitoring Wells

Monitoring Well No.	Ground Surface Elevation (m)	Groundwater Table Depth (m)	Elevation of Groundwater Table (m)
BH20-3	253.1	-0.17*	253.27*
BH20-4	269.0	5.69	263.31
BH20-9	263.0	0.73	262.27

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

*** High groundwater in BH20-3 is high (above existing grade).**

4. DISCUSSION AND RECOMMENDATIONS

4.1 SITE GRADING AND ENGINEERED FILL

The site will be developed as residential subdivision with residential lots, underground services, roads and driveways. In the areas where earth fill is required for site grading purposes, an engineered fill can be constructed below house foundations, roads, boulevards, etc.

In Boreholes BH20-3, BH20-6 and BH20-9 at the south part of the site, weak soils were encountered at the upper levels to depths ranging from 2.0 to 3.8 m. Additional boreholes will be required to delineate the boundary of the weak soils. In the area of BH20-3, the weak silty clay with high moisture content to a depth of 2.0 m should be sub-excavated and replaced with engineered fill. In the areas of BH20-6 and BH20-9, the weak sandy deposits to a depth of 3.8 m below the existing grade can be sub-excavated and replaced with engineered fill. Dewatering will be required for excavation below groundwater.

Alternatively, the weak sandy deposits in the areas of BH20-6 and BH20-9 can be left in place, provided field dynamic compaction is to be carried out to improve the ground by densifying the weak sandy deposits. We can provide further recommendations on the ground improvement by dynamic compaction, if required.

Prior to placement of engineered fill, all existing surficial organic material/topsoil, fill materials and weathered/disturbed/less competent native soils containing topsoil/organics should be stripped to expose the inorganic native subgrade. The exposed subgrade should then be proof rolled with a heavy sheepsfoot roller to identify weak areas. Any weak or excessively wet zones identified during proof-rolling should be sub-excavated and replaced with compacted competent material to establish stable and uniform conditions. Prior to placement of engineered fill, the subgrade should be inspected and approved by a geotechnical engineer.

General guidelines for the placement and preparation of engineered fill are presented on **Appendix A** of this report. To reduce the risk of improperly placed engineered compacted fill, full-time supervision of the contractor is essential.

The following is a recommended procedure for an engineered fill:

1. Prior to site work involving engineered fill, a site meeting to discuss all aspects must be convened. The surveyor, contractor, design engineer and geotechnical engineer must attend the meeting. At this meeting, the limits of the engineered fill will be defined. The contractor must make known where all fill material will be obtained, and samples must be provided to the geotechnical engineer for review, and approval before filling begins.
2. Detailed drawings indicating the lower boundaries as well as the upper boundaries of the engineered fill must be available at the site meeting and be approved by the geotechnical engineer.
3. The building footprint and base of the pad, including basements, garages, etc. must be defined by offset stakes that remain in place until the footings and service connections are all constructed. Confirmation that the footings are within the pad, service lines are in place, and that the grade conforms to drawings, must be obtained by the owner in writing from the surveyor and DS. Without this confirmation no responsibility for the performance of the structure can be accepted by DS. Survey drawing of the pre and post fill location and elevations will also be required.
4. The area must be stripped of all topsoil, fill materials, weathered/disturbed and less competent native soils, **to be confirmed on site during grading/excavation process, especially at the south portion of the property.**

Subgrade must be proof-rolled. Soft spots must be dug out. The stripped native subgrade must be examined and approved by a DS engineer prior to placement of fill.

5. The approved engineered fill must be compacted to 100% Standard Proctor Maximum Dry Density throughout. Granular Fill preferred. Engineered fill should not be placed (where it will support footings) during the winter months. Engineered fill compacted to 100% SPMDD will settle under its own weight approximately 0.5% of the fill height and the structural engineer must be aware of this settlement. In addition to the settlement of the fill, additional settlement due to consolidation of the underlying soils from the structural and fill loads will occur.
6. Full-time geotechnical inspection by DS during placement of engineered fill is required. Work cannot commence or continue without the presence of the DS representative.
7. The fill must be placed such that the specified geometry is achieved. Refer to sketches for minimum requirements. Take careful note that the projection of the compacted pad beyond the footing

at footing level is a minimum of 2 m. The base of the compacted pad extends 2 m plus the depth of excavation beyond the edge of the footing.

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

10. After completion of the pad a second contractor may be selected to install footings. All excavations must be backfilled under full time supervision by DS to the same degree as the engineered fill pad. Surface water cannot be allowed to pond in excavations or to be trapped in clear stone backfill. Clear stone backfill can only be used with the approval of DS.

11. After completion of compaction, the surface of the pad must be protected from disturbance from traffic, rain and frost.

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

4.2 ROADS

The investigation has shown that the predominant subgrade soil, after stripping the topsoil and any other organic and otherwise unsuitable and less competent subsoil, will generally consist sandy silt to silty sand till.

Based on the above and assuming that traffic usage will be residential local road, the following minimum pavement thickness is recommended for roads to be constructed within the development:

40 mm HL3 Asphaltic Concrete

70 mm HL8 Asphaltic Concrete

150 mm Granular 'A'

300 mm Granular 'B'

These values may need to be adjusted according to the City of Barrie Standards. The site subgrade and weather conditions (i.e. if wet) at the time of construction may necessitate the placement of thicker granular sub-base layer in order to facilitate the construction. The need for filter fabric/geo-grid can be evaluated during construction stage. Furthermore, heavy construction equipment may have to be kept off the newly constructed roads before the placement of asphalt and/or immediately thereafter, to avoid damaging the weak subgrade by heavy truck traffic.

4.2.1 STRIPPING, SUB-EXCAVATION AND GRADING

The site should be stripped of all topsoil and any organic, weathered or otherwise unsuitable/less competent soils to the full depth of the roads, both in cut and fill areas. Following stripping, the site should be graded to the subgrade level and approved. The subgrade should then be proof-rolled, in the presence of the Geotechnical Engineer, by at least several passes of a heavy compactor having a rated capacity of at least 8 tonnes. Any soft spots thus exposed should be removed and replaced by select fill material, similar to the existing subgrade soil and approved by the Geotechnical Engineer.

The subgrade should then be re-compacted from the surface to at least 98% of its Standard Proctor Maximum Dry Density (SPMDD). The final subgrade should be cambered or otherwise shaped properly to facilitate rapid drainage and to prevent the formation of local depressions in which water could accumulate.

Proper cambering is required to allow the surface water to escape towards the sides, where it can be removed by means of subdrains. Otherwise, any water collected in the granular sub-base materials could be trapped thus causing problems due to softened subgrade, differential frost heave, etc. For the same reason damaging the subgrade during and after placement of the granular materials by heavy construction traffic should be avoided. If the moisture content of the local material cannot be maintained at $\pm 2\%$ of the optimum moisture content, imported granular material may need to be used.

Any fill required for re-grading the site or backfill should be select, clean material, free of topsoil, organic or other foreign and unsuitable matter. The fill should be placed in thin layers and compacted to at least 95% of its SPMDD.

The degree of compaction should be increased to 98% within the top 1.0 m of the subgrade, or as per the City Standards. The compaction of the new fill should be checked by frequent field density tests.

4.2.2 ROAD CONSTRUCTION

Once the subgrade has been inspected and approved, the granular base and sub-base course materials should be placed in layers not exceeding 200 mm (uncompacted thickness) and should be compacted to 100% of their respective SPMDD. The grading of the material should conform to current OPS Specifications.

The placing, spreading and rolling of the asphalt should be in accordance with OPS Specifications or, as required by the local authorities.

Frequent field density tests should be carried out on both the asphalt and granular base and sub-base materials to ensure that the required degree of compaction is achieved.

4.2.3 DRAINAGE

The City of Barrie requires the installation of full-length subdrains on all roads with curb and gutter. The subdrains should be properly filtered to prevent the loss of (and clogging by) soil fines.

All paved surfaces should be sloped to provide satisfactory drainage towards catch-basins. As discussed in Section 4.2.1, by means of good planning any water trapped in the granular sub-base materials should be drained rapidly towards subdrains or other interceptors.

4.3 SEWERS

As a part of the site development, a network of new watermain, storm and sanitary sewers will be constructed. It is assumed that the trenches will generally be within 4 to 5 m below the existing grade.

The type of material for the pipes to be used for watermain or sewers will be the choice of civil engineer.

4.3.1 TRENCHING

The boreholes show that below the existing topsoil, the trenches will be mostly dug through the sandy silt and silty sand (till) soils. Water seepage in excavations above groundwater can be controlled by conventional pumping methods. **Positive dewatering** will be required prior to any excavation in sandy silt till to silty sand and cohesionless soils (sand, silt, sand & gravel, sandy silt to silty sand till) below the groundwater table; otherwise it will result in unstable base and flowing sides. The groundwater table should be lowered to a minimum depth of 1 m below the base of the excavation.

Additional boreholes must be drilled at the site prior to the construction of the subdivision, especially in the south portion to confirm the subsurface soil and groundwater conditions.

Excavations in fill (if any) and native soils can be carried out with heavy hydraulic backhoe.

All excavations must be carried out in accordance with the most recent Occupational Health and Safety Act (OHSA). In accordance with OHSA, sandy silt and silty sand deposits can be classified as Type 3 Soil above the groundwater table and Type 4 below the groundwater table. Silty sand till, sand, silt, sandy silt to silty sand and sand & gravel can be classified as Type 3 Soil above the groundwater table and Type 4 Soil below the groundwater table.

It should be noted that the till is a non-sorted sediment and therefore contain cobble and boulders. Possible large obstructions such as buried concrete pieces are also anticipated in the fill material. Provisions must be made in the excavation contract for the removal of possible boulders in the till and obstructions in the fill material.

4.3.2 BEDDING

The undisturbed native soils encountered in the boreholes are considered to be competent to provide adequate support for the sewer pipes and will allow the use of normal Class B type bedding. The recommended minimum thickness of Class B bedding below the invert of the pipes is 150 mm. The thickness of the bedding may, however, have to be increased depending on the pipe diameter or in accordance with local standards or if wet or weak subgrade conditions are encountered, especially when the soil at the trench base level consists of wet, dilatant silt.

However, subject to design grades and the depth of service utilities in the south portion of the site, where less competent soil is encountered, then this material must be removed and replaced with granular engineered fill prior to placing the bedding material.

It is recommended that the bedding material consist of well-graded granular material such as Granular 'A' (OPSS 1010). To avoid the loss of soil fines from the subgrade, uniformly graded clear stone should not be used unless, below the granular bedding material, a suitable, approved filter fabric (geotextile) is placed. The geotextile should extend along the sides of the trench and should be wrapped all around the uniformly graded bedding material.

4.3.3 BACKFILLING OF TRENCHES

Based on visual and tactile examination, the existing fill material containing topsoil and organics is considered unsuitable for backfilling. Selected fill material and native soils can be reused as backfill material provided its moisture content is within 2 percent of optimum moisture content.

The fine silty soils will have to be compacted using heavy equipment suitable for these soils which may be difficult to operate in the narrow confines of the trenches. Unless the silty materials are properly pulverized and compacted in sufficiently thin lifts, post-construction settlements could occur. Their use in narrow trenches such as laterals (where heavy compaction equipment cannot be operated) may not be feasible.

The backfill should be placed in maximum 200 mm thick layers at or near ($\pm 2\%$) their optimum moisture content and each layer should be compacted to at least 95% SPMDD. In the upper 1.0 m of the subgrade, underneath the road base, the compaction should be increased to 98% SPMDD. Unsuitable materials such as organic soils, boulders, cobbles, frozen soils, etc. should not be used for backfilling.

Granular B material should be used as backfill for trenches located under slab on grade or paved areas. Compaction of the granular soils should be carried out with vibratory compactors and loose lifts not exceeding about 200 mm.

Imported granular fill, which can be compacted with hand held equipment, should be used in confined areas.

The excavated soils are not considered to be free draining. Where free draining backfill is required, imported granular fill such as OPSS Granular B should be used.

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

4.4 FOUNDATION CONDITIONS

It is understood that the proposed subdivision will consist of single-family homes (detached, townhomes, back-to-back, and/or stacked) with one level of basement.

Subject to design grades, due to the difference in ground elevations, and Based on the borehole information, due to the variable soil condition and the presence of less competent soils, the proposed townhouses can be supported by conventional footings founded on the competent undisturbed native sandy silt to silty sand (till) soils. Soil bearing resistance and founding depths/elevations are presented in Table 2.

Table 2: Bearing Values and Founding Levels of Footings

BH No.	Borehole Elevation (m)	Bearing Capacity at SLS (kPa)	Factored Geotechnical Resistance at ULS (kPa)	Minimum Depth below Existing Ground (m)	Founding Level at or Below Elevation (m)
BH20-1	262.7	150	225	1.0	261.7
BH20-2	260.4	150	225	1.0	259.4
BH20-3	253.1	150	225	2.0	251.1
BH20-4	269.0	150	225	1.5	267.5
BH20-5	265.2	150	225	2.0	263.2
BH20-6	256.5	150	225	3.8	252.7
BH20-7	271.9	150	225	1.5	270.4
BH20-8	268.5	150	225	1.0	267.5
BH20-9	263.0	150	225	3.8	259.2

In the areas of BH20-3, BH20-6 and BH20-9, subexcavation of weak soils and replacing with engineered fill should be carried out or ground improvement by dynamic compaction can be conducted, as discussed in Section 4.1 of this report.

In addition, potential differential settlements are to be evaluated by our office after completion of the foundation drawings and subgrade assessment.

The encountered sandy silt till to silty sand at the base of footings can be easily disturbed by construction activities. A concrete skim coat, about 50 mm in thickness, on the founding subgrade immediately after its approval might be required, on a case by case basis, to prevent its disturbance by construction activities.

Again Due to the difference in ground elevations/presence of less competent soils and subject to design grades, should the proposed footings be founded above the competent native soils, then the proposed houses can also be supported by spread and strip footings founded on engineered fill for a bearing capacity of 150 kPa at the serviceability limit states (SLS) and for a factored geotechnical resistance of 225 kPa at the ultimate limit states (ULS), provided all requirements on **Appendix A** are adhered to.

Foundations designed to the specified bearing capacities at the serviceability limit states (SLS) are expected to settle less than 25 mm total and 19 mm differential.

All footings exposed to seasonal freezing conditions must have at least 1.5 metres of soil cover for frost protection.

All footings bases must be inspected by this office to confirm the bearing capacity values, prior to pouring concrete.

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

It should be noted that the recommended bearing capacities have been calculated by DS from the limited borehole information for the design stage only. The investigation and comments are necessarily on-going as new information of the underground conditions becomes available.

For example, more specific information is available with respect to conditions between boreholes when foundation construction is underway. The interpretation between boreholes and the recommendations of this report must therefore be checked through field inspections provided by DS to validate the information for use during the construction stage.

4.5 EARTH PRESSURES

The lateral earth pressures acting on foundation and basement walls may be calculated from the following expression:

$$p = k(\gamma h + q)$$

where, p	=	Lateral earth pressure in kPa acting at depth h
K	=	Earth pressure coefficient, assumed to be 0.40 for vertical walls and horizontal backfill for permanent construction
γ	=	Unit weight of backfill, a value of 21 kN/m ³ may be assumed
h	=	Depth to point of interest in metres
q	=	Equivalent value of surcharge on the ground surface in kPa

The above expression assumes that the perimeter drainage system prevents the build up of any hydrostatic pressure behind the wall.

4.6 FLOOR SLAB AND PERMANENT DRAINAGE

The floor slab can be supported on grade provided all organic materials/topsoil, fill (if encountered), and surficial softened/disturbed native soils are removed and the base thoroughly proof rolled.

The fill required to raise the grade can consist of inorganic soil, approved by this office, placed in shallow lifts and compacted to 98 percent of Standard Proctor Maximum Dry Density (SPMDD).

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

A moisture barrier consisting of at least 200 mm of 19 mm clear crushed stone should be installed under the floor slab.

A perimeter and underfloor drainage system will be required around the exterior basement walls, as shown on **Drawing 13**.

4.7 STORMWATER MANAGEMENT POND

The proposed stormwater management pond which will be located at the southwest portion of the subject site.

The pond design grades are not available at this stage. Due to the variable soil conditions, high groundwater in this area and the presence of different types of soils at different depths,

recommendations will be provided at later stage including the clay liner recommendations, if required, when design information are available.

Based on the subsurface conditions encountered in boreholes BH20-3 and subject to design grades, the soils at the pond sides and base after removing the existing topsoil/disturbed materials will consist of silt, silty clay and silty sand to sandy silt. The groundwater levels measured in the monitoring well within the pond areas was about 0.17 m above existing grade BH20-3), corresponding to Elevations 253.27.

Dewatering system will be required for excavations below groundwater levels, subject to further groundwater investigation and monitoring depth of excavations and type of soils encountered, to be confirmed during design stage.

5. GENERAL COMMENTS AND LIMITATIONS OF REPORT

DS Consultants Ltd. (DS) should be retained for a general review of the final design and specifications to verify that this report has been properly interpreted and implemented. If not accorded the privilege of making this review, DS will assume no responsibility for interpretation of the recommendations in the report.

This report is intended solely for the Client named. The material in it reflects our best judgment in light of the information available to DS at the time of preparation.

Unless otherwise agreed in writing by DS, it shall not be used to express or imply warranty as to the fitness of the property for a particular purpose. No portion of this report may be used as a separate entity, it is written to be read in its entirety.

The conclusions and recommendations given in this report are based on information determined at the test hole locations. The information contained herein in no way reflects on the environment aspects of the project, unless otherwise stated. Subsurface and groundwater conditions between and beyond the test holes may differ from those encountered at the test hole locations, and conditions may become apparent during construction, which could not be detected or anticipated at the time of the site investigation. The benchmark and elevations used in this report are primarily to establish relative elevation differences between the test hole locations and should not be used for other purposes, such as grading, excavating, planning, development, etc.

The design recommendations given in this report are applicable only to the project described in the text and then only if constructed substantially in accordance with the details stated in this report.

The comments made in this report on potential construction problems and possible methods are intended only for the guidance of the designer. The number of test holes may not be sufficient to determine all the factors that may affect construction methods and costs. For example, the thickness of surficial topsoil or fill layers may vary markedly and unpredictably.

The contractors bidding on this project or undertaking the construction should, therefore, make their own interpretation of the factual information presented and draw their own conclusions as to how the subsurface conditions may affect their work. This work has been undertaken in accordance with normally accepted geotechnical engineering practices.

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. DS accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

We accept no responsibility for any decisions made or actions taken as a result of this report unless we are specifically advised of and participate in such action, in which case our responsibility will be as agreed to at that time.

We trust that the information contained in this report is satisfactory. Should you have any questions, please do not hesitate to contact this office.

DS CONSULTANTS LTD.



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Drawings



Legend

-  Borehole
-  Borehole / Monitoring Well



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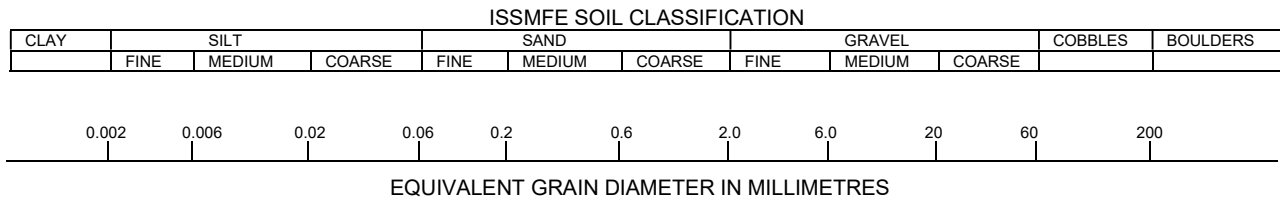
Title:
Borehole and Monitoring Well Location Plan



Size: 11x17	Approved By: B.D	Drawn By: S.W	Date: September 2020
	Scale: As Shown	Project No.: 20-231-400	Figure No.: 1
Rev: 0	Image/Map Source: Google Satellite Image		

Drawing 1A: Notes On Sample Descriptions

1. All sample descriptions included in this report generally follow the Unified Soil Classification. Laboratory grain size analyses provided by DSCL also follow the same system. Different classification systems may be used by others, such as the system by the International Society for Soil Mechanics and Foundation Engineering (ISSMFE). Please note that, with the exception of those samples where a grain size analysis and/or Atterberg Limits testing have been made, all samples are classified visually. Visual classification is not sufficiently accurate to provide exact grain sizing or precise differentiation between size classification systems.



CLAY (PLASTIC) TO	FINE	MEDIUM	CRS.	FINE	COARSE
SILT (NONPLASTIC)	SAND			GRAVEL	

UNIFIED SOIL CLASSIFICATION

2. **Fill:** Where fill is designated on the borehole log it is defined as indicated by the sample recovered during the boring process. The reader is cautioned that fills are heterogeneous in nature and variable in density or degree of compaction. The borehole description may therefore not be applicable as a general description of site fill materials. All fills should be expected to contain obstruction such as wood, large concrete pieces or subsurface basements, floors, tanks, etc., none of these may have been encountered in the boreholes. Since boreholes cannot accurately define the contents of the fill, test pits are recommended to provide supplementary information. Despite the use of test pits, the heterogeneous nature of fill will leave some ambiguity as to the exact composition of the fill. Most fills contain pockets, seams, or layers of organically contaminated soil. This organic material can result in the generation of methane gas and/or significant ongoing and future settlements. Fill at this site may have been monitored for the presence of methane gas and, if so, the results are given on the borehole logs. The monitoring process does not indicate the volume of gas that can be potentially generated nor does it pinpoint the source of the gas. These readings are to advise of the presence of gas only, and a detailed study is recommended for sites where any explosive gas/methane is detected. Some fill material may be contaminated by toxic/hazardous waste that renders it unacceptable for deposition in any but designated land fill sites; unless specifically stated the fill on this site has not been tested for contaminants that may be considered toxic or hazardous. This testing and a potential hazard study can be undertaken if requested. In most residential/commercial areas undergoing reconstruction, buried oil tanks are common and are generally not detected in a conventional preliminary geotechnical site investigation.
3. **Till:** The term till on the borehole logs indicates that the material originates from a geological process associated with glaciation. Because of this geological process the till must be considered heterogeneous in composition and as such may contain pockets and/or seams of material such as sand, gravel, silt or clay. Till often contains cobbles (60 to 200 mm) or boulders (over 200 mm). Contractors may therefore encounter cobbles and boulders during excavation, even if they are not indicated by the borings. It should be appreciated that normal sampling equipment cannot differentiate the size or type of any obstruction. Because of the horizontal and vertical variability of till, the sample description may be applicable to a very limited zone; caution is therefore essential when dealing with sensitive excavations or dewatering programs in till materials.

PROJECT: Geotechnical Investigation

CLIENT: Mattamy Homes

PROJECT LOCATION: 620 Lockhart Road, Barrie, Ontario

DATUM: Geodetic

BOREHOLE LOCATION: See Drawing 1 N 4910499.315 E 608729.072

DRILLING DATA

Method: Solid Stem Auger

Diameter: 150mm

Date: Sep/09/2020

REF. NO.: 20-231-400

ENCL NO.: 2

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT NATURAL LIQUID LIMIT MOISTURE CONTENT LIMIT			POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m ³)	METHANE AND GRAIN SIZE DISTRIBUTION (%)			
(m)	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS 0.3 m			SHEAR STRENGTH (kPa)				W _p W W _L					GR	SA	SI	CL
ELEV								○ UNCONFINED + FIELD VANE & Sensitivity				○								
DEPTH								● QUICK TRIAXIAL × LAB VANE				WATER CONTENT (%)								
						20	40	60	80	100	10	20	30							
262.7																				
260.9	TOPSOIL: 150mm		1	SS	6							○								
261.9	SANDY SILT: trace clay, some organic, brown, moist, loose, disturbed material																			
261.9	SANDY SILT: trace clay, trace gravel, brown, moist, compact		2	SS	11							○								
260.5																				
260.5			3	SS	18							○								
258.4	SILTY SAND TILL: with gravel, trace clay, grey, moist, compact																			
258.4			4	SS	39							○								
257.5																				
257.5			5	SS	32							○								
254.5	SAND: sand seam, some gravel, trace silt, saturated, dense																			
254.5			6	SS	40							○								
	SILTY SAND TILL: with gravel, trace clay, grey, wet, very dense																			
			7	SS	80							○								

GROUNDWATER ELEVATIONS

Measurement 1st 2nd 3rd 4th

GRAPH NOTES

+ 3, × 3: Numbers refer to Sensitivity

○ = 3% Strain at Failure

PROJECT: Geotechnical Investigation

CLIENT: Mattamy Homes

PROJECT LOCATION: 620 Lockhart Road, Barrie, Ontario

DATUM: Geodetic

BOREHOLE LOCATION: See Drawing 1 N 4910243.586 E 608797.335

DRILLING DATA

Method: Solid Stem Auger

Diameter: 150mm

Date: Sep/10/2020

REF. NO.: 20-231-400

ENCL NO.: 3

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT					POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m ³)	METHANE AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
(m) ELEV DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS 0.3 m			SHEAR STRENGTH (kPa)								WATER CONTENT (%)		
								20	40	60	80	100				W _p	W	W _L
260.4																		
260.0																		
260.2			1	SS	7													
259.5			2	SS	16													
0.9																		
			3	SS	12													
2																		
258.1			4	SS	43													
2.3																		
			5	SS	53													
255.9			6	SS	61													
4.5																		
			7	SS	57													
			8	SS	43													
252.2																		
8.2																		
		</																

GROUNDWATER ELEVATIONS

Measurement 1st 2nd 3rd 4th

GRAPH
NOTES+ 3, × 3: Numbers refer
to Sensitivity

○ = 3% Strain at Failure

PROJECT: Geotechnical Investigation

CLIENT: Mattamy Homes

PROJECT LOCATION: 620 Lockhart Road, Barrie, Ontario

DATUM: Geodetic

BOREHOLE LOCATION: See Drawing 1 N 4909956.586 E 608856.231

DRILLING DATA

Method: Solid Stem Auger

Diameter: 150mm

Date: Sep/10/2020

REF. NO.: 20-231-400

ENCL NO.: 4

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC NATURAL LIQUID LIMIT MOISTURE CONTENT LIMIT			POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m ³)	METHANE AND GRAIN SIZE DISTRIBUTION (%)
(m) ELEV DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS 0.3 m			SHEAR STRENGTH (kPa)				WATER CONTENT (%)					
								20 40 60 80 100	FIELD VANE & Sensitivity			W _p W W _L	GR SA SI CL				
253.1																	
252.9	TOPSOIL: 230mm		1	SS	9		W. L. 253.3 m Sep 30, 2020										
0.2	SILT: with fine sand, brown, moist to wet, loose, weathered																
252.0			2	SS	6		252										
1.1	SILTY CLAY: trace sand, brown to grey, very moist, firm to stiff																
251.1			3	SS	12		251									0 2 32 66	
2.0	SILT AND SAND: fine sand, trace gravel, trace clay, grey, wet, compact						Bentonite										
250.1			4	SS	13												
3.0	SANDY SILT TILL: with gravel, trace clay, grey, wet, loose to compact						250										
			5	SS	11												
							249										
			6	SS	9		248									wet spoon	
							Filter Pack										
			7	SS	29		247 Slotted Pipe										
246.1																	
7.0	END OF BOREHOLE: Notes: 1) 50mm dia. monitoring well installed upon completion. 2) Water level Reading: Date: Water Level (mbgl): Sept 30, 2020 -0.17															Grinding on boulder, Auger refusal	

GROUNDWATER ELEVATIONS

Measurement 1st 2nd 3rd 4th

GRAPH
NOTES

+ 3 , × 3 : Numbers refer to Sensitivity

○ = 3% Strain at Failure

PROJECT: Geotechnical Investigation

CLIENT: Mattamy Homes

PROJECT LOCATION: 620 Lockhart Road, Barrie, Ontario

DATUM: Geodetic

BOREHOLE LOCATION: See Drawing 1 N 4910539.485 E 608901.801

DRILLING DATA

Method: Solid Stem Auger

Diameter: 150mm

Date: Sep/09/2020

REF. NO.: 20-231-400

ENCL NO.: 5

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT				POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m ³)	METHANE AND GRAIN SIZE DISTRIBUTION (%)
(m) ELEV DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS 0.3 m			SHEAR STRENGTH (kPa)						
								UNCONFINED		FIELD VANE & Sensitivity				
								○	+	×	×			
269.0														
268.9	TOPSOIL: 250mm		1	SS	6									
0.3	SILT: disturbed material, trace sand, some organic, brown, moist, loose													
268.2														
0.8	SILT: some sand, trace gravel, trace clay, brown, moist, loose		2	SS	7									
267.5														
1.5	SILTY SAND TILL: some gravel, trace clay, grey, moist, dense to very dense		3	SS	32									
			4	SS	58									
			5	SS	68									
			6	SS	>100									

GROUNDWATER ELEVATIONS

Measurement 1st 2nd 3rd 4th

GRAPH
NOTES

+ 3, × 3: Numbers refer to Sensitivity

○ = 3% Strain at Failure

DS SOIL LOG 20-231-400 MATTAMY, 620 LOCKHART GPJ DS GDT 20/10/2

PROJECT: Geotechnical Investigation

CLIENT: Mattamy Homes

PROJECT LOCATION: 620 Lockhart Road, Barrie, Ontario

DATUM: Geodetic

BOREHOLE LOCATION: See Drawing 1 N 4910273.423 E 608949.757

DRILLING DATA

Method: Solid Stem Auger

Diameter: 150mm

Date: Sep/10/2020

REF. NO.: 20-231-400

ENCL NO.: 6

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	POCKET PEN. (C _u) (kPa)	NATURAL UNIT WT (kN/m ³)	METHANE AND GRAIN SIZE DISTRIBUTION (%)				
(m) ELEV DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS 0.3 m			SHEAR STRENGTH (kPa)										GR	SA	SI	CL
265.2							265	20	40	60	80	100									
265.0	TOPSOIL: 150mm		1	SS	7		265														
264.9	SILT: trace organics, trace sand, brown, moist, loose, weathered																				
264.4	SANDY SILT: trace gravel, grey, moist, loose		2	SS	9		264														
263.7	SILTY SAND TILL: with gravel, trace clay, grey, moist, compact to very dense		3	SS	10		264														
1.5			4	SS	36		263														
			5	SS	32		262														
			6	SS	57		261														
	wet, sand seams		7	SS	45		260														
			8	SS	>100		259														
	saturated						258														
8.2	END OF BOREHOLE: Notes: 1) Water level at 3.4m below grade at completion of drilling. 2) No cave-in upon completion.						257														

GROUNDWATER ELEVATIONS

Measurement 1st 2nd 3rd 4th

GRAPH NOTES

+ 3, × 3: Numbers refer to Sensitivity

○ = 3% Strain at Failure

PROJECT: Geotechnical Investigation

CLIENT: Mattamy Homes

PROJECT LOCATION: 620 Lockhart Road, Barrie, Ontario

DATUM: Geodetic

BOREHOLE LOCATION: See Drawing 1 N 4910014.013 E 609016.963

DRILLING DATA

Method: Solid Stem Auger

Diameter: 150mm

Date: Sep/11/2020

REF. NO.: 20-231-400

ENCL NO.: 7

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC NATURAL LIQUID LIMIT			POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m ³)	METHANE AND GRAIN SIZE DISTRIBUTION (%)			
(m)	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS 0.3 m			SHEAR STRENGTH (kPa)				W _p	W	W _L			GR	SA	SI	CL
256.5								20	40	60	80	100								
0.0	SAND AND GRAVEL FILL: brown, compact, moist		1	SS	11		256													
255.3			2	SS	13		255													
255.2	TOPSOIL: 200mm, black, moist																			
1.4	SILTY SAND TILL: trace gravel, trace clay, brown, moist to wet, loose		3	SS	8		255													
	Grey, with gravel, wet		4	SS	4		254													
			5	SS	6		253													
	compact below 3.8m		6	SS	13		252													
251.8							251													
4.7	SANDY SILT: with gravel, some clay, grey, compact, wet		7	SS	21		250													
250.4							249													
6.1	SILTY SAND: some to trace gravel, sand seams at 6.4m, brown, saturated, compact to very dense		8	SS	20		248													
	grey		9	SS	>100		247													
			10	SS	>100															
9.8	END OF BOREHOLE: Notes: 1) Water level at 1.5m during drilling. 2) No cave-in upon completion.																			

GROUNDWATER ELEVATIONS

Measurement 1st 2nd 3rd 4th

GRAPH NOTES

+ 3 , × 3 : Numbers refer to Sensitivity

○ = 3% Strain at Failure

DS SOIL LOG 20-231-400 MATTAMY, 620 LOCKHART GPJ DS GDT 20/10/2

PROJECT: Geotechnical Investigation

CLIENT: Mattamy Homes

PROJECT LOCATION: 620 Lockhart Road, Barrie, Ontario

DATUM: Geodetic

BOREHOLE LOCATION: See Drawing 1 N 4910578.452 E 609026.09

DRILLING DATA

Method: Solid Stem Auger

Diameter: 150mm

Date: Sep/09/2020

REF. NO.: 20-231-400

ENCL NO.: 8

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT NATURAL LIQUID LIMIT MOISTURE LIMIT 		
--------------	--	--	---------	--	--	----------------------------	-----------	---	--	--	--	--	--	--

GROUNDWATER ELEVATIONS

Measurement 1st 2nd 3rd 4th

GRAPH NOTES

+ 3, × 3: Numbers refer to Sensitivity

○ = 3% Strain at Failure

DS SOIL LOG 20-231-400 MATTAMY, 620 LOCKHART GPJ DS GDT 20/10/2

PROJECT: Geotechnical Investigation

CLIENT: Mattamy Homes

PROJECT LOCATION: 620 Lockhart Road, Barrie, Ontario

DATUM: Geodetic

BOREHOLE LOCATION: See Drawing 1 N 4910311.883 E 609091.492

DRILLING DATA

Method: Solid Stem Auger

Diameter: 150mm

Date: Sep/10/2020

REF. NO.: 20-231-400

ENCL NO.: 9

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT W _P	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	POCKET PEN (C _u) (kPa)	NATURAL UNIT WT (kN/m ³)	METHANE AND GRAIN SIZE DISTRIBUTION (%)			
(m)	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS 0.3 m			SHEAR STRENGTH (kPa)										WATER CONTENT (%)		
ELEV DEPTH								○ UNCONFINED ● QUICK TRIAXIAL	+ FIELD VANE & Sensitivity	× LAB VANE	20							40	60	80
268.5																	GR SA SI CL			
268.0	TOPSOIL: 200mm																			
0.2	SANDY SILT: some organics, trace gravel, brown, moist, loose, weathered		1	SS	5		268													
267.6																				
0.9	SILTY SAND TILL: with gravel, trace clay, grey, moist, compact small seam of red sand at 1.2m dense		2	SS	16		267													
			3	SS	31		267													
			4	SS	41		266													
			5	SS	62		265													
	seam of red sand		6	SS	81		264													
							263													
	saturated		7	SS	>100		262													
260.9							261													
7.6	SAND: some gravel, grey, saturated, dense		8	SS	35															
260.3																				
8.2	END OF BOREHOLE: Notes: 1) Water at depth of 4.6m at completion of drilling. 2) Cave-in at 6.6m upon completion																			

GROUNDWATER ELEVATIONS

Measurement 1st 2nd 3rd 4th

GRAPH NOTES

+ 3, × 3: Numbers refer to Sensitivity

○ = 3% Strain at Failure

PROJECT: Geotechnical Investigation

CLIENT: Mattamy Homes

PROJECT LOCATION: 620 Lockhart Road, Barrie, Ontario

DATUM: Geodetic

BOREHOLE LOCATION: See Drawing 1 N 4910084.417 E 609199.788

DRILLING DATA

Method: Solid Stem Auger

Diameter: 150mm

Date: Sep/11/2020

REF. NO.: 20-231-400

ENCL NO.: 10

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m ³)	METHANE AND GRAIN SIZE DISTRIBUTION (%)				
(m) ELEV DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS 0.3 m			SHEAR STRENGTH (kPa)													
263.0								20	40	60	80	100									
262.9	TOPSOIL: 150mm		1	SS	4																
262.1	SANDY SILT: with gravel, some cobble, some clay, brown, wet, loose, weathered		2	SS	10																
260.5	SANDY SILT: some gravel, trace clay, brown, wet, loose to compact		3	SS	8																
260.0	SILTY SAND: Brown, trace gravel, compact, saturated		4	SS	12																
256.9	SILTY SAND TILL: trace gravel, trace clay, grey, wet, loose to dense		5	SS	5																
255.4			6	SS	15																
254.8			7	SS	46																
254.8	SILTY SAND: trace gravel and cobbles, interbedded with sand and silt, brown, wet, very dense		8	SS	60																
254.8			9	SS	>100																
254.8	SANDY SILT: Grey, with gravel, wet, very dense																				
254.8	END OF BOREHOLE: Notes: 1) 50mm dia. monitoring well installed upon completion. 2) Water level Reading: Date: Water Level (mbgl): Sept 30, 2020 0.73																				

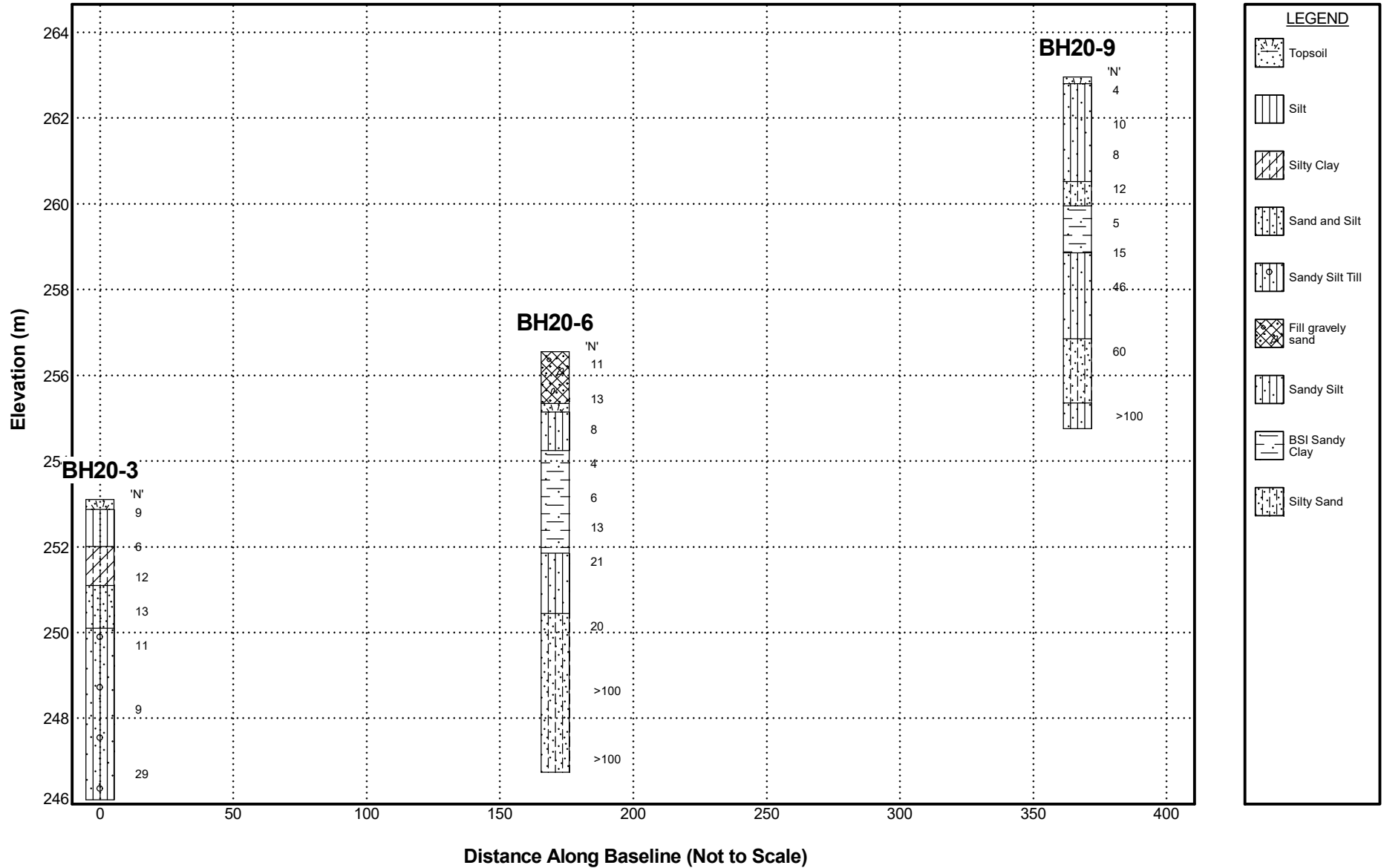
GROUNDWATER ELEVATIONS

Measurement 1st 2nd 3rd 4th

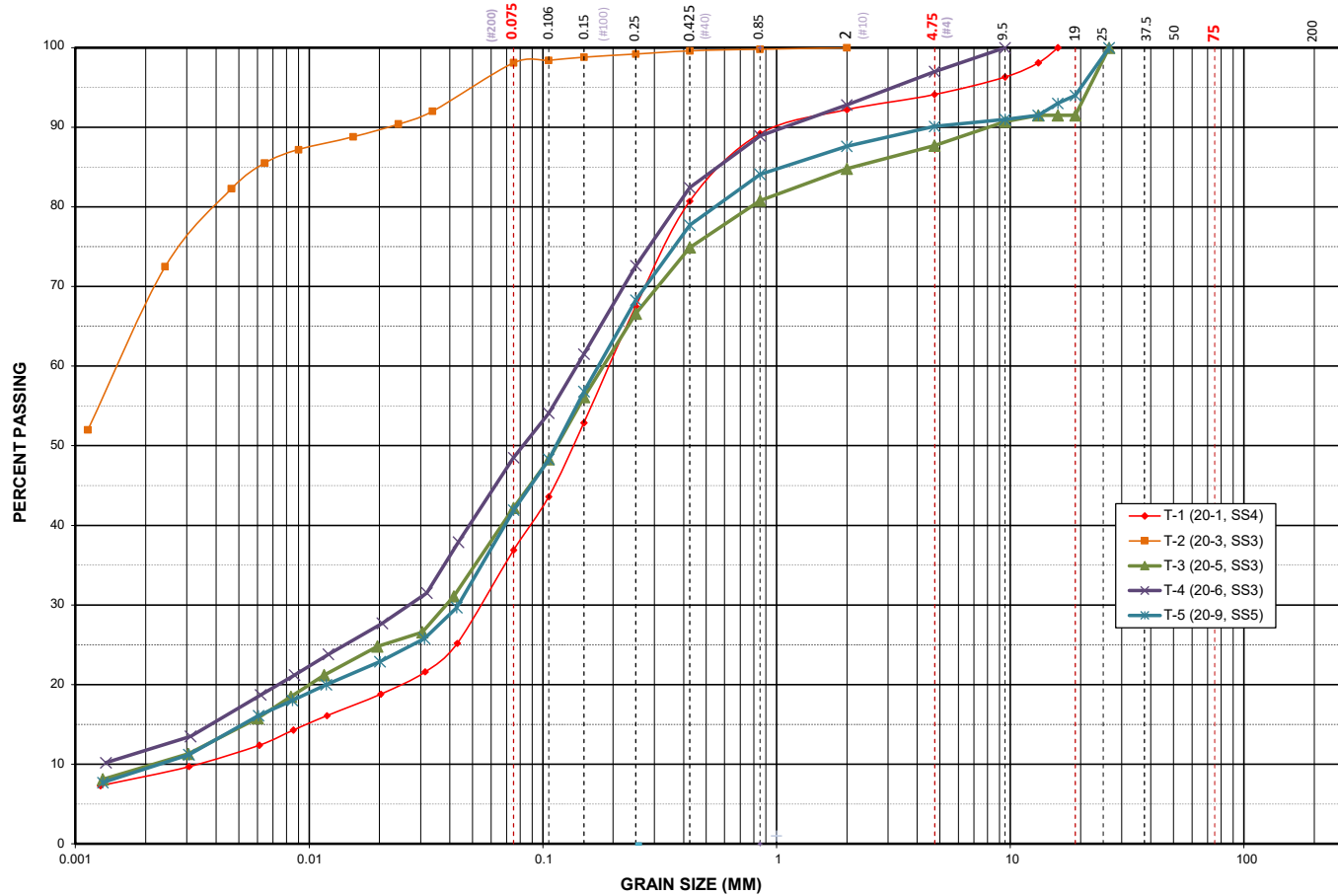
GRAPH
NOTES+ 3 , × 3 : Numbers refer
to Sensitivity

○ = 3% Strain at Failure

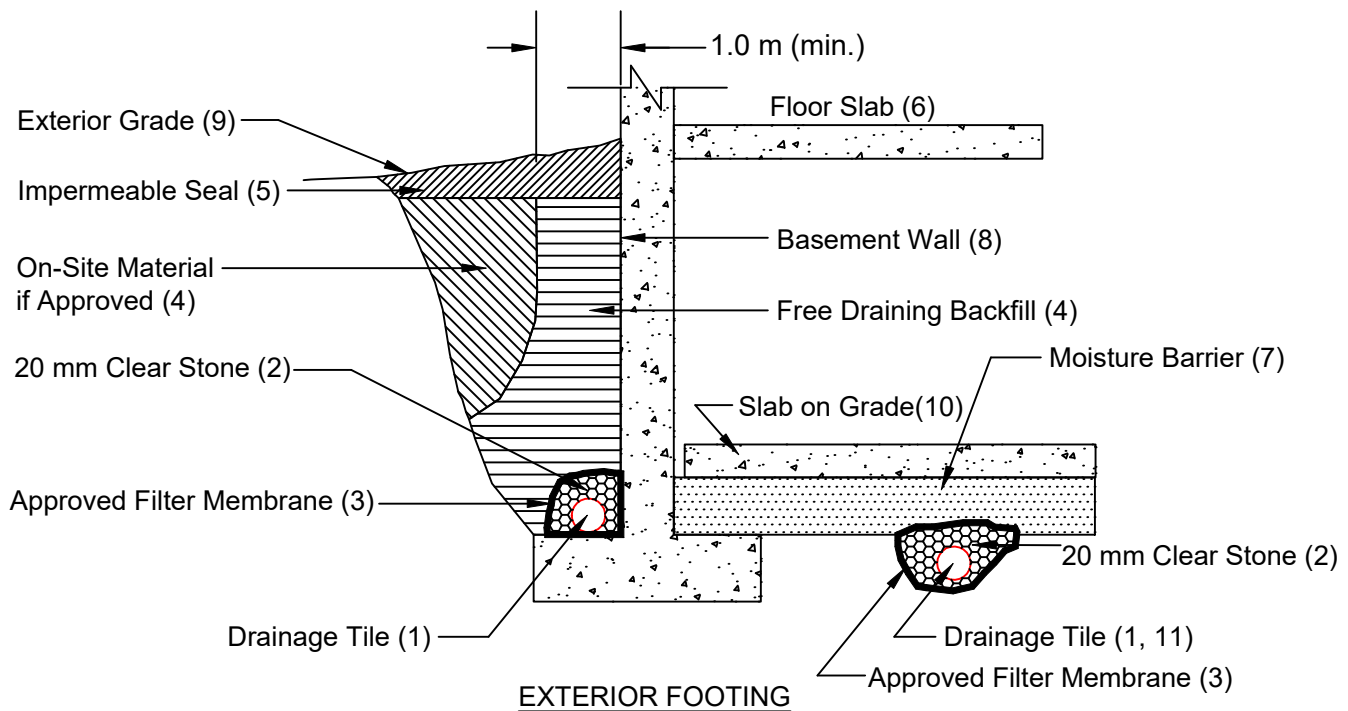
DS SOIL LOG 20-231-400 MATTAMY, 620 LOCKHART GPJ DS GDT 20/10/2



Particle Size Distribution (ASTM-D421/D422)



Silt and Clay		Sand			Gravel		Cobble +
Clay	Silt	Fine	Medium	Coarse	Fine	Coarse	
Specification and Comments:							
 DS CONSULTANTS LTD. 6221 Highway 7, Unit 16 Vaughan, Ontario, L4H 0K8 Telephone: (905) 264-9393 www.dsconsultants.ca		Project:	Geotechnical Investigation, 620 Lockhart Rd.			Tested by :	Matt
		Project No.:	20-231-400			Date:	Sept-30-2020
		Client:	Mattamy Homes			Figure No.:	12



Notes

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

DRAINAGE AND BACKFILL RECOMMENDATIONS

Basement with Underfloor Drainage

(not to scale)

GENERAL REQUIREMENTS FOR ENGINEERED FILL

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

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

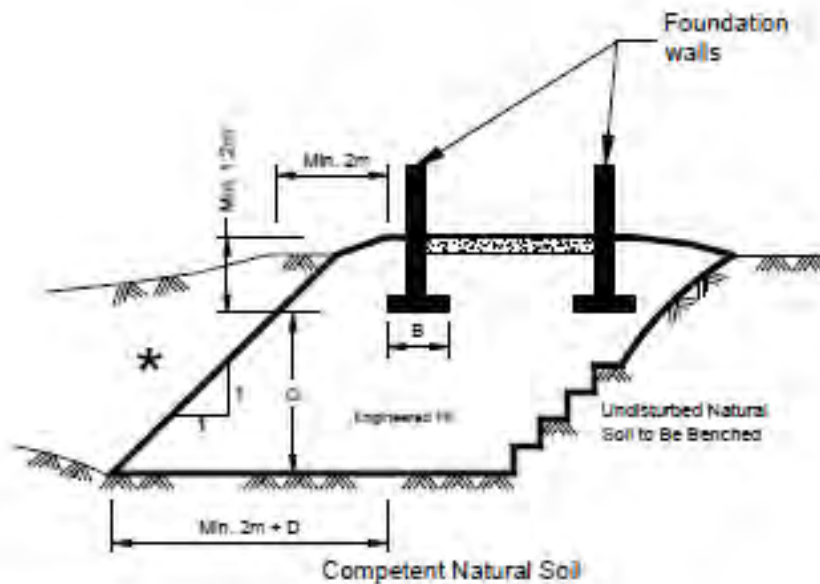
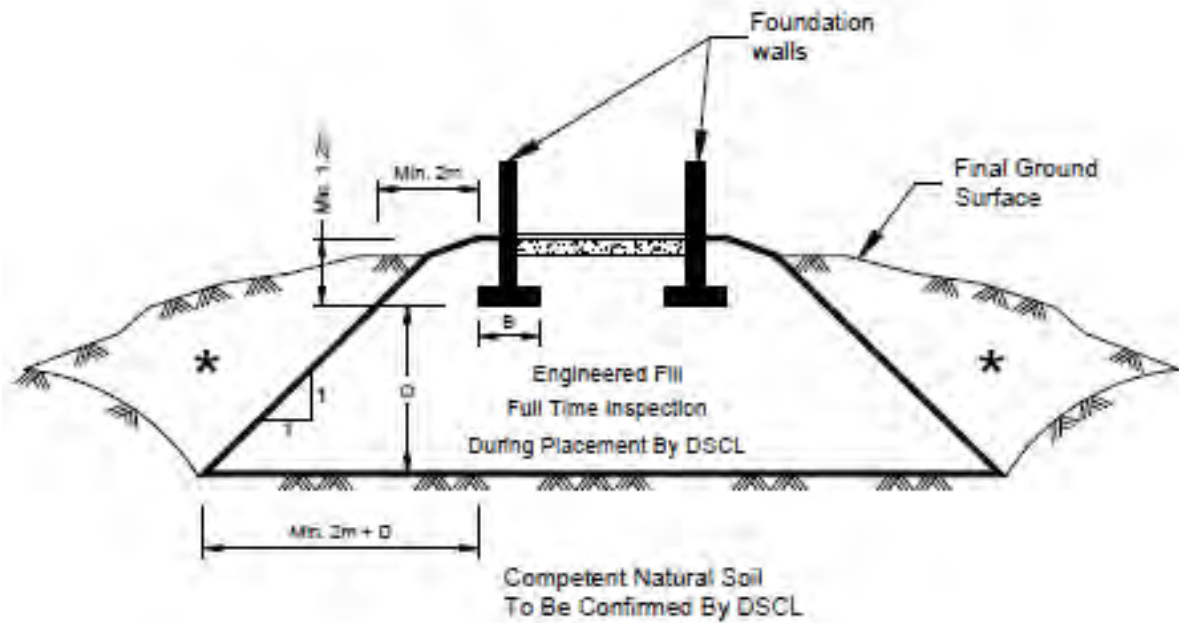
Adverse weather conditions such as rain make the placement of engineered fill to the required degree of density difficult or impossible; engineered fill cannot be placed during freezing conditions, i.e. normally not between December 15 and April 1 of each year.

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

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

1. Prior to site work involving engineered fill, a site meeting to discuss all aspects must be convened. The surveyor, contractor, design engineer and geotechnical engineer must attend the meeting. At this meeting, the limits of the engineered fill will be defined. The contractor must make known where all fill material will be obtained from and samples must be provided to the geotechnical engineer for review, and approval before filling begins.
2. Detailed drawings indicating the lower boundaries as well as the upper boundaries of the engineered fill must be available at the site meeting and be approved by the geotechnical engineer.
3. The building footprint and base of the pad, including basements, garages, etc. must be defined by offset stakes that remain in place until the footings and service connections are all constructed. Confirmation that the footings are within the pad, service lines are in place, and that the grade conforms to drawings, must be obtained by the owner in writing from the surveyor and DS Consultants Ltd (DSCL). Without this confirmation no responsibility for the performance of the structure can be accepted by DSCL. Survey drawing of the pre and post fill location and elevations will also be required.
4. The area must be stripped of all topsoil and fill materials. Subgrade must be proof-rolled. Soft spots must be dug out. The stripped native subgrade must be examined and approved by a DSCL engineer prior to placement of fill.

5. The approved engineered fill material must be compacted to 100% Standard Proctor Maximum Dry Density throughout. Engineered fill should not be placed during the winter months. Engineered fill compacted to 100% SPMDD will settle under its own weight approximately 0.5% of the fill height and the structural engineer must be aware of this settlement. In addition to the settlement of the fill, additional settlement due to consolidation of the underlying soils from the structural and fill loads will occur and should be evaluated prior to placing the fill.
6. Full-time geotechnical inspection by DSCL during placement of engineered fill is required. Work cannot commence or continue without the presence of the DSCL representative.
7. The fill must be placed such that the specified geometry is achieved. Refer to the attached sketches for minimum requirements. Take careful note that the projection of the compacted pad beyond the footing at footing level is a minimum of 2 m. The base of the compacted pad extends 2 m plus the depth of excavation beyond the edge of the footing.
8. A bearing capacity of 150 kPa at SLS (225 kPa at ULS) can be used provided that all conditions outlined above are adhered to. A minimum footing width of 500 mm (20 inches) is suggested and footings must be provided with nominal steel reinforcement.
9. All excavations must be done in accordance with the Occupational Health and Safety Regulations of Ontario.
10. After completion of the engineered fill pad a second contractor may be selected to install footings. The prepared footing bases must be evaluated by engineering staff from DSCL prior to footing concrete placements. All excavations must be backfilled under full time supervision by DSCL to the same degree as the engineered fill pad. Surface water cannot be allowed to pond in excavations or to be trapped in clear stone backfill. Clear stone backfill can only be used with the approval of DSCL.
11. After completion of compaction, the surface of the engineered fill pad must be protected from disturbance from traffic, rain and frost. During the course of fill placement, the engineered fill must be smooth-graded, proof-rolled and sloped/crowned at the end of each day, prior to weekends and any stoppage in work in order to promote rapid runoff of rainwater and to avoid any ponding surface water. Any stockpiles of fill intended for use as engineered fill must also be smooth-bladed to promote runoff and/or protected from excessive moisture take up.
12. If there is a delay in construction, the engineered fill pad must be inspected and accepted by the geotechnical engineer. The location of the structure must be reconfirmed that it remains within the pad.
13. The geometry of the engineered fill as illustrated in these General Requirements is general in nature. Each project will have its own unique requirements. For example, if perimeter sidewalks are to be constructed around the building, then the projection of the engineered fill beyond the foundation wall may need to be greater.
14. These guidelines are to be read in conjunction with DS Consultants Ltd report attached.



★ Backfill in this area to be as per the DSCL report.

PROJECT: Geotechnical Investigation

CLIENT: Mattamy Homes

PROJECT LOCATION: 620 Lockhart Road, Barrie, Ontario

DATUM: Geodetic

BOREHOLE LOCATION: See Drawing 1 N 4910499.315 E 608729.072

DRILLING DATA

Method: Solid Stem Auger

Diameter: 150mm

Date: Sep/09/2020

REF. NO.: 20-231-400

ENCL NO.: 2

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC NATURAL LIQUID LIMIT MOISTURE CONTENT LIMIT			POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m ³)	METHANE AND GRAIN SIZE DISTRIBUTION (%)			
(m) ELEV DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS 0.3 m			SHEAR STRENGTH (kPa)				W _p	W	W _L			GR	SA	SI	CL
262.7	TOPSOIL: 150mm							20	40	60	80	100								
260.9	SANDY SILT: trace clay, some organic, brown, moist, loose, disturbed material		1	SS	6		262													
261.9	SANDY SILT: trace clay, trace gravel, brown, moist, compact		2	SS	11		261													
260.5			3	SS	18		260													
258.4	SILTY SAND TILL: with gravel, trace clay, grey, moist, compact		4	SS	39		259													
257.5			5	SS	32		258													
254.5	SAND: sand seam, some gravel, trace silt, saturated, dense		6	SS	40		257													
			7	SS	80		256													
	SILTY SAND TILL: with gravel, trace clay, grey, wet, very dense		8	SS	>100		255													
8.2	END OF BOREHOLE: Notes: 1) Water level at 3.2m below grade at the completion of drilling. 2) Cave-in to 4.6m upon completion																			

GROUNDWATER ELEVATIONS

Measurement 1st 2nd 3rd 4th

GRAPH
NOTES

+ 3, × 3: Numbers refer to Sensitivity

○ = 3% Strain at Failure

PROJECT: Geotechnical Investigation

CLIENT: Mattamy Homes

PROJECT LOCATION: 620 Lockhart Road, Barrie, Ontario

DATUM: Geodetic

BOREHOLE LOCATION: See Drawing 1 N 4910243.586 E 608797.335

DRILLING DATA

Method: Solid Stem Auger

Diameter: 150mm

Date: Sep/10/2020

REF. NO.: 20-231-400

ENCL NO.: 3

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT				POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m ³)	METHANE AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
(m) ELEV DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS 0.3 m			SHEAR STRENGTH (kPa)							WATER CONTENT (%)		
20 40 60 80 100								PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT									
○ UNCONFINED + FIELD VANE & Sensitivity ● QUICK TRIAXIAL × LAB VANE								w _p w w _L									
260.4																	
260.0			1	SS	7		260										
259.5			2	SS	16		259										
258.1			3	SS	12		258										
255.9			4	SS	43		257										
252.2			6	SS	61		256										
			7	SS	57		254										
			8	SS	43		253										
8.2	END OF BOREHOLE: Notes: 1) Water level at 3.7m below grade at the completion of drilling. 2) cave-in at 7.3m below grade upon completion																

GROUNDWATER ELEVATIONS

Measurement 1st 2nd 3rd 4th

GRAPH NOTES

+ 3, × 3: Numbers refer to Sensitivity

○ = 3% Strain at Failure

PROJECT: Geotechnical Investigation

CLIENT: Mattamy Homes

PROJECT LOCATION: 620 Lockhart Road, Barrie, Ontario

DATUM: Geodetic

BOREHOLE LOCATION: See Drawing 1 N 4909956.586 E 608856.231

DRILLING DATA

Method: Solid Stem Auger

Diameter: 150mm

Date: Sep/10/2020

REF. NO.: 20-231-400

ENCL NO.: 4

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC NATURAL LIQUID LIMIT MOISTURE CONTENT LIMIT			POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m ³)	METHANE AND GRAIN SIZE DISTRIBUTION (%)
(m) ELEV DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS 0.3 m		SHEAR STRENGTH (kPa)				W _p	W	W _L			
253.1							20 40 60 80 100									
252.9	TOPSOIL: 230mm						40 60 80 100									
0.2	SILT: with fine sand, brown, moist to wet, loose, weathered		1	SS	9		UNCONFINED + FIELD VANE & Sensitivity									
252.0			2	SS	6		● QUICK TRIAXIAL × LAB VANE									
1.1	SILTY CLAY: trace sand, brown to grey, very moist, firm to stiff		3	SS	12		WATER CONTENT (%)									
251.1			4	SS	13											
2.0	SILT AND SAND: fine sand, trace gravel, trace clay, grey, wet, compact		5	SS	11											
250.1			6	SS	9											
3.0	SANDY SILT TILL: with gravel, trace clay, grey, wet, loose to compact		7	SS	29											
4																
5																
6																
6																
247																
246.1																
7.0	END OF BOREHOLE: Notes: 1) 50mm dia. monitoring well installed upon completion. 2) Water level Reading: Date: Water Level (mbgl): Sept 30, 2020 -0.17 Jan 11, 2021 -0.31															

GROUNDWATER ELEVATIONS

Measurement 1st 2nd 3rd 4th

GRAPH
NOTES

+ 3 , × 3 : Numbers refer to Sensitivity

○ = 3% Strain at Failure

PROJECT: Geotechnical Investigation

CLIENT: Mattamy Homes

PROJECT LOCATION: 620 Lockhart Road, Barrie, Ontario

DATUM: Geodetic

BOREHOLE LOCATION: See Drawing 1 N 4910539.485 E 608901.801

DRILLING DATA

Method: Solid Stem Auger

Diameter: 150mm

Date: Sep/09/2020

REF. NO.: 20-231-400

ENCL NO.: 5

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	POCKET PEN. (C _u) (kPa)	NATURAL UNIT WT (kN/m ³)	METHANE AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
(m) ELEV DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS 0.3 m			SHEAR STRENGTH (kPa)									
								○ UNCONFINED + FIELD VANE & Sensitivity ● QUICK TRIAXIAL × LAB VANE									
								20 40 60 80 100			10 20 30						
269.0																	
268.9	TOPSOIL: 250mm		1	SS	6												
0.3	SILT: disturbed material, trace sand, some organic, brown, moist, loose																
268.2																	
1 0.8	SILT: some sand, trace gravel, trace clay, brown, moist, loose		2	SS	7		268										
267.5																	
1.5	SILTY SAND TILL: some gravel, trace clay, grey, moist, dense to very dense		3	SS	32		267										
2																	
3			4	SS	58		266										
4																	
5			5	SS	68		265										
6																	
7			6	SS	>100		264										
8																	
260.8																	
8.2	END OF BOREHOLE: Notes: 1) 50mm dia. monitoring well installed upon completion. 2) Water level Reading: Date: Water Level (mbgl): Sept 30, 2020 5.69 Jan 11, 2021 5.11																

GROUNDWATER ELEVATIONS

Measurement 1st 2nd 3rd 4th

GRAPH NOTES

+ 3, X 3: Numbers refer to Sensitivity

○ = 3% Strain at Failure

DS SOIL LOG 20-231-400 MATTAMY, 620 LOCKHART GPJ DS GDT 21/1/13

PROJECT: Geotechnical Investigation

CLIENT: Mattamy Homes

PROJECT LOCATION: 620 Lockhart Road, Barrie, Ontario

DATUM: Geodetic

BOREHOLE LOCATION: See Drawing 1 N 4910273.423 E 608949.757

DRILLING DATA

Method: Solid Stem Auger

Diameter: 150mm

Date: Sep/10/2020

REF. NO.: 20-231-400

ENCL NO.: 6

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	POCKET PEN. (C _u) (kPa)	NATURAL UNIT WT (kN/m ³)	METHANE AND GRAIN SIZE DISTRIBUTION (%)									
(m) ELEV DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS 0.3 m			SHEAR STRENGTH (kPa)							WATER CONTENT (%)			GR	SA	SI	CL			
								20 40 60 80 100							10 20 30									
								○ UNCONFINED + FIELD VANE & Sensitivity ● QUICK TRIAXIAL × LAB VANE																
265.2							265																	
265.0																								
264.4							264																	
263.7							263																	
262.0							262																	
261.0							261																	
260.0							260																	
259.0							259																	
258.0							258																	
257.0							257																	
8.2																								

GROUNDWATER ELEVATIONS

Measurement 1st 2nd 3rd 4th

GRAPH NOTES

+ 3, × 3: Numbers refer to Sensitivity

○ = 3% Strain at Failure

PROJECT: Geotechnical Investigation

CLIENT: Mattamy Homes

PROJECT LOCATION: 620 Lockhart Road, Barrie, Ontario

DATUM: Geodetic

BOREHOLE LOCATION: See Drawing 1 N 4910014.013 E 609016.963

DRILLING DATA

Method: Solid Stem Auger

Diameter: 150mm

Date: Sep/11/2020

REF. NO.: 20-231-400

ENCL NO.: 7

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	POCKET PEN. (C _u) (kPa)	NATURAL UNIT WT (kN/m ³)	METHANE AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL						
(m) ELEV DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS 0.3 m			SHEAR STRENGTH (kPa)										WATER CONTENT (%)					
256.5	0.0		1	SS	11		256										3 49 37 11						
255.3	255.3		2	SS	13		255																
255.2	1.4			3	SS		8	254															
2				4	SS		4	253															
3				5	SS		6	252															
4				6	SS		13	251															
251.8	4.7		7	SS	21		250											spoon refusal on boulder					
5			8	SS	20		249																
6			9	SS	>100		248																
250.4		6.1	10	SS	>100		247									cobble in spoon							
7																							
8																9		SS	>100	247			
9	246.7	9.8	END OF BOREHOLE: Notes: 1) Water level at 1.5m during drilling. 2) No cave-in upon completion.																				

GROUNDWATER ELEVATIONS

Measurement

GRAPH NOTES

+ 3, × 3: Numbers refer to Sensitivity

○ = 3% Strain at Failure

DS SOIL LOG 20-231-400 MATTAMY, 620 LOCKHART GPJ DS GDT 21/1/13

PROJECT: Geotechnical Investigation

CLIENT: Mattamy Homes

PROJECT LOCATION: 620 Lockhart Road, Barrie, Ontario

DATUM: Geodetic

BOREHOLE LOCATION: See Drawing 1 N 4910578.452 E 609026.09

DRILLING DATA

Method: Solid Stem Auger

Diameter: 150mm

Date: Sep/09/2020

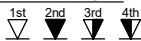
REF. NO.: 20-231-400

ENCL NO.: 8

[illegible]

GROUNDWATER ELEVATIONS

Measurement



GRAPH
NOTES

+ 3, × 3: Numbers refer to Sensitivity

○ $\epsilon = 3\%$ Strain at Failure

PROJECT: Geotechnical Investigation

CLIENT: Mattamy Homes

PROJECT LOCATION: 620 Lockhart Road, Barrie, Ontario

DATUM: Geodetic

BOREHOLE LOCATION: See Drawing 1 N 4910311.883 E 609091.492

DRILLING DATA

Method: Solid Stem Auger

Diameter: 150mm

Date: Sep/10/2020

REF. NO.: 20-231-400

ENCL NO.: 9

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT W _P	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	POCKET PEN. (C _u) (kPa)	NATURAL UNIT WT (kN/m ³)	METHANE AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
(m) ELEV DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS 0.3 m			SHEAR STRENGTH (kPa)									
268.5								20	40	60	80	100					
268.0	TOPSOIL: 200mm																
0.2	SANDY SILT: some organics, trace gravel, brown, moist, loose, weathered		1	SS	5		268										
267.6																	
0.9	SILTY SAND TILL: with gravel, trace clay, grey, moist, compact small seam of red sand at 1.2m dense		2	SS	16		267										
			3	SS	31		266										
			4	SS	41		265										
			5	SS	62		264										
	seam of red sand		6	SS	81		263										
	saturated		7	SS	>100		262										
260.9							261										
7.6	SAND: some gravel, grey, saturated, dense		8	SS	35												
260.3																	
8.2	END OF BOREHOLE: Notes: 1) Water at depth of 4.6m at completion of drilling. 2) Cave-in at 6.6m upon completion																

GROUNDWATER ELEVATIONS

Measurement 1st 2nd 3rd 4th

GRAPH NOTES

+ 3, X 3: Numbers refer to Sensitivity

○ = 3% Strain at Failure

PROJECT: Geotechnical Investigation

CLIENT: Mattamy Homes

PROJECT LOCATION: 620 Lockhart Road, Barrie, Ontario

DATUM: Geodetic

BOREHOLE LOCATION: See Drawing 1 N 4910084.417 E 609199.788

DRILLING DATA

Method: Solid Stem Auger

Diameter: 150mm

Date: Sep/11/2020

REF. NO.: 20-231-400

ENCL NO.: 10

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m ³)	METHANE AND GRAIN SIZE DISTRIBUTION (%)						
(m)	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS 0.3 m			SHEAR STRENGTH (kPa)										WATER CONTENT (%)			GR	SA	SI	CL
ELEV DEPTH								○ UNCONFINED ● QUICK TRIAXIAL	+ FIELD VANE & Sensitivity × LAB VANE	20	40	60						80	100	10				
263.0																								
262.9	TOPSOIL: 150mm		1	SS	4									○										
262.1	SANDY SILT: with gravel, some cobble, some clay, brown, wet, loose, weathered																							
262.1	SANDY SILT: some gravel, trace clay, brown, wet, loose to compact		2	SS	10									○										
261.2																								
261.2			3	SS	8									○										
260.5																								
260.5	SILTY SAND: Brown, trace gravel, compact, saturated		4	SS	12									○										
260.0																								
260.0	SILTY SAND TILL: trace gravel, trace clay, grey, wet, loose to dense		5	SS	5									○						10 48 33 9				
259.4																								
259.4			6	SS	15									○										
258.6																								
258.6			7	SS	46									○										
257.6																								
257.6																								
256.9																								
256.9	SILTY SAND: trace gravel and cobbles, interbedded with sand and silt, brown, wet, very dense		8	SS	60									○										
255.7																								
255.7																								
255.4																								
255.4																								
254.8	SANDY SILT: Grey, with gravel, wet, very dense		9	SS	>100									○						spoon bouncing				
254.8																								
8.2	END OF BOREHOLE: Notes: 1) 50mm dia. monitoring well installed upon completion. 2) Water level Reading: Date: Water Level (mbgl): Sept 30, 2020 0.73 Jan 11, 2021 0.63																							

GROUNDWATER ELEVATIONS

Measurement 1st 2nd 3rd 4th

GRAPH
NOTES+ 3, × 3: Numbers refer
to Sensitivity

○ = 3% Strain at Failure

DS SOIL LOG 20-231-400 MATTAMY, 620 LOCKHART GPJ DS.GDT 21/1/13

PROJECT: Geotechnical Investigation

CLIENT: Mattamy Homes

PROJECT LOCATION: 620 Lockhart Road, Barrie, Ontario

DATUM: Geodetic

BOREHOLE LOCATION: N 4910484.333 E 608995.132

DRILLING DATA

Method: Solid Stem Auger

Diameter: 150mm

Date: Dec/03/2020

REF. NO.: 20-231-400

ENCL NO.: 11

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m ³)	METHANE AND GRAIN SIZE DISTRIBUTION (%)			
(m) ELEV DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS 0.3 m			SHEAR STRENGTH (kPa)				W _p W W _L					GR SA SI CL			
												○ UNCONFINED + FIELD VANE & Sensitivity								
270.0								20	40	60	80	100								
268.9																				
268.5																				
268.5																				
266.9																				
266.3																				
3.7																				

GROUNDWATER ELEVATIONS

Measurement 1st 2nd 3rd 4th

GRAPH NOTES

+ 3, × 3: Numbers refer to Sensitivity

○ = 3% Strain at Failure

PROJECT: Geotechnical Investigation

CLIENT: Mattamy Homes

PROJECT LOCATION: 620 Lockhart Road, Barrie, Ontario

DATUM: Geodetic

BOREHOLE LOCATION: N 4910486.773 E 608945.472

DRILLING DATA

Method: Solid Stem Auger

Diameter: 150mm

Date: Dec/03/2020

REF. NO.: 20-231-400

ENCL NO.: 12

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT		POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m ³)	METHANE AND GRAIN SIZE DISTRIBUTION (%)			
(m) ELEV DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS 0.3 m			SHEAR STRENGTH (kPa)		W _p W W _L				GR SA SI CL			
20 40 60 80 100								20 40 60 80 100		10 20 30							
○ UNCONFINED + FIELD VANE & Sensitivity								● QUICK TRIAXIAL × LAB VANE									
270.6																	
270.3			1	SS	6		270										
0.3																	
269.7																	
0.9			2	SS	5		269										
268.8																	
1.8			3	SS	5		268										
267.6																	
3.1			4	SS	29		267										
267.0																	
3.7			5	SS	37												
END OF BOREHOLE:																	
Notes: 1) Borehole remained open at the completion of drilling.																	

GROUNDWATER ELEVATIONS

Measurement 1st 2nd 3rd 4th

GRAPH
NOTES

+ 3 , × 3 : Numbers refer to Sensitivity

○ = 3% Strain at Failure

PROJECT: Geotechnical Investigation

CLIENT: Mattamy Homes

PROJECT LOCATION: 620 Lockhart Road, Barrie, Ontario

DATUM: Geodetic

BOREHOLE LOCATION: N 4910419.047 E 608969.214

DRILLING DATA

Method: Solid Stem Auger

Diameter: 150mm

Date: Dec/03/2020

REF. NO.: 20-231-400

ENCL NO.: 13

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _P	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	POCKET PEN (C _u) (kPa)	NATURAL UNIT WT (kN/m ³)	METHANE AND GRAIN SIZE DISTRIBUTION (%)		
(m) ELEV DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS 0.3 m			SHEAR STRENGTH (kPa)												
								○ UNCONFINED	● QUICK TRIAXIAL	+	×	FIELD VANE & Sensitivity							LAB VANE	
270.6							20	40	60	80	100						GR	SA	SI	CL
270.3	0.9	TOPSOIL: 300mm		1	SS	7														
0.3		SAND: trace organic, brown, moist, loose, disturbed																		
269.7	0.9	SAND: some gravel, trace cobble, brown, moist, compact to dense		2	SS	16														
		gravelly at 1.5m																		
				3	SS	17														
				4	SS	23														
		layered																		
266.9				5	SS	30														
3.7		END OF BOREHOLE:																		
		Notes: 1) Borehole remained open upon completion of drilling.																		

GROUNDWATER ELEVATIONS

Measurement 1st 2nd 3rd 4th

GRAPH
NOTES+ 3 , × 3 : Numbers refer
to Sensitivity

○ = 3% Strain at Failure

PROJECT: Geotechnical Investigation

CLIENT: Mattamy Homes

PROJECT LOCATION: 620 Lockhart Road, Barrie, Ontario

DATUM: Geodetic

BOREHOLE LOCATION: N 4910180.413 E 609083.344

DRILLING DATA

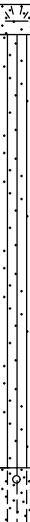
Method: Solid Stem Auger

Diameter: 150mm

Date: Dec/04/2020

REF. NO.: 20-231-400

ENCL NO.: 14

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT				POCKET PEN (C _u) (kPa)	NATURAL UNIT WT (kN/m ³)	METHANE AND GRAIN SIZE DISTRIBUTION (%)				
(m) ELEV DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS 0.3 m			SHEAR STRENGTH (kPa)										
261.6	TOPSOIL: 300mm																	
261.3	SANDY SILT: trace gravel, trace clay, brown, wet, loose		1	SS	6													
			2	SS	7													
			3	SS	11													
			4	SS	6													
			5	SS	12													
	compact below 3m																	
257.0	SILTY SAND TILL: tracee gravel, grey, wet, very dense		6	SS	50													
256.5	END OF BOREHOLE:																	
5.2																		

GROUNDWATER ELEVATIONS

Measurement 1st 2nd 3rd 4th

GRAPH
NOTES

+ 3 , × 3 : Numbers refer to Sensitivity

○ = 3% Strain at Failure

○ $\epsilon = 3\%$ Strain at Failure

PROJECT: Geotechnical Investigation

CLIENT: Mattamy Homes

PROJECT LOCATION: 620 Lockhart Road, Barrie, Ontario

DATUM: Geodetic

BOREHOLE LOCATION: N 4910057.43 E 608896.02

DRILLING DATA

Method: Solid Stem Auger

Diameter: 150mm

Date: Dec/04/2020

REF. NO.: 20-231-400

ENCL NO.: 16

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT					POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m ³)	METHANE AND GRAIN SIZE DISTRIBUTION (%)
(m) ELEV DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS 0.3 m			SHEAR STRENGTH (kPa)							
254.0								20 40 60 80 100							
253.9	TOPSOIL: 100mm		1	SS	6			20 40 60 80 100							GR SA SI CL
253.7	SANDY SILT: brown to grey, wet, compact		2	SS	12		253								
252.5	SILTY CLAY: grey, wet, soft		3	SS	7		252								
1.5	sand seams below 2.3m		4	SS	8		251								
251.0	SILTY SAND: trace gravel, grey, saturated, loose		5	SS	11		250								
3.1			6	SS	6		249								
			7	SS	6		248								
			8	SS	9		247								
245.8	some gravel below 7.6m						246								
8.2	END OF BOREHOLE:														

GROUNDWATER ELEVATIONS

Measurement 1st 2nd 3rd 4th

GRAPH
NOTES

+ 3, × 3: Numbers refer to Sensitivity

○ = 3% Strain at Failure

PROJECT: Geotechnical Investigation

CLIENT: Mattamy Homes

PROJECT LOCATION: 620 Lockhart Road, Barrie, Ontario

DATUM: Geodetic

BOREHOLE LOCATION: N 4910454.565 E 608519.325

DRILLING DATA

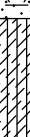
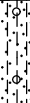
Method: Solid Stem Auger

Diameter: 150mm

Date: Dec/02/2020

REF. NO.: 20-231-400

ENCL NO.: 17

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT				POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m ³)	METHANE AND GRAIN SIZE DISTRIBUTION (%)						
(m) ELEV DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS 0.3 m			SHEAR STRENGTH (kPa) ○ UNCONFINED + FIELD VANE & Sensitivity ● QUICK TRIAXIAL × LAB VANE							PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L			
254.1	TOPSOIL: 300mm						254	20	40	60	80	100								
253.8	CLAYEY SILT: some sand, trace gravel, brown, moist to wet, soft		1	SS	6		254													
0.3								W. L. 253.6 m Jan 11, 2021												
252.6				2	SS		3	253												
1.5			SANDY SILT: trace gravel, trace clay, brown, wet, loose						252											
251.8																				
2.3	SILTY SAND TILL: trace gravel, brown to grey, wet, dense to very dense				4		SS	31	251											
							5	SS	>100											
				6	SS	>100														

GROUNDWATER ELEVATIONS

Measurement 1st 2nd 3rd 4th

GRAPH NOTES

+ 3 , × 3 : Numbers refer to Sensitivity

○ = 3% Strain at Failure

BOREHOLE LOCATION: N 4910651.555 E 609062.995

Measurement    

PROJECT: Geotechnical Investigation

CLIENT: Mattamy Homes

PROJECT LOCATION: 620 Lockhart Road, Barrie, Ontario

DATUM: Geodetic

BOREHOLE LOCATION: N 4910081.23 E 609200.298

DRILLING DATA

Method: Solid Stem Auger

Diameter: 150mm

Date: Dec/04/2020

REF. NO.: 20-231-400

ENCL NO.: 19

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT			NATURAL MOISTURE CONTENT			LIQUID LIMIT			POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m ³)	METHANE AND GRAIN SIZE DISTRIBUTION (%)																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
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GROUNDWATER ELEVATIONS

Measurement 1st 2nd 3rd 4th

GRAPH NOTES

+ 3, × 3: Numbers refer to Sensitivity

○ = 3% Strain at Failure

PROJECT: Geotechnical Investigation

CLIENT: Mattamy Homes

PROJECT LOCATION: 620 Lockhart Road, Barrie, Ontario

DATUM: Geodetic

BOREHOLE LOCATION: N 4910262.152 E 609040.767

DRILLING DATA

Method: Solid Stem Auger

Diameter: 150mm

Date: Dec/04/2020

REF. NO.: 20-231-400

ENCL NO.: 20

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m ³)	METHANE AND GRAIN SIZE DISTRIBUTION (%)
(m) ELEV DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS 0.3 m			SHEAR STRENGTH (kPa)									
266.3								20	40	60	80	100					
0.0	TOPSOIL: 300mm																
266.0																	
0.3	SILTY CLAY: trace sand, redish brown, moist, soft		1	SS	7		266										
265.5																	
0.8	SANDY SILT: trace gravel, trace clay, brown, moist to wet, loose to compact		2	SS	7		265										
			3	SS	21		264										
264.0																	
2.3	SILTY SAND TILL: trace gravel, grey, moist to wet, very dense		4	SS	62		263										
			5	SS	50		262										
			6	SS	>100		261										
			7	SS	>100		260										
			8	SS	80		259										
258.1																	
8.2	END OF BOREHOLE: Notes: 1) 50mm dia. monitoring well installed upon completion. 2) Water level Reading: Date: Jan 11, 2021 Water Level (mbgl): 2.57																

GROUNDWATER ELEVATIONS

Measurement 1st 2nd 3rd 4th

GRAPH
NOTES+ 3, × 3: Numbers refer
to Sensitivity

○ = 3% Strain at Failure

C:\Project\20-231-400\Shapes\BH Location.qgs



Legend

-  Site Boundary
-  Borehole
-  Monitoring Well



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Client:

Mattamy Homes

Project:
Geotechnical Investigation - 620 Lockhart Road, Barrie ON

Title:
Borehole and Monitoring Well Location Plan



Size: 11x17	Approved By: D.D	Drawn By: M.Z	Date: January 2021
	Scale: As Shown	Project No.: 20-231-400	Figure No.: 1
Rev: 0	Image/Map Source: <i>Google Satellite Image</i>		



BURNSIDE

[THE DIFFERENCE IS OUR PEOPLE]

Appendix C

Hydrogeological Report

**Hydrogeological Assessment
620 Lockhart Road**

**Mattamy (Lockhart) Limited
Barrie, Ontario**

**Hydrogeological Assessment
620 Lockhart Road**

**Mattamy (Lockhart) Limited
Barrie, Ontario**

**R.J. Burnside & Associates Limited
292 Speedvale Avenue West Unit 20
Guelph ON N1H 1C4 CANADA**

**July 2021
3000052092.0001**

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Record of Revisions

Revision	Date	Description
-	July 8, 2021	Initial Submission to Mattamy (Lockhart) Limited

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Table of Contents

1.0	Introduction.....	1
1.1	Scope of Work	1
2.0	Physical Setting	3
2.1	Topography and Drainage	3
2.2	Geology	3
2.3	Regional Hydrostratigraphy	3
2.4	Local Stratigraphy.....	5
3.0	Hydrogeology.....	5
3.1	Hydraulic Conductivity	5
3.1.1	Grainsize Analysis.....	5
3.1.2	Single Well Response Tests.....	6
3.1.3	Hydraulic Conductivity Discussion.....	6
3.2	Local Groundwater Use	7
3.3	Water Level Monitoring Results	8
3.4	Interpreted Groundwater Flow Pattern	9
3.5	Recharge and Discharge Conditions	9
3.6	Significant Groundwater Recharge Areas and Ecologically Significant Groundwater Recharge Areas	10
3.7	Aquifer Vulnerability.....	11
3.8	Water Quality.....	11
3.8.1	Groundwater Quality	11
4.0	Water Balance	12
4.1	Water Balance Components	13
4.2	Approach and Methodology	14
4.3	Water Balance Component Values	15
4.4	Pre-Development Water Balance (Existing Conditions)	15
4.5	Potential Urban Development Impacts to Water Balance.....	15
4.6	Post-Development Water Balance with No Mitigation	16
4.7	Mitigation Measures.....	17
5.0	Development Considerations.....	17
5.1	Construction Below the Water Table.....	17
5.2	Groundwater Control in Foundations	18
5.3	Local Groundwater Supply Wells	18
5.4	Well Decommissioning	18
6.0	References	20

Tables

Table 1: Summary of Grainsize Analyses	6
Table 2: Single Well Response Testing Results	6
Table 3: Water Balance Component Values	15

Figures

Figure 1	Site Location
Figure 2	Monitoring Locations
Figure 3	Topography and Drainage
Figure 4	Surficial Geology
Figure 5	Borehole, Well and Cross Section Locations
Figure 6	Interpreted Geological Cross Section A-A'
Figure 7	Interpreted Geological Cross Section B-B'
Figure 8	MECP Water Well Locations
Figure 9	Interpreted Groundwater Flow
Figure 10	Recharge Areas
Figure 11	Aquifer Vulnerability

Appendices

Appendix A	MECP Well Records
Appendix B	Borehole Logs
Appendix C	Hydraulic Conductivity
Appendix D	Groundwater Levels
Appendix E	Water Quality
Appendix F	Water Balance

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1.0 Introduction

R.J. Burnside & Associates Limited (Burnside) has been retained by Mattamy (Lockhart) Limited to complete a hydrogeological assessment of the lands known as 620 Lockhart Road, Barrie in support of a draft plan of subdivision. The Mattamy lands, herein referred to as the subject lands are located north of Lockhart Road and west of Yonge Street in the City of Barrie, Ontario (Figure 1). The subject lands are located within the Barrie Annexed Lands and the OPA 39 Hewitt's Secondary Plan Area (SPA) located on the southern boundary of the City of Barrie. The Hewitt's Creek SPA includes lands bounded by Lockhart Road to the south, Sideroad 20 to the east, Maplevue Drive and Big Bay Point Road to the north (Figure 1). In 2016, a Subwatershed Impact Study (SIS) of the Hewitt's SPA was completed for the Hewitt's Creek Landowners Group (Burnside, 2016). The SIS evaluated the hydrogeological setting of the Hewitt's SPA, including the subject lands at a regional scale. The SIS forms the baseline information that the current study seeks to build upon in support of the draft plan application.

1.1 Scope of Work

The scope of work completed for the hydrogeological study was developed to build upon the more regional work completed for the SIS (Burnside, 2016) and to address requirements for hydrogeological studies in support of draft plan approval. The scope of work included completion of the following tasks:

The scope of the hydrogeological assessment involved a review of available regional information as well as the completion of site-specific investigations as described below:

1. Review of published geological and hydrogeological information: A review of background material for the area, including topography, surficial geology and bedrock geology mapping and existing geotechnical and hydrogeological reports was completed to assess the regional hydrogeological setting.
2. Review of the Ministry of the Environment, Conservation and Parks (MECP) water well records: The MECP maintains a database that provides geological records of water supply wells drilled in the province. A list of the available MECP water well records for local wells is provided in Appendix A and the well locations are plotted on Figure 8. It is noted that the well locations listed in the MECP records are approximations only and may not be representative of the precise well locations in the field. These well data were compiled and mapped to characterize the local groundwater resources and assess potential impacts to the local private wells from development of the subject lands.
3. Establish groundwater monitoring network: Groundwater monitoring locations were established to determine the depth to water table and characterize

seasonal variations in the water table. Wells installed as part of geotechnical investigation were included in the monitoring program. The locations of the monitoring wells included in the monitoring network are shown on Figure 2. The monitoring well construction details are provided on the borehole logs in Appendix B.

4. Hydraulic conductivity testing: Burnside conducted single well response tests in order to determine hydraulic conductivity. Single well response tests were completed at 4 groundwater monitoring wells (MW1, MW3d, MW4 and MW5) in May 2021. The hydraulic conductivity field testing results are provided in Appendix C.
5. Monitoring of groundwater levels: Monitoring has been completed to measure the depth to the water table and assess the horizontal and vertical groundwater flow conditions. Groundwater level monitoring was completed from January 2021 to June 2021. Automatic water level recorders (dataloggers) were installed in three monitoring wells to document the range of groundwater fluctuations and the response of aquifers to precipitation events (MW3d, MW4 and BH20-4). Barometric data from a barologger installed in the vicinity of the subject lands was used for calibration of the datalogger results. The groundwater monitoring data and hydrographs are provided in Appendix D.
6. Water quality review and testing: Water quality data was collected from selected monitoring wells to typify the groundwater quality in the vicinity of the subject lands. Groundwater samples were collected in 2021 from MW3d and MW4. The water samples were submitted to a qualified laboratory for analyses of general water quality indicators (e.g., pH, hardness, and conductivity), basic ions (including chloride and nitrate) and selected metals to characterize the background water quality at the property. The laboratory water quality data are provided in Appendix E.
7. Water balance calculations: Pre and post-development water balance calculations have been completed to assess the groundwater infiltration volumes across the study area. The local climate data and detailed water balance calculations are provided in Appendix F.
8. Data compilation, assessment of site conditions and reporting: All data compiled as part of the above scope were analyzed and a detailed report on site-specific conditions was prepared to outline the findings and recommendations of the study. The current report provides reporting on the above items.

2.0 Physical Setting

2.1 Topography and Drainage

The subject lands are located within the Lake Simcoe watershed and the majority of the subject lands is located in the Lovers Creek subwatershed. A small portion of the subject lands, the northeast corner is located in the Hewitt's Creek subwatershed (Figure 3). The topography of the subject lands is gently rolling and slopes to the west and southwest. The highest elevation is located at the northeast corner of the subject lands at approximately 272 meters above sea level (masl). The lowest portion of the subject lands is located in the southwest corner at Lockhart Road at an elevation of approximately 253 masl. There are no watercourses on the subject lands.

2.2 Geology

The subject lands are located in the physiographic region known as the Peterborough Drumlin Field. The region is characterized as a rolling drumlinized till plain. The drumlins through the region are comprised of highly calcareous till (Chapman & Putnam, 1984).

The overburden was deposited as a series of advances and retreats of the Simcoe glacial ice lobe. This has resulted in drumlinized sheets of glacial till (Newmarket till), stratified glaciolacustrine deposits of sand and gravel, littoral-foreshore deposits and massive-well laminated deposits of sand and gravel. A review of the quaternary geology mapping for the area (OGS, 2010) indicates that the overburden sediments of the subject lands consist of silty to sandy glacial till, ice contact stratified sediments of sand and gravel and glaciolacustrine deposits of silty and clay in the southwest corner of the subject lands (Figure 4).

The bedrock underlying the subject lands is mapped as the Lindsay Formation of the Simcoe Group, which consists of limestone and shale (OGS, 2007).

2.3 Regional Hydrostratigraphy

The sediments found at surface within a study area will influence groundwater occurrence and flow. Within the subject lands, the surficial sediments are overburden sediments of glacial origin. The overburden has been interpreted by regional studies such as the Tier 3 Water Balance (AquaResource, 2011) and Source Water Protection Assessment Report (LSRCA, 2012) to consist of alternating sequences of coarser-grained permeable areas (aquifers) and finer-grained less permeable areas (aquitards) of varying thicknesses. The basic hydrostratigraphic sequence that was modelled in the regional studies (AquaResource, 2011) consists of four main aquifer areas (A1-A4) and four main aquitards (C1 to C4) with a confining layer (UC) over the uppermost aquifer (A1).

A description of the interpreted regional hydrostratigraphic framework is provided below (LSRCA, 2012):

- **Surficial Geology Layer** – This layer represents coarse grained sediments in stream beds and at surface surficial geology areas that overly the UC. The thickness ranges from 0.1 m to 3 m.
- **UC – Upper Confining Layer** – Represents smaller areas of less permeable surficial material. The upper confining layer has been mapped as coarse-grained lacustrine deposits which are part of a regionally extensive sand plain (LSRCA, 2012). Regional studies such as the AquaResource (2011) report indicate that the confining layer (UC) is patchy in the area of the study area.
- **A1** – Represents the uppermost aquifer. Frequently exists as a surficial unconfined aquifer. It is generally associated with coarse grained glacial and interglacial sediments mapped as ice contact stratified drift. The majority of the local domestic wells are completed within this area. The upper aquifer A1 is reported to be present throughout the larger Barrie area, and has been interpreted to occur extensively in the study area.
- **C1 – Upper aquitard**; Described as varved clay and silt (LRSCA, 2012).
- **A2 – Intermediate aquifer** which is stratigraphically equivalent to areas within the Northern Till. The aquifer is generally described as being composed of sand with some clast rich portions (LRSCA, 2012). This area is used for the Innisfil Heights water supply.
- **C2 – Intermediate aquitard**.
- **A3** – This area constitutes the main Barrie municipal aquifer and is the source of the Stroud water supply; it is stratigraphically equivalent to the Thorncliffe deposits in the Upland regions.
- **C3 – Lower aquitard**.
- **A4 – Lower aquifer**, thin and sometimes combined with A3 where C3 is thin or absent.
- **C4 – Lower aquitard** but may also represent weathered bedrock.

2.4 Local Stratigraphy

Eighteen geotechnical boreholes were completed on the subject lands in 2020 by DS Consultants Limited (DSCL) (logs provided in Appendix B and locations shown on Figure 5). The boreholes indicated that the overburden stratigraphy is generally composed of layers of glacial till and sand. The till deposits were generally composed of sandy silt to silty sand with varying amounts of clay and gravel. Occasional layers of silty clay, silt, sandy silt and sand were encountered.

To illustrate the shallow stratigraphy of the subject lands, schematic geologic cross-sections have been prepared (Figures 6 and 7) using the MECP well records (Appendix A) and the soils information collected during drilling of boreholes and monitoring wells (Appendix B). The locations of the cross sections are illustrated on Figure 5 along with the locations of water wells and boreholes used in the construction of the cross-sections. Where appropriate, the interpretations of the cross-sections was aided by the knowledge gained from the SIS.

The cross-sections illustrate that the subject lands are underlain by sandy silt to silty sand till with a thickness of 5 to 10 m (Figures 6 and 7). Underlying the till layer is a sand layer that is interpreted to form the local aquifer where supply wells are completed. In the northeast portion of the subject lands the sand layer is unconfined (Figure 6).

3.0 Hydrogeology

3.1 Hydraulic Conductivity

In order to predict aquifer responses and groundwater movement it is important to understand the hydrogeological properties of the subsurface materials encountered at a particular site. Hydraulic conductivity is a measure of the ability of soils to transmit groundwater. High hydraulic conductivity means that groundwater is easily transmitted, while a low hydraulic conductivity is associated with low potential for groundwater transmission. There are various methods that can be used to assess soil hydraulic conductivity, and different methods are suitable for different circumstances. Grainsize data and soil characteristics can be used to provide a general estimate of hydraulic conductivity. In situ bail-down or slug-testing methods are used in groundwater monitoring wells to assess site-specific hydraulic conductivity. These methods have been used to estimate the hydraulic conductivity of the soils encountered in the study area as discussed below.

3.1.1 Grainsize Analysis

Grainsize analysis from the geotechnical report (DSCL, 2020) were reviewed in order to obtain estimates of hydraulic conductivity. To estimate hydraulic conductivity based on grainsize analysis, an empirical formula method known as the Hazen estimation is used.

This method is an approximation of hydraulic conductivity based on grainsize curves for sandy soils. The approximation does not strictly apply to finer grained materials; however, the approximation is still considered useful for finer grained materials to provide a general indication of the range of the hydraulic conductivity values. Hydraulic conductivity values were derived empirically using the Hazen method for four samples collected during borehole drilling on the subject lands. The grainsize distribution graphs are provided in Appendix C and the calculated hydraulic conductivity values are provided in Table 1.

Table 1: Summary of Grainsize Analyses

Sample ID	Depth of Sample (mbgs)	Soil Classification	% Fines	Estimated Hydraulic Conductivity (cm/s)
BH20-1 SS4	2.3	Silty Sand Till	37	1.2×10^{-5}
BH20-3 SS3	1.5	Silty Clay	98	na
BH20-5 SS3	1.5	Silty Sand Till	42	5.3×10^{-6}
BH20-6 SS3	1.5	Silty Sand Till	48	2.3×10^{-6}
BH20-9 SS5	3.1	Silty Sand Till	42	5.3×10^{-6}

3.1.2 Single Well Response Tests

To assess the in-situ hydraulic conductivity of the sediments, single well response tests (bail-down tests) were conducted at monitoring wells MW1, MW4, MW5 and MW3d (BH20-9). The results from the tests were plotted (Appendix C) and analyzed to calculate hydraulic conductivity of the sediments screened. A summary the calculated hydraulic conductivities is provided below in Table 2.

Table 2: Single Well Response Testing Results

Monitoring Well	Screen Interval (mbgs)*	Formation Screened	Hydraulic Conductivity (cm/sec)
MW1	6.1 – 7.6	Silty Sand Till	2.7×10^{-6}
MW4	6.3 – 7.8	Silty Sand Till	1.4×10^{-5}
MW5	6.3 – 7.8	Silty Sand Till	4.3×10^{-8}
MW3d	5.6 – 7.1	Silty Sand	1.4×10^{-5}

*metres below ground surface

3.1.3 Hydraulic Conductivity Discussion

Grainsize analyses results indicate that the silty sand till sediments can range from 37% to 48% fines and the silty clay layer encountered at BH20-3 had 98% fines. The greater amount of fines within a deposit impacts the ability of the material to transmit water and

generally lowers the overall hydraulic conductivity. Groundwater flow is generally limited by fine grained sediments with lower hydraulic conductivity. The hydraulic conductivities estimated from the grainsize analyses for the dominant sediment type, silty sand till ranges between 10^{-5} to 10^{-6} cm/sec. The single well response test analyses resulted in similar hydraulic conductivities ranging from 10^{-5} to 10^{-6} cm/sec. The hydraulic conductivity measured at MW5 (4.3×10^{-8} cm/sec) was very low due to the till sediments being very dense.

3.2 Local Groundwater Use

The City of Barrie obtains its water supply from a combination of groundwater and surface water based sources. Municipal servicing is assumed to be available for lands within the municipal boundary and areas outside of the city are privately serviced. It is our understanding that municipal servicing is being extended as part of the development of the Hewitt's Secondary Plan Area. Areas that were previously privately serviced are assumed to still have individual private water supply wells as the servicing works are not yet complete however the subject lands were previously farm land and did not have extensive residential use.

A review of the MECP water well records indicated that there are approximately 10 water supply well records within 500 m of the subject lands. Based on the well records and interpreted hydrostratigraphy, most of these wells are completed in the surficial (local) aquifer with depths ranging from 7 m to 38 m. The cross-sections completed indicate that the top of the shallow productive aquifer zone is generally located at elevations between 245 and 255 masl and generally in excess of 5 m below grade across the subject lands. The locations of the MECP water well records are shown on Figure 8. As a condition of draft plan approvals for other developments in the Hewitt's SPA, the City of Barrie has required that a well survey and monitoring of domestic wells should take place. This condition requires that domestic wells within 300 m of individual properties be evaluated for impacts due to construction. On behalf of the Hewitt's Landowners Group, Burnside has undertaken a well survey of all lands within the Hewitt's SPA and is currently implementing a monitoring and mitigation plan for domestic wells. The Burnside monitoring and mitigation plan has been approved by the City of Barrie. Participation in the Landowners Group would allow the Burnside study to be utilized for the subject lands.

There are no municipal water supply wells located in the vicinity of the subject lands. The closest municipal supply wells are located on the west and northern sides of the city and more than 5 kilometers from the subject lands. The subject lands do not fall within any wellhead protection areas or intake protection zones associated with the City of Barrie water supply systems (LSRCA, 2012). The City of Barrie groundwater supply wells are located in deep aquifers (A3 and A4 in the regional hydrostratigraphy). These aquifers are interpreted to be found at elevations of 150 masl to 195 masl and 115 masl

to 160 masl respectively and are therefore significantly below (approximately 70 to 100 m below the surficial layer found on the subject lands) and separated from any potential impact due to the proposed development (AquaResource et al., 2011).

3.3 Water Level Monitoring Results

Groundwater levels were monitored at eight monitoring wells across the subject lands in order to gain information on groundwater distribution and fluctuations. Groundwater levels were monitored between January 2021 and June 2021. Additional groundwater monitoring is ongoing in order to obtain four seasons of monitoring, however the data that is available at the time of report preparation is being provided at this time. Groundwater level data is provided in tables and hydrographs in Appendix D. Groundwater elevations are plotted with daily precipitation data obtained from a nearby climate station – Barrie-Oro Climate Station (Climate Station ID#6117700) which is the closest station with daily precipitation values for 2021.

In addition to the manual water level measurements recorded at each location, automatic water level recorders (loggers) collected hourly water level data at MW3, BH20-4 and MW4. The datalogger data collected are included on the hydrographs provided in Appendix D.

The groundwater monitoring data show the following (refer to Figure 2 for the monitoring locations and the data tables and hydrographs in Appendix D):

- The groundwater table is interpreted to be dependent on the topography and local geological conditions. From January 2021 to June 2021, groundwater elevations in the monitoring wells ranged from 252.7 masl to 264.3 masl. The period from January to June is typically expected to be the period during which the seasonal groundwater high is encountered and therefore this period is considered to be the most critical to understanding the potential for impacts due to high water table conditions.
- Typically, in shallow wells in southern Ontario, a seasonal groundwater level pattern is apparent with highest levels occurring in the spring, declining throughout the summer and early fall and then rising again in the late fall/early winter. Seasonal variations tend to be less in sandy sediments such as observed on the subject lands. Seasonal variation observed at the monitoring wells during the period of monitoring January to June ranged from 0.2 m at MW2 to 1.1 m at MW5 (Figures D-1 to D-8, Appendix D).
- MW1, MW3d, MW5 and BH20-3 are screened in a silty sand till that overlies the regional sand aquifer. Water levels at these wells were measured 0 to 2 m below surface (Figure D-1, D-3, D-5 and D-6, Appendix D). At MW5 and BH20-3 there is a

confining lens of silty clay resulting in potentiometric (pressure) heads that are near or above grade (Figure D-5 and Figure D-6, Appendix D).

- MW2 located at the topographic high in the northeast corner of the subject lands is screened in the unconfined regional sand aquifer at a depth of 9.9 m. Groundwater levels at MW2 ranged from 8.9 m to 9.1 m bgs and are reflective of unconfined conditions in this area of the subject lands (Figure D-2, Appendix D).
- Continuous water level data at MW3d, MW4 and BH20-4 are plotted against precipitation to determine if there is a correlation between changes in water level and the occurrence of precipitation events (Figures D-3, D-4 and D-7, Appendix D). The logger data shows correlation between water levels and large precipitation events (>20 mm) such as seen on March 26, 2021 and April 11, 2021. The impact on water levels differs between wells. At MW3d, the response is immediate while the response at BH20-4 appears to be more gradual and delayed. The wells are completed in the silty sand till layer which functions as a poor aquifer and the response to precipitation is interpreted to be due to fracturing of the till layer.

3.4 Interpreted Groundwater Flow Pattern

Groundwater flow on the subject lands is interpreted to be influenced by the surface topography with groundwater flow from the topographically higher areas towards topographically lower areas and surface water features. Groundwater elevation data (March 2021) obtained from the monitoring wells are shown on Figure 9, along with the interpreted groundwater elevation contours for the area. Arrows perpendicular to the groundwater elevation contours shown on Figure 9 illustrate the interpreted direction of the groundwater movement. Shallow groundwater flows on the subject lands is interpreted to be west and southwest.

3.5 Recharge and Discharge Conditions

Areas where water from precipitation or runoff infiltrates into the ground and moves downward (i.e., areas of downward hydraulic gradients) are known as recharge areas. These areas are generally found at relatively higher topographic elevation. Areas where groundwater moves upward (i.e., areas of upward hydraulic gradients) or where groundwater intersects the ground surface are discharge areas and these generally occur in areas of relatively lower topographic elevation, such as along watercourses.

When evaluating groundwater recharge or discharge conditions, nested wells (two wells screened at different depths at the same location) can be used to determine vertical hydraulic gradients and groundwater recharge or discharge conditions in the subsurface.

The monitoring of groundwater levels in the nested wells MW3s/d was intended to assist with the determination of vertical hydraulic gradients and thereby to assist with the evaluation of groundwater recharge or discharge conditions on the subject lands. Downward gradients calculated MW3s/d confirm that recharge conditions occur in this area (Figure D-3, Appendix D).

3.6 Significant Groundwater Recharge Areas and Ecologically Significant Groundwater Recharge Areas

Significant Groundwater Recharge Areas (SGRAs) can be described as areas that can effectively move water from the surface through the unsaturated soil zone to replenish available groundwater resources (LSRCA, 2012). SGRAs were mapped by the Source Water Protection Assessment Report (LSRCA, 2012) as a requirement of the Clean Water Act, 2006 and based on guidance provided by the MECP. The delineation of these areas was completed using numerical models and analyses that included the evaluation of numerous factors including precipitation, temperature and other climate data along with land use, soil type, topography and vegetation to predict groundwater recharge, runoff and evapotranspiration. SGRAs represent areas where the annual recharge rate is greater than 115% of the average recharge of 164 mm/year across the Lake Simcoe watershed (or greater than the threshold recharge rate of 189 mm/year) (LSRCA, 2012). Figure 10 indicates that SGRAs are mapped in the northeast portion of the subject lands. Boreholes in this area and groundwater monitoring at MW2 indicate that this area is sandy and unconfined and supports the interpretation that recharge occurs in this area.

Ecologically Significant Groundwater Recharge Areas (ESGRAs) were identified as areas of land that are assumed to support groundwater systems or environmentally sensitive features like lakes, cold water streams and wetlands (Earthfx, 2012). ESGRAs were delineated by identifying pathways in which recharge, if it occurred, would reach an ecologically significant feature. Ecologically significant features used for the delineation of the ESGRAs included headwater streams, cold water fisheries, wetlands, and brook trout and sculpin capture sites. Within the LSRCA jurisdiction, ESGRAs were delineated for the Barrie Creek, Lovers Creek and Hewitt's Creek subwatersheds by Earthfx (2012) using the model developed by AquaResources for the Source Protection studies. ESGRAs.

Figure 10 shows the LSRCA mapping of ESGRAs on the subject lands. Within the subject lands, areas mapped as ESGRAs are generally located in the southwest corner and along Lockhart Road and the north east portion of the subject lands (Figure 10). The actual recharge rates (based on expected groundwater flux) through the sediments confirmed on the subject lands are not expected to be significant as the silty sand till sediments that have been characterized as having a moderate to low hydraulic conductivity have a limited potential to move significant quantities of groundwater.

Higher recharge is expected in the northeast portion of the subject lands where sands were encountered at surface.

3.7 Aquifer Vulnerability

Aquifer vulnerability refers to the susceptibility of the aquifer to potential contamination. Some degree of protection for groundwater quality from natural and human impacts is provided by the soil above the water table. The degree of protection is dependent upon the depth to the water table (for unconfined aquifers) or the depth of the aquifer (for confined aquifers) and the type of soil above the water table or aquifer. As these two properties vary over any given area, the degree of protection or vulnerability of the groundwater to contamination also varies.

The aquifer vulnerability for the subject lands was mapped in the Lakes Simcoe and Couchiching-Black River SPA Part 1 Approved Assessment Report, Lake Simcoe Region Conservation Authority, 2015. The approach used by the LSRCA to create a regional vulnerability map using the aquifer vulnerability index (AVI) method. Using water well records for the area to determine the soil types and depths to aquifer an AVI was calculated for each delineated aquifer to produce a map of regional groundwater vulnerability. The high aquifer vulnerability mapping for the subject lands is provided in Figure 11. Most of the subject lands is mapped with a high vulnerability.

Depending on land use, runoff from urban developments may contain a variety of dilute contaminants such as suspended solids, chloride from road salt, oil and grease, metals, pesticide residues, bacteria and viruses. For groundwater, generally, with the exception of the dissolved constituents such as nitrogen and salt, most contaminants are attenuated by filtration during groundwater transport through the soils. The potential for effects on local groundwater quality from infiltration in the urban areas is therefore expected to be limited. It is noted from the geological cross-sections (Figures 6 and 7) that a layer of sandy silt till overlies the surficial sand aquifer that local wells are screened in. This layer will provide some protection to the underlying sand aquifer.

3.8 Water Quality

3.8.1 Groundwater Quality

Water quality data was collected from selected monitoring wells to typify the groundwater quality on the subject lands. Groundwater sampling was completed on May 14, 2021 at two groundwater monitoring wells (MW3d and MW4). The water samples were submitted to an accredited laboratory for analyses of general water quality indicators (e.g., pH, hardness, and conductivity), basic ions (including chloride and nitrate) and selected metals to characterize the background water quality.

For comparison purposes, the Ontario Drinking Water Quality Standards (ODWQS) and the Provincial Water Quality Objectives (PWQO) are provided with the results on Table E-1, Appendix E. The groundwater will not be used for drinking water however the ODWQS provides an indication of acceptable concentrations for potable water. The PWQO provide an indication of whether the groundwater on the subject lands could be discharged to surface water should pumping associated to construction be required. The groundwater testing results from the analytical laboratory are provided in Table E-1, Appendix E and discussed below.

- The results showed that the water generally met the Ontario Drinking Water Quality Standards (ODWQS) except for total hardness, alkalinity, turbidity and nitrate.
- Both samples exceeded the ODWQS for total hardness (100 mg/L) with values of 354 mg/L (MW3d) and 301 mg/L (MW4). Hardness in groundwater is caused by dissolved calcium and magnesium and is typically related to the geologic material of the aquifer. Elevated values are typical for aquifers in Southern Ontario. Exceedances in alkalinity are also related to dissolved calcium.
- Elevated nitrate was detected in both samples with values of 11.8 mg/L (MW3s) and 19.4 mg/L (MW4). Nitrate in shallow groundwater is typical of areas where agricultural activities are present such as the subject lands. Both samples exceed the ODWQS for nitrate, 10 mg/L and indicate that the groundwater has been impacted from agricultural activities in the vicinity of the subject lands.
- The results show that the groundwater samples met the Provincial Water Quality Objectives with the exception of total phosphorus at both wells and zinc at MW3d.
- Total phosphorus in the samples was 0.05 mg/L in MW3d and 1.46 mg/L in MW4 which exceeds the Provincial Water Quality Objective of 0.03 mg/L. Elevated phosphorus is another indication of impacts to the groundwater from agricultural activities in the vicinity of the subject lands.
- Zinc at MW3d was reported at a concentration of 0.034 mg/L which is slightly higher than the PWQO of 0.03 mg/L.

4.0 Water Balance

A water balance assessment is required in order to assess potential land development impacts on the local groundwater conditions. The water balance completed for this study has been completed to determine the pre-development recharge volumes (based on existing land use conditions) and the post-development recharge volumes that would be expected based on the proposed land use plan. The detailed water balance calculations are provided in Appendix F.

4.1 Water Balance Components

A water balance is an accounting of the water resources within a given area. As a concept, the water balance is relatively simple and may be estimated from the following equation:

$$P = S + ET + R + I$$

Where:

P	=	precipitation
S	=	change in groundwater storage
ET	=	evapotranspiration/evaporation
R	=	surface water runoff
I	=	infiltration

The components of the water balance vary in space and time and depend on climatic conditions as well as the soil and land cover conditions (i.e., rainfall intensity, land slope, soil hydraulic conductivity and vegetation). Runoff, for example, occurs particularly during periods of snowmelt when the ground is frozen, or during intense rainfall events. Precise measurement of the water balance components is difficult and as such, approximations and simplifications are made to characterize the water balance of a property. Field observations of the drainage conditions, land cover and soil types, groundwater levels and local climatic records are important input considerations for the water balance calculations.

The groundwater balance components for the subject lands are discussed below:

Precipitation (P)

The long-term average annual precipitation for the area of the subject lands is 933 mm based on data from the Environment Canada Barrie WPCC (Station 6110557, 44°22'33.012" N, 79°41'23.010" W, elevation 221.0 masl) for the period between 1981 and 2010. The climate station is located 6 km northeast of the subject lands. Average monthly records of precipitation and temperature from this station have been used for the water balance calculations in this study (Appendix F).

Storage (S)

Although there are groundwater storage gains and losses on a short-term basis, the net change in groundwater storage on a long-term basis is assumed to be zero so this term is dropped from the equation and not considered for the calculations.

Evapotranspiration (ET)

Evapotranspiration and evaporation components vary based on the characteristics of the land surface cover (i.e., type of vegetation, soil moisture conditions, perviousness of

surfaces, etc.). Potential evapotranspiration (PET) refers to the water loss from a vegetated surface to the atmosphere under conditions of an unlimited water supply. The actual rate of evapotranspiration (AET) is generally less than the PET under dry conditions (i.e., during the summer when there is a soil moisture deficit). In this report, the PET and AET have been calculated using a soil-moisture balance approach.

Water Surplus ($R + I$)

The difference between the mean annual P and the mean annual ET is referred to as the water surplus. Part of the water surplus travels across the surface of the soil as surface or overland runoff (R) and the remainder infiltrates the surficial soil (I). The infiltration is comprised of two end member components: one component that moves vertically downward to the groundwater table (referred to as recharge) and a second component that moves laterally through the topsoil profile or shallow soils as interflow that re-emerges locally to surface (i.e., as runoff) at some short time following cessation of precipitation. As opposed to the “direct” component of surface runoff that occurs during precipitation or snowmelt events, interflow becomes an “indirect” component of runoff. The interflow component of surface runoff is not accounted for in the water balance equation cited above since it is often difficult to distinguish between interflow and direct (overland) runoff, however both interflow and direct runoff together form the total surface water runoff component.

4.2 Approach and Methodology

The analytical approach to calculate the water balance utilized for this assessment involves monthly soil-moisture balance calculations to determine the pre-development (based on existing land use) infiltration volumes. For the purposes of this study, the water balance calculations were undertaken using a spreadsheet model. The soil-moisture balance approach utilized assumes that soils do not release water as potential recharge while a soil moisture deficit exists. During wetter periods, any excess of precipitation over evapotranspiration first goes to restore soil moisture. Once the soil moisture deficit is overcome, any further excess water can then pass through the soil as infiltration and either become interflow (indirect runoff) or recharge (deep infiltration).

The soil moisture capacity for the soils on the subject lands were estimated based on guidance available in the MECP SWM Planning and Design Manual (2003). A soil moisture storage capacity of 150 mm was used for the areas where the land cover was predominantly short to moderate-rooted vegetation in the fields and agricultural areas (Table F-1, Appendix F). A soil moisture storage capacity of 75 mm was used to represent the post-development vegetation which will be dominantly urban lawn (Table F-2, Appendix F). Tables F-1 to F-2 in Appendix F detail the monthly potential evapotranspiration calculations accounting for latitude and climate, and then calculate the actual evapotranspiration and water surplus components of the water balance based on the monthly precipitation and soil moisture conditions.

The MECP SWM Planning and Design Manual (2003) methodology for calculating total infiltration based on topography, soil type and land cover was used and a corresponding runoff component was calculated for the soil moisture storage conditions. The calculated water balance components from this table are then used to assess the pre-development and post-development volumes for runoff and infiltration as presented on Table F-3 in Appendix F.

4.3 Water Balance Component Values

The detailed monthly calculations of the water balance components are provided in Tables F-1 and F-2 in Appendix F. For these calculations, it has been assumed that sandy loam soils are representative for the subject lands for estimating the soil infiltration factor. The calculations show that a water surplus is generally available from November to May (see Figure F-1). The monthly water balance calculations illustrate how infiltration occurs during periods when there is sufficient water available to overcome the soil moisture storage requirements. The monthly calculations are summed to provide estimates of the annual water balance component values (Tables F-1 and F-2, Appendix F). A summary of these values is provided in Table 3.

Table 3: Water Balance Component Values

Water Balance Component	Agricultural Lands	Urban Lawn
Average Precipitation	933 mm/year	933 mm/year
Actual Evapotranspiration	593 mm/year	555 mm/year
Water Surplus	340 mm/year	378 mm/year
Infiltration	204 mm/year	227 mm/year
Runoff	136 mm/year	151 mm/year

4.4 Pre-Development Water Balance (Existing Conditions)

The pre-development water balance calculations are presented in Table F-3 in Appendix F. As summarized on Table F-3, the total area of the subject lands is about 27.9 ha. The water balance component values from Table F-1 and Table F-2 were used to calculate the average annual volume of infiltration across the subject lands. Based on these component values, the pre-development infiltration volume for the subject lands is calculated to be about 56,900 m³/year (Table F-3, Appendix F).

4.5 Potential Urban Development Impacts to Water Balance

It is recognized that the urban development of an area affects the natural water balance. The most significant difference is the addition of impervious surfaces as a type of surface cover (i.e., roads, parking lots, driveways, and rooftops). Impervious surfaces prevent infiltration of water into the soils and the removal of the vegetation removes the

evapotranspiration component of the natural water balance. The evaporation component from impervious surfaces is relatively minor (estimated to be 10% to 20% of precipitation) compared to the evapotranspiration component that occurs with vegetation in this area (about 64% of precipitation in the area of the subject lands. So, the net effect of the construction of impervious surfaces is that most of the precipitation that falls onto impervious surfaces becomes surplus water and direct runoff. The natural infiltration components (interflow and deep recharge) are reduced.

A water balance calculation of the potential water surplus for impervious areas is shown at the bottom of Table F-1 in Appendix F. There is an evaporation component from impervious surfaces and this is typically estimated to be between about 10% and 20% of the total precipitation. For the purposes of the calculations in this study, the evaporation has been estimated to be 15% of precipitation. The remaining 85% of the precipitation that falls on impervious surfaces is assumed to become runoff. Therefore, assuming an evaporation/loss from impervious surfaces of 15% of the precipitation, there is a potential water surplus from impervious areas of 793 mm/year.

It is noted that the proposed development will be serviced by municipal water supply and wastewater services. Therefore, there will be no impact on the water balance and local groundwater or surface water quantity and quality conditions related to any on-site groundwater supply pumping or disposal of septic effluent.

4.6 Post-Development Water Balance with No Mitigation

To assess potential development impacts on infiltration, the post-development infiltration volumes have been calculated for the subject lands on Table F-3 in Appendix F. The land use areas and the associated percentage imperviousness were based on the current design layout provided by the design engineers.

The infiltration and runoff components for the post-development land uses have been calculated using the MECP SWM Planning and Design Manual (2003) methodology based on topography, soil type and land cover as shown on Table F-1 and Table F-2 in Appendix F. In summary from these appendix tables, the average calculated post-development infiltration volume (without mitigation) is about 27,900 m³/year.

Comparing the pre- and post-development infiltration volumes, shows that development has the potential to reduce the average infiltration on the subject lands from 56,900 m³/year to 27,900 m³/year, i.e., a reduction of about 29,000 m³/year or 51%. These calculations assume no low impact development (LID) measures for stormwater management are in place.

4.7 Mitigation Measures

The use of Low Impact Development (LID) measures for stormwater management can be used to mitigate the potential impacts of development on the water balance. The overall deficit in groundwater infiltration post-development has been estimated to be 29,000 m³/year (see Table F-3 in Appendix F). To mitigate the loss of infiltration on the subject lands an infiltration gallery is proposed in the park block. Calculations completed as part of the Functional Servicing Report indicate that the infiltration gallery will result in an additional 31,865 m³/year of infiltration.

5.0 Development Considerations

5.1 Construction Below the Water Table

Based on groundwater level data collected as part of this study water table on the subject lands range from 0 m to 8 m below ground surface. Groundwater has been interpreted to exist within the local supply aquifer with seasonal variations, discharge gradients and local semi-confining conditions resulting in shallow groundwater conditions on a temporal and spatial basis. Should excavations during construction of servicing extend below the water table the local soils may need to be dewatered. Significant groundwater flows may be encountered in the deeper higher permeability sand and gravel layers while groundwater flows are expected to be minimal in the shallower low permeability till sediments.

The construction of buried services below the water table has the potential to capture and redirect groundwater flow through more permeable fill materials typically placed in the base of excavations. Groundwater may also infiltrate into joints in storm sewers and manholes. Over the long-term, these impacts can lower the groundwater table across the development area. To mitigate this effect, services to be installed below the water table should be constructed to prevent redirection of groundwater flow. This will involve the use of anti-seepage collars or clay plugs surrounding the pipes to provide barriers to flow and prevent groundwater flow along granular bedding material and erosion of the backfill materials.

Due to the potential for encountering the water table during construction, the dewatering of local aquifers may be required in order for services to be installed below the water table. The undertaking of dewatering according to industry standards and in accordance with a MECP processes will ensure that adequate attention is paid to potential adverse impacts to the environment. Currently the MECP allows for construction dewatering of less than 400,000 L/d to proceed under the Environmental Activity Sector Registry (EASR) process. If dewatering is to be above this threshold, then the standard Permit to Take Water (PTTW) process applies. In both cases, a scientific study is required in support of EASR registration or PTTW application. This scientific study must review the potential for environmental impacts and provide mitigation and monitoring measures to

the satisfaction of the MECP or other review agency. The requirements for construction dewatering will be confirmed by geotechnical/hydrogeological investigations completed in support of detailed design.

5.2 Groundwater Control in Foundations

The City of Barrie requires 0.5 m separation between foundations and seasonal high groundwater levels. It is expected that in some areas of the subject lands where shallow groundwater conditions exist this separation may not be achieved during the seasonal groundwater high conditions. From discussions with the design engineers it is understood that a gravity drain with connection to the sewer will be installed at 0.5 m below the foundation in areas where groundwater control is required. At this elevation the drain will function to divert groundwater from the area of the foundation and will maintain the required 0.5 m separation between seasonal groundwater high and the underside of foundations.

5.3 Local Groundwater Supply Wells

The area surrounding the subject lands is not currently serviced and residences are supplied by private wells. A water well survey has been completed on behalf of the Hewitt's Landowners Group to identify private water supply wells within 300 m of the Hewitt's SPA area (Burnside, 2019). The survey confirmed the location of private wells along Lockhart Road. The private wells are assumed to be completed in the local sand and gravel layer that underlies the shallow sandy silt till zone. The low permeability of the shallow sandy silt till is expected to restrict the potential zone of influence due to construction activities and hence construction impacts are not expected to be extensive in area but rather limited to the immediate vicinity of the excavations. Dewatering of the subject lands may result in short-term removal of water from the subsurface however this impact is expected to be limited to the shallow sandy silt layer that is above and separated from the sand and gravel layer in which most of the private domestic wells are completed. A monitoring program for high-risk wells has been implemented by the Hewitt's Landowner Group starting in the spring of 2019. An impact contingency and mitigation plan for private well impacts was included in the monitoring program. The plan provides a mechanism for interference complaints to be addressed and for a temporary alternate water supply to be provided. Details of the monitoring and mitigation plan are provided in the report entitled "Hewitt's SPA Lands Well Survey Report" R.J. Burnside & Associates Limited (Revised June 2019).

5.4 Well Decommissioning

Prior to or during construction, it is necessary to ensure that all inactive wells within the development footprint have been located and properly decommissioned by a licensed water well contractor according to Ontario Regulation 903. This regulation applies

private domestic wells and to the groundwater observation wells installed for this study unless they are maintained throughout the construction for monitoring purposes.

6.0 References

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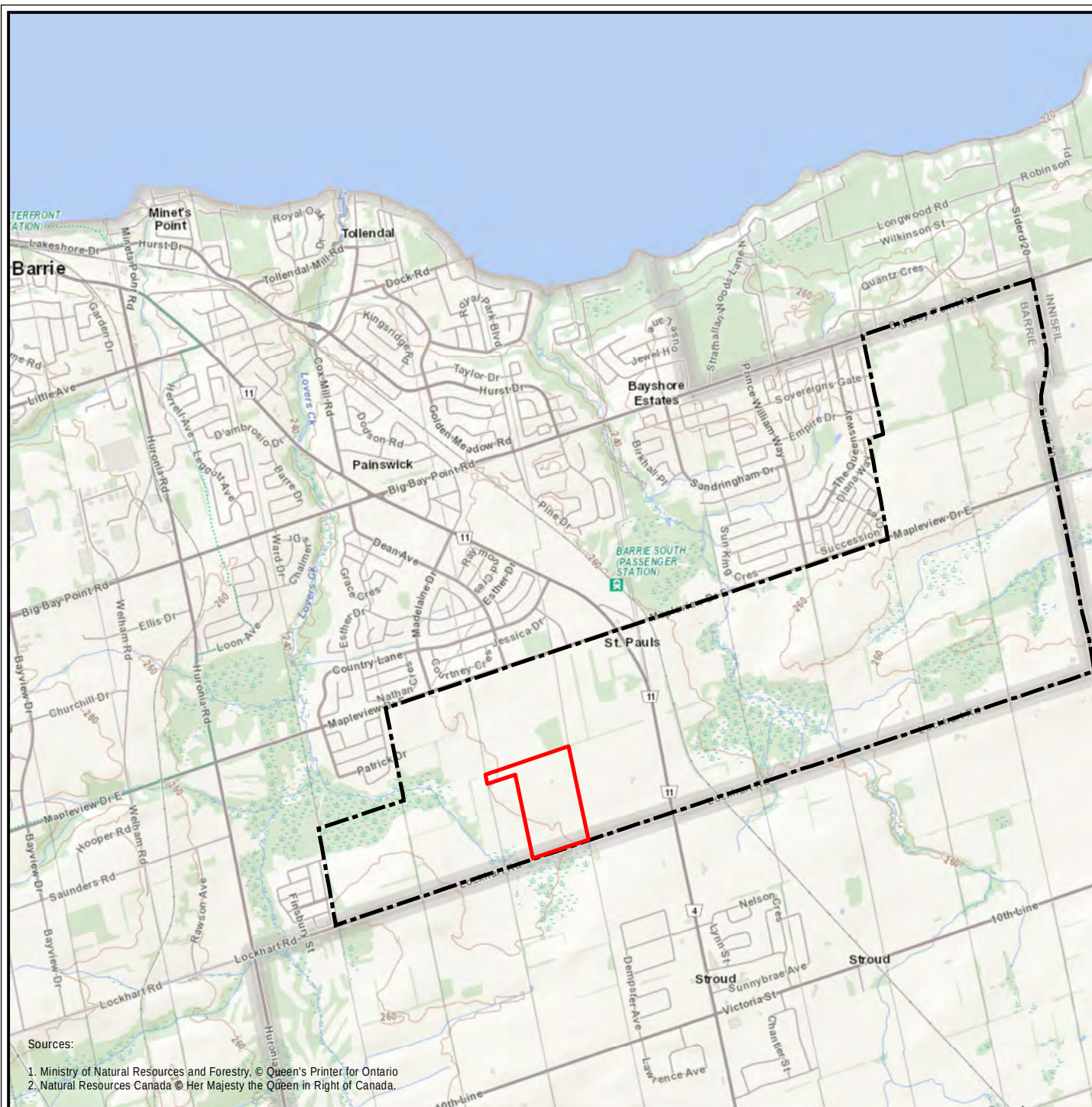


BURNSIDE

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Figures

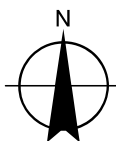
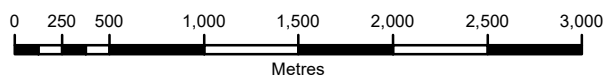


Sources:

1. Ministry of Natural Resources and Forestry, © Queen's Printer for Ontario
2. Natural Resources Canada © Her Majesty the Queen in Right of Canada.

LEGEND

- SUBJECT LANDS
- HEWITTS SECONDARY PLAN AREA



Client / Report

**MATTAMY (LOCKHART) LIMITED
BARRIE, ONTARIO**

HYDROGEOLOGICAL ASSESSMENT

Figure Title:

SITE LOCATION

Drawn	Checked	Date	Figure No.
SK	SC	July 2021	1
Scale		Project No.	
1:40,000		300052092	



LEGEND

- SUBJECT LANDS
- WATERCOURSE
- DRAINAGE DITCH
- ⊕ MONITORING WELL (DS CONSULTANTS, 2020)



Client / Report

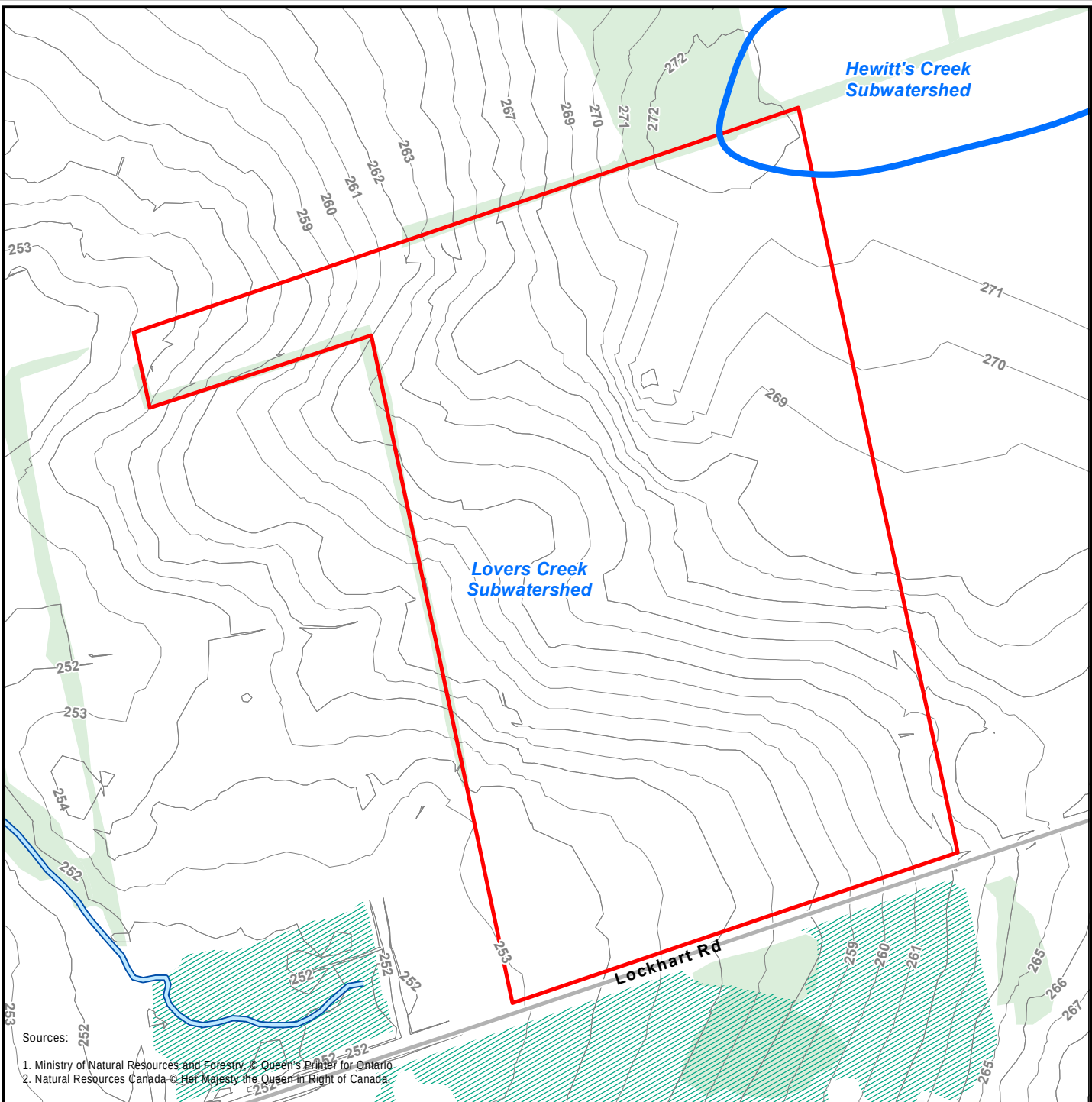
MATTAMY (LOCKHART) LIMITED
INNISFIL, ONTARIO
HYDROGEOLOGICAL ASSESSMENT

Figure Title

MONITORING LOCATIONS

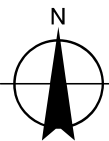
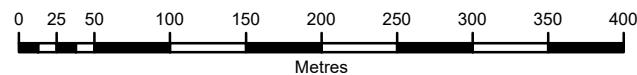
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Scale 1:5,000		Project No. 300052092	





LEGEND

- SUBJECT LANDS
- SUBWATERSHED BOUNDARY
- ROADWAY
- WATERCOURSE
- CONTOUR (1m intervals - masl)
- WETLAND
- WOODED AREA



Client / Report

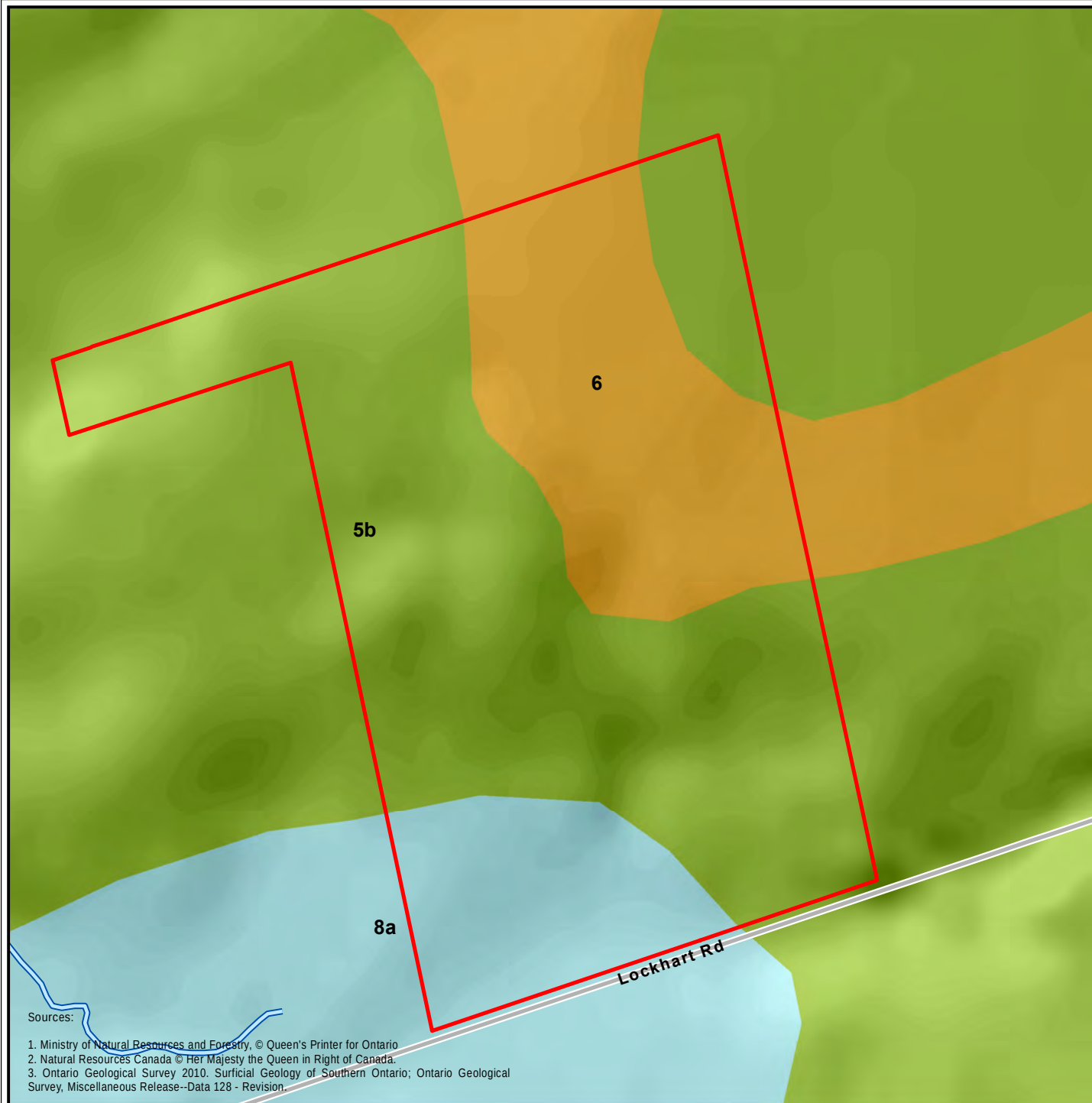
MATTAMY (LOCKHART) LIMITED
BARRIE, ONTARIO

HYDROGEOLOGICAL ASSESSMENT

Figure Title:

TOPOGRAPHY AND DRAINAGE

Drawn	Checked	Date	Figure No. 3
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Scale 1:5,000		Project No. 300052092	

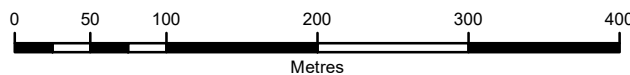


Sources:

1. Ministry of Natural Resources and Forestry, © Queen's Printer for Ontario
2. Natural Resources Canada © Her Majesty the Queen in Right of Canada.
3. Ontario Geological Survey 2010. Surficial Geology of Southern Ontario; Ontario Geological Survey, Miscellaneous Release--Data 128 - Revision.

LEGEND

- SUBJECT LANDS
- ROADWAY
- WATERCOURSE
- 5b: Till: Stone-poor, carbonate-derived silty to sandy till
- 6: Ice-contact stratified deposits - sand and gravel
- 8a: Fine-textured glaciolacustrine deposits: clay and silt, massive-well laminated



Client / Report

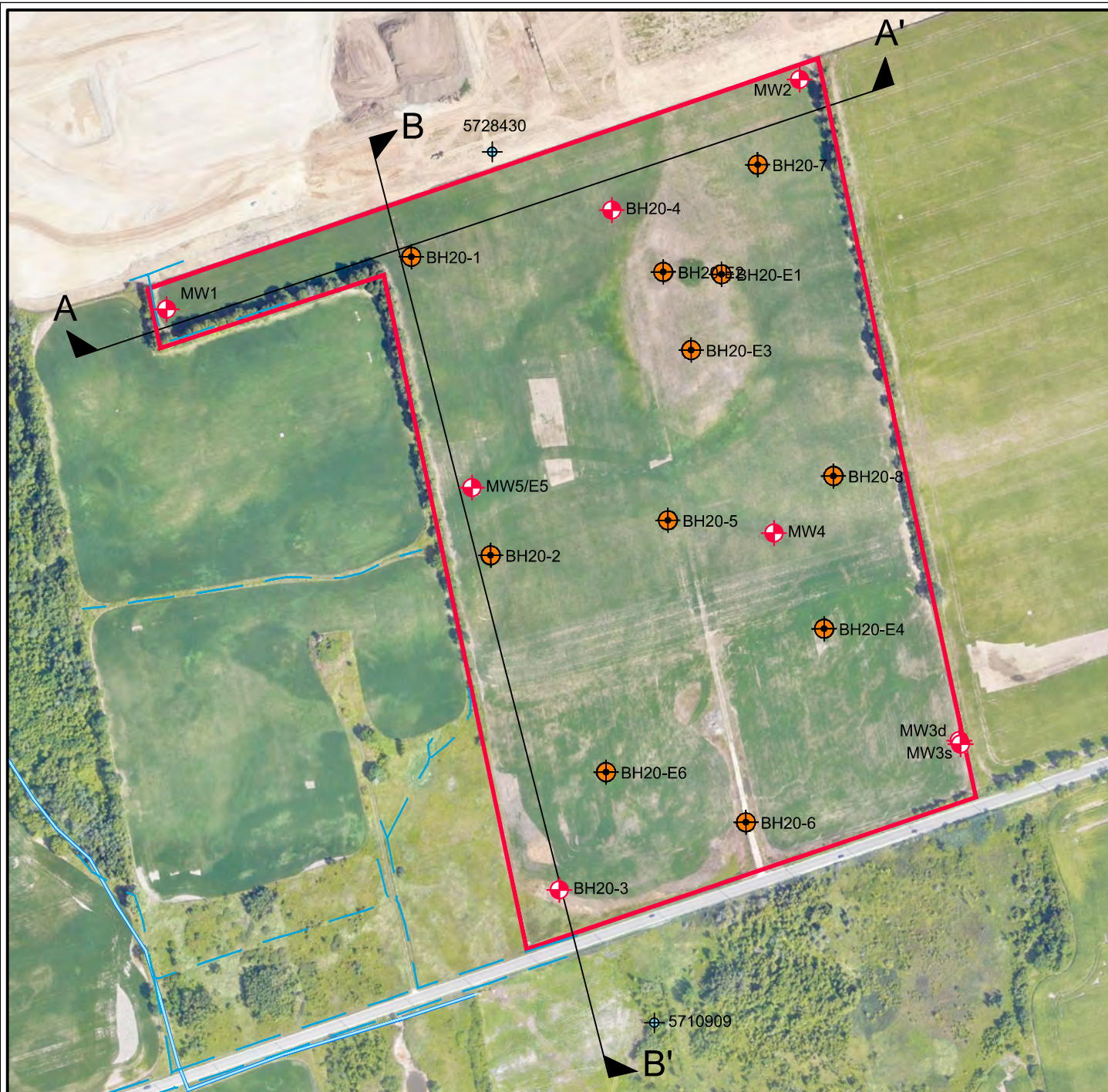
**MATTAMY (LOCKHART) LIMITED
BARRIE, ONTARIO**

HYDROGEOLOGICAL ASSESSMENT

Figure Title:

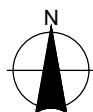
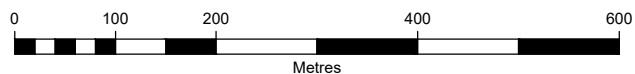
SURFICIAL GEOLOGY

Drawn	Checked	Date	Figure No.
SK	SC	July 2021	4
Scale 1:5,000		Project No. 300052092	



LEGEND

- SUBJECT LANDS
- WATERCOURSE
- ⊕ MONITORING WELL (DS, 2020)
- ⊕ BOREHOLE (DS, 2020)
- ⊕ MECP WELL RECORD LOCATION
- A A' CROSS-SECTION LOCATION KEY



Client / Report

MATTAMY (LOCKHART) LIMITED
INNISFIL, ONTARIO

HYDROGEOLOGICAL ASSESSMENT

Figure Title

BOREHOLE, WELL AND CROSS-SECTION LOCATION PLAN

Drawn

SK

Checked

SC

Date

July 2021

Scale

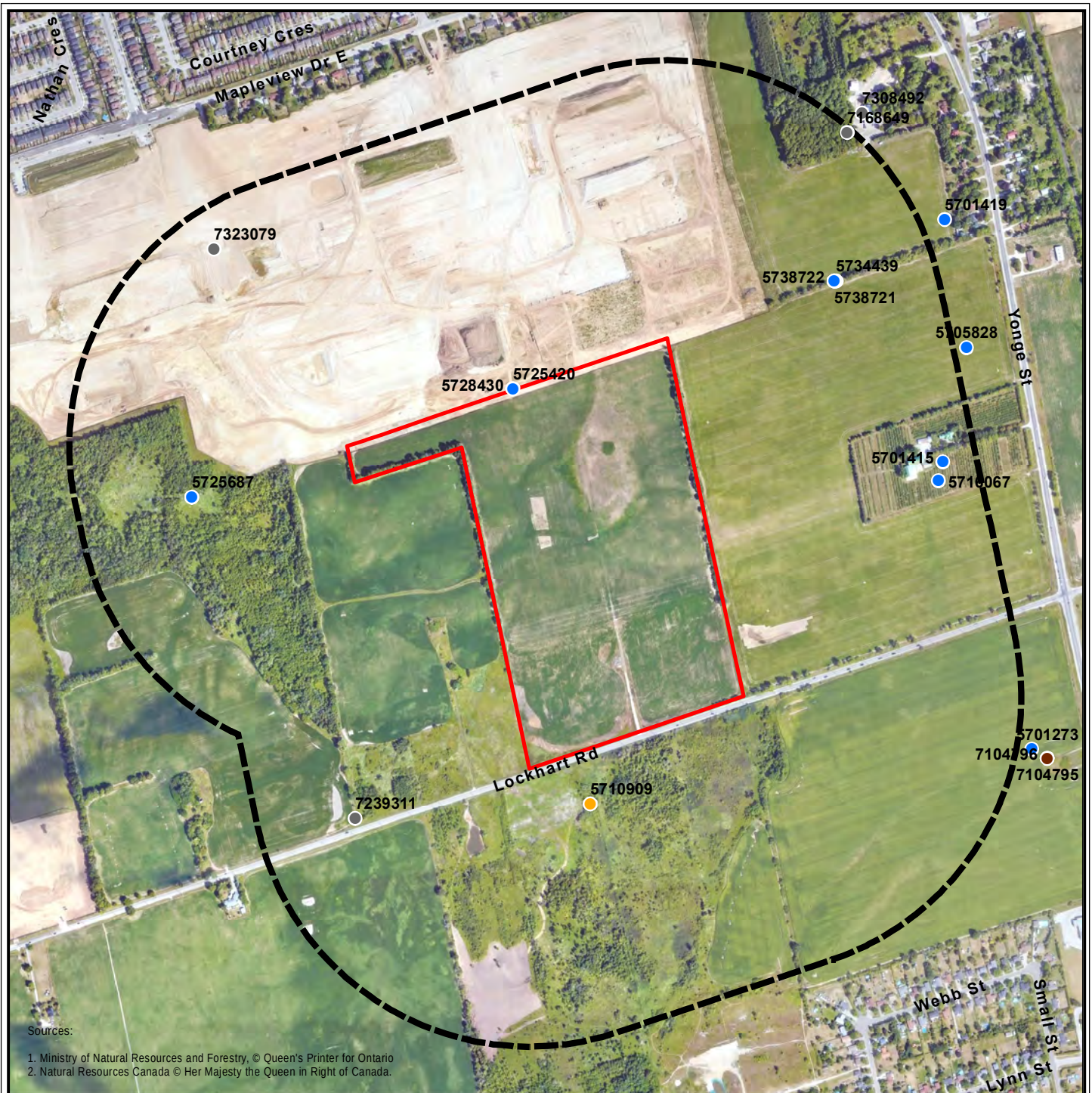
1:7,500

Project No.

300052092

Figure No.

5



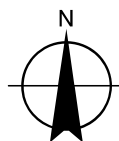
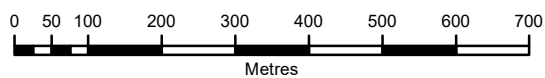
LEGEND

SUBJECT LANDS

BUFFER (500m)

MECP WELL USE:

- WATER SUPPLY
- ABANDONED - SUPPLY
- ABANDONED - OTHER
- UNKNOWN



Client / Report

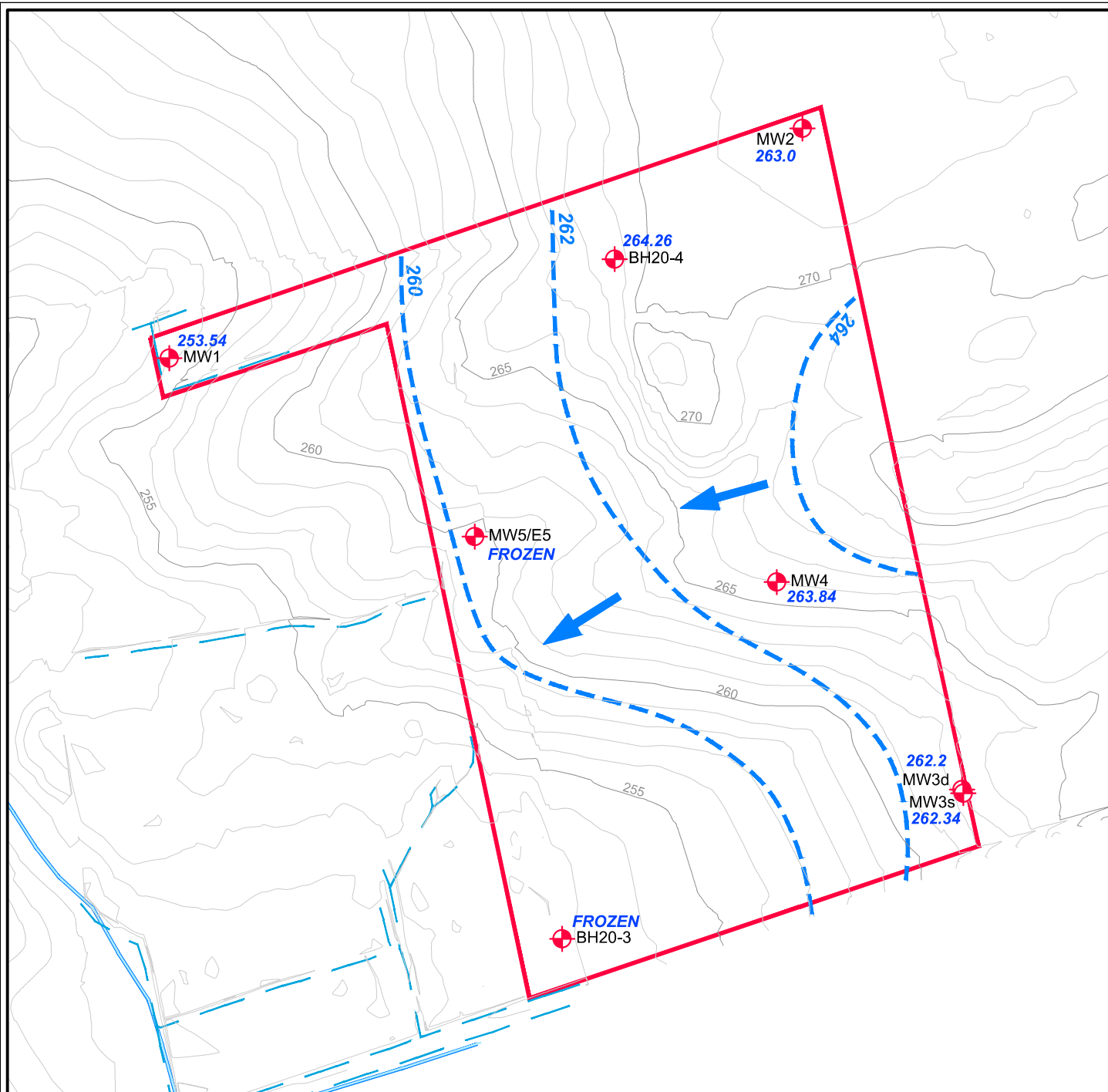
MATTAMY (LOCKHART) LIMITED
BARRIE, ONTARIO

HYDROGEOLOGICAL ASSESSMENT

Figure Title:

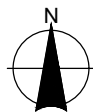
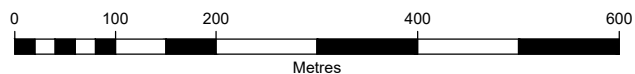
MECP WELL RECORD LOCATION

Drawn	Checked	Date	Figure No.
SK	SC	July 2021	8
Scale		Project No.	
1:10,284		300052092	



LEGEND

- SUBJECT LANDS
- WATERCOURSE
- ⊕ MONITORING WELL (RJB, 2014)
- ⊕ MONITORING WELL (SOIL ENG., 2019)
- INTERPRETED GROUNDWATER CONTOUR (masl)
- 263.84 MEASURED WATER LEVEL (MARCH, 2021)
- ➔ INTERPRETED GROUNDWATER FLOW DIRECTION



Client / Report

MATTAMY (LOCKHART) LIMITED
INNISFIL, ONTARIO

HYDROGEOLOGICAL ASSESSMENT

Figure Title

INTERPRETED GROUNDWATER FLOW

Drawn

SK

Checked

SC

Date

July 2021

Scale

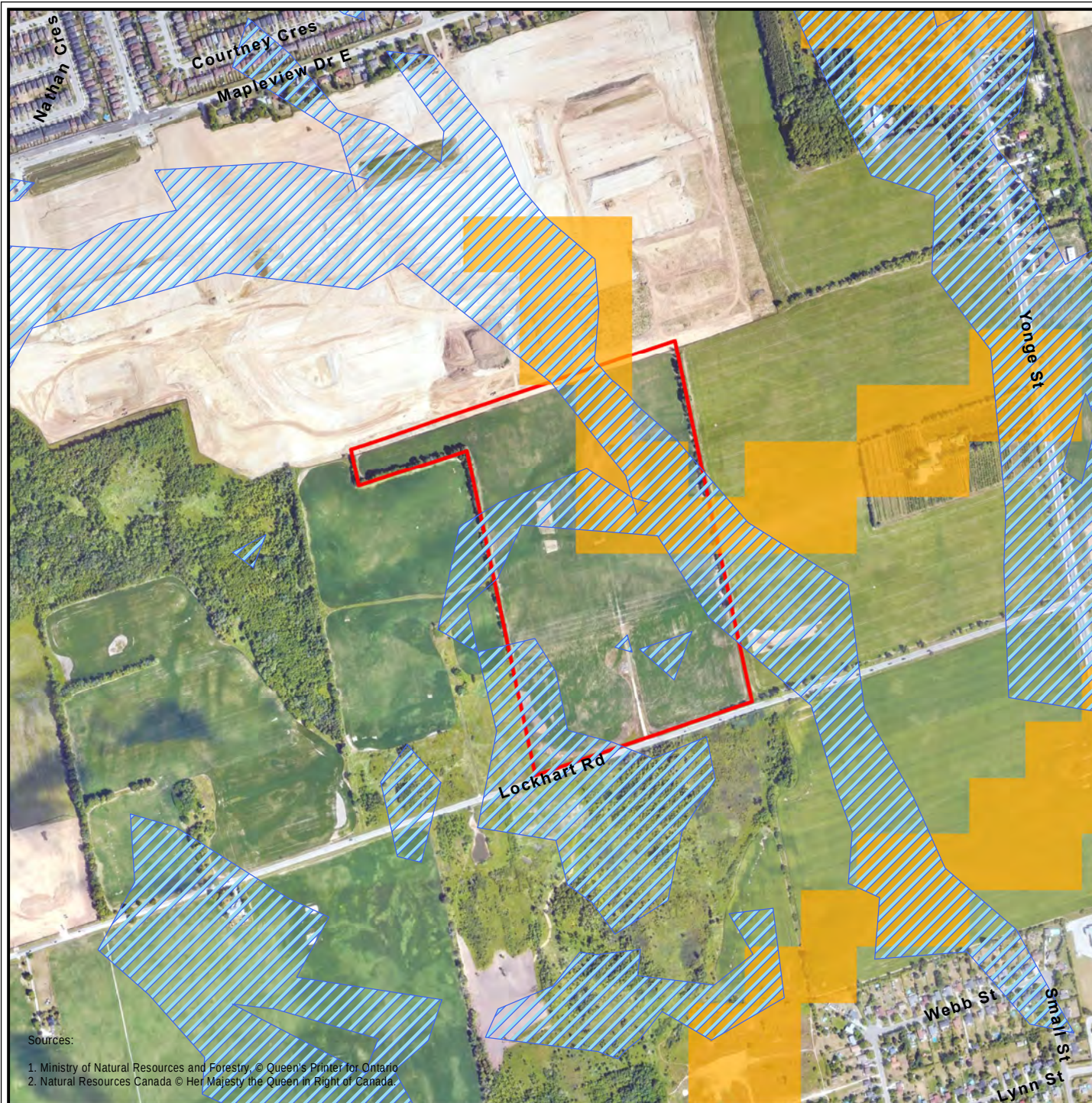
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Project No.

300052092

Figure No.

9

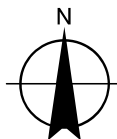
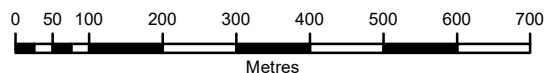


Sources:

1. Ministry of Natural Resources and Forestry, © Queen's Printer for Ontario
2. Natural Resources Canada © Her Majesty the Queen in Right of Canada.

LEGEND

- SUBJECT LANDS
- ECOLOGICALLY SIGNIFICANT GROUNDWATER RECHARGE AREAS (ESGRA, LSRCA)
- SIGNIFICANT GROUNDWATER RECHARGE AREAS (SGRA, LSRCA)



BURNSIDE

Client / Report

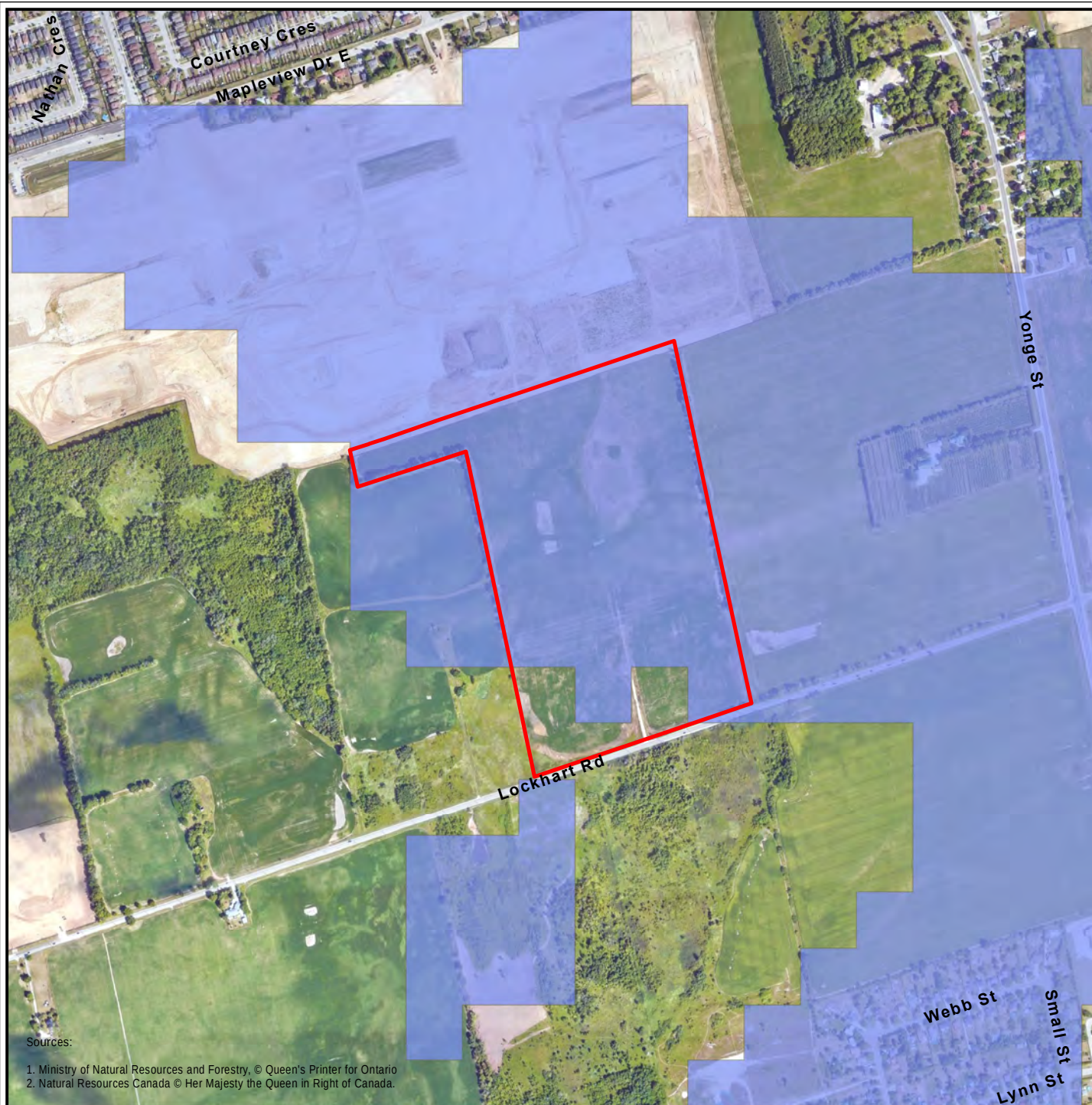
**MATTAMY (LOCKHART) LIMITED
BARRIE, ONTARIO**

HYDROGEOLOGICAL ASSESSMENT

Figure Title:

RECHARGE AREAS

Drawn	Checked	Date	Figure No.
SK	SC	July 2021	10
Scale 1:10,284		Project No. 300052092	

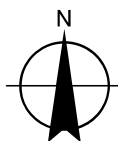
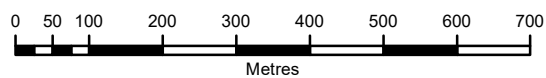


Sources:

1. Ministry of Natural Resources and Forestry, © Queen's Printer for Ontario
2. Natural Resources Canada © Her Majesty the Queen in Right of Canada.

LEGEND

- SUBJECT LANDS
- HIGH AQUIFER VULNERABILITY



BURNSIDE

Client / Report

**MATTAMY (LOCKHART) LIMITED
BARRIE, ONTARIO**

HYDROGEOLOGICAL ASSESSMENT

Figure Title:

AQUIFER VULNERABILITY

Drawn	Checked	Date	Figure No.
SK	SC	July 2021	11
Scale 1:10,284		Project No. 300052092	



BURNSIDE

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Appendix A

MECP Well Records

Water Well Records

Thursday, June 10, 2021

10:32:39 AM

TOWNSHIP CON LOT	UTM	DATE CNTR	CASING DIA	WATER	PUMP TEST	WELL USE	SCREEN	WELL	FORMATION
BARRIE CITY (INNISFI	17 608260 4910840 W	7314						7323079 (C38641) A139433 P	
INNISFIL TOWNSHIP CON 10 014	17 608937 4909842 W	1973/06 4816						5710909 () A	CLAY SAND 0028 SAND CLAY 0045 GRVL CLAY 0087 SAND GRVL 0098 CLAY SILT 0174 CLAY GRVL 0226 CLAY 0267 MSND 0273 CLAY SILT 0315
INNISFIL TOWNSHIP CON 10 015	17 609760 4909924 W	2008/03 1663	43.3			NU		7104796 (Z77794) A	
INNISFIL TOWNSHIP CON 10 015	17 609760 4909924 W	2007/03 1663	5			NU		7104795 (Z77795) A	
INNISFIL TOWNSHIP CON 10 015	17 609732 4909940 W	1962/10 2514	6	FR 0054	35/57/5/1:0	ST DO	0057 3	5701273 ()	PRDG 0037 BRWN CLAY MSND GRVL 0054 MSND 0060
INNISFIL TOWNSHIP CON 11 013	17 608220 4910394 L	1989/09 3030	36	UK 0006	6///:	DO		5725687 (61061)	BRWN LOAM 0001 BRWN SAND 0006 BRWN SAND 0023
INNISFIL TOWNSHIP CON 11 013	17 608514 4909816 W	2014/03 6809						7239311 (C25733) A152308 P	
INNISFIL TOWNSHIP CON 11 014	17 608798 4910589 L	1989/08 1583	6 5	FR 0116	32//12/1:0	DO	0109 2	5725420 (64384)	BRWN CLAY TILL SNDY 0040 BLUE CLAY 0073 GREY CLAY GRVL STNS 0103 BRWN FSND 0118 GREY CLAY 0125
INNISFIL TOWNSHIP CON 11 014	17 608798 4910589 L	1990/09 3660	6	FR 0032	32/57/4/1:0	DO	0064 5	5728430 (87995)	BLCK LOAM 0001 GREY GRVL 0008 GREY CLAY HARD 0032 BRWN SAND SILT WBRG 0070 GREY SAND SILT CLAY 0075
INNISFIL TOWNSHIP CON 11 015	17 609376 4910783 L	2004/04 2513	6.28	FR 0085	36/55/2/1:0	DO	0086 6	5738721 (Z00199) A000103	BRWN SAND SILT STNS 0014 YLLW SAND 0062 BLUE SAND SILT CLAY 0085 GREY SAND SILT CMTD 0092
INNISFIL TOWNSHIP CON 11 015	17 609376 4910783 L	2004/04 2513				NU		5738722 (Z00200) A000104 A	
INNISFIL TOWNSHIP CON 11 015	17 609400 4911050 W	2011/02 2513				NU		7168649 (Z103439) _NO_TAG A	
INNISFIL TOWNSHIP CON 11 015	17 609564 4910423 W	1979/04 3203	6 5	FR 0060	30/75/2/6:10	DO	0080 3	5716067 ()	PRDG 0030 PRDR 0060 BRWN SAND CLAY 0064 GREY SAND CLAY LYRD 0083 GREY CLAY 0092
INNISFIL TOWNSHIP CON 11 015	17 609427 4911085 W	2017/12 7626						7308492 (C39439) A235213 P	
INNISFIL TOWNSHIP CON 11 015	17 609614 4910663 W	1968/09 4608	30	FR 0025	26///:	DO		5705828 ()	BRWN CLAY STNS 0020 MSND 0036

TOWNSHIP CON LOT	UTM	DATE CNTR	CASING DIA	WATER	PUMP TEST	WELL USE	SCREEN	WELL	FORMATION
INNISFIL TOWNSHIP CON 11 015	17 609575 4910893 W	1967/01 4608	30	FR 0035	35//2/:	DO		5701419 ()	BRWN CLAY 0035 MSND 0050
INNISFIL TOWNSHIP CON 11 015	17 609572 4910457 W	1965/08 2514	6	FR 0043	30/52/3/2:30	ST DO	0052 3	5701415 ()	PRDG 0033 MSND CLAY 0043 MSND 0055 FSND 0058
INNISFIL TOWNSHIP CON 11 015	17 609379 4910783 L	1999/03 2513	6	FR 0064	26/58/9/1:0	DO	0060 6	5734439 (195331)	LOAM 0001 YLLW SAND 0004 YLLW SILT 0018 YLLW SAND 0027 YLLW SAND SILT CLAY 0052 YLLW SAND 0064 YLLW CLAY 0064

Notes:

UTM: UTM in Zone, Easting, Northing and Datum is NAD83; L: UTM estimated from Centroid of Lot; W: UTM not from Lot Centroid

DATE CNTR: Date Work Completedand Well Contractor Licence Number

CASING DIA: . Casing diameter in inches

WATER: Unit of Depth in Fee. See Table 4 for Meaning of Code

PUMP TEST: Static Water Level in Feet / Water Level After Pumping in Feet / Pump Test Rate in GPM / Pump Test Duration in Hour : Minutes

WELL USE: See Table 3 for Meaning of Code

SCREEN: Screen Depth and Length in feet

WELL: WEL (AUDIT #) Well Tag . A: Abandonment; P: Partial Data Entry Only

FORMATION: See Table 1 and 2 for Meaning of Code

1. Core Material and Descriptive terms

Code	Description	Code	Description	Code	Description	Code	Description	Code	Description
BLDR	BOULDERS	FCRD	FRACTURED	IRFM	IRON FORMATION	PORS	POROUS	SOFT	SOFT
BSLT	BASALT	FGRD	FINE-GRAINED	LIMY	LIMY	PRDG	PREVIOUSLY DUG	SPST	SOAPSTONE
CGRD	COARSE-GRAINED	FGVL	FINE GRAVEL	LMSN	LIMESTONE	PRDR	PREV. DRILLED	STKY	STICKY
CGVL	COARSE GRAVEL	FILL	FILL	LOAM	TOPSOIL	QRTZ	QUARTZITE	STNS	STONES
CHRT	CHERT	FLDS	FELDSPAR	LOOS	LOOSE	QSND	QUICKSAND	STNY	STONEY
CLAY	CLAY	FLNT	FLINT	LTCL	LIGHT-COLOURED	QTZ	QUARTZ	THIK	THICK
CLN	CLEAN	FOSS	FOSILIFEROUS	LYRD	LAYERED	ROCK	ROCK	THIN	THIN
CLYY	CLAYEY	FSND	FINE SAND	MARL	MARL	SAND	SAND	TILL	TILL
CMTD	CEMENTED	GNIS	GNEISS	MGRD	MEDIUM-GRAINED	SHLE	SHALE	UNKN	UNKNOWN TYPE
CONG	CONGLOMERATE	GRNT	GRANITE	MGVL	MEDIUM GRAVEL	SHLY	SHALY	VERY	VERY
CRYS	CRYSTALLINE	GRSN	GREENSTONE	MRBL	MARBLE	SHRP	SHARP	WBRG	WATER-BEARING
CSND	COARSE SAND	GRVL	GRAVEL	MSND	MEDIUM SAND	SHST	SCHIST	WDFR	WOOD FRAGMENTS
DKCL	DARK-COLOURED	GRWK	GREYWACKE	MUCK	MUCK	SILT	SILT	WTHD	WEATHERED
DLMT	DOLOMITE	GVLY	GRAVELLY	OBDN	OVERBURDEN	SLTE	SLATE		
DNSE	DENSE	GYPG	GYPG	PCKD	PACKED	SLTY	SILTY		
DRTY	DIRTY	HARD	HARD	PEAT	PEAT	SNDS	SANDSTONE		
DRY	DRY	HPAN	HARDPAN	PGVL	PEA GRAVEL	SNDY	SANDYOPSTONE		

2. Core Color

Code	Description
WHIT	WHITE
GREY	GREY
BLUE	BLUE
GRN	GREEN
YLLW	YELLOW
BRWN	BROWN
RED	RED
BLCK	BLACK
BLGY	BLUE-GREY

3. Well Use

Code	Description	Code	Description
DO	Domestic	OT	Other
ST	Livestock	TH	Test Hole
IR	Irrigation	DE	Dewatering
IN	Industrial	MO	Monitoring
CO	Commercial	MT	Monitoring TestHole
MN	Municipal		
PS	Public		
AC	Cooling And A/C		
NU	Not Used		

4. Water Detail

Code	Description	Code	Description
FR	Fresh	GS	Gas
SA	Salty	IR	Iron
SU	Sulphur		
MN	Mineral		
UK	Unknown		



BURNSIDE

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Appendix B

Borehole Logs

PROJECT: Geotechnical Investigation

CLIENT: Mattamy Homes

PROJECT LOCATION: 620 Lockhart Road, Barrie, Ontario

DATUM: Geodetic

BOREHOLE LOCATION: See Drawing 1 N 4910499.315 E 608729.072

DRILLING DATA

Method: Solid Stem Auger

Diameter: 150mm

Date: Sep/09/2020

REF. NO.: 20-231-400

ENCL NO.: 2

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			POCKET PEN (C _u) (kPa)	NATURAL UNIT WT (kN/m ³)	METHANE AND GRAIN SIZE DISTRIBUTION (%)																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																										
(m) ELEV DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS 0.3 m			SHEAR STRENGTH (kPa)					W _P W W _L					GR	SA	SI	CL																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																							
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GROUNDWATER ELEVATIONS

Measurement 1st 2nd 3rd 4th

GRAPH NOTES

+ 3 , × 3 : Numbers refer to Sensitivity

○ = 3% Strain at Failure

PROJECT: Geotechnical Investigation

CLIENT: Mattamy Homes

PROJECT LOCATION: 620 Lockhart Road, Barrie, Ontario

DATUM: Geodetic

BOREHOLE LOCATION: See Drawing 1 N 4910243.586 E 608797.335

DRILLING DATA

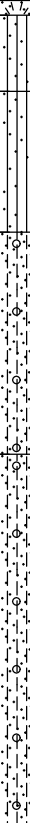
Method: Solid Stem Auger

Diameter: 150mm

Date: Sep/10/2020

REF. NO.: 20-231-400

ENCL NO.: 3

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	DYNAMIC CONE PENETRATION RESISTANCE PLOT				POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m ³)	METHANE AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
(m) ELEV DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS 0.3 m		SHEAR STRENGTH (kPa)							WATER CONTENT (%)		
							○ UNCONFINED + FIELD VANE & Sensitivity ● QUICK TRIAXIAL × LAB VANE							PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L
260.4	TOPSOIL: 150mm		1	SS	7	260										
260.2	SANDY SILT: disturbed, some organic, brown, moist, loose															
259.5	SANDY SILT: trace gravel, brown, moist, compact		2	SS	16	259										
	Some gravel, moist, sand seams															
			3	SS	12	258										
258.1	SILTY SAND TILL: some gravel, trace clay, grey, moist, dense															
255.9	Wet sand layer at 3.7m		4	SS	43	257										
255.9	SILTY SAND TILL: some gravel, trace clay, grey, wet, very dense															
4.5		5	SS	53	256											
		6	SS	61	255											
		7	SS	57	254											
252.2	END OF BOREHOLE:		8	SS	43	253										
8.2	Notes: 1) Water level at 3.7m below grade at the completion of drilling. 2) cave-in at 7.3m below grade upon completion															

GROUNDWATER ELEVATIONS

	1st	2nd	3rd	4th
Measurement				

GRAPH
NOTES

+ 3, × 3: Numbers refer to Sensitivity

○ $\epsilon = 3\%$ Strain at Failure

DS SOIL LOG 20-231-400 MATTAMY, 620 LOCKHART.GPJ DS.GDT 21/1/13

PROJECT: Geotechnical Investigation

CLIENT: Mattamy Homes

PROJECT LOCATION: 620 Lockhart Road, Barrie, Ontario

DATUM: Geodetic

BOREHOLE LOCATION: See Drawing 1 N 4909956.586 E 608856.231

DRILLING DATA

Method: Solid Stem Auger

Diameter: 150mm

Date: Sep/10/2020

REF. NO.: 20-231-400

ENCL NO.: 4

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC NATURAL LIQUID LIMIT MOISTURE CONTENT LIMIT			POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m ³)	METHANE AND GRAIN SIZE DISTRIBUTION (%)
(m) ELEV DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS 0.3 m		SHEAR STRENGTH (kPa)				W _p	W	W _L			
253.1							20 40 60 80 100									
252.9	TOPSOIL: 230mm						40 60 80 100									
0.2	SILT: with fine sand, brown, moist to wet, loose, weathered		1	SS	9		UNCONFINED + FIELD VANE & Sensitivity									
252.0			2	SS	6		● QUICK TRIAXIAL × LAB VANE									
1.1	SILTY CLAY: trace sand, brown to grey, very moist, firm to stiff						WATER CONTENT (%)									
251.1			3	SS	12											
2.0	SILT AND SAND: fine sand, trace gravel, trace clay, grey, wet, compact		4	SS	13											
250.1			5	SS	11											
3.0	SANDY SILT TILL: with gravel, trace clay, grey, wet, loose to compact															
4																
5			6	SS	9											
6																
6			7	SS	29											
246.1																
7.0	END OF BOREHOLE: Notes: 1) 50mm dia. monitoring well installed upon completion. 2) Water level Reading: Date: Water Level (mbgl): Sept 30, 2020 -0.17 Jan 11, 2021 -0.31															

GROUNDWATER ELEVATIONS

Measurement 1st 2nd 3rd 4th

GRAPH NOTES

+ 3 , × 3 : Numbers refer to Sensitivity

○ = 3% Strain at Failure

DS SOIL LOG 20-231-400 MATTAMY, 620 LOCKHART GPJ DS.GDT 21/1/13

PROJECT: Geotechnical Investigation

CLIENT: Mattamy Homes

PROJECT LOCATION: 620 Lockhart Road, Barrie, Ontario

DATUM: Geodetic

BOREHOLE LOCATION: See Drawing 1 N 4910539.485 E 608901.801

DRILLING DATA

Method: Solid Stem Auger

Diameter: 150mm

Date: Sep/09/2020

REF. NO.: 20-231-400

ENCL NO.: 5

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT				POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m ³)	METHANE AND GRAIN SIZE DISTRIBUTION (%)			
(m) ELEV DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS 0.3 m			SHEAR STRENGTH (kPa)							WATER CONTENT (%)		
20 40 60 80 100								PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT									
○ UNCONFINED + FIELD VANE & Sensitivity ● QUICK TRIAXIAL × LAB VANE								w _p w w _L									
269.0																	
268.9	TOPSOIL: 250mm		1	SS	6												
0.3	SILT: disturbed material, trace sand, some organic, brown, moist, loose																
268.2																	
0.8	SILT: some sand, trace gravel, trace clay, brown, moist, loose		2	SS	7												
267.5																	
1.5	SILTY SAND TILL: some gravel, trace clay, grey, moist, dense to very dense		3	SS	32												
			4	SS	58												
			5	SS	68												
			6	SS	>100												

GROUNDWATER ELEVATIONS

Measurement 1st 2nd 3rd 4th

GRAPH NOTES

+ 3, X 3: Numbers refer to Sensitivity

○ = 3% Strain at Failure

DS SOIL LOG 20-231-400 MATTAMY, 620 LOCKHART GPJ DS GDT 21/1/13

PROJECT: Geotechnical Investigation

CLIENT: Mattamy Homes

PROJECT LOCATION: 620 Lockhart Road, Barrie, Ontario

DATUM: Geodetic

BOREHOLE LOCATION: See Drawing 1 N 4910273.423 E 608949.757

DRILLING DATA

Method: Solid Stem Auger

Diameter: 150mm

Date: Sep/10/2020

REF. NO.: 20-231-400

ENCL NO.: 6

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m ³)	METHANE AND GRAIN SIZE DISTRIBUTION (%)						
(m) ELEV DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS 0.3 m			SHEAR STRENGTH (kPa)									WATER CONTENT (%)			GR	SA	SI	CL
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE															
								20	40	60	80						100	10	20				
265.2							265																
265.0		TOPSOIL: 150mm		1	SS	7																	
264.9		SILT: trace organics, trace sand, brown, moist, loose, weathered																					
264.4																							
264.1	0.8	SANDY SILT: trace gravel, grey, moist, loose		2	SS	9																	
263.7																							
263.2	1.5	SILTY SAND TILL: with gravel, trace clay, grey, moist, compact to very dense		3	SS	10												12	46				
262.7																							
262.2				4	SS	36																	
261.7																							
261.2																							
260.7				5	SS	32																	
260.2																							
259.7		wet, sand seams		6	SS	57																	
259.2																							
258.7																							
258.2																							
257.7																							
257.2																							
256.7																							
256.2																							
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GROUNDWATER ELEVATIONS

Measurement 1st 2nd 3rd 4th

GRAPH NOTES

+ 3, × 3: Numbers refer to Sensitivity

○ = 3% Strain at Failure

PROJECT: Geotechnical Investigation

CLIENT: Mattamy Homes

PROJECT LOCATION: 620 Lockhart Road, Barrie, Ontario

DATUM: Geodetic

BOREHOLE LOCATION: See Drawing 1 N 4910014.013 E 609016.963

DRILLING DATA

Method: Solid Stem Auger

Diameter: 150mm

Date: Sep/11/2020

REF. NO.: 20-231-400

ENCL NO.: 7

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC NATURAL LIQUID LIMIT MOISTURE CONTENT LIMIT			POCKET PEN (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	METHANE AND GRAIN SIZE DISTRIBUTION (%)
(m) ELEV DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS 0.3 m			SHEAR STRENGTH (kPa)				WATER CONTENT (%)					
256.5							20	40	60	80	100						GR SA SI CL
0.0	SAND AND GRAVEL FILL: brown, compact, moist		1	SS	11												3 49 37 11
255.3			2	SS	13												
255.2	TOPSOIL: 200mm, black, moist																
1.4	SILTY SAND TILL: trace gravel, trace clay, brown, moist to wet, loose		3	SS	8												
	Grey, with gravel, wet		4	SS	4												
			5	SS	6												
	compact below 3.8m		6	SS	13												
251.8																	
4.7	SANDY SILT: with gravel, some clay, grey, compact, wet		7	SS	21												
250.4																	
6.1	SILTY SAND: some to trace gravel, sand seams at 6.4m, brown, saturated, compact to very dense		8	SS	20												
	grey		9	SS	>100												
246.7			10	SS	>100												
9.8	END OF BOREHOLE: Notes: 1) Water level at 1.5m during drilling. 2) No cave-in upon completion.																

GROUNDWATER ELEVATIONS

Measurement 1st 2nd 3rd 4th

GRAPH NOTES

+ 3 , × 3 : Numbers refer to Sensitivity

○ = 3% Strain at Failure

DS SOIL LOG 20-231-400 MATTAMY, 620 LOCKHART GPJ DS GDT 21/1/13

PROJECT: Geotechnical Investigation

CLIENT: Mattamy Homes

PROJECT LOCATION: 620 Lockhart Road, Barrie, Ontario

DATUM: Geodetic

BOREHOLE LOCATION: See Drawing 1 N 4910578.452 E 609026.09

DRILLING DATA

Method: Solid Stem Auger

Diameter: 150mm

Date: Sep/09/2020

REF. NO.: 20-231-400

ENCL NO.: 8

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT NATURAL LIQUID LIMIT MOISTURE LIMIT 		
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GROUNDWATER ELEVATIONS

Measurement 1st 2nd 3rd 4th

GRAPH NOTES

+ 3 , × 3 : Numbers refer to Sensitivity

○ = 3% Strain at Failure

DS SOIL LOG 20-231-400 MATTAMY, 620 LOCKHART GPJ DS.GDT 21/1/13

PROJECT: Geotechnical Investigation

CLIENT: Mattamy Homes

PROJECT LOCATION: 620 Lockhart Road, Barrie, Ontario

DATUM: Geodetic

BOREHOLE LOCATION: See Drawing 1 N 4910311.883 E 609091.492

DRILLING DATA

Method: Solid Stem Auger

Diameter: 150mm

Date: Sep/10/2020

REF. NO.: 20-231-400

ENCL NO.: 9

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT W _P	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	POCKET PEN. (C _u) (kPa)	NATURAL UNIT WT (kN/m ³)	METHANE AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
(m) ELEV DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS 0.3 m			SHEAR STRENGTH (kPa)									
268.5								20	40	60	80	100					
268.0	TOPSOIL: 200mm																
0.2	SANDY SILT: some organics, trace gravel, brown, moist, loose, weathered		1	SS	5		268										
267.6																	
0.9	SILTY SAND TILL: with gravel, trace clay, grey, moist, compact small seam of red sand at 1.2m dense		2	SS	16		267										
			3	SS	31												
			4	SS	41		266										
			5	SS	62		265										
	seam of red sand		6	SS	81		264										
							263										
	saturated		7	SS	>100		262										
260.9							261										
7.6	SAND: some gravel, grey, saturated, dense		8	SS	35												
260.3																	
8.2	END OF BOREHOLE: Notes: 1) Water at depth of 4.6m at completion of drilling. 2) Cave-in at 6.6m upon completion																

GROUNDWATER ELEVATIONS

Measurement 1st 2nd 3rd 4th

GRAPH NOTES

+ 3, X 3: Numbers refer to Sensitivity

○ = 3% Strain at Failure

DS SOIL LOG 20-231-400 MATTAMY, 620 LOCKHART GPJ DS GDT 21/1/13

PROJECT: Geotechnical Investigation

CLIENT: Mattamy Homes

PROJECT LOCATION: 620 Lockhart Road, Barrie, Ontario

DATUM: Geodetic

BOREHOLE LOCATION: See Drawing 1 N 4910084.417 E 609199.788

DRILLING DATA

Method: Solid Stem Auger

Diameter: 150mm

Date: Sep/11/2020

REF. NO.: 20-231-400

ENCL NO.: 10

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT					POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m ³)	METHANE AND GRAIN SIZE DISTRIBUTION (%)					
(m) ELEV DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS 0.3 m			SHEAR STRENGTH (kPa)								WATER CONTENT (%)				
263.0								20	40	60	80	100	W _p	W	W _L	GR	SA	SI	CL	
262.9	TOPSOIL: 150mm		1	SS	4									o						
262.1	SANDY SILT: with gravel, some cobble, some clay, brown, wet, loose, weathered		2	SS	10									o						
260.5	SANDY SILT: some gravel, trace clay, brown, wet, loose to compact		3	SS	8									o						
260.0	SILTY SAND: Brown, trace gravel, compact, saturated		4	SS	12									o						
256.9	SILTY SAND TILL: trace gravel, trace clay, grey, wet, loose to dense		5	SS	5									o				10	48	
255.4			6	SS	15									o				33	9	
254.8			7	SS	46									o						
254.8	SILTY SAND: trace gravel and cobbles, interbedded with sand and silt, brown, wet, very dense		8	SS	60									o						
254.8	SANDY SILT: Grey, with gravel, wet, very dense		9	SS	>100									o				spoon bouncing		
8.2	END OF BOREHOLE: Notes: 1) 50mm dia. monitoring well installed upon completion. 2) Water level Reading: Date: Water Level (mbgl): Sept 30, 2020 0.73 Jan 11, 2021 0.63																			

GROUNDWATER ELEVATIONS

Measurement 1st 2nd 3rd 4th

GRAPH
NOTES+ 3, × 3: Numbers refer
to Sensitivity

○ = 3% Strain at Failure

DS SOIL LOG 20-231-400 MATTAMY, 620 LOCKHART GPJ DS.GDT 21/1/13

PROJECT: Geotechnical Investigation

CLIENT: Mattamy Homes

PROJECT LOCATION: 620 Lockhart Road, Barrie, Ontario

DATUM: Geodetic

BOREHOLE LOCATION: N 4910484.333 E 608995.132

DRILLING DATA

Method: Solid Stem Auger

Diameter: 150mm

Date: Dec/03/2020

REF. NO.: 20-231-400

ENCL NO.: 11

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT NATURAL MOISTURE LIQUID LIMIT			POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m ³)	METHANE AND GRAIN SIZE DISTRIBUTION (%)			
(m) ELEV DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS 0.3 m			SHEAR STRENGTH (kPa)				WATER CONTENT (%)					GR	SA	SI	CL
								20 40 60 80 100	W _p	W	W _L									
270.0																				
268.9			1	SS	7															
268.5			2	SS	9															
268.5			3	SS	15															
266.9			4	SS	13															
266.3			5	SS	29															
3.7	END OF BOREHOLE:																			
	Notes: 1) Borehole remained open at the completion of drilling.																			

GROUNDWATER ELEVATIONS

Measurement 1st 2nd 3rd 4th

GRAPH NOTES

+ 3 , × 3 : Numbers refer to Sensitivity

○ = 3% Strain at Failure

PROJECT: Geotechnical Investigation

CLIENT: Mattamy Homes

PROJECT LOCATION: 620 Lockhart Road, Barrie, Ontario

DATUM: Geodetic

BOREHOLE LOCATION: N 4910486.773 E 608945.472

DRILLING DATA

Method: Solid Stem Auger

Diameter: 150mm

Date: Dec/03/2020

REF. NO.: 20-231-400

ENCL NO.: 12

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT		NATURAL MOISTURE CONTENT		LIQUID LIMIT		POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m ³)	METHANE AND GRAIN SIZE DISTRIBUTION (%)
(m)	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS 0.3 m			SHEAR STRENGTH (kPa)		W _p	W	W _p	W	W _L				
270.6	TOPSOIL: 300mm							20 40 60 80 100										GR SA SI CL
270.3	SAND: some gravel, some organic, dark brown, moist, loose, fill		1	SS	6		270											
269.7	CLAYEY SILT: with organics and wood, dark brown, wet, soft, fill		2	SS	5		269											
268.8	SAND: trace gravel, grey, wet, dense		3	SS	5		268											
267.6	SANDY SILT TILL: trace gravel, trace cobble, grey, moist, dense		4	SS	29		267											
267.0	END OF BOREHOLE:		5	SS	37													
3.7	Notes: 1) Borehole remained open at the completion of drilling.																	

GROUNDWATER ELEVATIONS

Measurement 1st 2nd 3rd 4th

GRAPH
NOTES

+ 3 , × 3 : Numbers refer to Sensitivity

○ = 3% Strain at Failure

PROJECT: Geotechnical Investigation

CLIENT: Mattamy Homes

PROJECT LOCATION: 620 Lockhart Road, Barrie, Ontario

DATUM: Geodetic

BOREHOLE LOCATION: N 4910419.047 E 608969.214

DRILLING DATA

Method: Solid Stem Auger

Diameter: 150mm

Date: Dec/03/2020

REF. NO.: 20-231-400

ENCL NO.: 13

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _P	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	POCKET PEN (C _u) (kPa)	NATURAL UNIT WT (kN/m ³)	METHANE AND GRAIN SIZE DISTRIBUTION (%)			
(m) ELEV DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS 0.3 m			SHEAR STRENGTH (kPa)											WATER CONTENT (%)		
								20 40 60 80 100											20 40 60 80 100		
270.6																					
270.3																					
0.3			1	SS	7		270														
269.7																					
0.9			2	SS	16		269														
			3	SS	17		268														
			4	SS	23		267														
			5	SS	30																
266.9																					
3.7																					

GROUNDWATER ELEVATIONS

Measurement 1st 2nd 3rd 4th

GRAPH
NOTES+ 3 , × 3 : Numbers refer
to Sensitivity

○ = 3% Strain at Failure

PROJECT: Geotechnical Investigation

CLIENT: Mattamy Homes

PROJECT LOCATION: 620 Lockhart Road, Barrie, Ontario

DATUM: Geodetic

BOREHOLE LOCATION: N 4910180.413 E 609083.344

DRILLING DATA

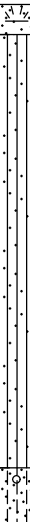
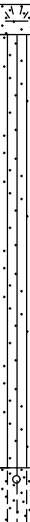
Method: Solid Stem Auger

Diameter: 150mm

Date: Dec/04/2020

REF. NO.: 20-231-400

ENCL NO.: 14

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT				POCKET PEN (C _u) (kPa)	NATURAL UNIT WT (kN/m ³)	METHANE AND GRAIN SIZE DISTRIBUTION (%)				
(m) ELEV DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS 0.3 m			SHEAR STRENGTH (kPa)						WATER CONTENT (%)			GR	SA
261.6	TOPSOIL: 300mm																	
261.3	SANDY SILT: trace gravel, trace clay, brown, wet, loose		1	SS	6													
261.0			2	SS	7													
260.7			3	SS	11													
260.4			4	SS	6													
260.1			5	SS	12													
257.0	compact below 3m																	
256.5			6	SS	50													
5.2	END OF BOREHOLE:																	

GROUNDWATER ELEVATIONS

Measurement 1st 2nd 3rd 4th

GRAPH
NOTES

+ 3, × 3: Numbers refer to Sensitivity

○ = 3% Strain at Failure

PROJECT: Geotechnical Investigation

CLIENT: Mattamy Homes

PROJECT LOCATION: 620 Lockhart Road, Barrie, Ontario

DATUM: Geodetic

BOREHOLE LOCATION: N 4910057.43 E 608896.02

DRILLING DATA

Method: Solid Stem Auger

Diameter: 150mm

Date: Dec/04/2020

REF. NO.: 20-231-400

ENCL NO.: 16

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC NATURAL LIQUID LIMIT			POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m ³)	METHANE AND GRAIN SIZE DISTRIBUTION (%)
(m)	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS 0.3 m			SHEAR STRENGTH (kPa)				W _p	W	W _L			
254.0								20	40	60	80	100					
253.9	TOPSOIL: 100mm		1	SS	6			20	40	60	80	100					GR SA SI CL
253.7	SANDY SILT: brown to grey, wet, compact		2	SS	12		253										
252.5	SILTY CLAY: grey, wet, soft		3	SS	7		252										
251.0	sand seams below 2.3m		4	SS	8		251										
251.0	SILTY SAND: trace gravel, grey, saturated, loose		5	SS	11		250										
249.0			6	SS	6		249										
248.0			7	SS	6		248										
247.0			8	SS	9		247										
246.0	some gravel below 7.6m						246										
8.2	END OF BOREHOLE:																

GROUNDWATER ELEVATIONS

Measurement 1st 2nd 3rd 4th

GRAPH NOTES

+ 3, × 3: Numbers refer to Sensitivity

○ = 3% Strain at Failure

PROJECT: Geotechnical Investigation

CLIENT: Mattamy Homes

PROJECT LOCATION: 620 Lockhart Road, Barrie, Ontario

DATUM: Geodetic

BOREHOLE LOCATION: N 4910454.565 E 608519.325

DRILLING DATA

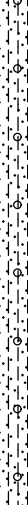
Method: Solid Stem Auger

Diameter: 150mm

Date: Dec/02/2020

REF. NO.: 20-231-400

ENCL NO.: 17

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT				POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m ³)	METHANE AND GRAIN SIZE DISTRIBUTION (%)
(m) ELEV DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS 0.3 m			SHEAR STRENGTH (kPa)						
254.1	TOPSOIL: 300mm						254	20 40 60 80 100						GR SA SI CL
253.8	CLAYEY SILT: some sand, trace gravel, brown, moist to wet, soft		1	SS	6		254	20 40 60 80 100						
0.3							W. L. 253.6 m Jan 11, 2021							
			2	SS	3		253	20 40 60 80 100						
252.6	SANDY SILT: trace gravel, trace clay, brown, wet, loose		3	SS	10		252	20 40 60 80 100						
1.5														
251.8			SILTY SAND TILL: trace gravel, brown to grey, wet, dense to very dense		4		SS	31	251	20 40 60 80 100				
2.3							Bentonite							
	5	SS			>100		250	20 40 60 80 100						
	6	SS			>100	249	20 40 60 80 100							
						248	20 40 60 80 100							
			7	SS	>100	247	20 40 60 80 100							
						246.5	20 40 60 80 100							
7.6	SAND: trace gravel, grey, wet, very dense		8	SS	>100		246	20 40 60 80 100						
245.9	END OF BOREHOLE: Notes: 1) 50mm dia. monitoring well installed upon completion. 2) Water level Reading: Date: Jan 11, 2021 Water Level (mbgl): 0.49													grinding through boulder at 6.9m
8.2														

GROUNDWATER ELEVATIONS

Measurement 1st 2nd 3rd 4th

GRAPH NOTES

+ 3, × 3: Numbers refer to Sensitivity

○ = 3% Strain at Failure

DS SOIL LOG 20-231-400 MATTAMY, 620 LOCKHART ENVIRO.GPJ DS.GDT 21/1/13

PROJECT: Geotechnical Investigation

CLIENT: Mattamy Homes

PROJECT LOCATION: 620 Lockhart Road, Barrie, Ontario

DATUM: Geodetic

BOREHOLE LOCATION: N 4910651.555 E 609062.995

DRILLING DATA

Method: Solid Stem Auger

Diameter: 150mm

Date: Dec/03/2020

REF. NO.: 20-231-400

ENCL NO.: 18

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT				POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m ³)	METHANE AND GRAIN SIZE DISTRIBUTION (%)						
(m) ELEV DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS 0.3 m			SHEAR STRENGTH (kPa)							WATER CONTENT (%)					
								○ UNCONFINED		+ FIELD VANE & Sensitivity					Wp					
								● QUICK TRIAXIAL		x LAB VANE					W					
							20	40	60	80	100	10	20	30			GR	SA	SI	CL
272.1																				
272.0	TOPSOIL: 150mm		1	SS	5															
271.9	SILTY SAND: some organics, trace gravel, brown, moist, loose, disturbed																			
271.3			2	SS	34															
271.3	SAND: trace gravel, brown, moist, dense to very dense																			
271.0																				
270.8			3	SS	47															
270.6																				
270.4			4	SS	53															
270.2																				
270.0																				
269.8			5	SS	70															
269.6																				
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267.8			6	SS	72															
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PROJECT: Geotechnical Investigation

CLIENT: Mattamy Homes

PROJECT LOCATION: 620 Lockhart Road, Barrie, Ontario

DATUM: Geodetic

BOREHOLE LOCATION: N 4910081.23 E 609200.298

DRILLING DATA

Method: Solid Stem Auger

Diameter: 150mm

Date: Dec/04/2020

REF. NO.: 20-231-400

ENCL NO.: 19

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT			NATURAL MOISTURE CONTENT			LIQUID LIMIT			POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m ³)	METHANE AND GRAIN SIZE DISTRIBUTION (%)			
(m)	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS 0.3 m			SHEAR STRENGTH (kPa)				W _p	W	W _L	WATER CONTENT (%)			GR	SA	SI			CL			
ELEV DEPTH								UNCONFINED + FIELD VANE & Sensitivity																		
								○ UNCONFINED	● QUICK TRIAXIAL	× LAB VANE																
263.0						20	40	60	80	100	10	20	30													
262.9	TOPSOIL: 50mm		1	SS	4							○														
262.2	SILT: some sand, some org, trace gravel, brown, moist, loose, disturbed																									
261.5	SILT: some sand, trace clay, trace gravel, brown, wet, compact		2	SS	13								○													
261.5	SANDY SILT: Brown, trace gravel, wet, compact		3	SS	12								○													
261.5	clayey and soft below 2.5m		4	SS	12								○													
260.0			5	SS	7								○													
259.0			6	SS	73								○													
258.1	SAND: trace gravel, grey, wet, very dense																									
257.8	SILTY SAND TILL: Grey, trace gravel, wet, very dense																									
5.2	END OF BOREHOLE: Notes: 1) 50mm dia. monitoring well installed upon completion. 2) Water level Reading: Date: Jan 11, 2021 Water Level (mbgl): 0.83																									

GROUNDWATER ELEVATIONS

Measurement 1st 2nd 3rd 4th

GRAPH
NOTES

+ 3, × 3: Numbers refer to Sensitivity

○ = 3% Strain at Failure

DRILLING DATA

Method: Solid Stem Auger

Diameter: 150mm

REF. NO.: 20-231-400

Date: Dec/04/2020

ENCL NO.: 20

BOREHOLE LOCATION: N 4910262.152 E 609040.767

[illegible]

GROUNDWATER ELEVATIONS

	1st	2nd	3rd	4th
Measurement				

GRAPH
NOTES

+ 3, × 3: Numbers refer to Sensitivity

○ $\epsilon = 3\%$ Strain at Failure

PROJECT: Geotechnical Investigation

CLIENT: Mattamy Homes

PROJECT LOCATION: 620 Lockhart Road, Barrie, Ontario

DATUM: Geodetic

BOREHOLE LOCATION: N 4910301.466 E 608781.543

DRILLING DATA

Method: Solid Stem Auger

Diameter: 150mm

Date: Dec/03/2020

REF. NO.: 20-231-400

ENCL NO.: 15

[illegible]

GROUNDWATER ELEVATIONS

	1st	2nd	3rd	4th
Measurement				

GRAPH
NOTES

+ 3, × 3: Numbers refer to Sensitivity

○ $\epsilon = 3\%$ Strain at Failure

DDS SOIL LOG 20-231-400 MATTAMY, 620 LOCKHART ENVIRO.GPJ DS.GDT 21/1/13



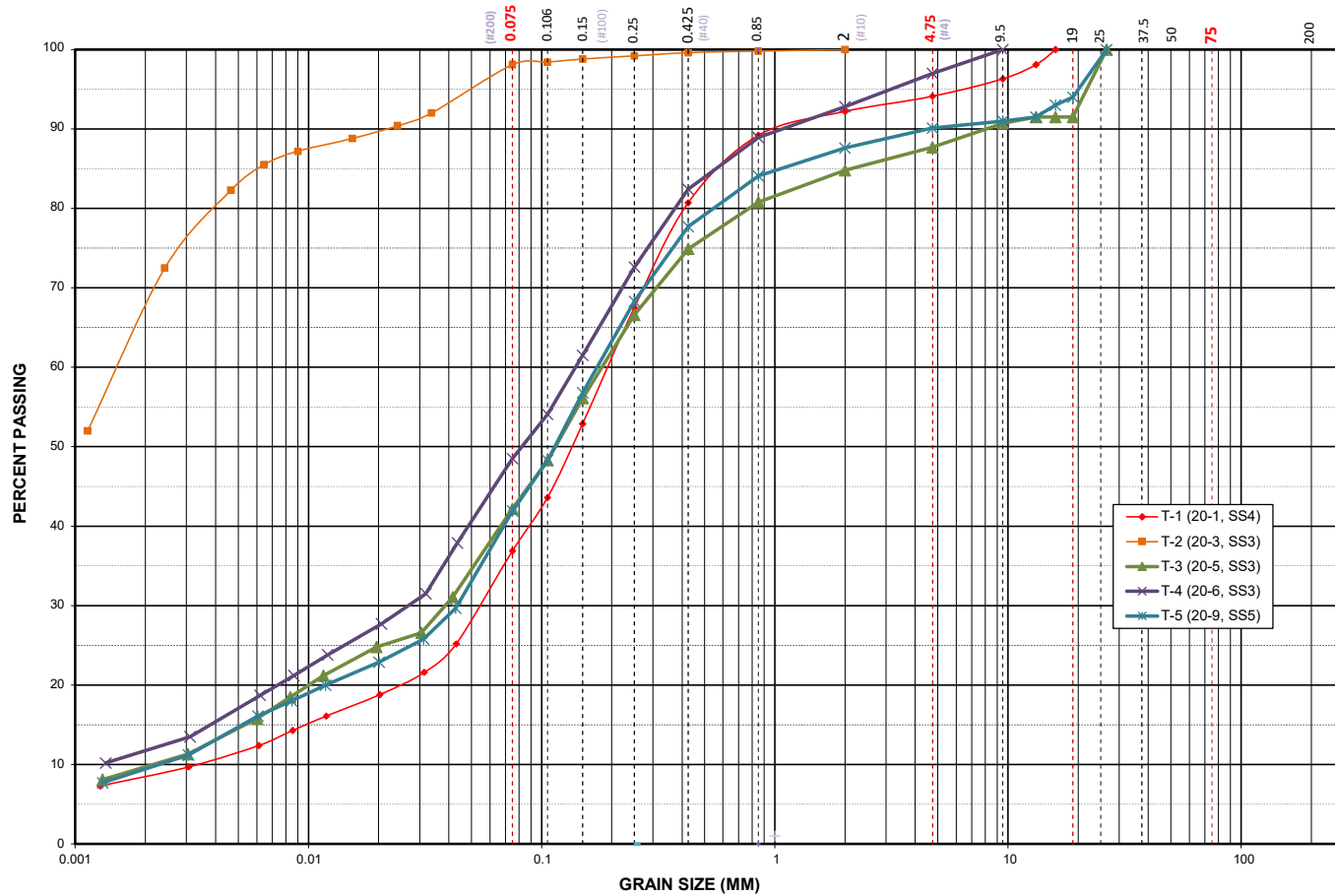
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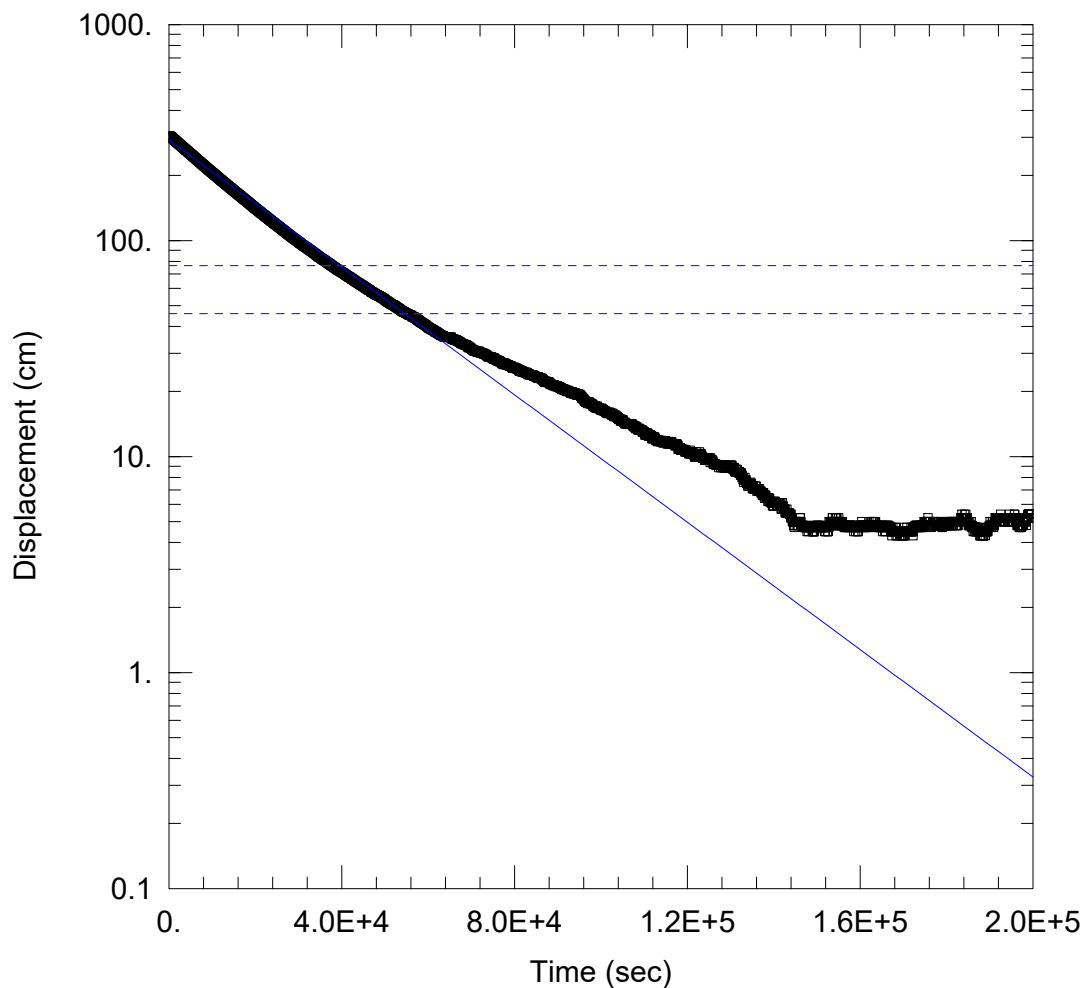
Appendix C

Hydraulic Conductivity

Particle Size Distribution (ASTM-D421/D422)



Silt and Clay		Sand			Gravel		Cobble +
Clay	Silt	Fine	Medium	Coarse	Fine	Coarse	
Specification and Comments:							
 DS CONSULTANTS LTD. 6221 Highway 7, Unit 16 Vaughan, Ontario, L4H 0K8 Telephone: (905) 264-9393 www.dsconsultants.ca		Project:	Geotechnical Investigation, 620 Lockhart Rd.			Tested by :	Matt
		Project No.:	20-231-400			Date:	Sept-30-2020
		Client:	Mattamy Homes			Figure No.:	12



HYDRAULIC CONDUCTIVITY TEST AT MW1- SCREENED IN SILTY SAND TILL

PROJECT INFORMATION

Company: R.J Burnside & Associates Ltd.
 Project: 300052092
 Location: 620 Lockhart Road, Barrie
 Test Well: MW1
 Test Date: May 11, 2021

AQUIFER DATA

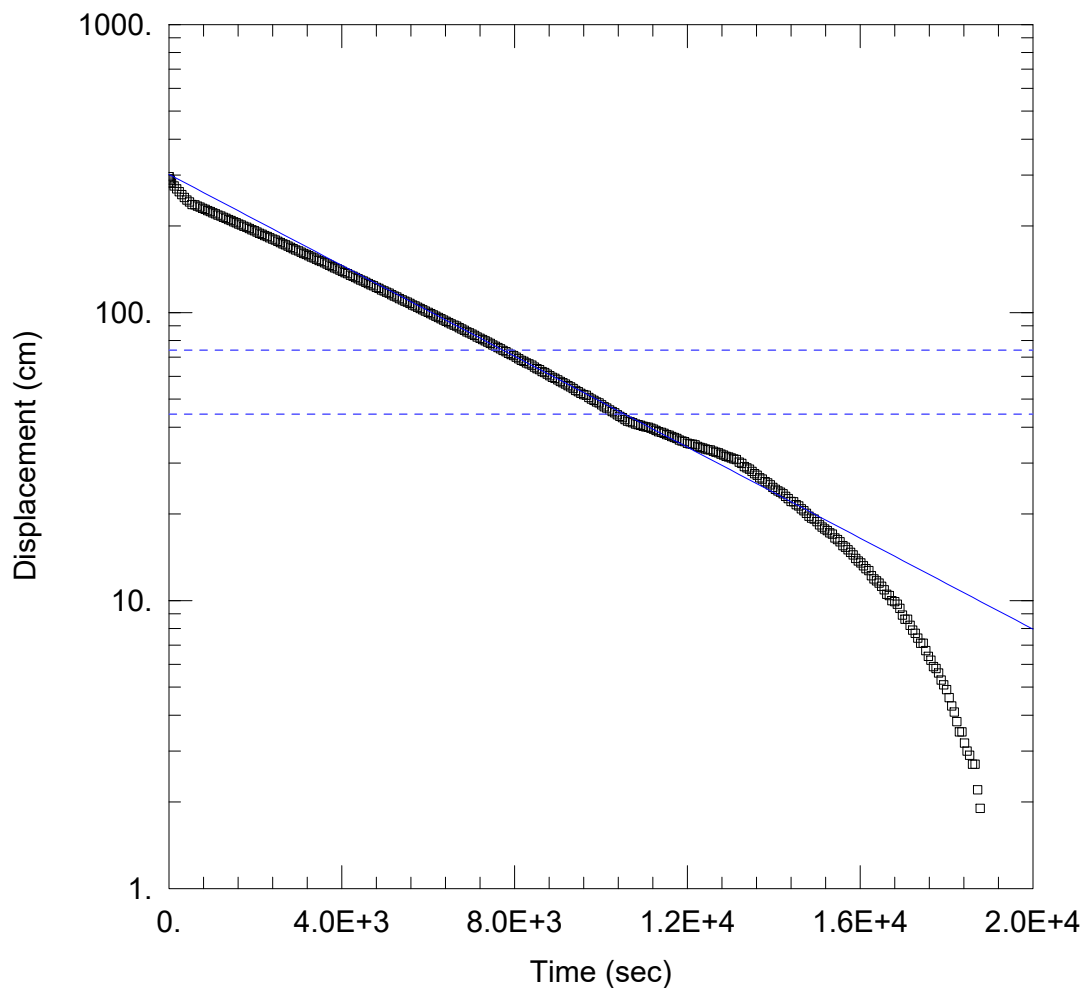
Saturated Thickness: 695. cm Anisotropy Ratio (K_z/K_r): 1.

WELL DATA (MW1)

Initial Displacement: 306. cm Static Water Column Height: 695. cm
 Total Well Penetration Depth: 695. cm Screen Length: 152. cm
 Casing Radius: 2.54 cm Well Radius: 7.62 cm

SOLUTION

Aquifer Model: Unconfined Solution Method: Hvorslev
 $K = 2.657E-6$ cm/sec $y_0 = 292.1$ cm



HYDRAULIC CONDUCTIVITY TEST AT MW3D- SCREENED IN SILTY SAND

PROJECT INFORMATION

Company: R.J Burnside & Associates Ltd.
 Project: 300052092
 Location: 620 Lockhart Road, Barrie
 Test Well: MW3d
 Test Date: May 11, 2021

AQUIFER DATA

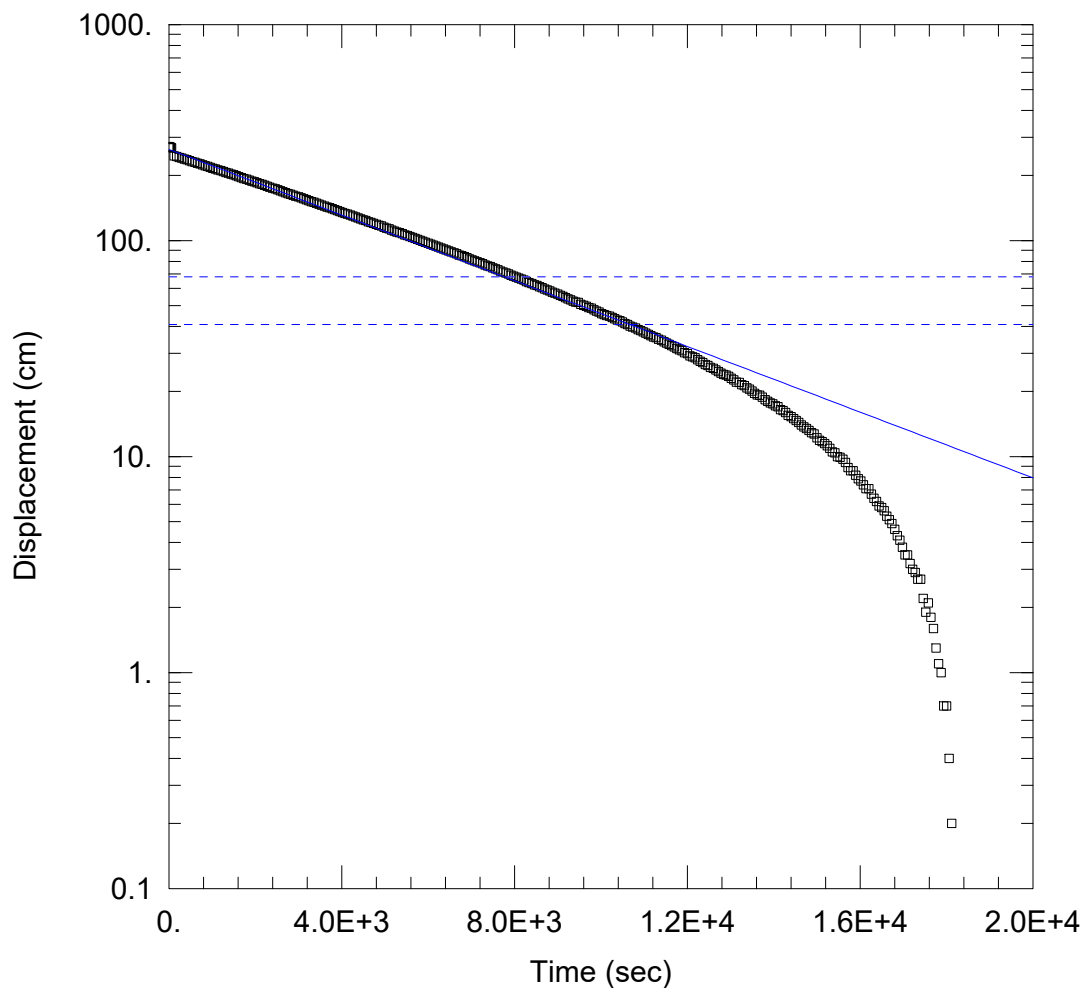
Saturated Thickness: 639. cm Anisotropy Ratio (K_z/K_r): 1.

WELL DATA (MW3d)

Initial Displacement: 296. cm Static Water Column Height: 639. cm
 Total Well Penetration Depth: 639. cm Screen Length: 152. cm
 Casing Radius: 2.54 cm Well Radius: 7.62 cm

SOLUTION

Aquifer Model: Unconfined Solution Method: Hvorslev
 $K = 1.422E-5$ cm/sec $y_0 = 301.8$ cm



HYDRAULIC CONDUCTIVITY TEST AT MW4- SCREENED IN SILTY SAND TILL

PROJECT INFORMATION

Company: R.J Burnside & Associates Ltd.
 Project: 300052092
 Location: 620 Lockhart Road, Barrie
 Test Well: MW4
 Test Date: May 11, 2021

AQUIFER DATA

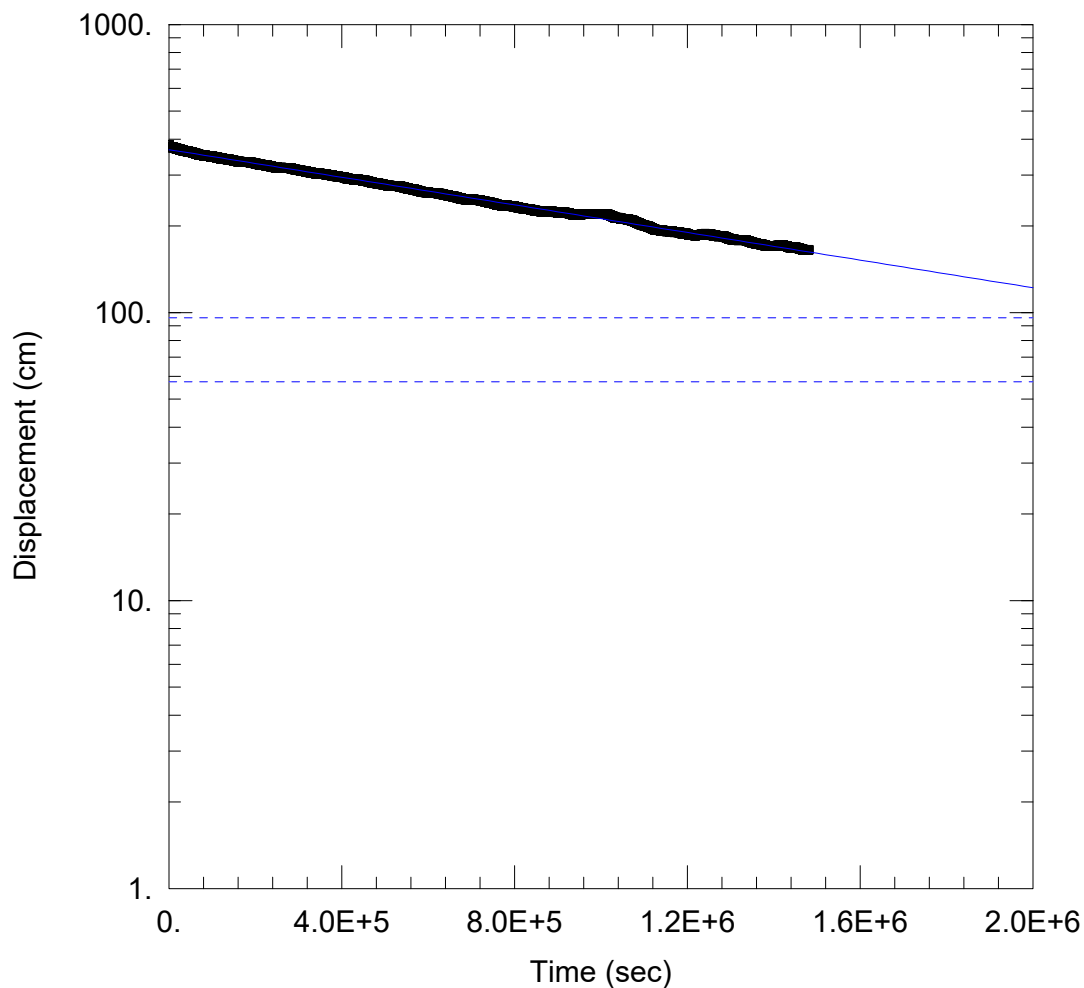
Saturated Thickness: 518. cm Anisotropy Ratio (K_z/K_r): 1.

WELL DATA (MW4)

Initial Displacement: 272. cm Static Water Column Height: 518. cm
 Total Well Penetration Depth: 518. cm Screen Length: 152. cm
 Casing Radius: 2.54 cm Well Radius: 7.62 cm

SOLUTION

Aquifer Model: Unconfined Solution Method: Hvorslev
 $K = 1.37E-5$ cm/sec $y_0 = 264.3$ cm



HYDRAULIC CONDUCTIVITY TEST AT MW5 - SCREENED IN SILTY SAND TILL

PROJECT INFORMATION

Company: R.J Burnside & Associates Ltd.
 Project: 300052092
 Location: 620 Lockhart Road, Barrie
 Test Well: MW5
 Test Date: May 11, 2021

AQUIFER DATA

Saturated Thickness: 830. cm Anisotropy Ratio (K_z/K_r): 1.

WELL DATA (MW5)

Initial Displacement: 383. cm Static Water Column Height: 830. cm
 Total Well Penetration Depth: 830. cm Screen Length: 152. cm
 Casing Radius: 2.54 cm Well Radius: 7.62 cm

SOLUTION

Aquifer Model: Unconfined Solution Method: Hvorslev
 $K = 4.32E-8$ cm/sec $y_0 = 367.7$ cm



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Appendix D

Groundwater Levels

**Table D-1
Groundwater Elevations**

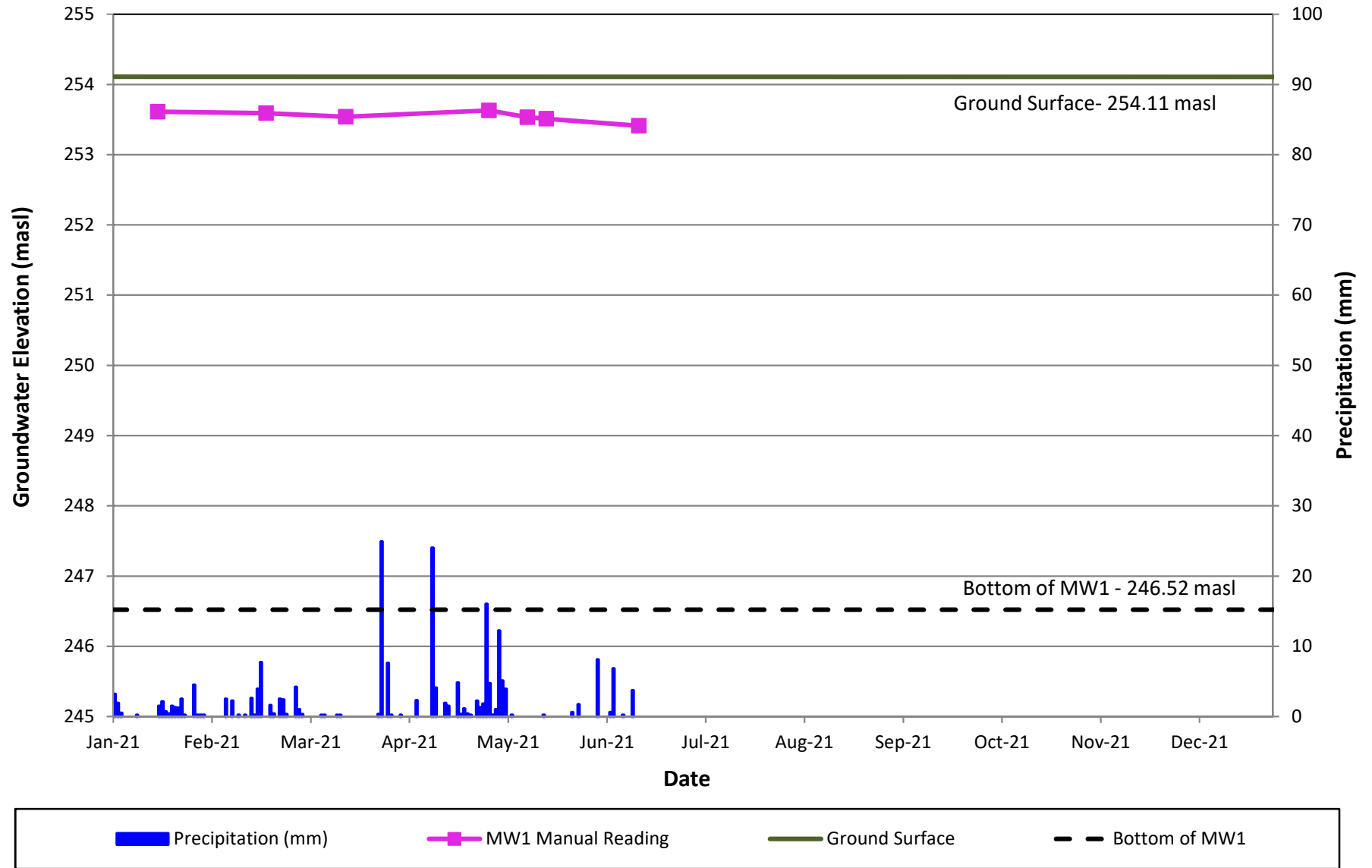
Well	Well Depth (mbgs)	Ground Surface Elevation (masl)	January 15, 2021		February 18, 2021		March 15, 2021		April 29, 2021		May 17, 2021		June 15, 2021	
			Water Level (mbgs)	Water Elevation (masl)	Water Level (mbgs)	Water Elevation (masl)	Water Level (mbgs)	Water Elevation (masl)	Water Level (mbgs)	Water Elevation (masl)	Water Level (mbgs)	Water Elevation (masl)	Water Level (mbgs)	Water Elevation (masl)
MW1	7.59	254.11	0.50	253.61	0.52	253.59	0.57	253.54	0.48	253.63	0.60	253.51	0.70	253.41
MW2	9.88	272.05	9.01	263.04	9.01	263.04	9.05	263.00	8.96	263.09	8.96	263.09	9.05	263.00
MW3s	4.58	263.01	1.03	261.98	0.87	262.14	0.67	262.34	0.66	262.35	0.74	262.27	0.92	262.09
MW3d	7.08	263.00	0.47	262.53	0.54	262.46	0.80	262.20	0.92	262.08	1.05	261.95	1.23	261.77
MW4	7.78	266.30	2.60	263.70	2.57	263.73	2.46	263.84	2.69	263.61	2.68	263.62	2.91	263.39
MW5	7.80	260.02	0.42	259.60	Frozen	Frozen	Frozen	Frozen	-0.12	260.14	-	-	0.64	259.38
BH20-3	7.00	253.10	Frozen	Frozen	Frozen	Frozen	Frozen	Frozen	-0.21	253.31	0.30	252.80	0.37	252.73
BH20-4	6.31	269.00	5.17	263.83	5.05	263.95	4.74	264.26	5.35	263.65	5.23	263.77	5.74	263.26

'-' denotes data unavailable

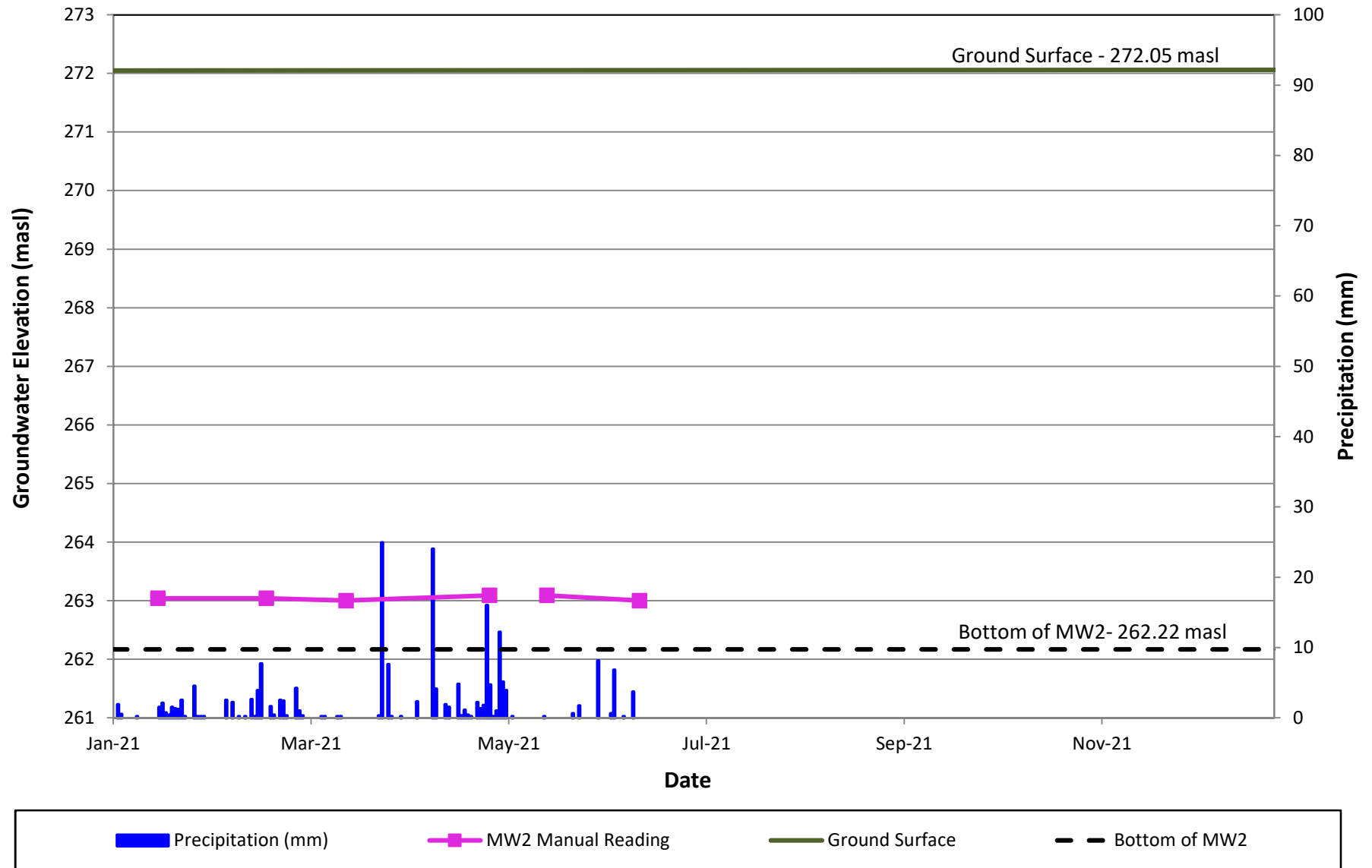
mbgs - metres below ground surface

masl - metres above sea level

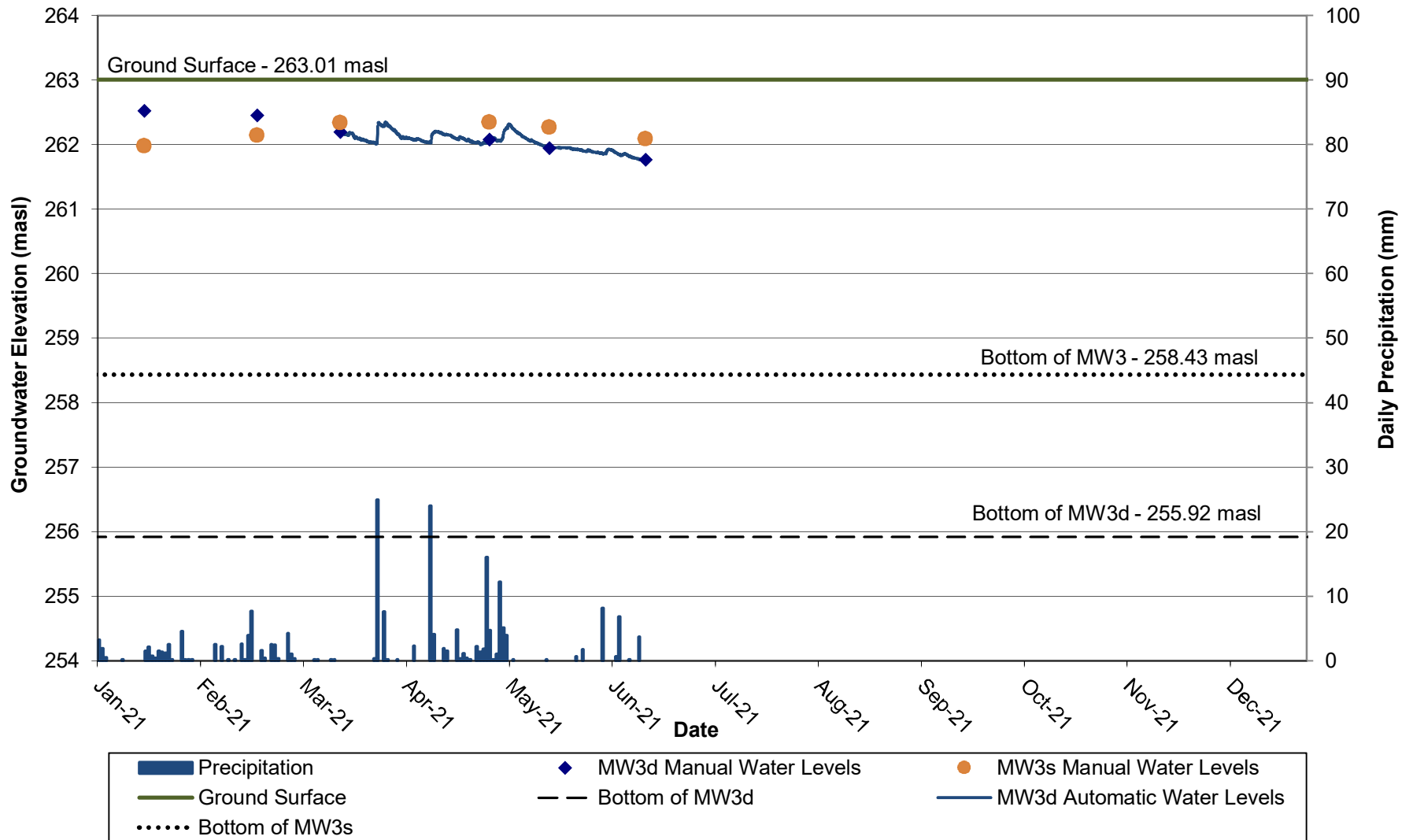
MW1 (Well Depth: 7.6 m, Screened in Silty Sand Till) Groundwater Elevations



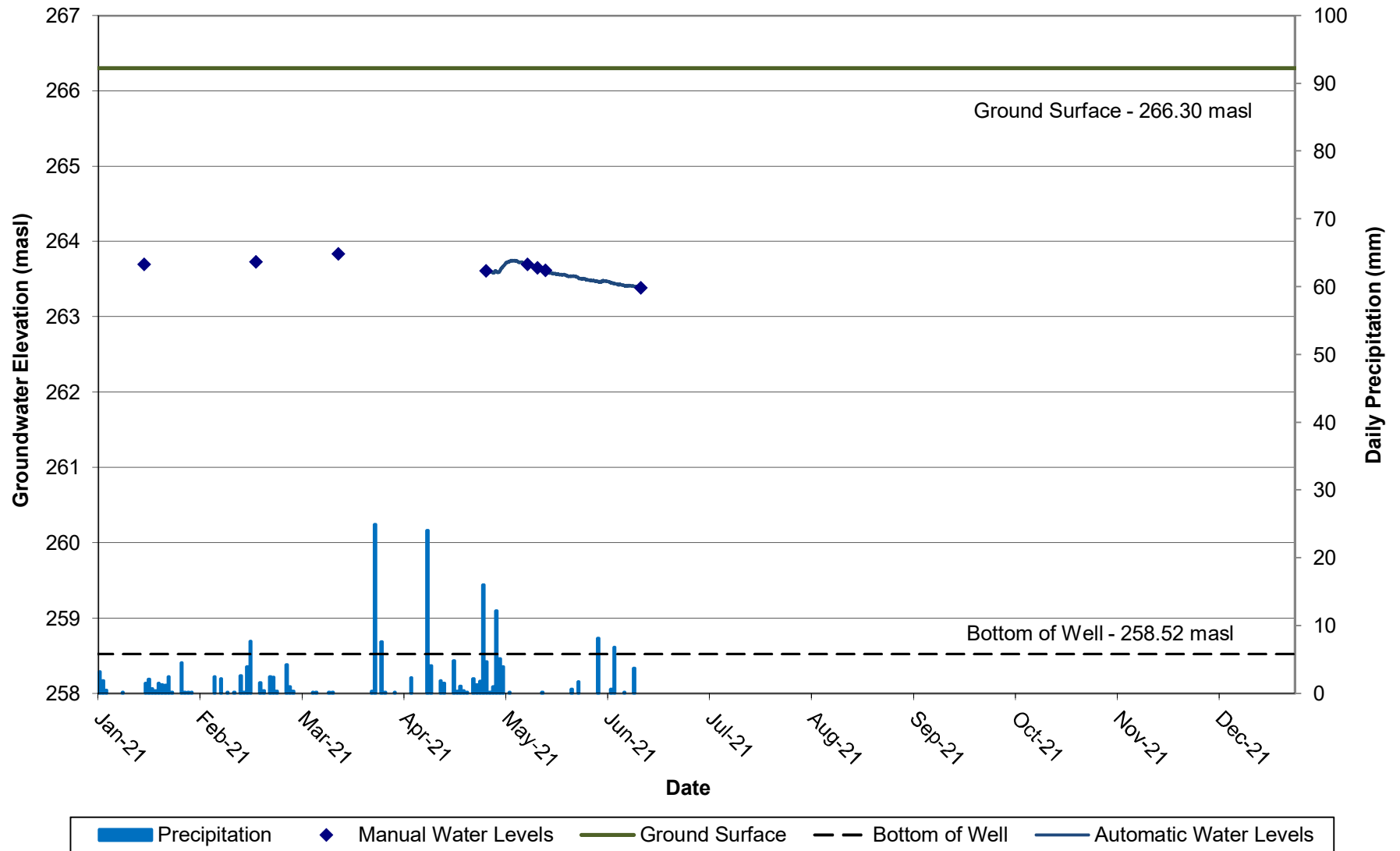
MW2 (Well Depth: 9.9 m, Screened in Sand) Groundwater Elevations



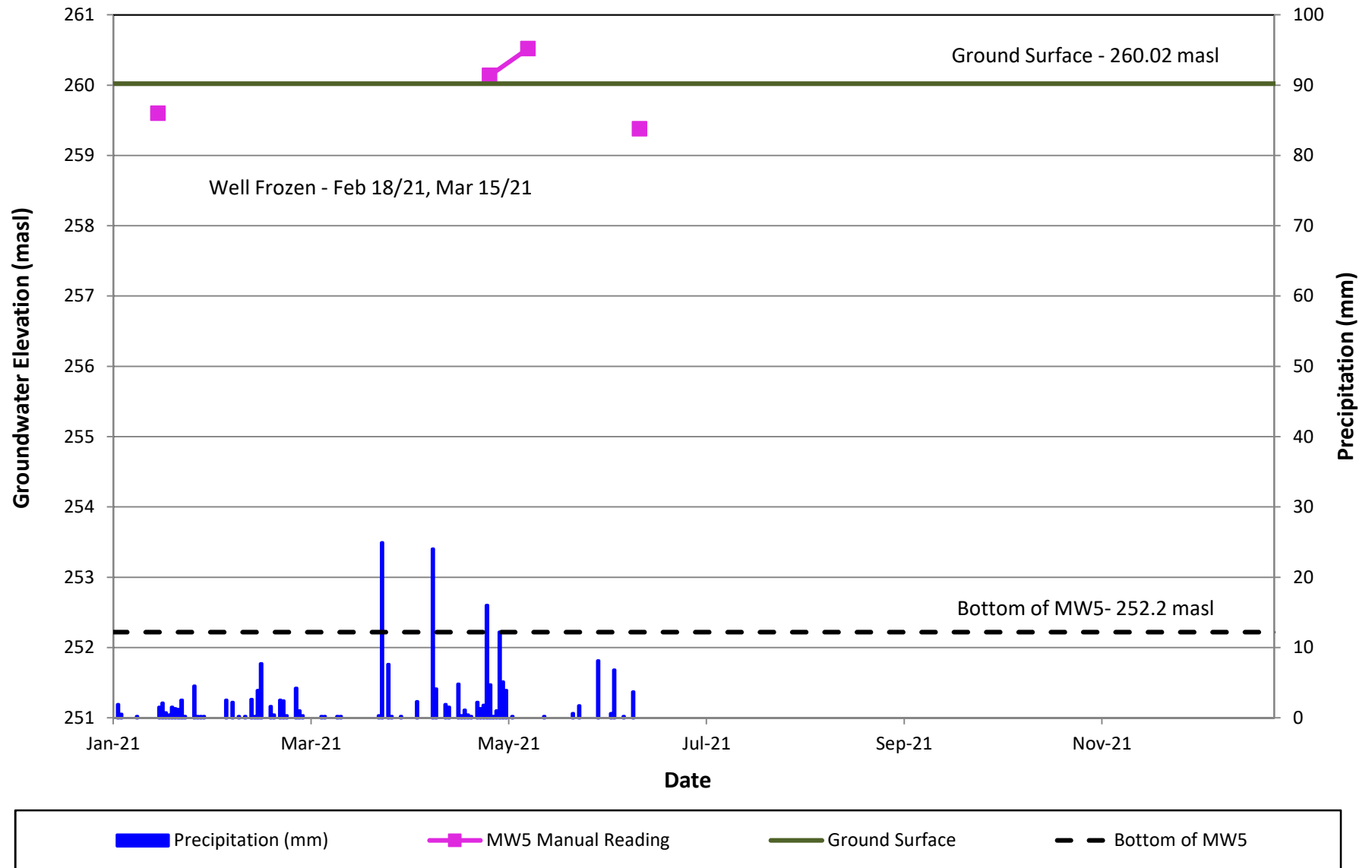
**MW3s (Well Depth: 4.4 m, Screened in Sandy Silt/Sand)
MW3d (Well Depth: 7.3 m, Screened in Silty Sand)
Groundwater Elevations**



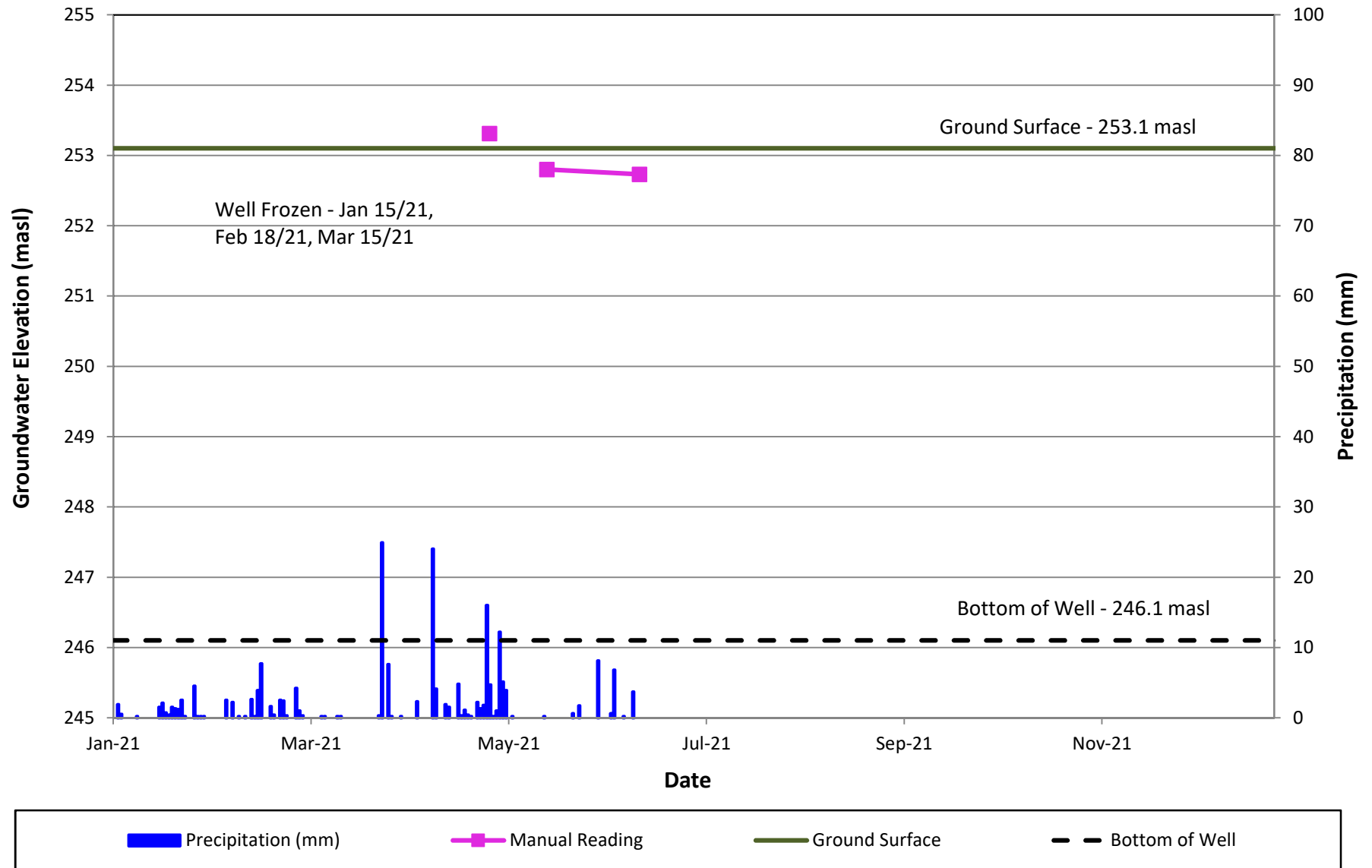
MW4 (Well Depth: 7.8 m, Screened in Silty Sand Till)
Groundwater Elevations



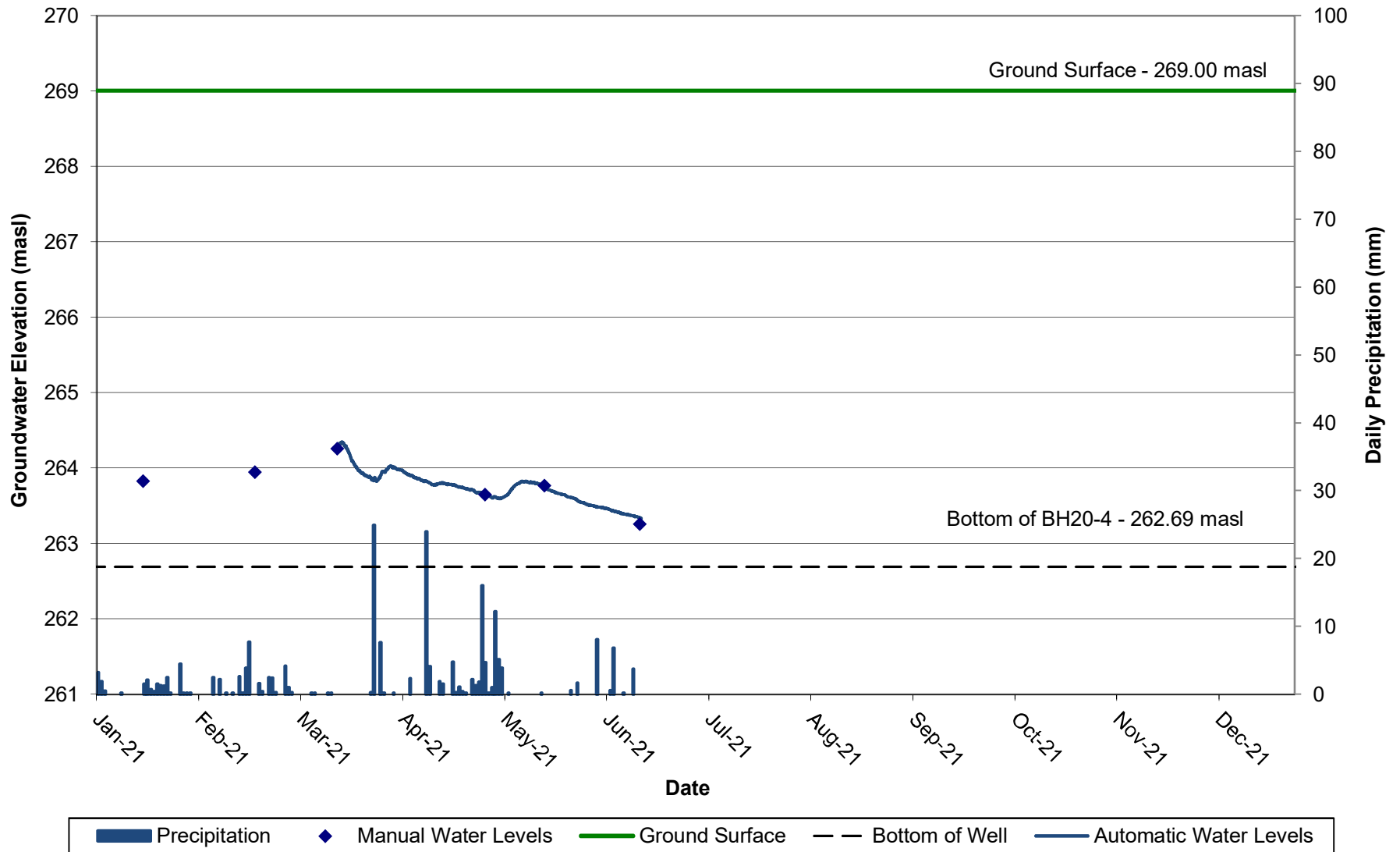
MW5 (Well Depth: 7.8 m, Screened in Silty Sand Till) Groundwater Elevations



BH20-3 (Well Depth: 7.0 m, Screened in Sandy Silt Till) Groundwater Elevations



BH20-4 (Well Depth: 6.3 m, Screened in Silty Sand Till) **Groundwater Elevations**





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Appendix E

Water Quality

Table E-1
Groundwater Quality

Monitoring Well					MW3d	MW4
Date Sampled					14-May-21	14-May-21
Parameter	Unit	RDL	ODWQS	PWQO		
Electrical Conductivity	µS/cm	2			607	550
pH	pH Units	NA	(6.5-8.5)	(6.5-8.5)	7.8	7.87
Saturation pH (Calculated)					6.33	6.58
Langelier Index (Calculated)					1.47	1.29
Total Hardness (as CaCO ₃) (Calculated)	mg/L	0.5	(80-100)		354	301
Total Dissolved Solids	mg/L	30	500		354	403
Alkalinity (as CaCO ₃)	mg/L	2	(30-500)		2030	1270
Bicarbonate (as CaCO ₃)	mg/L	2			2030	1270
Carbonate (as CaCO ₃)	mg/L	2			< 2	< 2
Hydroxide (as CaCO ₃)	mg/L	2			< 2	< 2
Fluoride	mg/L	0.06	1.5		< 0.06	0.12
Chloride	mg/L	1	250		48	32
Nitrate as N	mg/L	0.06	10.0		11.8	19.4
Nitrite as N	mg/L	0.03	1.0		<0.03	<0.03
Bromide	mg/L	0.3			<0.3	<0.3
Sulphate	mg/L	10	500		15	<10
Phosphate (total reactive)	mg/L	0.03			<0.03	0.05
Ammonia+Ammonium (N)	mg/L	0.04			<0.04	<0.04
Total Phosphorus	mg/L	0.03		0.03	<u>0.05</u>	<u>1.46</u>
Total Organic Carbon	mg/L	0.5			1	1
Colour	TCU	3	5		24	8
Calcium	mg/L	0.01			117	100
Magnesium	mg/L	0.001			15.3	12.2
Sodium	mg/L	0.01	20 (200)		7.17	5.92
Potassium	mg/L	0.009			1.51	2.32
Aluminum	mg/L	0.001	0.1	0.075	0.019	0.004
Antimony	mg/L	0.0009	0.006		< 0.0009	< 0.0009
Arsenic	mg/L	0.0002	0.025	1	< 0.0002	< 0.0002
Barium	mg/L	0.00002	1		0.08243	0.01243
Beryllium	mg/L	0.000007			< 0.000007	< 0.000007
Boron	mg/L	0.002	5	2	0.007	0.008
Cadmium	mg/L	0.000003	0.005	0.0002	0.000003	0.000003
Chromium	mg/L	0.00008	0.05	0.009	0.00123	0.00037
Cobalt	mg/L	0.000004			0.00005	0.000039
Copper	mg/L	0.0002	1	0.005	0.0006	0.0004
Iron	mg/L	0.007	0.3	0.3	0.022	0.007
Lead	mg/L	0.00009	0.01	0.001	< 0.00009	< 0.00009
Manganese	mg/L	0.00001	0.05		0.00363	0.00348
Mercury	mg/L	0.00001	0.001	0.0002	< 0.00001	< 0.00001
Molybdenum	mg/L	0.00004		0.04	0.00027	0.00211
Nickel	mg/L	0.0001		0.025	0.0012	0.0018
Selenium	mg/L	0.00004	0.01	0.01	0.00032	0.00009
Silver	mg/L	0.00005		<0.002	< 0.00005	< 0.00005
Strontium	mg/L	0.00002			0.257	0.258
Thallium	mg/L	0.000005		0.0003	< 0.000005	< 0.000005
Tin	mg/L	0.00006			0.00009	0.00009
Titanium	mg/L	0.00005			0.00113	0.00017
Tungsten	mg/L	0.00002			< 0.00002	0.00008
Uranium	mg/L	0.000002	0.02	0.005	0.000442	0.000118
Vanadium	mg/L	0.00001	3		0.00065	0.00089
Zinc	mg/L	0.002	5	0.03	<u>0.034</u>	0.006
Zirconium	mg/L	0.002			< 0.002	< 0.002

ODWQS - Ontario Drinking Water Quality Standards

RDL - Reported Detection Limit

PWQS - Provincial Water Quality Standards

Bold indicates an exceedence of the ODWQS



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Appendix F

Water Balance

WATER BALANCE CALCULATIONS

Mattamy (Lockhart) Limited
620 Lockhart Road
Barrie, ON
PROJECT No.300052092



TABLE F-1

Water Balance Components													
Based on Thornthwaite's Soil Moisture Balance Approach with a Soil Moisture Retention of 150 mm (moderately-rooted vegetation in sandy loam soils)													
Precipitation data from Barrie WPCC Climate Station (1981 - 2010)													

Potential Evapotranspiration Calculation	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
Average Temperature (Degree C)	-7.7	-6.6	-2.1	5.6	12.3	17.9	20.8	19.7	15.3	8.7	2.7	-3.5	6.9
Heat index: $i = (t/5)^{1.514}$	0.00	0.00	0.00	1.19	3.91	6.90	8.66	7.97	5.44	2.31	0.39	0.00	36.8
Unadjusted Daily Potential Evapotranspiration U (mm)	0.00	0.00	0.00	25.18	58.76	88.02	103.48	97.59	74.33	40.47	11.47	0.00	499
Adjusting Factor for U (Latitude 44° 20' N)	0.81	0.82	1.02	1.13	1.27	1.29	1.3	1.2	1.04	0.95	0.8	0.76	
Adjusted Potential Evapotranspiration PET (mm)	0	0	0	28	75	114	135	117	77	38	9	0	593
WATER BALANCE COMPONENTS	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
Precipitation (P)	83	62	58	62	82	85	77	90	94	78	89	74	933
Potential Evapotranspiration (PET)	0	0	0	28	75	114	135	117	77	38	9	0	593
P - PET	83	62	58	34	8	-29	-57	-27	17	39	80	74	340
Change in Soil Moisture Storage	0	0	0	0	0	-29	-57	-27	17	39	58	0	0
Soil Moisture Storage max 150 mm	150	150	150	150	150	121	64	37	53	92	150	150	
Actual Evapotranspiration (AET)	0	0	0	28	75	114	135	117	77	38	9	0	593
Soil Moisture Deficit max 150 mm	0	0	0	0	0	29	86	113	97	58	0	0	
Water Surplus - available for infiltration or runoff	83	62	58	34	8	0	0	0	0	0	22	74	340
Potential Infiltration (based on MOE methodology*; independent of temperature)	50	37	35	20	5	0	0	0	0	0	13	44	204
Potential Direct Surface Water Runoff (independent of temperature)	33	25	23	13	3	0	0	0	0	0	9	29	136
IMPERVIOUS AREA WATER SURPLUS	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
Precipitation (P)	933	mm/year											
Potential Evaporation (PE) from impervious areas (assume 15%)	140	mm/year											
P-PE (surplus available for runoff from impervious areas)	793	mm/year											

Assume January storage is 100% of Soil Moisture Storage
Soil Moisture Storage

150 mm

-- See "Water Holding Capacity" values in Table 3.1, MOE SWMPDM, 2003

*MOE SWM infiltration calculations

topography - hilly

0.1

soils - sandy loam

0.4

cover - predominantly cultivated land

0.1

Infiltration factor

0.6

-- Infiltration Factors from the bottom section of Table 3.1, MOE SWMPDM, 2003

-- Infiltration Factors from the bottom section of Table 3.1, MOE SWMPDM, 2003

-- Infiltration Factors from the bottom section of Table 3.1, MOE SWMPDM, 2003

Latitude of site (or climate station)

44 ° N.

WATER BALANCE CALCULATIONS

Mattamy (Lockhart) Limited
620 Lockhart Road
Barrie, ON
PROJECT No.300052092



TABLE F-2

Post-Development Water Balance Components													
Based on Thornthwaite's Soil Moisture Balance Approach with a Soil Moisture Retention of 75 mm (urban lawn in sandy loam soils)													
Precipitation data from Barrie WPCC Climate Station (1981 - 2010)													

Potential Evapotranspiration Calculation	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
Average Temperature (Degree C)	-7.7	-6.6	-2.1	5.6	12.3	17.9	20.8	19.7	15.3	8.7	2.7	-3.5	6.9
Heat index: $i = (t/5)^{1.514}$	0.00	0.00	0.00	1.19	3.91	6.90	8.66	7.97	5.44	2.31	0.39	0.00	36.8
Unadjusted Daily Potential Evapotranspiration U (mm)	0.00	0.00	0.00	25.18	58.76	88.02	103.48	97.59	74.33	40.47	11.47	0.00	499
Adjusting Factor for U (Latitude 44° 20' N)	0.81	0.82	1.02	1.13	1.27	1.29	1.3	1.2	1.04	0.95	0.8	0.76	
Adjusted Potential Evapotranspiration PET (mm)	0	0	0	28	75	114	135	117	77	38	9	0	593
WATER BALANCE COMPONENTS	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
Precipitation (P)	83	62	58	62	82	85	77	90	94	78	89	74	933
Potential Evapotranspiration (PET)	0	0	0	28	75	114	135	117	77	38	9	0	593
P - PET	83	62	58	34	8	-29	-57	-27	17	39	80	74	340
Change in Soil Moisture Storage	0	0	0	0	0	-29	-46	0	17	39	19	0	0
Soil Moisture Storage max 75 mm	75	75	75	75	75	46	0	0	17	56	75	75	
Actual Evapotranspiration (AET)	0	0	0	28	75	114	123	90	77	38	9	0	555
Soil Moisture Deficit max 75 mm	0	0	0	0	0	29	75	75	58	19	0	0	
Water Surplus - available for infiltration or runoff	83	62	58	34	8	0	0	0	0	0	60	74	378
Potential Infiltration (based on MOE methodology*; independent of temperature)	50	37	35	20	5	0	0	0	0	0	36	44	227
Potential Direct Surface Water Runoff (independent of temperature)	33	25	23	13	3	0	0	0	0	0	24	29	151
IMPERVIOUS AREA WATER SURPLUS													
Precipitation (P)	933	mm/year											
Potential Evaporation (PE) from impervious areas (assume 15%)	140	mm/year											
P-PE (surplus available for runoff from impervious areas)	793	mm/year											

Assume January storage is 100% of Soil Moisture Storage
Soil Moisture Storage

75 mm

<-- See "Water Holding Capacity" values in Table 3.1, MOE SWMPDM, 2003

*MOE SWM infiltration calculations

topography - hilly land

0.1

soils - sandy loam

0.4

cover - urban lawn

0.1

Infiltration factor

0.6

<-- Infiltration Factors from the bottom section of Table 3.1, MOE SWMPDM, 2003

<-- Infiltration Factors from the bottom section of Table 3.1, MOE SWMPDM, 2003

<-- Infiltration Factors from the bottom section of Table 3.1, MOE SWMPDM, 2003

Latitude of site (or climate station)

44 ° N.

WATER BALANCE CALCULATIONS

Mattamy (Lockhart) Limited
620 Lockhart Road
Barrie, ON
PROJECT No.300052092



TABLE F-3

Water Balance for Pre- and Post-Development Land Use Conditions (with no SWM/LID measures in place)												
Land Use Description	Approx. Land Area (m ²)	Estimated Impervious Fraction for Land Use*	Estimated Impervious Area (m ²)	Runoff from Impervious Area** (m/a)	Runoff Volume from Impervious Area (m ³ /a)	Estimated Pervious Area (m ²)	Runoff from Pervious Area** (m/a)	Runoff Volume from Pervious Area (m ³ /a)	Infiltration from Pervious Area** (m/a)	Infiltration Volume from Pervious Area (m ³ /a)	Total Runoff Volume (m ³ /a)	Total Infiltration Volume (m ³ /a)
Pre-Development Land Use												
Open Space /Agricultural	279,300	0.00	0	0.793	0	279,300	0.136	37,953	0.204	56,930	37,953	56,930
TOTAL PRE-DEVELOPMENT	279,300		0		0	279,300		37,953		56,930	37,953	56,930
Post-Development Land Use (with no LID measures in place)												
Residential	160,500	0.50	80,250	0.793	63,635	80,250	0.151	12,134	0.227	18,201	75,769	18,201
Park	25,200	0.05	1,260	0.793	999	23,940	0.151	3,620	0.227	5,430	4,619	5,430
Roads (ROW)	93,600	0.80	74,880	0.793	59,377	18,720	0.151	2,830	0.227	4,246	62,208	4,246
TOTAL POST-DEVELOPMENT	279,300		156,390		124,012	122,910		18,584		27,876	142,596	27,876
% Change from Pre to Post											376	51
Effect of development (with no mitigation)											3.7 times increase in runoff	51% reduction of infiltration

** figures from Tables F-1 and F-2.

To balance pre- to post-,
the infiltration target (m³/a)=

29,054

Figure F-1
Pre-Development Monthly Site Water Balance





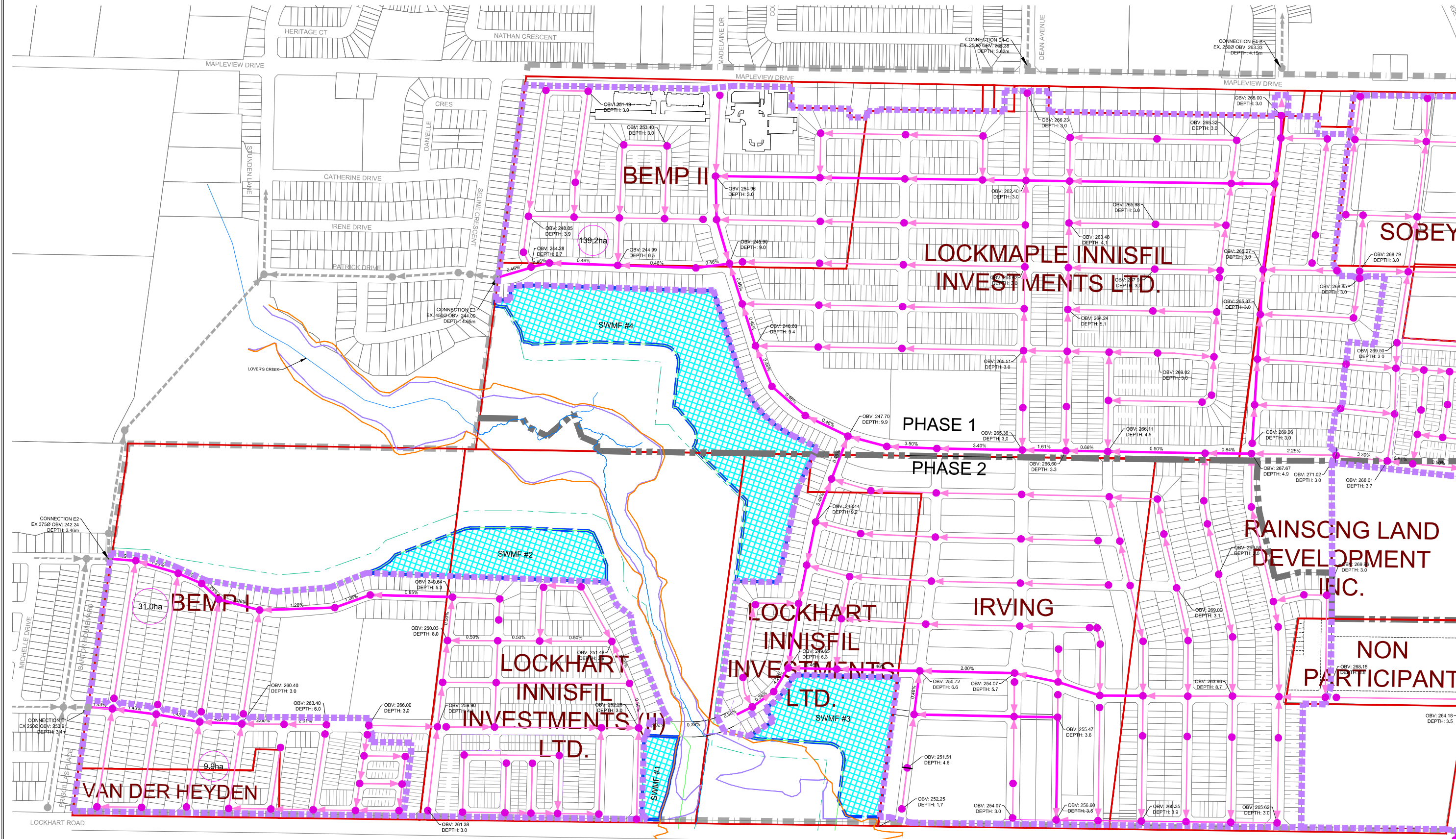


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Appendix D

Background References



REFER TO FIGURE 14

REFER TO FIGURE 14

LEGEND

- SURVEYED NHS LIMIT (2015)
- NHS BUFFER LIMIT
- 2031 PHASE LIMITS
- 2031 PHASE LIMITS DEV. LIMITS
- 2031 PHASE LIMITS PHASING LIMITS
- 2031 PHASE LIMITS
- EXISTING 100 YR FLOOD LIMITS
- EXISTING REGIONAL FLOOD LIMITS
- PROPOSED 100 YR FLOOD LIMITS
- PROPOSED REGIONAL FLOOD LIMITS
- PROPOSED DRAINAGE BOUNDARY

DASHED FLOOD LINES ARE APPROXIMATE ONLY, BASED ON INTERPOLATED DATA BETWEEN FINGERLAKES AND 1091369 ONTARIO INC. DETAILED TOPOGRAPHIC DATA. FLOODLINES ARE SUBJECT TO CHANGE BASED ON ADDITION OF DETAILED TOPOGRAPHIC SURVEY.

— FLOW DIRECTION ARROW

— SANITARY DC TRUNK SEWER

— SANITARY LOCAL TRUNK SEWER

— SANITARY LOCAL COLLECTOR SEWER

— SANITARY FORCEMAIN

— SANITARY MANHOLE

— EXISTING SANITARY SEWER

— FLOW DIRECTION ARROW DEPICTS SEWER CONTINUES ON IN ARROW DIRECTION

P PUMP STATION

0 60 120 180 240

Metres

NOTE: "SCALE ONLY VALID FOR 24" x 36" SIZED PLOTS"

BURNSIDE

HEWITT'S CREEK LANDOWNERS GROUP INC.

Figure Title: HEWITT'S SECONDARY PLAN AREA SUBWATERSHED IMPACT STUDY PROPOSED SANITARY SEWER PLAN (1 OF 3)

Client	Drawn	Checked	Date	Figure No.
HEWITT'S CREEK LANDOWNERS GROUP INC.	BH	CC	16/09/07	FIG 13
	Scale: H 1:3,000		Project No: 300032860	

Subwatershed Impact Study Lover's, Hewitt's and Sandy Cove Creeks
September 2016

Point	Identification	Master Plan	SIS	Pipe Capacity
		Discharge Flow (L/s)	Discharge Flow (L/s)	(L/s)
E1	SAP09044	5	7.3	59.5
E2	SAP09067	77	20.8	96.0
E3	SAP09006A	66	79.8	156.2
E4A	6940	24	34.5	40.3
E4B	SAP25122	11	n/a	n/a
E4C	SAP25121	1	n/a	n/a
E5	SAH08044	129	157.7	1435.4
E6	SAH09043	2	2.3	229.3
E7	SAH08021	8	1.0	40.8
E8	SAH08063	16	14.6	53.0
E9	SAH08066	14	15.5	37.6

The proposed sanitary flows and areas based on the revised conceptual plan vary (in some cases significantly) from the proposed Master Plan flows, however the proposed flows are less than the capacity of the receiving pipe. The full downstream pipe network should be reviewed with the City to confirm capacity to the discharge point.

In the case of connection point E4A, which includes the sanitary discharge from the Sobey's lands, the downstream pipe capacity may limit development. At detailed design, the pipe discharge should not exceed 85% capacity of the receiving pipe, which may limit the number of units within this parcel. Additional detailed analysis will be required to confirm pipe sizing and the distribution of the proposed units within the development area.

6.4 Water Distribution

6.4.1 External Water Supply

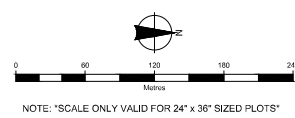
The municipal water supply for the City of Barrie is currently obtained from twelve groundwater wells as well as several surface water sources, with a total combined capacity of 81.3 million liters per day (MLD), with an additional two wells at design stage. The City is divided into five major pressure zones, with the two southern zones (2S and 3S) being serviced by surface water sources, and the remaining three northern zones (1, 2N and 3N) being serviced by groundwater sources.

The Hewitt's SPA lies within pressure zone 2S, which is serviced by a surface water treatment plant (SWTP) located on the shore of Kempenfelt Bay. The ultimate capacity of the plant is 240 MLD, however it is being implemented in phases, with the initial capacity at 60 MLD.



LEGEND

- STAKED NHS LIMITS (2015)
- NHS BUFFER LIMITS
- CoB GENERATED BUFFER LIMITS (2013)
- 2031 BOUNDARY
- EXISTING 100 YR FLOOD LIMITS
- EXISTING REGIONAL FLOOD LIMITS
- PROPOSED 100 YR FLOOD LIMITS
- PROPOSED REGIONAL FLOOD LIMITS
- DASHED FLOOD LINES ARE APPROXIMATE ONLY, BASED ON INTERPOLATED DATA BETWEEN FINGERLAKES AND 1691369 ONTARIO INC. DETAILED TOPOGRAPHIC DATA. FLOODLINES ARE SUBJECT TO CHANGE BASED ON ADDITION OF DETAILED TOPOGRAPHIC SURVEY.
- 263.99 EXISTING ELEVATION
- 263.99 PROPOSED ELEVATION
- PROPOSED OVERLAND FLOW ROUTE



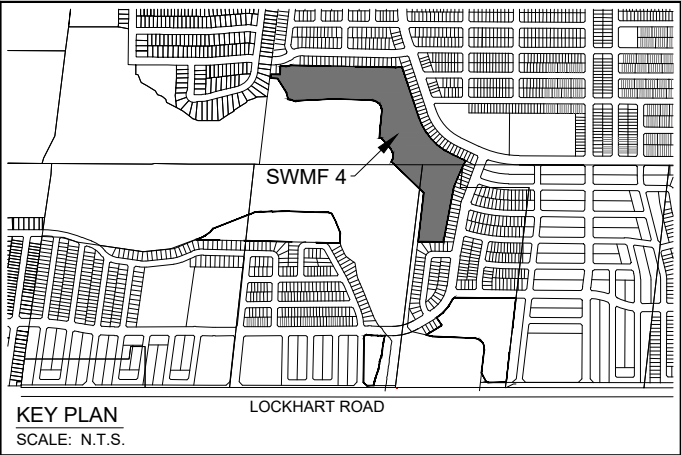
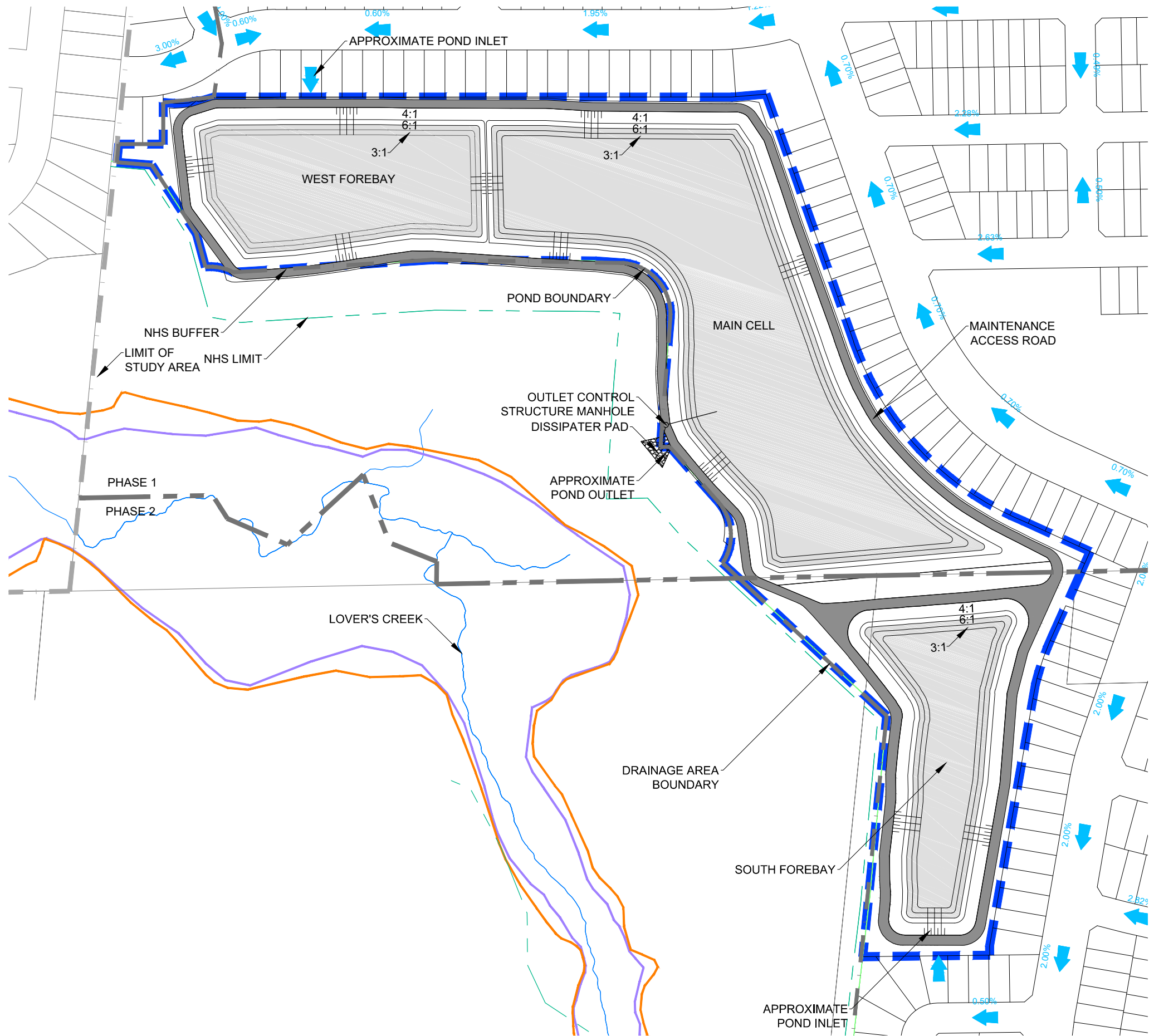


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Client
HEWITT'S CREEK LANDOWNERS GROUP INC.

Figure Title
HEWITT'S SECONDARY PLAN AREA SUBWATERSHED IMPACT STUDY
PROPOSED CONDITION GRADING PLAN (3 OF 3)

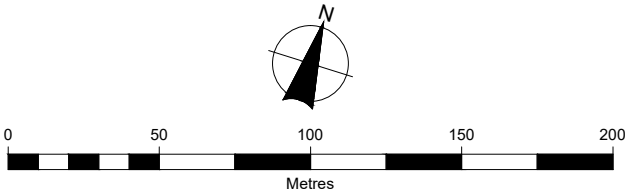
Drawn AD	Checked CC	Date 16/09/07	Figure No. FIG 8
Scale H 1:3,000		Project No. 300032860	



- LEGEND**
- ➡ OVERLAND FLOW DIRECTION
 - EXISTING 100 YEAR FLOOD LIMIT
 - EXISTING REGIONAL FLOOD LIMIT
 - PROPOSED REGIONAL FLOOD LIMIT
 - CONCEPTUAL SWMF BLOCK

POND STATISTICS

TOP OF POND ELEV	:249.94m
NWL ELEV	:247.64m
MAX DEPTH	:2.82m
PERMANENT POOL VOL	:51,813m ³
ACTIVE STORAGE VOL	:92,241m ³
CONCEPTUAL SWMF BLOCK AREA	:86,241.1m ²



Client

HEWITT'S CREEK LANDOWNERS GROUP INC.

Figure Title

**HEWITT'S SECONDARY PLAN AREA
SUBWATERSHED IMPACT STUDY**

Preliminary SWMF Design – Facility No. 4

Drawn	Checked	Date	Figure No.
T.S.	C.C.	16/01/28	
Scale	Project No.		
1:2500	300032860		FIG 20

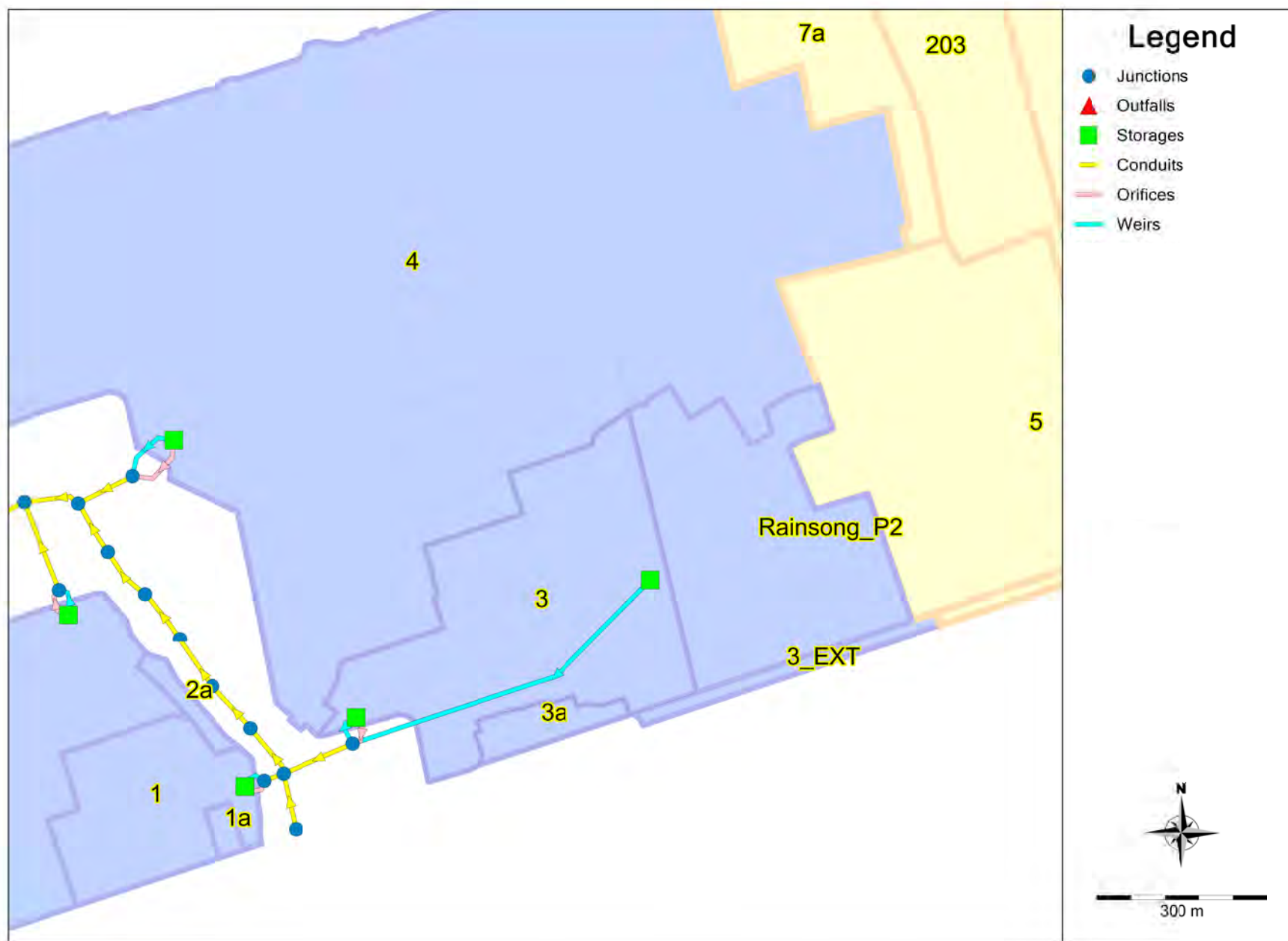


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Appendix E

PCSWMM Modelling Outputs



CONTINUOUS SIMULATION MODEL

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.010)

PROJECT TITLE: East Moratorium Lands
PROJECT NO: 300032860
MODEL CREATED BY: R.J.BURNSIDE AND ASSOCIATES LTD

Element Count

Number of rain gages 19
Number of subcatchments ... 49
Number of nodes 103
Number of links 105
Number of pollutants 0
Number of land uses 0

Raingage Summary

Name	Data Source	Data Type	Recording Interval
100yr_SCS_24h_Type_II_133.6mm	100yr_SCS_24h_Type_II_133.6mm	INTENSITY	15 min.
100yr_SCS_6h_106.5mm	100yr_SCS_6h_106.5mm	INTENSITY	5 min.
10yr_SCS_24h_Type_II_89.9mm	10yr_SCS_24h_Type_II_89.9mm	INTENSITY	15 min.
10yr_SCS_6h_70.8mm	10yr_SCS_6h_70.8mm	INTENSITY	5 min.
25mm	25mm	INTENSITY	5 min.
25mm_SCS_24h_Type_II_25mm	25mm_SCS_24h_Type_II_25mm	INTENSITY	15 min.
25mm_SCS_6h_25mm	25mm_SCS_6h_25mm	INTENSITY	5 min.
25yr_SCS_24h_Type_II_107.5mm	25yr_SCS_24h_Type_II_107.5mm	INTENSITY	15 min.
25yr_SCS_6h_85.2mm	25yr_SCS_6h_85.2mm	INTENSITY	5 min.
2yr_SCS_24h_Type_II_55mm	2yr_SCS_24h_Type_II_55mm	INTENSITY	15 min.
2yr_SCS_6h_42.3mm	2yr_SCS_6h_42.3mm	INTENSITY	5 min.
50yr_SCS_24h_Type_II_120.6mm	50yr_SCS_24h_Type_II_120.6mm	INTENSITY	15 min.
50yr_SCS_6h_95.9mm	50yr_SCS_6h_95.9mm	INTENSITY	5 min.
5yr_SCS_24h_Type_II_76mm	5yr_SCS_24h_Type_II_76mm	INTENSITY	15 min.
5yr_SCS_6h_59.5mm	5yr_SCS_6h_59.5mm	INTENSITY	5 min.
Cont_Hourly_984mm	Cont_Hourly_984	INTENSITY	60 min.
Hurricane_Hazel_(Southern_Ontario)	Hurricane_Hazel_(Southern_Ontario)	INTENSITY	60 min.
NO_RAIN	NO_RAIN	INTENSITY	5 min.
SCS_6h_1mm_Jordan	SCS_6h_1mm_Jordan	INTENSITY	5 min.

Subcatchment Summary

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
1	7.92	263.97	56.00	2.3000	Cont_Hourly_984mm	SWMF1
10	39.31	595.60	54.00	2.0000	Cont_Hourly_984mm	SWMF10
10a	1.14	567.90	0.00	2.0000	Cont_Hourly_984mm	J30
11	29.17	566.33	56.00	0.6000	Cont_Hourly_984mm	SWMF11
11B	7.06	196.03	57.00	1.2000	Cont_Hourly_984mm	SWMF11
12	9.63	192.68	53.00	2.0000	Cont_Hourly_984mm	SWMF12
13	24.90	332.01	56.00	0.6000	Cont_Hourly_984mm	SWMF13
13a	0.40	221.22	0.00	2.0000	Cont_Hourly_984mm	J51
13SWMF	1.87	155.97	50.00	25.0000	Cont_Hourly_984mm	SWMF13
14	40.19	521.97	52.00	1.2000	Cont_Hourly_984mm	SWMF14
14-EXT	2.27	37.78	50.00	1.0000	Cont_Hourly_984mm	SWMF14
15	22.24	370.72	57.00	1.5000	Cont_Hourly_984mm	SWMF15
15a	4.48	154.41	0.00	1.0000	Cont_Hourly_984mm	H11
16	21.35	533.69	57.00	1.5000	Cont_Hourly_984mm	SWMF16
16a	1.55	57.40	25.00	3.0000	Cont_Hourly_984mm	H11a
17	5.19	129.63	54.00	3.0000	Cont_Hourly_984mm	SWMF17
17a	0.40	332.75	0.00	2.0000	Cont_Hourly_984mm	J52
18	2.02	77.61	58.00	0.6000	Cont_Hourly_984mm	SWMF18
18a	1.65	659.72	0.00	2.0000	Cont_Hourly_984mm	S15
18SWMF	0.63	89.37	50.00	25.0000	Cont_Hourly_984mm	SWMF18
1a	0.40	47.09	58.00	2.0000	Cont_Hourly_984mm	J1
2	33.85	583.59	51.00	3.0000	Cont_Hourly_984mm	SWMF2
2_EXT	0.75	20.76	50.00	1.1000	Cont_Hourly_984mm	SWMF2
201	1.82	86.55	56.00	2.5000	Cont_Hourly_984mm	L02
202	0.57	92.06	59.00	3.0000	Cont_Hourly_984mm	L04
203	16.08	229.72	23.00	4.0000	Cont_Hourly_984mm	H07
204	0.29	18.07	0.00	2.0000	Cont_Hourly_984mm	H09
205	0.30	20.24	14.00	2.0000	Cont_Hourly_984mm	H10
206	1.39	555.20	0.00	2.0000	Cont_Hourly_984mm	S14
2a	0.69	230.50	50.00	5.0000	Cont_Hourly_984mm	J5
3	20.11	223.41	59.00	2.0000	Cont_Hourly_984mm	SWMF3
3_EXT	1.34	24.36	50.00	2.7000	Cont_Hourly_984mm	SWMF3
3a	1.58	242.32	54.00	2.0000	Cont_Hourly_984mm	J1
4	123.77	1090.47	55.00	2.5000	Cont_Hourly_984mm	SWMF4
5	40.47	518.86	74.00	1.5000	Cont_Hourly_984mm	SWMF5
5_EXT	1.65	21.48	50.00	2.0000	Cont_Hourly_984mm	SWMF5
6	14.57	331.06	53.00	2.0000	Cont_Hourly_984mm	SWMF6
7	8.66	201.30	58.00	1.0000	Cont_Hourly_984mm	SWMF7
7a	10.59	384.97	69.00	1.0000	Cont_Hourly_984mm	SWMF7
8	16.35	255.43	56.00	1.5000	Cont_Hourly_984mm	SWMF8
8a	1.02	511.70	0.00	2.0000	Cont_Hourly_984mm	J72

8b	0.23	116.05	0.00	2.0000	Cont_Hourly_984mm	J72
8c	4.47	99.38	0.00	1.1000	Cont_Hourly_984mm	J72
8d	0.17	55.70	0.00	2.0000	Cont_Hourly_984mm	J68
8e	1.67	145.10	55.00	2.0000	Cont_Hourly_984mm	J68
8-EXT	2.00	18.90	50.00	2.5000	Cont_Hourly_984mm	SWMF8
9	31.43	378.71	53.00	1.0000	Cont_Hourly_984mm	SWMF9
9a	0.42	168.76	0.00	2.0000	Cont_Hourly_984mm	J72
Rainsong_P2	15.84	176.00	59.00	2.0000	Cont_Hourly_984mm	SU1

Node Summary

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
J1	JUNCTION	251.52	5.00	0.0	
J10	JUNCTION	245.32	1.79	0.0	
J11	JUNCTION	246.63	2.55	0.0	
J12	JUNCTION	251.87	2.56	0.0	
J13	JUNCTION	251.87	2.99	0.0	
J14	JUNCTION	255.77	2.56	0.0	
J15	JUNCTION	249.11	2.56	0.0	
J16	JUNCTION	247.64	2.77	0.0	
J17	JUNCTION	252.62	2.56	0.0	
J18	JUNCTION	247.38	2.56	0.0	
J19	JUNCTION	251.67	2.56	0.0	
J2	JUNCTION	251.37	1.61	0.0	
J20	JUNCTION	258.46	1.99	0.0	
J21	JUNCTION	251.39	3.72	0.0	
J22	JUNCTION	251.00	2.66	0.0	
J23	JUNCTION	250.82	2.66	0.0	
J24	JUNCTION	250.64	2.66	0.0	
J25	JUNCTION	250.00	2.66	0.0	
J26	JUNCTION	249.21	3.60	0.0	
J27	JUNCTION	248.49	3.60	0.0	
J28	JUNCTION	248.15	2.41	0.0	
J29	JUNCTION	248.06	2.16	0.0	
J3	JUNCTION	250.53	2.88	0.0	
J30	JUNCTION	247.98	2.24	0.0	
J31	JUNCTION	247.52	2.52	0.0	
J32	JUNCTION	247.11	2.52	0.0	
J33	JUNCTION	246.50	3.40	0.0	
J34	JUNCTION	246.05	3.40	0.0	
J35	JUNCTION	245.46	2.94	0.0	
J36	JUNCTION	246.60	2.41	0.0	

J37	JUNCTION	247.85	2.56	0.0
J38	JUNCTION	257.81	1.44	0.0
J39	JUNCTION	258.62	0.87	0.0
J4	JUNCTION	250.17	3.18	0.0
J40	JUNCTION	248.93	2.45	0.0
J41	JUNCTION	253.18	1.98	0.0
J42	JUNCTION	252.00	1.98	0.0
J43	JUNCTION	251.75	1.91	0.0
J44	JUNCTION	251.50	1.46	0.0
J45	JUNCTION	251.10	2.21	0.0
J46	JUNCTION	250.71	2.26	0.0
J47	JUNCTION	250.31	2.67	0.0
J48	JUNCTION	250.18	2.67	0.0
J49	JUNCTION	250.18	2.45	0.0
J5	JUNCTION	249.60	3.18	0.0
J50	JUNCTION	250.17	2.20	0.0
J51	JUNCTION	250.17	1.81	0.0
J52	JUNCTION	250.17	2.89	0.0
J53	JUNCTION	250.16	2.99	0.0
J54	JUNCTION	249.33	3.38	0.0
J55	JUNCTION	248.65	3.70	0.0
J56	JUNCTION	246.12	3.70	0.0
J6	JUNCTION	248.63	2.58	0.0
J62	JUNCTION	256.00	2.84	0.0
J63	JUNCTION	253.13	3.72	0.0
J64	JUNCTION	254.90	2.84	0.0
J65	JUNCTION	254.00	2.36	0.0
J66	JUNCTION	251.82	2.36	0.0
J67	JUNCTION	251.49	2.36	0.0
J68	JUNCTION	252.33	3.72	0.0
J69	JUNCTION	252.16	3.72	0.0
J7	JUNCTION	247.53	1.79	0.0
J70	JUNCTION	251.99	3.72	0.0
J71	JUNCTION	251.81	3.72	0.0
J72	JUNCTION	251.64	3.72	0.0
J73	JUNCTION	251.47	3.72	0.0
J8	JUNCTION	246.92	1.79	0.0
J9	JUNCTION	246.14	1.79	0.0
H07	OUTFALL	0.00	0.00	0.0
H08	OUTFALL	245.32	2.83	0.0
H09	OUTFALL	0.00	0.00	0.0
H10	OUTFALL	257.66	0.00	0.0
H11	OUTFALL	0.00	249.83	0.0
H11a	OUTFALL	0.00	255.81	0.0
L01	OUTFALL	260.01	0.00	0.0
L02	OUTFALL	246.63	0.00	0.0

L03	OUTFALL	245.29	1.79	0.0
L04	OUTFALL	0.00	0.00	0.0
L05	OUTFALL	251.07	0.00	0.0
L06	OUTFALL	266.00	0.00	0.0
S12	OUTFALL	246.00	2.85	0.0
S13	OUTFALL	243.90	1.00	0.0
S14	OUTFALL	251.00	0.00	0.0
S15	OUTFALL	246.50	1.00	0.0
SU1	STORAGE	263.45	1.30	0.0
SWMF1	STORAGE	250.83	4.30	0.0
SWMF10	STORAGE	246.61	3.80	0.0
SWMF11	STORAGE	251.71	3.80	0.0
SWMF12	STORAGE	249.43	3.80	0.0
SWMF13	STORAGE	245.50	3.80	0.0
SWMF14	STORAGE	249.90	3.80	0.0
SWMF15	STORAGE	256.50	3.80	0.0
SWMF16	STORAGE	259.50	3.80	0.0
SWMF17	STORAGE	245.96	2.80	0.0
SWMF18	STORAGE	247.58	3.80	0.0
SWMF2	STORAGE	248.00	3.80	0.0
SWMF3	STORAGE	251.03	3.83	0.0
SWMF4	STORAGE	246.14	3.80	0.0
SWMF5	STORAGE	255.43	3.60	0.0
SWMF6	STORAGE	247.87	3.80	0.0
SWMF7	STORAGE	246.61	3.80	0.0
SWMF8	STORAGE	251.25	4.30	0.0
SWMF9	STORAGE	250.43	3.80	0.0

Link Summary

Name	From Node	To Node	Type	Length	%Slope	Roughness
C1	J11	J9	CONDUIT	166.3	0.2965	0.0130
C1_10	J9	J10	CONDUIT	100.0	0.8160	0.0500
C1_11	J10	L03	CONDUIT	32.1	0.0996	0.0500
C1_2	J1	J2	CONDUIT	100.0	0.1500	0.0500
C1_20	J20	J62	CONDUIT	100.0	2.4647	0.0500
C1_21	J62	J64	CONDUIT	100.0	1.1011	0.0500
C1_22	J64	J65	CONDUIT	100.0	0.8990	0.0500
C1_23	J65	J66	CONDUIT	100.0	2.1825	0.0500
C1_24	J66	J67	CONDUIT	100.0	0.3240	0.0500
C1_25	J67	J21	CONDUIT	52.3	0.1911	0.0500
C1_3	J2	J3	CONDUIT	100.0	0.8440	0.0500
C1_4	J3	J4	CONDUIT	100.0	0.3590	0.0500

C1_5	J4	J5	CONDUIT	100.0	0.5660	0.0500
C1_6	J5	J6	CONDUIT	100.0	0.9720	0.0500
C1_7	J6	J7	CONDUIT	100.0	1.1001	0.0500
C1_8	J7	J8	CONDUIT	100.0	0.6100	0.0500
C1_9	J8	J9	CONDUIT	100.0	0.7840	0.0500
C10	J37	J35	CONDUIT	25.3	9.4929	0.0130
C11	J38	H11	CONDUIT	455.9	1.8998	0.0130
C12	J39	H11a	CONDUIT	349.1	1.0199	0.0130
C13	J36	S13	CONDUIT	135.2	1.9970	0.0130
C14	J40	S15	CONDUIT	70.0	3.4745	0.0400
C2	J12	J2	CONDUIT	36.1	1.3793	0.0130
C2_1	J21	J22	CONDUIT	100.0	0.3940	0.0500
C2_10	J30	J31	CONDUIT	100.0	0.4630	0.0500
C2_11	J31	J32	CONDUIT	100.0	0.4080	0.0500
C2_12	J32	J33	CONDUIT	100.0	0.6070	0.0500
C2_13	J33	J34	CONDUIT	100.0	0.4470	0.0500
C2_14	J34	J35	CONDUIT	100.0	0.5940	0.0500
C2_15	J35	H08	CONDUIT	46.0	0.3044	0.0500
C2_18	J41	J42	CONDUIT	100.0	1.1801	0.0500
C2_19	J42	J43	CONDUIT	100.0	0.2500	0.0500
C2_2	J22	J23	CONDUIT	100.0	0.1800	0.0500
C2_20	J43	J44	CONDUIT	100.0	0.2500	0.0500
C2_21	J44	J45	CONDUIT	100.0	0.4000	0.0500
C2_22	J45	J46	CONDUIT	100.0	0.3900	0.0500
C2_23	J46	J47	CONDUIT	100.0	0.3980	0.0500
C2_24	J47	J48	CONDUIT	100.0	0.1290	0.0500
C2_25	J48	J49	CONDUIT	100.0	0.0060	0.0500
C2_26	J49	J50	CONDUIT	100.0	0.0030	0.0500
C2_27	J50	J51	CONDUIT	100.0	0.0030	0.0500
C2_28	J51	J52	CONDUIT	100.0	0.0030	0.0500
C2_29	J52	J53	CONDUIT	100.0	0.0030	0.0500
C2_3	J23	J24	CONDUIT	100.0	0.1760	0.0500
C2_30	J53	J54	CONDUIT	100.0	0.8310	0.0500
C2_31	J54	J55	CONDUIT	100.0	0.6840	0.0500
C2_32	J55	J56	CONDUIT	100.0	2.5308	0.0500
C2_33	J56	S12	CONDUIT	39.0	0.3075	0.0500
C2_34	J63	J68	CONDUIT	100.0	0.7960	0.0500
C2_35	J68	J69	CONDUIT	100.0	0.1720	0.0500
C2_36	J69	J70	CONDUIT	100.0	0.1720	0.0500
C2_37	J70	J71	CONDUIT	100.0	0.1720	0.0500
C2_38	J71	J72	CONDUIT	100.0	0.1720	0.0500
C2_39	J72	J73	CONDUIT	100.0	0.1720	0.0500
C2_4	J24	J25	CONDUIT	100.0	0.6440	0.0500
C2_40	J73	J21	CONDUIT	42.8	0.1776	0.0500
C2_5	J25	J26	CONDUIT	100.0	0.7920	0.0500
C2_6	J26	J27	CONDUIT	100.0	0.7230	0.0500

C2_7	J27	J28	CONDUIT	100.0	0.3350	0.0500
C2_8	J28	J29	CONDUIT	100.0	0.0900	0.0500
C2_9	J29	J30	CONDUIT	100.0	0.0810	0.0500
C3	J13	J2	CONDUIT	132.4	0.3760	0.0130
C4	J14	J64	CONDUIT	54.2	1.6084	0.0130
C5	J15	J29	CONDUIT	72.6	1.4460	0.0130
C6	J16	J35	CONDUIT	60.7	3.5938	0.0130
C7	J17	J69	CONDUIT	36.5	1.2672	0.0130
C8	J18	J8	CONDUIT	107.0	0.4292	0.0130
C9	J19	J22	CONDUIT	285.5	0.2347	0.0130
OR1	SWMF2	J11	ORIFICE			
OR10	SWMF10	J37	ORIFICE			
OR11	SWMF15	J38	ORIFICE			
OR12	SWMF16	J39	ORIFICE			
OR13	SWMF11	J41	ORIFICE			
OR14	SWMF12	J49	ORIFICE			
OR15	SWMF13	J56	ORIFICE			
OR16	SWMF14	J36	ORIFICE			
OR17	SWMF18	J40	ORIFICE			
OR18	SWMF17	J56	ORIFICE			
OR2	SWMF1	J12	ORIFICE			
OR3	SWMF3	J13	ORIFICE			
OR4	SWMF5	J14	ORIFICE			
OR5	SWMF6	J15	ORIFICE			
OR6	SWMF7	J16	ORIFICE			
OR7	SWMF8	J17	ORIFICE			
OR8	SWMF4	J18	ORIFICE			
OR9	SWMF9	J19	ORIFICE			
OR19	SU1	J13	WEIR			
W1	SWMF2	J11	WEIR			
W10	SWMF10	J37	WEIR			
W11	SWMF15	J38	WEIR			
W12	SWMF16	J39	WEIR			
W13	SWMF11	J41	WEIR			
W14	SWMF12	J49	WEIR			
W15	SWMF13	J56	WEIR			
W16	SWMF14	J36	WEIR			
W17	SWMF18	J40	WEIR			
W18	SWMF17	J56	WEIR			
W2	SWMF1	J12	WEIR			
W3	SWMF3	J13	WEIR			
W4	SWMF5	J14	WEIR			
W5	SWMF6	J15	WEIR			
W6	SWMF7	J16	WEIR			
W7	SWMF8	J17	WEIR			
W8	SWMF4	J18	WEIR			

W9

SWMF9

J19

WEIR

Cross Section Summary

Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow
C1	TRAPEZOIDAL	1.00	13.00	0.80	16.00	1	46.79
C1_10	1_7	1.79	80.48	0.81	99.00	1	126.22
C1_11	1_7	1.79	80.48	0.81	99.00	1	44.10
C1_2	1_2	1.61	57.41	0.57	100.00	1	30.62
C1_20	1_20	1.99	112.76	1.12	98.60	1	382.45
C1_21	1_21	2.84	188.54	1.90	98.60	1	607.59
C1_22	1_22	1.82	94.90	0.95	98.80	1	173.78
C1_23	1_23	2.36	416.53	1.39	299.00	1	1530.99
C1_24	1_23	2.36	416.53	1.39	299.00	1	589.88
C1_25	1_23	2.36	416.53	1.39	299.00	1	453.02
C1_3	1_3	1.41	69.86	0.70	99.00	1	101.46
C1_4	1_4	2.88	118.12	1.19	98.80	1	158.79
C1_5	1_5	3.18	155.04	1.56	98.50	1	314.39
C1_6	1_6	2.58	128.63	1.30	98.50	1	302.02
C1_7	1_7	1.79	80.48	0.81	99.00	1	146.55
C1_8	1_7	1.79	80.48	0.81	99.00	1	109.13
C1_9	1_7	1.79	80.48	0.81	99.00	1	123.72
C10	TRAPEZOIDAL	1.00	13.00	0.80	16.00	1	264.75
C11	CIRCULAR	0.68	0.36	0.17	0.68	1	1.16
C12	CIRCULAR	0.75	0.44	0.19	0.75	1	1.12
C13	TRAPEZOIDAL	1.00	6.00	0.64	9.00	1	48.62
C14	TRAPEZOIDAL	1.00	8.00	0.71	11.00	1	29.58
C2	TRAPEZOIDAL	1.00	13.00	0.80	16.00	1	100.92
C2_1	2_5	2.66	157.37	1.59	98.20	1	268.65
C2_10	2_10	2.24	106.10	1.07	98.50	1	151.22
C2_11	2_11	2.52	115.39	1.16	98.70	1	162.93
C2_12	2_12	2.15	79.83	0.83	98.60	1	109.61
C2_13	2_13	3.40	193.79	1.93	98.60	1	402.06
C2_14	2_14	2.94	149.33	1.50	98.70	1	301.08
C2_15	2_15	2.83	151.77	1.51	99.70	1	220.55
C2_18	2_18	1.98	95.65	0.96	99.00	1	202.37
C2_19	2_19	1.91	80.50	0.81	99.00	1	69.88
C2_2	2_5	2.66	157.37	1.59	98.20	1	181.59
C2_20	2_20	1.31	46.13	0.46	98.70	1	27.69
C2_21	2_21	1.46	50.65	0.51	98.00	1	41.10
C2_22	2_22	2.21	136.50	1.38	98.40	1	211.41
C2_23	2_23	2.26	136.62	1.37	99.00	1	212.96

C2_24	2_24	2.67	123.98	1.24	99.00	1	102.96
C2_25	2_25	2.45	105.73	1.06	99.00	1	17.03
C2_26	2_26	2.20	78.67	0.79	99.00	1	7.35
C2_27	2_28	1.81	60.41	0.61	98.00	1	4.78
C2_28	2_28	1.81	60.41	0.61	98.00	1	4.78
C2_29	2_29	2.89	128.35	1.30	98.00	1	16.76
C2_3	2_5	2.66	157.37	1.59	98.20	1	179.56
C2_30	2_30	2.99	116.36	1.18	98.00	1	236.87
C2_31	2_31	3.38	137.44	1.39	98.00	1	282.67
C2_32	2_32	3.70	163.81	1.68	98.00	1	735.38
C2_33	2_33	2.85	104.64	1.18	99.00	1	129.77
C2_34	2_34	3.72	207.33	2.09	98.40	1	605.55
C2_35	2_34	3.72	207.33	2.09	98.40	1	281.48
C2_36	2_34	3.72	207.33	2.09	98.40	1	281.48
C2_37	2_34	3.72	207.33	2.09	98.40	1	281.48
C2_38	2_34	3.72	207.33	2.09	98.40	1	281.48
C2_39	2_34	3.72	207.33	2.09	98.40	1	281.48
C2_4	2_5	2.66	157.37	1.59	98.20	1	343.47
C2_40	2_34	3.72	207.33	2.09	98.40	1	286.00
C2_5	2_5	2.66	157.37	1.59	98.20	1	380.90
C2_6	2_6	3.60	202.25	2.04	98.60	1	552.63
C2_7	2_7	2.41	145.65	1.47	98.40	1	218.24
C2_8	2_8	1.94	102.31	1.03	98.60	1	62.73
C2_9	2_9	2.16	127.01	1.27	98.70	1	84.75
C3	TRAPEZOIDAL	1.00	13.00	0.80	16.00	1	52.69
C4	TRAPEZOIDAL	1.00	13.00	0.80	16.00	1	108.98
C5	TRAPEZOIDAL	1.00	13.00	0.80	16.00	1	103.33
C6	TRAPEZOIDAL	1.00	13.00	0.80	16.00	1	162.90
C7	TRAPEZOIDAL	1.00	13.00	0.80	16.00	1	96.73
C8	TRAPEZOIDAL	1.00	13.00	0.80	16.00	1	56.29
C9	TRAPEZOIDAL	1.00	13.00	0.80	16.00	1	41.63

Transect Summary

Transect 1_1

Area:

0.0006	0.0017	0.0032	0.0050	0.0071
0.0093	0.0119	0.0146	0.0176	0.0209
0.0244	0.0282	0.0322	0.0365	0.0410
0.0457	0.0507	0.0558	0.0613	0.0669
0.0727	0.0788	0.0852	0.0917	0.0985
0.1056	0.1129	0.1204	0.1282	0.1363

	0.1446	0.1531	0.1620	0.1710	0.1804
	0.1900	0.2026	0.2230	0.2636	0.3155
	0.3720	0.4321	0.4947	0.5600	0.6278
	0.6984	0.7713	0.8462	0.9227	1.0000
Hrad:					
	0.0438	0.0940	0.1380	0.1838	0.2310
	0.2758	0.3189	0.3608	0.3996	0.4378
	0.4755	0.5130	0.5521	0.5915	0.6305
	0.6691	0.7079	0.7469	0.7856	0.8240
	0.8620	0.8986	0.9351	0.9715	1.0078
	1.0415	1.0753	1.1092	1.1432	1.1776
	1.2111	1.2447	1.2786	1.3130	1.3475
	1.3816	1.3846	1.3248	1.1644	0.4760
	0.5278	0.5801	0.6326	0.6849	0.7357
	0.7850	0.8359	0.8874	0.9431	1.0000
Width:					
	0.0123	0.0168	0.0212	0.0249	0.0279
	0.0310	0.0340	0.0371	0.0403	0.0436
	0.0469	0.0502	0.0532	0.0562	0.0592
	0.0622	0.0652	0.0681	0.0710	0.0739
	0.0768	0.0798	0.0828	0.0859	0.0889
	0.0922	0.0954	0.0987	0.1019	0.1052
	0.1085	0.1118	0.1151	0.1184	0.1217
	0.1277	0.1977	0.3933	0.6218	0.7018
	0.7519	0.7894	0.8226	0.8544	0.8899
	0.9239	0.9510	0.9751	0.9887	1.0000
Transect 1_10					
Area:					
	0.0005	0.0017	0.0035	0.0059	0.0088
	0.0123	0.0164	0.0216	0.0283	0.0358
	0.0443	0.0543	0.0662	0.0796	0.0952
	0.1130	0.1334	0.1543	0.1757	0.1974
	0.2195	0.2417	0.2644	0.2872	0.3105
	0.3344	0.3592	0.3842	0.4092	0.4343
	0.4595	0.4850	0.5108	0.5370	0.5634
	0.5902	0.6174	0.6449	0.6728	0.7010
	0.7294	0.7581	0.7872	0.8164	0.8462
	0.8762	0.9067	0.9374	0.9686	1.0000
Hrad:					
	0.0152	0.0375	0.0501	0.0701	0.0890
	0.1017	0.1196	0.1313	0.1396	0.1599
	0.1686	0.1762	0.1822	0.1890	0.1974
	0.2046	0.2036	0.2310	0.2586	0.2840
	0.3132	0.3415	0.3683	0.3969	0.4213
	0.4477	0.4559	0.4864	0.5168	0.5471

	0.5771	0.5982	0.6225	0.6467	0.6713
	0.6926	0.7136	0.7378	0.7577	0.7836
	0.8089	0.8321	0.8536	0.8799	0.8955
	0.9167	0.9392	0.9570	0.9808	1.0000
Width:					
	0.0312	0.0446	0.0690	0.0839	0.0985
	0.1209	0.1409	0.1938	0.2281	0.2424
	0.2864	0.3405	0.4027	0.4667	0.5224
	0.6209	0.6552	0.6679	0.6793	0.6950
	0.7008	0.7079	0.7178	0.7240	0.7464
	0.7732	0.7879	0.7899	0.7919	0.7939
	0.7962	0.8108	0.8206	0.8303	0.8392
	0.8522	0.8651	0.8741	0.8879	0.8945
	0.9018	0.9110	0.9221	0.9278	0.9450
	0.9558	0.9653	0.9795	0.9875	1.0000
Transect 1_11					
Area:					
	0.0027	0.0145	0.0287	0.0438	0.0593
	0.0751	0.0913	0.1077	0.1245	0.1415
	0.1586	0.1761	0.1938	0.2116	0.2297
	0.2480	0.2664	0.2851	0.3038	0.3228
	0.3421	0.3618	0.3817	0.4017	0.4220
	0.4425	0.4631	0.4840	0.5051	0.5264
	0.5479	0.5696	0.5915	0.6136	0.6359
	0.6584	0.6812	0.7041	0.7273	0.7506
	0.7742	0.7980	0.8221	0.8467	0.8714
	0.8964	0.9217	0.9474	0.9734	1.0000
Hrad:					
	0.0116	0.0288	0.0533	0.0782	0.1040
	0.1280	0.1538	0.1781	0.2018	0.2272
	0.2511	0.2746	0.2989	0.3236	0.3464
	0.3698	0.3940	0.4178	0.4411	0.4634
	0.4810	0.5015	0.5240	0.5460	0.5678
	0.5896	0.6112	0.6326	0.6536	0.6744
	0.6953	0.7160	0.7367	0.7571	0.7770
	0.7974	0.8176	0.8375	0.8570	0.8768
	0.8965	0.9134	0.9245	0.9419	0.9595
	0.9770	0.9930	1.0059	1.0164	1.0000
Width:					
	0.3185	0.5024	0.5390	0.5599	0.5701
	0.5868	0.5939	0.6049	0.6170	0.6229
	0.6319	0.6415	0.6485	0.6541	0.6631
	0.6706	0.6764	0.6824	0.6890	0.6967
	0.7113	0.7215	0.7285	0.7359	0.7432
	0.7506	0.7578	0.7651	0.7729	0.7806

0.7880	0.7955	0.8030	0.8105	0.8184
0.8258	0.8332	0.8407	0.8486	0.8561
0.8636	0.8736	0.8893	0.8989	0.9082
0.9175	0.9282	0.9418	0.9577	1.0000

Transect 1_12

Area:

0.0003	0.0010	0.0024	0.0043	0.0067
0.0099	0.0139	0.0189	0.0248	0.0315
0.0389	0.0471	0.0562	0.0663	0.0772
0.0888	0.1011	0.1143	0.1283	0.1432
0.1588	0.1750	0.1918	0.2095	0.2279
0.2470	0.2669	0.2876	0.3094	0.3325
0.3567	0.3819	0.4084	0.4373	0.4689
0.5020	0.5355	0.5694	0.6035	0.6380
0.6727	0.7077	0.7431	0.7791	0.8153
0.8518	0.8885	0.9256	0.9627	1.0000

Hrad:

0.0195	0.0403	0.0548	0.0781	0.0894
0.1035	0.1166	0.1273	0.1477	0.1681
0.1876	0.2070	0.2174	0.2370	0.2589
0.2798	0.2995	0.3146	0.3340	0.3533
0.3744	0.3989	0.4199	0.4347	0.4561
0.4779	0.4941	0.5093	0.5205	0.5248
0.5422	0.5612	0.5490	0.5494	0.5389
0.5647	0.5967	0.6285	0.6603	0.6919
0.7234	0.7535	0.7788	0.8087	0.8394
0.8699	0.9004	0.9332	0.9667	1.0000

Width:

0.0140	0.0249	0.0446	0.0552	0.0751
0.0958	0.1198	0.1491	0.1690	0.1884
0.2086	0.2287	0.2601	0.2814	0.2998
0.3189	0.3392	0.3653	0.3863	0.4075
0.4264	0.4411	0.4593	0.4846	0.5025
0.5198	0.5431	0.5678	0.5979	0.6371
0.6617	0.6843	0.7482	0.8006	0.8751
0.8937	0.9020	0.9100	0.9178	0.9254
0.9330	0.9419	0.9567	0.9655	0.9730
0.9806	0.9880	0.9926	0.9963	1.0000

Transect 1_13

Area:

0.0003	0.0012	0.0025	0.0042	0.0064
0.0089	0.0118	0.0148	0.0182	0.0217
0.0254	0.0295	0.0340	0.0391	0.0449
0.0514	0.0589	0.0669	0.0755	0.0849

	0.0951	0.1061	0.1178	0.1303	0.1433
	0.1570	0.1713	0.1869	0.2038	0.2220
	0.2416	0.2619	0.2830	0.3051	0.3283
	0.3541	0.3821	0.4111	0.4407	0.4721
	0.5075	0.5465	0.5900	0.6368	0.6867
	0.7405	0.8003	0.8646	0.9315	1.0000
Hrad:					
	0.0353	0.0775	0.1214	0.1461	0.1823
	0.2262	0.2733	0.3181	0.3642	0.4100
	0.4537	0.4696	0.4913	0.5009	0.4973
	0.5047	0.5225	0.5518	0.5781	0.5935
	0.6206	0.6452	0.6680	0.6999	0.7380
	0.7736	0.7895	0.7904	0.8053	0.8024
	0.8277	0.8744	0.9010	0.9311	0.9352
	0.8982	0.9170	0.9655	1.0108	0.9860
	0.9545	0.9051	0.8912	0.9095	0.9138
	0.9105	0.9335	0.9643	1.0131	1.0000
Width:					
	0.0097	0.0158	0.0205	0.0285	0.0349
	0.0394	0.0430	0.0466	0.0498	0.0528
	0.0560	0.0627	0.0692	0.0779	0.0901
	0.1019	0.1126	0.1212	0.1306	0.1431
	0.1532	0.1643	0.1763	0.1860	0.1941
	0.2028	0.2169	0.2363	0.2530	0.2766
	0.2919	0.2995	0.3140	0.3276	0.3510
	0.3942	0.4168	0.4259	0.4360	0.4907
	0.5317	0.6040	0.6622	0.7004	0.7516
	0.8245	0.9067	0.9540	0.9869	1.0000
Transect 1_14					
Area:					
	0.0021	0.0068	0.0131	0.0207	0.0297
	0.0393	0.0492	0.0593	0.0696	0.0805
	0.0919	0.1037	0.1159	0.1288	0.1423
	0.1564	0.1708	0.1854	0.2002	0.2154
	0.2309	0.2465	0.2625	0.2787	0.2960
	0.3151	0.3361	0.3581	0.3809	0.4044
	0.4293	0.4556	0.4828	0.5110	0.5393
	0.5678	0.5964	0.6251	0.6539	0.6829
	0.7120	0.7413	0.7713	0.8024	0.8340
	0.8660	0.8988	0.9325	0.9662	1.0000
Hrad:					
	0.0178	0.0430	0.0639	0.0856	0.1064
	0.1360	0.1658	0.1976	0.2291	0.2447
	0.2754	0.3054	0.3342	0.3590	0.3805
	0.4065	0.4328	0.4593	0.4810	0.5038

	0.5297	0.5554	0.5758	0.5852	0.6146
	0.6397	0.6608	0.6815	0.6981	0.7124
	0.6646	0.6873	0.7093	0.6102	0.6417
	0.6731	0.7044	0.7342	0.7638	0.7945
	0.8254	0.8560	0.8829	0.9072	0.9343
	0.9613	0.9798	0.9350	0.9675	1.0000
Width:					
	0.1201	0.1589	0.2057	0.2518	0.2796
	0.2895	0.2976	0.3008	0.3063	0.3344
	0.3436	0.3521	0.3721	0.3898	0.4154
	0.4224	0.4284	0.4345	0.4445	0.4536
	0.4603	0.4670	0.4775	0.4836	0.5442
	0.5829	0.6366	0.6627	0.6843	0.7126
	0.7652	0.7919	0.8186	0.8378	0.8408
	0.8439	0.8469	0.8516	0.8563	0.8597
	0.8627	0.8795	0.9064	0.9328	0.9420
	0.9513	0.9950	0.9975	0.9987	1.0000
Transect 1_15					
Area:					
	0.0010	0.0046	0.0093	0.0147	0.0210
	0.0276	0.0344	0.0416	0.0491	0.0569
	0.0650	0.0732	0.0818	0.0906	0.0997
	0.1090	0.1186	0.1287	0.1390	0.1502
	0.1630	0.1780	0.1944	0.2120	0.2315
	0.2537	0.2784	0.3056	0.3349	0.3648
	0.3950	0.4258	0.4569	0.4882	0.5195
	0.5509	0.5823	0.6138	0.6454	0.6770
	0.7087	0.7405	0.7723	0.8042	0.8363
	0.8684	0.9008	0.9335	0.9665	1.0000
Hrad:					
	0.0127	0.0383	0.0617	0.0826	0.1090
	0.1369	0.1648	0.1895	0.2136	0.2394
	0.2664	0.2911	0.3139	0.3393	0.3637
	0.3834	0.4025	0.4218	0.4416	0.4591
	0.4702	0.4775	0.4801	0.4875	0.4498
	0.4447	0.4147	0.4117	0.3776	0.4055
	0.4335	0.4592	0.4886	0.5210	0.5534
	0.5856	0.6179	0.6501	0.6819	0.7137
	0.7454	0.7770	0.8085	0.8394	0.8702
	0.9008	0.9293	0.9552	0.9816	1.0000
Width:					
	0.0831	0.1194	0.1480	0.1758	0.1897
	0.1984	0.2058	0.2162	0.2264	0.2341
	0.2401	0.2477	0.2566	0.2629	0.2698
	0.2798	0.2902	0.3003	0.3100	0.3526

0.4055	0.4657	0.4996	0.5362	0.6216
0.6839	0.7760	0.8389	0.8734	0.8859
0.8974	0.9130	0.9208	0.9225	0.9242
0.9258	0.9275	0.9292	0.9312	0.9332
0.9353	0.9373	0.9394	0.9421	0.9458
0.9510	0.9583	0.9679	0.9788	1.0000

Transect 1_16

Area:

0.0005	0.0012	0.0020	0.0030	0.0040
0.0051	0.0072	0.0122	0.0195	0.0283
0.0382	0.0492	0.0612	0.0740	0.0877
0.1030	0.1204	0.1389	0.1581	0.1789
0.2015	0.2257	0.2508	0.2761	0.3016
0.3271	0.3529	0.3788	0.4049	0.4313
0.4579	0.4847	0.5117	0.5389	0.5663
0.5938	0.6216	0.6495	0.6776	0.7059
0.7345	0.7632	0.7922	0.8214	0.8507
0.8803	0.9101	0.9400	0.9699	1.0000

Hrad:

0.0217	0.0471	0.0701	0.0915	0.1118
0.1305	0.0979	0.0799	0.0860	0.0992
0.1145	0.1301	0.1492	0.1684	0.1871
0.1995	0.2027	0.2228	0.2416	0.2455
0.2654	0.2730	0.3006	0.3288	0.3571
0.3850	0.4127	0.4394	0.4653	0.4908
0.5174	0.5438	0.5701	0.5959	0.6218
0.6475	0.6732	0.6986	0.7237	0.7486
0.7733	0.7973	0.8211	0.8451	0.8693
0.8938	0.9189	0.9460	0.9730	1.0000

Width:

0.0225	0.0259	0.0292	0.0326	0.0359
0.0394	0.1164	0.2135	0.2762	0.3109
0.3451	0.3821	0.4119	0.4409	0.4705
0.5523	0.5966	0.6254	0.6569	0.7310
0.7757	0.8295	0.8370	0.8422	0.8468
0.8519	0.8572	0.8641	0.8722	0.8806
0.8868	0.8930	0.8992	0.9057	0.9121
0.9183	0.9245	0.9308	0.9373	0.9439
0.9506	0.9580	0.9655	0.9725	0.9791
0.9853	0.9907	0.9938	0.9969	1.0000

Transect 1_17

Area:

0.0007	0.0022	0.0044	0.0073	0.0107
0.0146	0.0190	0.0241	0.0296	0.0355

	0.0419	0.0489	0.0564	0.0646	0.0737
	0.0838	0.0957	0.1100	0.1260	0.1433
	0.1623	0.1831	0.2054	0.2298	0.2563
	0.2836	0.3113	0.3392	0.3671	0.3952
	0.4233	0.4516	0.4800	0.5084	0.5369
	0.5655	0.5941	0.6229	0.6519	0.6812
	0.7109	0.7409	0.7715	0.8025	0.8340
Hrad:	0.8659	0.8984	0.9314	0.9652	1.0000
	0.0231	0.0415	0.0617	0.0810	0.1031
	0.1252	0.1424	0.1621	0.1833	0.2039
	0.2240	0.2447	0.2669	0.2778	0.2971
	0.3129	0.3197	0.3266	0.3356	0.3440
	0.3516	0.3624	0.3708	0.3795	0.3579
	0.3671	0.4017	0.4363	0.4707	0.5051
	0.5394	0.5737	0.6078	0.6335	0.6680
	0.7024	0.7359	0.7647	0.7927	0.8202
	0.8467	0.8676	0.8899	0.9112	0.9327
Width:	0.9547	0.9737	0.9930	0.9988	1.0000
	0.0308	0.0528	0.0712	0.0895	0.1037
	0.1165	0.1337	0.1484	0.1613	0.1741
	0.1894	0.2045	0.2176	0.2397	0.2754
	0.3023	0.3695	0.4275	0.4706	0.5107
	0.5628	0.6053	0.6473	0.7314	0.7579
	0.7786	0.7821	0.7855	0.7888	0.7918
	0.7948	0.7978	0.8008	0.8025	0.8038
	0.8050	0.8072	0.8144	0.8224	0.8305
	0.8395	0.8539	0.8668	0.8806	0.8941
	0.9070	0.9227	0.9380	0.9663	1.0000
Transect 1_18					
Area:					
	0.0011	0.0031	0.0058	0.0100	0.0156
	0.0226	0.0310	0.0407	0.0518	0.0645
	0.0788	0.0952	0.1139	0.1331	0.1525
	0.1722	0.1921	0.2123	0.2327	0.2534
	0.2742	0.2954	0.3168	0.3386	0.3608
	0.3833	0.4061	0.4291	0.4525	0.4761
	0.5000	0.5241	0.5485	0.5732	0.5982
	0.6236	0.6492	0.6750	0.7010	0.7273
	0.7538	0.7805	0.8073	0.8343	0.8615
	0.8888	0.9163	0.9441	0.9720	1.0000
Hrad:					
	0.0182	0.0397	0.0566	0.0697	0.0812
	0.0918	0.1053	0.1189	0.1303	0.1428

	0.1512	0.1563	0.1679	0.1936	0.2198
	0.2442	0.2691	0.2942	0.3189	0.3432
	0.3668	0.3909	0.4119	0.4328	0.4544
	0.4756	0.4979	0.5196	0.5409	0.5640
	0.5869	0.6068	0.6277	0.6489	0.6655
	0.6888	0.7076	0.7317	0.7565	0.7728
	0.7965	0.8198	0.8435	0.8667	0.8891
	0.9109	0.9321	0.9535	0.9768	1.0000
Width:					
	0.0619	0.0786	0.1257	0.1720	0.2274
	0.2736	0.3211	0.3676	0.4246	0.4789
	0.5506	0.6303	0.6784	0.6875	0.6940
	0.7052	0.7140	0.7218	0.7299	0.7382
	0.7476	0.7557	0.7691	0.7825	0.7939
	0.8059	0.8155	0.8260	0.8366	0.8443
	0.8519	0.8636	0.8738	0.8834	0.8989
	0.9053	0.9174	0.9226	0.9267	0.9411
	0.9464	0.9521	0.9571	0.9626	0.9689
	0.9757	0.9831	0.9901	0.9950	1.0000
Transect 1_19					
Area:					
	0.0013	0.0104	0.0246	0.0394	0.0546
	0.0702	0.0862	0.1026	0.1193	0.1362
	0.1534	0.1708	0.1884	0.2065	0.2249
	0.2434	0.2622	0.2811	0.3002	0.3195
	0.3389	0.3586	0.3785	0.3985	0.4187
	0.4392	0.4598	0.4806	0.5017	0.5230
	0.5445	0.5662	0.5881	0.6103	0.6327
	0.6554	0.6783	0.7015	0.7249	0.7487
	0.7727	0.7969	0.8213	0.8459	0.8708
	0.8959	0.9213	0.9470	0.9732	1.0000
Hrad:					
	0.0088	0.0225	0.0467	0.0727	0.0981
	0.1232	0.1485	0.1708	0.1967	0.2218
	0.2457	0.2702	0.2939	0.3127	0.3368
	0.3617	0.3861	0.4096	0.4333	0.4567
	0.4793	0.5027	0.5258	0.5487	0.5701
	0.5919	0.6140	0.6359	0.6562	0.6771
	0.6984	0.7196	0.7389	0.7578	0.7769
	0.7956	0.8148	0.8339	0.8500	0.8683
	0.8895	0.9088	0.9269	0.9467	0.9665
	0.9822	0.9975	1.0128	1.0198	1.0000
Width:					
	0.1509	0.4631	0.5261	0.5419	0.5567
	0.5702	0.5803	0.6011	0.6068	0.6145

0.6244	0.6324	0.6414	0.6605	0.6679
0.6732	0.6792	0.6864	0.6928	0.6996
0.7072	0.7134	0.7198	0.7263	0.7346
0.7420	0.7490	0.7559	0.7646	0.7725
0.7796	0.7868	0.7960	0.8053	0.8145
0.8238	0.8325	0.8412	0.8529	0.8623
0.8687	0.8768	0.8861	0.8936	0.9009
0.9121	0.9236	0.9351	0.9543	1.0000

Transect 1_2

Area:

0.0004	0.0015	0.0029	0.0047	0.0069
0.0094	0.0122	0.0154	0.0189	0.0227
0.0268	0.0313	0.0361	0.0411	0.0464
0.0521	0.0582	0.0647	0.0715	0.0788
0.0867	0.0956	0.1049	0.1153	0.1272
0.1404	0.1554	0.1723	0.1910	0.2114
0.2337	0.2578	0.2837	0.3114	0.3410
0.3723	0.4055	0.4404	0.4772	0.5158
0.5561	0.5983	0.6424	0.6882	0.7358
0.7853	0.8365	0.8896	0.9443	1.0000

Hrad:

0.0306	0.0662	0.0985	0.1328	0.1652
0.1969	0.2282	0.2589	0.2885	0.3188
0.3488	0.3785	0.4102	0.4430	0.4753
0.4952	0.5170	0.5420	0.5649	0.5852
0.5965	0.5837	0.6182	0.5734	0.5719
0.5561	0.5460	0.5437	0.5470	0.5545
0.5652	0.5784	0.5936	0.6105	0.6287
0.6480	0.6682	0.6892	0.7109	0.7332
0.7560	0.7793	0.8029	0.8269	0.8512
0.8758	0.9006	0.9256	0.9598	1.0000

Width:

0.0143	0.0219	0.0294	0.0355	0.0416
0.0475	0.0534	0.0592	0.0652	0.0709
0.0766	0.0823	0.0875	0.0923	0.0972
0.1046	0.1119	0.1186	0.1259	0.1340
0.1493	0.1630	0.1689	0.2003	0.2215
0.2517	0.2840	0.3162	0.3485	0.3807
0.4129	0.4452	0.4774	0.5097	0.5419
0.5741	0.6064	0.6386	0.6709	0.7031
0.7353	0.7676	0.7998	0.8321	0.8643
0.8965	0.9288	0.9610	0.9839	1.0000

Transect 1_20

Area:

	0.0017	0.0056	0.0108	0.0175	0.0253
	0.0343	0.0446	0.0566	0.0698	0.0842
	0.0997	0.1163	0.1337	0.1520	0.1709
	0.1905	0.2104	0.2303	0.2503	0.2704
	0.2907	0.3110	0.3314	0.3519	0.3726
	0.3934	0.4144	0.4356	0.4569	0.4784
	0.5001	0.5219	0.5440	0.5665	0.5892
	0.6122	0.6356	0.6593	0.6834	0.7079
	0.7330	0.7587	0.7851	0.8122	0.8405
	0.8699	0.9006	0.9324	0.9656	1.0000
Hrad:					
	0.0190	0.0423	0.0624	0.0839	0.1064
	0.1268	0.1413	0.1571	0.1786	0.1974
	0.2181	0.2398	0.2635	0.2885	0.3112
	0.3389	0.3721	0.4051	0.4379	0.4704
	0.5029	0.5352	0.5668	0.5979	0.6280
	0.6574	0.6866	0.7156	0.7443	0.7729
	0.8012	0.8266	0.8504	0.8728	0.8950
	0.9163	0.9380	0.9604	0.9776	0.9889
	1.0003	1.0130	1.0186	1.0182	1.0099
	1.0051	0.9988	0.9968	0.9904	1.0000
Width:					
	0.0913	0.1330	0.1762	0.2120	0.2415
	0.2740	0.3203	0.3651	0.3963	0.4325
	0.4635	0.4917	0.5146	0.5342	0.5569
	0.5699	0.5726	0.5754	0.5782	0.5811
	0.5837	0.5864	0.5897	0.5933	0.5976
	0.6024	0.6071	0.6120	0.6168	0.6215
	0.6264	0.6333	0.6414	0.6503	0.6594
	0.6690	0.6782	0.6868	0.6991	0.7157
	0.7325	0.7486	0.7701	0.7972	0.8319
	0.8651	0.9014	0.9353	0.9749	1.0000
Transect 1_21					
Area:					
	0.0030	0.0081	0.0147	0.0225	0.0316
	0.0417	0.0529	0.0651	0.0782	0.0922
	0.1069	0.1222	0.1381	0.1549	0.1722
	0.1902	0.2086	0.2274	0.2465	0.2658
	0.2855	0.3056	0.3260	0.3467	0.3678
	0.3893	0.4111	0.4333	0.4557	0.4786
	0.5018	0.5254	0.5492	0.5734	0.5978
	0.6225	0.6475	0.6728	0.6984	0.7242
	0.7503	0.7766	0.8032	0.8300	0.8573
	0.8850	0.9130	0.9415	0.9705	1.0000
Hrad:					

	0.0211	0.0410	0.0610	0.0796	0.0982
	0.1161	0.1343	0.1536	0.1702	0.1915
	0.2119	0.2333	0.2528	0.2695	0.2901
	0.3110	0.3334	0.3578	0.3816	0.4050
	0.4281	0.4496	0.4715	0.4926	0.5140
	0.5357	0.5566	0.5779	0.5988	0.6169
	0.6393	0.6591	0.6808	0.7026	0.7247
	0.7450	0.7661	0.7872	0.8087	0.8304
	0.8521	0.8740	0.8949	0.9134	0.9288
	0.9459	0.9612	0.9745	0.9876	1.0000
Width:					
	0.1470	0.1983	0.2407	0.2828	0.3214
	0.3596	0.3944	0.4242	0.4598	0.4818
	0.5047	0.5242	0.5466	0.5748	0.5938
	0.6117	0.6258	0.6357	0.6459	0.6566
	0.6670	0.6797	0.6914	0.7040	0.7157
	0.7268	0.7387	0.7498	0.7612	0.7759
	0.7851	0.7972	0.8068	0.8161	0.8249
	0.8356	0.8452	0.8547	0.8636	0.8721
	0.8805	0.8886	0.8974	0.9088	0.9231
	0.9355	0.9499	0.9662	0.9827	1.0000
Transect 1_22					
Area:					
	0.0013	0.0037	0.0068	0.0106	0.0151
	0.0205	0.0270	0.0346	0.0433	0.0530
	0.0635	0.0750	0.0874	0.1008	0.1150
	0.1301	0.1461	0.1630	0.1808	0.1994
	0.2186	0.2386	0.2592	0.2804	0.3024
	0.3250	0.3483	0.3724	0.3971	0.4225
	0.4480	0.4735	0.4992	0.5249	0.5508
	0.5768	0.6029	0.6294	0.6563	0.6837
	0.7116	0.7403	0.7698	0.8000	0.8309
	0.8624	0.8946	0.9277	0.9627	1.0000
Hrad:					
	0.0256	0.0510	0.0757	0.0974	0.1178
	0.1315	0.1447	0.1617	0.1803	0.2001
	0.2214	0.2393	0.2613	0.2777	0.2998
	0.3203	0.3388	0.3588	0.3797	0.4019
	0.4267	0.4497	0.4738	0.4961	0.5182
	0.5416	0.5630	0.5834	0.6050	0.6341
	0.6698	0.7054	0.7407	0.7752	0.8096
	0.8437	0.8740	0.8980	0.9182	0.9399
	0.9577	0.9632	0.9792	0.9915	1.0116
	1.0271	1.0402	1.0380	1.0067	1.0000
Width:					

0.0515	0.0728	0.0904	0.1094	0.1292
0.1573	0.1881	0.2159	0.2423	0.2670
0.2892	0.3160	0.3372	0.3656	0.3866
0.4094	0.4345	0.4578	0.4798	0.5000
0.5164	0.5346	0.5512	0.5696	0.5880
0.6047	0.6234	0.6431	0.6613	0.6710
0.6732	0.6753	0.6776	0.6804	0.6833
0.6862	0.6920	0.7028	0.7164	0.7288
0.7442	0.7696	0.7870	0.8075	0.8217
0.8398	0.8600	0.8936	0.9562	1.0000

Transect 1_23

Area:

0.0010	0.0035	0.0070	0.0115	0.0170
0.0237	0.0318	0.0427	0.0545	0.0668
0.0797	0.0931	0.1070	0.1215	0.1365
0.1520	0.1681	0.1847	0.2019	0.2196
0.2378	0.2566	0.2759	0.2957	0.3161
0.3370	0.3585	0.3805	0.4030	0.4261
0.4497	0.4738	0.4985	0.5237	0.5494
0.5757	0.6025	0.6299	0.6578	0.6862
0.7152	0.7447	0.7747	0.8053	0.8364
0.8681	0.9003	0.9330	0.9662	1.0000

Hrad:

0.0190	0.0384	0.0601	0.0775	0.0945
0.1111	0.1190	0.1257	0.1533	0.1800
0.2059	0.2311	0.2556	0.2797	0.3032
0.3263	0.3489	0.3713	0.3932	0.4149
0.4364	0.4575	0.4784	0.4992	0.5197
0.5400	0.5602	0.5802	0.6001	0.6199
0.6395	0.6590	0.6784	0.6977	0.7169
0.7360	0.7550	0.7740	0.7928	0.8116
0.8304	0.8490	0.8676	0.8862	0.9047
0.9231	0.9415	0.9599	0.9782	1.0000

Width:

0.0543	0.0901	0.1158	0.1479	0.1796
0.2131	0.2675	0.3395	0.3554	0.3712
0.3870	0.4028	0.4186	0.4344	0.4502
0.4660	0.4819	0.4977	0.5135	0.5293
0.5451	0.5609	0.5767	0.5925	0.6084
0.6242	0.6400	0.6558	0.6716	0.6874
0.7032	0.7191	0.7349	0.7507	0.7665
0.7823	0.7981	0.8139	0.8297	0.8456
0.8614	0.8772	0.8930	0.9088	0.9246
0.9404	0.9562	0.9721	0.9879	1.0000

Transect 1_24

Area:

0.0004	0.0016	0.0033	0.0056	0.0084
0.0119	0.0160	0.0206	0.0258	0.0315
0.0378	0.0448	0.0524	0.0609	0.0706
0.0815	0.0937	0.1070	0.1212	0.1365
0.1525	0.1696	0.1877	0.2067	0.2265
0.2472	0.2688	0.2914	0.3151	0.3396
0.3649	0.3911	0.4180	0.4460	0.4749
0.5045	0.5348	0.5660	0.5979	0.6305
0.6639	0.6979	0.7328	0.7684	0.8050
0.8425	0.8808	0.9200	0.9598	1.0000

Hrad:

0.0228	0.0441	0.0644	0.0881	0.1087
0.1265	0.1487	0.1705	0.1911	0.2130
0.2268	0.2492	0.2636	0.2662	0.2803
0.2892	0.2956	0.3114	0.3313	0.3529
0.3681	0.3873	0.4096	0.4296	0.4529
0.4711	0.4906	0.5093	0.5289	0.5495
0.5727	0.5936	0.6130	0.6344	0.6549
0.6798	0.7002	0.7264	0.7479	0.7710
0.7945	0.8174	0.8394	0.8572	0.8780
0.8967	0.9187	0.9381	0.9674	1.0000

Width:

0.0196	0.0354	0.0513	0.0638	0.0775
0.0943	0.1076	0.1208	0.1349	0.1476
0.1665	0.1795	0.1987	0.2287	0.2518
0.2817	0.3169	0.3434	0.3659	0.3866
0.4144	0.4380	0.4583	0.4811	0.5000
0.5247	0.5479	0.5722	0.5957	0.6180
0.6372	0.6589	0.6820	0.7032	0.7252
0.7422	0.7639	0.7792	0.7995	0.8179
0.8357	0.8539	0.8730	0.8965	0.9170
0.9397	0.9588	0.9807	0.9922	1.0000

Transect 1_25

Area:

0.0003	0.0015	0.0034	0.0062	0.0097
0.0141	0.0192	0.0251	0.0318	0.0393
0.0476	0.0566	0.0664	0.0770	0.0884
0.1005	0.1135	0.1272	0.1416	0.1567
0.1726	0.1894	0.2069	0.2253	0.2446
0.2647	0.2857	0.3076	0.3303	0.3539
0.3783	0.4036	0.4297	0.4567	0.4845
0.5132	0.5427	0.5731	0.6043	0.6363
0.6693	0.7029	0.7375	0.7728	0.8089

Hrad:	0.8457	0.8832	0.9216	0.9606	1.0000
	0.0179	0.0391	0.0570	0.0768	0.0982
	0.1158	0.1372	0.1581	0.1783	0.1963
	0.2182	0.2396	0.2582	0.2775	0.2979
	0.3186	0.3374	0.3580	0.3786	0.3991
	0.4181	0.4380	0.4555	0.4739	0.4928
	0.5075	0.5284	0.5455	0.5652	0.5824
	0.6026	0.6222	0.6419	0.6594	0.6787
	0.6987	0.7184	0.7360	0.7582	0.7731
	0.7963	0.8154	0.8352	0.8585	0.8767
	0.9009	0.9200	0.9436	0.9681	1.0000
Width:	0.0183	0.0373	0.0600	0.0805	0.0989
	0.1216	0.1401	0.1590	0.1784	0.2004
	0.2181	0.2363	0.2573	0.2775	0.2967
	0.3155	0.3363	0.3552	0.3738	0.3927
	0.4129	0.4323	0.4542	0.4754	0.4962
	0.5216	0.5407	0.5640	0.5845	0.6077
	0.6279	0.6488	0.6695	0.6927	0.7139
	0.7345	0.7555	0.7787	0.7971	0.8232
	0.8406	0.8622	0.8832	0.9002	0.9228
	0.9388	0.9601	0.9767	0.9922	1.0000
Transect 1_3					
Area:	0.0017	0.0052	0.0097	0.0148	0.0205
	0.0265	0.0327	0.0392	0.0461	0.0534
	0.0614	0.0699	0.0790	0.0889	0.0993
	0.1104	0.1223	0.1348	0.1481	0.1622
	0.1770	0.1925	0.2089	0.2260	0.2440
	0.2627	0.2823	0.3026	0.3235	0.3457
	0.3691	0.3941	0.4203	0.4476	0.4759
	0.5054	0.5358	0.5671	0.5995	0.6330
	0.6672	0.7022	0.7377	0.7736	0.8099
	0.8467	0.8841	0.9220	0.9606	1.0000
Hrad:	0.0253	0.0494	0.0806	0.1086	0.1400
	0.1733	0.2057	0.2338	0.2577	0.2782
	0.2962	0.3178	0.3319	0.3488	0.3683
	0.3841	0.3996	0.4159	0.4315	0.4492
	0.4639	0.4814	0.4976	0.5140	0.5298
	0.5464	0.5648	0.5866	0.6010	0.6033
	0.6112	0.6127	0.6261	0.6419	0.6577
	0.6729	0.6922	0.7113	0.7238	0.7435
	0.7688	0.7938	0.8236	0.8544	0.8844

Width:	0.9105	0.9373	0.9630	0.9821	1.0000
	0.0663	0.1048	0.1207	0.1363	0.1464
	0.1526	0.1588	0.1675	0.1787	0.1921
	0.2073	0.2199	0.2381	0.2547	0.2697
	0.2874	0.3059	0.3241	0.3432	0.3609
	0.3814	0.3999	0.4197	0.4396	0.4604
	0.4808	0.4998	0.5157	0.5381	0.5729
	0.6038	0.6431	0.6712	0.6973	0.7236
	0.7510	0.7740	0.7972	0.8282	0.8513
	0.8679	0.8846	0.8958	0.9054	0.9158
	0.9300	0.9432	0.9573	0.9781	1.0000

Transect 1_4

Area:	0.0011	0.0033	0.0060	0.0094	0.0136
	0.0184	0.0240	0.0303	0.0374	0.0454
	0.0540	0.0632	0.0732	0.0837	0.0949
	0.1069	0.1196	0.1329	0.1467	0.1611
	0.1761	0.1918	0.2083	0.2257	0.2437
	0.2626	0.2823	0.3028	0.3241	0.3463
	0.3693	0.3931	0.4180	0.4437	0.4703
	0.4977	0.5262	0.5554	0.5857	0.6168
	0.6489	0.6821	0.7164	0.7518	0.7885
	0.8268	0.8669	0.9088	0.9531	1.0000

Hrad:	0.0321	0.0647	0.0968	0.1177	0.1445
	0.1729	0.1944	0.2185	0.2409	0.2634
	0.2921	0.3140	0.3435	0.3725	0.3960
	0.4144	0.4417	0.4721	0.5020	0.5264
	0.5522	0.5763	0.5883	0.6125	0.6375
	0.6533	0.6766	0.6982	0.7153	0.7370
	0.7616	0.7757	0.7942	0.8191	0.8369
	0.8575	0.8790	0.8982	0.9200	0.9395
	0.9575	0.9728	0.9916	1.0056	1.0136
	1.0187	1.0172	1.0194	1.0071	1.0000

Width:	0.0356	0.0512	0.0622	0.0798	0.0941
	0.1066	0.1235	0.1387	0.1551	0.1720
	0.1845	0.2010	0.2127	0.2244	0.2391
	0.2575	0.2703	0.2810	0.2917	0.3054
	0.3183	0.3321	0.3534	0.3678	0.3817
	0.4013	0.4166	0.4330	0.4524	0.4692
	0.4842	0.5061	0.5257	0.5411	0.5613
	0.5798	0.5980	0.6178	0.6360	0.6560
	0.6772	0.7006	0.7220	0.7471	0.7775

	0.8113	0.8520	0.8913	0.9462	1.0000
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Transect 1_5

Area:

0.0012	0.0034	0.0065	0.0103	0.0148
0.0201	0.0262	0.0330	0.0405	0.0488
0.0578	0.0675	0.0779	0.0891	0.1010
0.1136	0.1269	0.1409	0.1557	0.1712
0.1875	0.2044	0.2220	0.2403	0.2593
0.2792	0.2999	0.3215	0.3439	0.3672
0.3913	0.4163	0.4420	0.4685	0.4959
0.5242	0.5534	0.5835	0.6145	0.6461
0.6785	0.7114	0.7450	0.7793	0.8143
0.8500	0.8862	0.9231	0.9608	1.0000

Hrad:

0.0260	0.0513	0.0753	0.0993	0.1215
0.1425	0.1651	0.1855	0.2078	0.2285
0.2499	0.2699	0.2923	0.3116	0.3326
0.3531	0.3749	0.3958	0.4149	0.4343
0.4562	0.4782	0.4993	0.5201	0.5393
0.5547	0.5715	0.5899	0.6073	0.6255
0.6435	0.6624	0.6829	0.7023	0.7186
0.7363	0.7527	0.7705	0.7931	0.8149
0.8395	0.8634	0.8854	0.9073	0.9302
0.9545	0.9782	1.0005	1.0169	1.0000

Width:

0.0445	0.0659	0.0857	0.1035	0.1221
0.1414	0.1587	0.1780	0.1951	0.2135
0.2311	0.2500	0.2665	0.2857	0.3035
0.3216	0.3384	0.3559	0.3751	0.3941
0.4108	0.4272	0.4444	0.4616	0.4805
0.5030	0.5244	0.5446	0.5660	0.5867
0.6078	0.6281	0.6469	0.6668	0.6898
0.7116	0.7349	0.7571	0.7745	0.7926
0.8079	0.8236	0.8411	0.8587	0.8752
0.8902	0.9058	0.9225	0.9447	1.0000

Transect 1_6

Area:

0.0013	0.0038	0.0068	0.0102	0.0142
0.0186	0.0237	0.0297	0.0363	0.0436
0.0517	0.0605	0.0701	0.0805	0.0921
0.1045	0.1180	0.1324	0.1476	0.1636
0.1803	0.1977	0.2160	0.2351	0.2551
0.2759	0.2975	0.3200	0.3433	0.3674
0.3925	0.4183	0.4448	0.4723	0.5006

	0.5295	0.5591	0.5892	0.6199	0.6511
	0.6829	0.7154	0.7486	0.7822	0.8164
Hrad:	0.8512	0.8866	0.9232	0.9610	1.0000

	0.0253	0.0539	0.0827	0.1096	0.1337
	0.1537	0.1696	0.1850	0.2058	0.2253
	0.2393	0.2588	0.2777	0.2909	0.3012
	0.3190	0.3326	0.3522	0.3738	0.3955
	0.4164	0.4372	0.4552	0.4738	0.4942
	0.5135	0.5317	0.5507	0.5717	0.5902
	0.6089	0.6303	0.6501	0.6683	0.6884
	0.7128	0.7393	0.7643	0.7897	0.8141
	0.8412	0.8581	0.8824	0.9120	0.9347
Width:	0.9554	0.9759	0.9830	0.9822	1.0000

	0.0517	0.0700	0.0819	0.0933	0.1058
	0.1210	0.1399	0.1603	0.1764	0.1934
	0.2158	0.2338	0.2525	0.2767	0.3055
	0.3276	0.3547	0.3759	0.3949	0.4135
	0.4328	0.4521	0.4744	0.4962	0.5161
	0.5371	0.5594	0.5809	0.6004	0.6224
	0.6444	0.6635	0.6840	0.7065	0.7270
	0.7427	0.7561	0.7707	0.7848	0.7997
	0.8117	0.8336	0.8482	0.8576	0.8733
	0.8907	0.9084	0.9391	0.9784	1.0000

Transect 1_7

Area:	0.0003	0.0011	0.0025	0.0055	0.0089
	0.0126	0.0168	0.0217	0.0274	0.0341
	0.0416	0.0500	0.0592	0.0693	0.0803
	0.0921	0.1049	0.1184	0.1328	0.1481
	0.1643	0.1810	0.1983	0.2163	0.2351
	0.2546	0.2751	0.2961	0.3179	0.3407
	0.3643	0.3887	0.4140	0.4402	0.4672
	0.4953	0.5242	0.5541	0.5850	0.6170
	0.6498	0.6836	0.7185	0.7546	0.7919
	0.8307	0.8712	0.9131	0.9561	1.0000

Hrad:	0.0224	0.0492	0.0486	0.0750	0.1101
	0.1416	0.1659	0.1795	0.1936	0.2124
	0.2304	0.2501	0.2696	0.2886	0.3106
	0.3281	0.3520	0.3731	0.3938	0.4124
	0.4389	0.4681	0.4959	0.5184	0.5407
	0.5592	0.5839	0.6106	0.6275	0.6465
	0.6667	0.6882	0.7088	0.7287	0.7468

	0.7640	0.7859	0.8028	0.8176	0.8380
	0.8599	0.8756	0.8909	0.9096	0.9177
Width:	0.9198	0.9297	0.9448	0.9677	1.0000

	0.0142	0.0231	0.0573	0.0732	0.0807
	0.0890	0.1010	0.1206	0.1415	0.1604
	0.1805	0.1997	0.2194	0.2400	0.2584
	0.2808	0.2978	0.3173	0.3372	0.3592
	0.3743	0.3868	0.3999	0.4172	0.4348
	0.4553	0.4711	0.4849	0.5066	0.5269
	0.5464	0.5649	0.5841	0.6041	0.6257
	0.6483	0.6671	0.6902	0.7156	0.7364
	0.7558	0.7808	0.8066	0.8298	0.8631
	0.9034	0.9374	0.9668	0.9883	1.0000

Transect 1_8

Area:	0.0002	0.0009	0.0020	0.0034	0.0054
	0.0080	0.0116	0.0156	0.0206	0.0262
	0.0321	0.0382	0.0446	0.0510	0.0577
	0.0644	0.0713	0.0785	0.0859	0.0948
	0.1052	0.1166	0.1301	0.1453	0.1609
	0.1788	0.1999	0.2222	0.2472	0.2749
	0.3041	0.3349	0.3668	0.3994	0.4328
	0.4667	0.5010	0.5356	0.5708	0.6063
	0.6424	0.6789	0.7159	0.7531	0.7909
	0.8302	0.8710	0.9132	0.9565	1.0000

Hrad:	0.0221	0.0452	0.0672	0.0952	0.1062
	0.1084	0.1324	0.1572	0.1675	0.2000
	0.2300	0.2668	0.3026	0.3393	0.3761
	0.4120	0.4424	0.4705	0.4969	0.4126
	0.4249	0.4342	0.3809	0.4124	0.4453
	0.3854	0.3987	0.4276	0.4043	0.4197
	0.4458	0.4639	0.4952	0.5255	0.5621
	0.5943	0.6336	0.6731	0.7039	0.7384
	0.7707	0.8053	0.8412	0.8787	0.9139
	0.9455	0.9744	0.9969	0.9592	1.0000

Width:	0.0101	0.0189	0.0294	0.0356	0.0514
	0.0742	0.0874	0.0995	0.1232	0.1310
	0.1396	0.1434	0.1474	0.1506	0.1535
	0.1566	0.1615	0.1670	0.1736	0.2301
	0.2480	0.2796	0.3421	0.3528	0.3617
	0.4645	0.5022	0.5264	0.6123	0.6557
	0.6831	0.7229	0.7416	0.7610	0.7708

0.7860	0.7914	0.7964	0.8114	0.8215
0.8339	0.8435	0.8513	0.8572	0.8824
0.9227	0.9521	0.9827	0.9973	1.0000

Transect 1_9

Area:

0.0002	0.0007	0.0014	0.0041	0.0075
0.0116	0.0178	0.0270	0.0378	0.0497
0.0624	0.0760	0.0912	0.1072	0.1243
0.1422	0.1611	0.1808	0.2008	0.2214
0.2423	0.2637	0.2856	0.3079	0.3308
0.3542	0.3781	0.4026	0.4276	0.4533
0.4794	0.5058	0.5324	0.5590	0.5858
0.6126	0.6395	0.6665	0.6936	0.7207
0.7480	0.7755	0.8030	0.8307	0.8586
0.8866	0.9146	0.9429	0.9713	1.0000

Hrad:

0.0153	0.0358	0.0375	0.0352	0.0600
0.0745	0.0761	0.0883	0.1061	0.1270
0.1471	0.1674	0.1831	0.1993	0.2175
0.2320	0.2499	0.2622	0.2844	0.3081
0.3301	0.3508	0.3719	0.3927	0.4124
0.4316	0.4501	0.4678	0.4856	0.5045
0.5249	0.5507	0.5768	0.6028	0.6298
0.6567	0.6836	0.7104	0.7361	0.7616
0.7872	0.8122	0.8366	0.8605	0.8849
0.9100	0.9349	0.9568	0.9787	1.0000

Width:

0.0139	0.0193	0.0366	0.1157	0.1260
0.1694	0.2682	0.3502	0.3980	0.4288
0.4555	0.4992	0.5440	0.5748	0.6070
0.6429	0.6710	0.6905	0.7074	0.7198
0.7352	0.7530	0.7691	0.7856	0.8034
0.8220	0.8414	0.8621	0.8822	0.9000
0.9150	0.9200	0.9243	0.9286	0.9314
0.9340	0.9366	0.9392	0.9431	0.9472
0.9509	0.9554	0.9605	0.9658	0.9706
0.9746	0.9785	0.9856	0.9926	1.0000

Transect 2_1

Area:

0.0013	0.0039	0.0074	0.0120	0.0174
0.0235	0.0305	0.0382	0.0468	0.0562
0.0667	0.0781	0.0907	0.1042	0.1190
0.1353	0.1532	0.1729	0.1935	0.2144
0.2358	0.2575	0.2795	0.3019	0.3247

	0.3480	0.3715	0.3952	0.4194	0.4438
	0.4686	0.4937	0.5191	0.5449	0.5709
	0.5972	0.6240	0.6510	0.6782	0.7059
	0.7339	0.7621	0.7907	0.8197	0.8490
	0.8786	0.9085	0.9389	0.9694	1.0000
Hrad:					
	0.0209	0.0387	0.0564	0.0744	0.0932
	0.1097	0.1291	0.1429	0.1621	0.1715
	0.1874	0.1985	0.2157	0.2257	0.2384
	0.2408	0.2476	0.2595	0.2868	0.3124
	0.3361	0.3607	0.3870	0.4097	0.4325
	0.4573	0.4832	0.5084	0.5298	0.5536
	0.5758	0.6006	0.6238	0.6468	0.6713
	0.6877	0.7124	0.7372	0.7593	0.7775
	0.8033	0.8202	0.8439	0.8634	0.8867
	0.9061	0.9249	0.9469	0.9735	1.0000
Width:					
	0.0655	0.1008	0.1319	0.1616	0.1865
	0.2147	0.2364	0.2678	0.2889	0.3278
	0.3564	0.3939	0.4208	0.4620	0.4995
	0.5622	0.6193	0.6667	0.6751	0.6869
	0.7020	0.7143	0.7228	0.7374	0.7513
	0.7614	0.7691	0.7778	0.7919	0.8020
	0.8143	0.8224	0.8325	0.8427	0.8506
	0.8687	0.8761	0.8833	0.8934	0.9082
	0.9137	0.9293	0.9372	0.9495	0.9576
	0.9697	0.9823	0.9916	0.9958	1.0000
Transect 2_10					
Area:					
	0.0005	0.0017	0.0037	0.0060	0.0087
	0.0118	0.0155	0.0196	0.0242	0.0293
	0.0351	0.0416	0.0489	0.0588	0.0700
	0.0828	0.0969	0.1128	0.1306	0.1504
	0.1720	0.1951	0.2194	0.2443	0.2697
	0.2952	0.3210	0.3470	0.3732	0.3996
	0.4261	0.4529	0.4798	0.5069	0.5343
	0.5618	0.5895	0.6174	0.6456	0.6740
	0.7027	0.7318	0.7611	0.7909	0.8212
	0.8522	0.8849	0.9208	0.9593	1.0000
Hrad:					
	0.0239	0.0437	0.0696	0.0976	0.1261
	0.1473	0.1648	0.1873	0.2071	0.2245
	0.2356	0.2533	0.2511	0.2267	0.2442
	0.2566	0.2696	0.2839	0.2867	0.3037
	0.3185	0.3406	0.3687	0.4040	0.4400

	0.4788	0.5158	0.5523	0.5898	0.6271
	0.6645	0.7014	0.7375	0.7734	0.8095
	0.8452	0.8804	0.9156	0.9492	0.9802
	1.0099	1.0420	1.0705	1.0942	1.1120
	1.1304	1.0854	1.0209	1.0091	1.0000
Width:					
	0.0195	0.0394	0.0524	0.0617	0.0693
	0.0803	0.0937	0.1044	0.1164	0.1302
	0.1486	0.1638	0.1945	0.2591	0.2866
	0.3225	0.3594	0.3970	0.4554	0.4951
	0.5400	0.5729	0.5950	0.6047	0.6128
	0.6165	0.6222	0.6281	0.6326	0.6370
	0.6411	0.6455	0.6504	0.6552	0.6598
	0.6645	0.6694	0.6741	0.6798	0.6873
	0.6956	0.7020	0.7107	0.7226	0.7383
	0.7536	0.8151	0.9019	0.9506	1.0000
Transect 2_11					
Area:					
	0.0009	0.0029	0.0060	0.0101	0.0150
	0.0205	0.0268	0.0337	0.0412	0.0492
	0.0576	0.0664	0.0757	0.0856	0.0963
	0.1076	0.1196	0.1323	0.1456	0.1594
	0.1738	0.1888	0.2046	0.2212	0.2387
	0.2570	0.2760	0.2961	0.3172	0.3392
	0.3623	0.3867	0.4121	0.4385	0.4659
	0.4943	0.5234	0.5533	0.5842	0.6160
	0.6488	0.6829	0.7182	0.7545	0.7927
	0.8329	0.8738	0.9152	0.9573	1.0000
Hrad:					
	0.0262	0.0516	0.0740	0.0932	0.1240
	0.1506	0.1759	0.2008	0.2285	0.2583
	0.2882	0.3165	0.3424	0.3569	0.3764
	0.3974	0.4184	0.4383	0.4635	0.4883
	0.5081	0.5277	0.5489	0.5608	0.5827
	0.6038	0.6218	0.6415	0.6612	0.6804
	0.6950	0.7068	0.7281	0.7458	0.7659
	0.7867	0.8102	0.8278	0.8501	0.8695
	0.8839	0.9018	0.9210	0.9345	0.9364
	0.8835	0.9150	0.9457	0.9736	1.0000
Width:					
	0.0343	0.0569	0.0807	0.1081	0.1210
	0.1364	0.1523	0.1677	0.1803	0.1904
	0.1998	0.2098	0.2210	0.2398	0.2558
	0.2709	0.2859	0.3018	0.3141	0.3263
	0.3419	0.3578	0.3735	0.3975	0.4146

0.4320	0.4540	0.4776	0.4990	0.5229
0.5506	0.5797	0.6007	0.6242	0.6471
0.6666	0.6838	0.7067	0.7261	0.7481
0.7749	0.8056	0.8292	0.8619	0.9079
0.9427	0.9548	0.9677	0.9832	1.0000

Transect 2_12

Area:

0.0011	0.0034	0.0069	0.0110	0.0157
0.0211	0.0269	0.0334	0.0406	0.0484
0.0570	0.0662	0.0762	0.0867	0.0978
0.1093	0.1216	0.1343	0.1475	0.1613
0.1756	0.1902	0.2053	0.2211	0.2377
0.2552	0.2734	0.2924	0.3123	0.3328
0.3540	0.3761	0.3992	0.4233	0.4482
0.4740	0.5007	0.5285	0.5581	0.5889
0.6207	0.6533	0.6870	0.7237	0.7659
0.8096	0.8549	0.9013	0.9492	1.0000

Hrad:

0.0302	0.0593	0.0935	0.1287	0.1613
0.1954	0.2260	0.2534	0.2820	0.3064
0.3302	0.3565	0.3845	0.4159	0.4474
0.4767	0.5026	0.5351	0.5658	0.5958
0.6275	0.6615	0.6917	0.7067	0.7205
0.7407	0.7588	0.7787	0.8011	0.8273
0.8444	0.8610	0.8765	0.8960	0.9131
0.9332	0.9543	0.9543	0.9523	0.9739
0.9988	1.0212	1.0307	1.0330	0.9178
0.9355	0.9707	0.9910	0.9973	1.0000

Width:

0.0341	0.0563	0.0715	0.0831	0.0951
0.1050	0.1160	0.1285	0.1401	0.1537
0.1679	0.1808	0.1928	0.2029	0.2126
0.2232	0.2353	0.2442	0.2536	0.2633
0.2721	0.2796	0.2886	0.3042	0.3209
0.3350	0.3504	0.3652	0.3791	0.3912
0.4078	0.4249	0.4430	0.4595	0.4775
0.4942	0.5105	0.5388	0.5703	0.5885
0.6047	0.6226	0.6486	0.7279	0.8116
0.8413	0.8557	0.8834	0.9241	1.0000

Transect 2_13

Area:

0.0008	0.0027	0.0051	0.0085	0.0133
0.0196	0.0272	0.0360	0.0456	0.0559
0.0668	0.0783	0.0903	0.1029	0.1160

	0.1297	0.1440	0.1588	0.1743	0.1903
	0.2070	0.2245	0.2426	0.2612	0.2806
	0.3008	0.3217	0.3433	0.3656	0.3888
	0.4128	0.4380	0.4642	0.4914	0.5195
	0.5483	0.5776	0.6076	0.6381	0.6690
	0.7003	0.7322	0.7644	0.7970	0.8300
	0.8634	0.8971	0.9312	0.9655	1.0000
Hrad:					
	0.0174	0.0435	0.0644	0.0754	0.0816
	0.0985	0.1149	0.1371	0.1590	0.1844
	0.2078	0.2327	0.2562	0.2802	0.3021
	0.3242	0.3455	0.3661	0.3867	0.4054
	0.4234	0.4407	0.4604	0.4813	0.4931
	0.5117	0.5292	0.5468	0.5604	0.5753
	0.5863	0.5958	0.6067	0.6176	0.6365
	0.6579	0.6796	0.6998	0.7233	0.7476
	0.7696	0.7928	0.8187	0.8437	0.8666
	0.8908	0.9155	0.9409	0.9705	1.0000
Width:					
	0.0456	0.0618	0.0808	0.1139	0.1647
	0.2013	0.2395	0.2655	0.2900	0.3067
	0.3251	0.3401	0.3564	0.3712	0.3882
	0.4044	0.4212	0.4384	0.4553	0.4744
	0.4942	0.5147	0.5325	0.5485	0.5751
	0.5941	0.6143	0.6344	0.6593	0.6830
	0.7117	0.7430	0.7733	0.8042	0.8245
	0.8412	0.8572	0.8751	0.8885	0.9006
	0.9153	0.9283	0.9379	0.9483	0.9608
	0.9718	0.9818	0.9911	0.9955	1.0000
Transect 2_14					
Area:					
	0.0005	0.0019	0.0037	0.0060	0.0089
	0.0125	0.0168	0.0220	0.0284	0.0360
	0.0446	0.0547	0.0658	0.0778	0.0907
	0.1043	0.1186	0.1336	0.1494	0.1660
	0.1833	0.2013	0.2198	0.2390	0.2588
	0.2793	0.3004	0.3222	0.3448	0.3680
	0.3919	0.4166	0.4420	0.4681	0.4949
	0.5226	0.5510	0.5802	0.6103	0.6415
	0.6739	0.7069	0.7409	0.7756	0.8115
	0.8480	0.8851	0.9229	0.9613	1.0000
Hrad:					
	0.0221	0.0455	0.0703	0.0898	0.1075
	0.1240	0.1391	0.1471	0.1580	0.1744
	0.1860	0.1999	0.2216	0.2444	0.2678

	0.2922	0.3165	0.3376	0.3603	0.3836
	0.4064	0.4310	0.4554	0.4792	0.5029
	0.5245	0.5473	0.5677	0.5880	0.6106
	0.6310	0.6498	0.6711	0.6915	0.7096
	0.7281	0.7490	0.7648	0.7790	0.7875
	0.8069	0.8208	0.8438	0.8578	0.8736
	0.8975	0.9202	0.9424	0.9691	1.0000
Width:					
	0.0248	0.0413	0.0529	0.0671	0.0834
	0.1013	0.1215	0.1500	0.1808	0.2073
	0.2413	0.2749	0.2985	0.3201	0.3405
	0.3588	0.3767	0.3979	0.4171	0.4353
	0.4536	0.4696	0.4853	0.5015	0.5174
	0.5353	0.5518	0.5706	0.5895	0.6059
	0.6245	0.6446	0.6621	0.6805	0.7013
	0.7216	0.7396	0.7627	0.7877	0.8191
	0.8393	0.8651	0.8813	0.9071	0.9314
	0.9468	0.9634	0.9804	0.9925	1.0000
Transect 2_15					
Area:					
	0.0002	0.0013	0.0033	0.0056	0.0081
	0.0110	0.0146	0.0197	0.0266	0.0353
	0.0459	0.0575	0.0702	0.0841	0.0991
	0.1154	0.1326	0.1504	0.1690	0.1882
	0.2080	0.2282	0.2489	0.2700	0.2915
	0.3134	0.3358	0.3586	0.3818	0.4054
	0.4294	0.4537	0.4785	0.5037	0.5293
	0.5554	0.5819	0.6091	0.6367	0.6650
	0.6943	0.7248	0.7563	0.7888	0.8221
	0.8562	0.8909	0.9265	0.9630	1.0000
Hrad:					
	0.0184	0.0301	0.0575	0.0872	0.1134
	0.1280	0.1306	0.1205	0.1266	0.1362
	0.1538	0.1769	0.1972	0.2164	0.2364
	0.2569	0.2817	0.3080	0.3336	0.3599
	0.3869	0.4158	0.4445	0.4723	0.4994
	0.5267	0.5539	0.5810	0.6078	0.6352
	0.6627	0.6894	0.7134	0.7383	0.7624
	0.7858	0.8074	0.8273	0.8505	0.8606
	0.8681	0.8700	0.8811	0.8927	0.9080
	0.9276	0.9440	0.9574	0.9739	1.0000
Width:					
	0.0113	0.0466	0.0577	0.0638	0.0710
	0.0854	0.1112	0.1632	0.2104	0.2654
	0.2990	0.3255	0.3566	0.3891	0.4199

0.4497	0.4713	0.4891	0.5073	0.5237
0.5382	0.5496	0.5606	0.5723	0.5844
0.5958	0.6070	0.6179	0.6288	0.6388
0.6484	0.6586	0.6711	0.6827	0.6947
0.7072	0.7212	0.7367	0.7491	0.7733
0.8003	0.8338	0.8591	0.8843	0.9062
0.9238	0.9445	0.9686	0.9893	1.0000

Transect 2_16

Area:

0.0018	0.0057	0.0109	0.0176	0.0255
0.0345	0.0448	0.0562	0.0691	0.0832
0.0989	0.1156	0.1332	0.1518	0.1712
0.1914	0.2121	0.2333	0.2547	0.2763
0.2981	0.3202	0.3424	0.3647	0.3872
0.4099	0.4328	0.4559	0.4791	0.5024
0.5259	0.5495	0.5733	0.5973	0.6214
0.6457	0.6701	0.6946	0.7193	0.7441
0.7690	0.7941	0.8194	0.8448	0.8703
0.8959	0.9217	0.9476	0.9738	1.0000

Hrad:

0.0160	0.0319	0.0485	0.0638	0.0791
0.0944	0.1089	0.1217	0.1351	0.1461
0.1599	0.1770	0.1938	0.2109	0.2263
0.2459	0.2669	0.2881	0.3115	0.3350
0.3579	0.3810	0.4043	0.4278	0.4510
0.4731	0.4960	0.5190	0.5423	0.5654
0.5872	0.6091	0.6311	0.6541	0.6769
0.6987	0.7205	0.7427	0.7649	0.7874
0.8095	0.8298	0.8515	0.8737	0.8956
0.9171	0.9379	0.9578	0.9789	1.0000

Width:

0.1152	0.1772	0.2249	0.2754	0.3219
0.3655	0.4111	0.4623	0.5113	0.5693
0.6185	0.6529	0.6878	0.7198	0.7566
0.7785	0.7950	0.8100	0.8179	0.8251
0.8330	0.8404	0.8470	0.8527	0.8588
0.8666	0.8727	0.8785	0.8834	0.8887
0.8956	0.9023	0.9086	0.9133	0.9181
0.9242	0.9301	0.9353	0.9404	0.9450
0.9500	0.9570	0.9623	0.9669	0.9717
0.9769	0.9828	0.9894	0.9947	1.0000

Transect 2_17

Area:

0.0014	0.0045	0.0089	0.0143	0.0206
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	0.0280	0.0363	0.0457	0.0559	0.0672
	0.0793	0.0923	0.1062	0.1208	0.1361
	0.1521	0.1689	0.1863	0.2043	0.2230
	0.2423	0.2621	0.2824	0.3033	0.3246
	0.3465	0.3690	0.3919	0.4153	0.4391
	0.4633	0.4881	0.5133	0.5390	0.5650
	0.5915	0.6185	0.6459	0.6738	0.7021
	0.7308	0.7598	0.7891	0.8186	0.8484
	0.8784	0.9086	0.9389	0.9694	1.0000
Hrad:					
	0.0186	0.0365	0.0558	0.0756	0.0921
	0.1102	0.1257	0.1431	0.1601	0.1757
	0.1939	0.2108	0.2285	0.2483	0.2673
	0.2844	0.3034	0.3236	0.3420	0.3605
	0.3806	0.4009	0.4213	0.4418	0.4607
	0.4795	0.4995	0.5200	0.5410	0.5609
	0.5803	0.6001	0.6195	0.6404	0.6603
	0.6795	0.6993	0.7172	0.7356	0.7557
	0.7769	0.8009	0.8245	0.8460	0.8712
	0.8966	0.9229	0.9490	0.9746	1.0000
Width:					
	0.0763	0.1241	0.1601	0.1891	0.2240
	0.2541	0.2889	0.3192	0.3494	0.3825
	0.4093	0.4380	0.4648	0.4868	0.5093
	0.5351	0.5569	0.5758	0.5976	0.6187
	0.6366	0.6538	0.6704	0.6865	0.7047
	0.7229	0.7387	0.7537	0.7676	0.7829
	0.7985	0.8134	0.8286	0.8416	0.8557
	0.8706	0.8845	0.9006	0.9160	0.9291
	0.9407	0.9487	0.9570	0.9677	0.9739
	0.9797	0.9845	0.9894	0.9947	1.0000
Transect 2_18					
Area:					
	0.0007	0.0019	0.0034	0.0051	0.0071
	0.0091	0.0114	0.0138	0.0163	0.0189
	0.0217	0.0246	0.0277	0.0312	0.0351
	0.0394	0.0442	0.0497	0.0564	0.0658
	0.0778	0.0926	0.1094	0.1280	0.1483
	0.1703	0.1942	0.2199	0.2476	0.2768
	0.3075	0.3393	0.3718	0.4049	0.4386
	0.4728	0.5074	0.5425	0.5780	0.6140
	0.6504	0.6873	0.7246	0.7625	0.8008
	0.8396	0.8790	0.9188	0.9592	1.0000
Hrad:					
	0.0279	0.0552	0.0869	0.1160	0.1434

	0.1725	0.2016	0.2298	0.2571	0.2836
	0.3095	0.3348	0.3398	0.3453	0.3527
	0.3529	0.3534	0.3443	0.2889	0.2499
	0.2370	0.2378	0.2531	0.2705	0.2873
	0.3053	0.3216	0.3373	0.3565	0.3789
	0.4037	0.4314	0.4653	0.4980	0.5306
	0.5639	0.5977	0.6318	0.6635	0.6967
	0.7288	0.7609	0.7912	0.8220	0.8535
	0.8823	0.9115	0.9410	0.9706	1.0000
Width:					
	0.0242	0.0345	0.0393	0.0441	0.0490
	0.0527	0.0560	0.0593	0.0627	0.0660
	0.0693	0.0726	0.0807	0.0895	0.0985
	0.1105	0.1239	0.1432	0.1943	0.2623
	0.3276	0.3886	0.4316	0.4725	0.5157
	0.5575	0.6034	0.6516	0.6941	0.7303
	0.7615	0.7863	0.7989	0.8130	0.8264
	0.8382	0.8488	0.8585	0.8710	0.8812
	0.8923	0.9032	0.9158	0.9276	0.9382
	0.9515	0.9643	0.9764	0.9882	1.0000
Transect 2_19					
Area:					
	0.0013	0.0030	0.0050	0.0071	0.0095
	0.0121	0.0148	0.0177	0.0208	0.0240
	0.0273	0.0308	0.0344	0.0381	0.0421
	0.0462	0.0505	0.0550	0.0598	0.0650
	0.0708	0.0774	0.0852	0.0944	0.1059
	0.1206	0.1406	0.1659	0.1943	0.2247
	0.2558	0.2877	0.3203	0.3537	0.3880
	0.4230	0.4589	0.4956	0.5331	0.5714
	0.6105	0.6504	0.6912	0.7328	0.7753
	0.8186	0.8627	0.9076	0.9534	1.0000
Hrad:					
	0.0386	0.0776	0.1130	0.1467	0.1799
	0.2131	0.2459	0.2775	0.3098	0.3419
	0.3732	0.4039	0.4339	0.4594	0.4840
	0.5084	0.5327	0.5527	0.5611	0.5568
	0.5332	0.5014	0.4719	0.4312	0.3836
	0.3347	0.2776	0.2893	0.3067	0.3436
	0.3813	0.4193	0.4558	0.4914	0.5261
	0.5602	0.5945	0.6284	0.6615	0.6942
	0.7259	0.7579	0.7889	0.8196	0.8503
	0.8802	0.9110	0.9416	0.9705	1.0000
Width:					
	0.0339	0.0388	0.0438	0.0485	0.0527

0.0564	0.0599	0.0633	0.0665	0.0694
0.0724	0.0753	0.0783	0.0820	0.0859
0.0898	0.0937	0.0983	0.1053	0.1153
0.1314	0.1531	0.1792	0.2177	0.2748
0.3593	0.5058	0.5730	0.6332	0.6532
0.6703	0.6856	0.7022	0.7194	0.7371
0.7548	0.7717	0.7884	0.8056	0.8228
0.8408	0.8579	0.8759	0.8940	0.9116
0.9299	0.9469	0.9639	0.9823	1.0000

Transect 2_2

Area:

0.0171	0.0343	0.0519	0.0696	0.0874
0.1054	0.1235	0.1418	0.1602	0.1786
0.1971	0.2158	0.2345	0.2534	0.2725
0.2916	0.3107	0.3300	0.3494	0.3689
0.3886	0.4084	0.4282	0.4481	0.4681
0.4883	0.5086	0.5291	0.5495	0.5701
0.5908	0.6116	0.6326	0.6536	0.6746
0.6958	0.7171	0.7384	0.7599	0.7814
0.8029	0.8246	0.8463	0.8681	0.8899
0.9118	0.9338	0.9558	0.9779	1.0000

Hrad:

0.0221	0.0435	0.0653	0.0867	0.1080
0.1294	0.1503	0.1711	0.1927	0.2142
0.2351	0.2556	0.2756	0.2958	0.3164
0.3375	0.3585	0.3779	0.3970	0.4165
0.4363	0.4570	0.4776	0.4967	0.5150
0.5337	0.5526	0.5730	0.5932	0.6123
0.6304	0.6480	0.6666	0.6885	0.7077
0.7250	0.7447	0.7644	0.7841	0.8034
0.8228	0.8423	0.8615	0.8808	0.9000
0.9198	0.9399	0.9600	0.9800	1.0000

Width:

0.7727	0.7901	0.7953	0.8025	0.8097
0.8150	0.8222	0.8288	0.8315	0.8342
0.8387	0.8442	0.8513	0.8568	0.8612
0.8640	0.8668	0.8733	0.8802	0.8860
0.8909	0.8938	0.8967	0.9023	0.9091
0.9150	0.9205	0.9235	0.9265	0.9312
0.9373	0.9440	0.9490	0.9494	0.9534
0.9598	0.9629	0.9661	0.9692	0.9727
0.9758	0.9790	0.9824	0.9856	0.9888
0.9914	0.9935	0.9957	0.9978	1.0000

Transect 2_20

Area:	0.0009	0.0024	0.0043	0.0065	0.0089
	0.0116	0.0144	0.0174	0.0206	0.0240
	0.0275	0.0312	0.0351	0.0392	0.0434
	0.0478	0.0523	0.0570	0.0619	0.0669
	0.0722	0.0777	0.0834	0.0895	0.0960
	0.1033	0.1116	0.1233	0.1387	0.1573
	0.1813	0.2095	0.2411	0.2752	0.3098
	0.3451	0.3809	0.4177	0.4558	0.4954
	0.5369	0.5805	0.6273	0.6775	0.7290
	0.7816	0.8350	0.8892	0.9442	1.0000

Hrad:	0.0384	0.0778	0.1158	0.1538	0.1963
	0.2367	0.2763	0.3144	0.3507	0.3867
	0.4218	0.4574	0.4929	0.5277	0.5637
	0.5986	0.6310	0.6631	0.6941	0.7210
	0.7480	0.7730	0.7928	0.7903	0.7813
	0.7490	0.6648	0.5197	0.4589	0.4255
	0.3882	0.3913	0.4066	0.4486	0.4976
	0.5449	0.5899	0.6277	0.6594	0.6863
	0.7098	0.7228	0.7248	0.7462	0.7841
	0.8285	0.8714	0.9139	0.9565	1.0000

Width:	0.0226	0.0304	0.0367	0.0420	0.0454
	0.0487	0.0519	0.0551	0.0584	0.0616
	0.0648	0.0679	0.0708	0.0737	0.0764
	0.0792	0.0822	0.0852	0.0884	0.0920
	0.0957	0.0996	0.1043	0.1123	0.1220
	0.1370	0.1671	0.2365	0.3015	0.3691
	0.4664	0.5349	0.5926	0.6130	0.6222
	0.6329	0.6454	0.6651	0.6908	0.7216
	0.7561	0.8030	0.8654	0.9079	0.9297
	0.9434	0.9582	0.9729	0.9872	1.0000

Transect 2_21

Area:	0.0025	0.0053	0.0085	0.0119	0.0155
	0.0192	0.0231	0.0271	0.0313	0.0356
	0.0401	0.0447	0.0494	0.0543	0.0592
	0.0643	0.0695	0.0748	0.0802	0.0858
	0.0915	0.0980	0.1071	0.1188	0.1333
	0.1506	0.1707	0.1955	0.2258	0.2566
	0.2874	0.3183	0.3494	0.3809	0.4128
	0.4453	0.4783	0.5118	0.5458	0.5806
	0.6161	0.6523	0.6895	0.7278	0.7674
	0.8085	0.8516	0.8972	0.9465	1.0000

Hrad:

0.0523	0.0989	0.1455	0.1917	0.2372
0.2833	0.3281	0.3715	0.4139	0.4553
0.4963	0.5364	0.5758	0.6172	0.6583
0.6987	0.7386	0.7779	0.8145	0.8504
0.8858	0.9117	0.9118	0.8944	0.8623
0.8191	0.7813	0.6457	0.4144	0.4690
0.5235	0.5779	0.6290	0.6757	0.7212
0.7638	0.8108	0.8535	0.8924	0.9316
0.9661	1.0018	1.0292	1.0531	1.0714
1.0886	1.0838	1.0673	1.0400	1.0000

Width:

0.0473	0.0538	0.0584	0.0620	0.0652
0.0677	0.0702	0.0728	0.0753	0.0778
0.0803	0.0828	0.0852	0.0873	0.0892
0.0912	0.0932	0.0952	0.0974	0.0997
0.1029	0.1358	0.1844	0.2328	0.2811
0.3313	0.3837	0.5053	0.5442	0.5461
0.5480	0.5500	0.5546	0.5627	0.5715
0.5822	0.5891	0.5987	0.6108	0.6224
0.6369	0.6504	0.6692	0.6904	0.7156
0.7422	0.7853	0.8403	0.9100	1.0000

Transect 2_22

Area:

0.0007	0.0018	0.0031	0.0048	0.0066
0.0087	0.0110	0.0138	0.0210	0.0370
0.0545	0.0721	0.0899	0.1079	0.1260
0.1443	0.1630	0.1820	0.2013	0.2209
0.2410	0.2615	0.2823	0.3036	0.3251
0.3469	0.3692	0.3919	0.4149	0.4385
0.4625	0.4870	0.5119	0.5373	0.5632
0.5896	0.6164	0.6435	0.6710	0.6990
0.7273	0.7561	0.7852	0.8148	0.8447
0.8750	0.9057	0.9368	0.9682	1.0000

Hrad:

0.0235	0.0453	0.0667	0.0872	0.1075
0.1260	0.1431	0.1012	0.0771	0.0676
0.0988	0.1299	0.1607	0.1910	0.2208
0.2486	0.2764	0.3027	0.3300	0.3539
0.3787	0.4042	0.4286	0.4533	0.4787
0.5011	0.5250	0.5465	0.5683	0.5881
0.6086	0.6281	0.6487	0.6688	0.6901
0.7071	0.7283	0.7517	0.7719	0.7918
0.8121	0.8347	0.8529	0.8744	0.8940
0.9152	0.9360	0.9569	0.9765	1.0000

Width:	0.0289	0.0388	0.0469	0.0543	0.0612
	0.0685	0.0764	0.1359	0.3619	0.5471
	0.5514	0.5553	0.5594	0.5645	0.5704
	0.5805	0.5896	0.6011	0.6099	0.6241
	0.6365	0.6469	0.6587	0.6696	0.6789
	0.6923	0.7032	0.7170	0.7300	0.7456
	0.7598	0.7753	0.7892	0.8034	0.8161
	0.8338	0.8463	0.8561	0.8693	0.8827
	0.8956	0.9058	0.9206	0.9318	0.9449
	0.9561	0.9676	0.9790	0.9916	1.0000

Transect 2_23

Area:	0.0003	0.0009	0.0017	0.0027	0.0038
	0.0050	0.0063	0.0078	0.0097	0.0123
	0.0155	0.0201	0.0362	0.0542	0.0725
	0.0912	0.1103	0.1300	0.1501	0.1708
	0.1920	0.2137	0.2359	0.2586	0.2817
	0.3056	0.3298	0.3545	0.3798	0.4056
	0.4320	0.4588	0.4861	0.5139	0.5420
	0.5706	0.5995	0.6286	0.6581	0.6878
	0.7178	0.7480	0.7784	0.8092	0.8403
	0.8716	0.9033	0.9352	0.9675	1.0000

Hrad:	0.0185	0.0402	0.0643	0.0863	0.1069
	0.1261	0.1443	0.1542	0.1409	0.1393
	0.1422	0.1191	0.0661	0.0976	0.1281
	0.1585	0.1859	0.2136	0.2401	0.2671
	0.2922	0.3186	0.3436	0.3694	0.3926
	0.4165	0.4403	0.4640	0.4856	0.5094
	0.5304	0.5551	0.5769	0.6013	0.6251
	0.6489	0.6764	0.7022	0.7274	0.7536
	0.7805	0.8064	0.8315	0.8553	0.8808
	0.9066	0.9289	0.9525	0.9780	1.0000

Width:	0.0158	0.0230	0.0270	0.0309	0.0348
	0.0390	0.0432	0.0500	0.0685	0.0875
	0.1081	0.3038	0.5472	0.5552	0.5661
	0.5754	0.5931	0.6083	0.6251	0.6394
	0.6571	0.6707	0.6866	0.7001	0.7175
	0.7335	0.7488	0.7641	0.7821	0.7963
	0.8144	0.8265	0.8426	0.8547	0.8671
	0.8794	0.8863	0.8952	0.9047	0.9127
	0.9197	0.9275	0.9362	0.9461	0.9540
	0.9614	0.9724	0.9819	0.9892	1.0000

Transect 2_24

Area:

0.0003	0.0010	0.0019	0.0029	0.0041
0.0055	0.0070	0.0086	0.0103	0.0122
0.0143	0.0164	0.0187	0.0211	0.0238
0.0266	0.0297	0.0333	0.0377	0.0456
0.0663	0.0897	0.1133	0.1369	0.1607
0.1847	0.2088	0.2330	0.2575	0.2823
0.3073	0.3334	0.3612	0.3905	0.4217
0.4546	0.4886	0.5237	0.5596	0.5966
0.6346	0.6734	0.7126	0.7523	0.7925
0.8331	0.8742	0.9157	0.9576	1.0000

Hrad:

0.0229	0.0535	0.0800	0.1089	0.1362
0.1621	0.1869	0.2106	0.2336	0.2575
0.2810	0.3041	0.3269	0.3441	0.3584
0.3736	0.3726	0.3539	0.2986	0.2441
0.1209	0.1626	0.2041	0.2453	0.2862
0.3269	0.3670	0.4063	0.4450	0.4826
0.5193	0.5533	0.5840	0.6121	0.5593
0.5774	0.6018	0.6275	0.6535	0.6777
0.7031	0.7351	0.7689	0.8010	0.8363
0.8684	0.9009	0.9354	0.9674	1.0000

Width:

0.0136	0.0184	0.0232	0.0266	0.0298
0.0331	0.0363	0.0396	0.0430	0.0461
0.0492	0.0523	0.0554	0.0594	0.0642
0.0690	0.0774	0.0916	0.1240	0.3187
0.5478	0.5508	0.5539	0.5571	0.5604
0.5638	0.5678	0.5725	0.5776	0.5837
0.5933	0.6339	0.6695	0.7071	0.7533
0.7866	0.8114	0.8341	0.8560	0.8801
0.9023	0.9158	0.9266	0.9391	0.9475
0.9593	0.9703	0.9789	0.9898	1.0000

Transect 2_25

Area:

0.0001	0.0006	0.0013	0.0023	0.0033
0.0045	0.0059	0.0073	0.0089	0.0106
0.0124	0.0143	0.0164	0.0186	0.0210
0.0235	0.0262	0.0290	0.0321	0.0355
0.0443	0.0593	0.0796	0.1048	0.1302
0.1556	0.1811	0.2068	0.2326	0.2587
0.2851	0.3118	0.3388	0.3661	0.3955
0.4272	0.4604	0.4949	0.5306	0.5679

	0.6067	0.6465	0.6880	0.7311	0.7748
	0.8190	0.8637	0.9088	0.9542	1.0000
Hrad:					
	0.0228	0.0455	0.0685	0.1003	0.1316
	0.1609	0.1888	0.2157	0.2417	0.2672
	0.2923	0.3170	0.3398	0.3596	0.3797
	0.4000	0.4179	0.4363	0.4388	0.4347
	0.3558	0.2702	0.1446	0.1898	0.2349
	0.2798	0.3241	0.3677	0.4111	0.4522
	0.4921	0.5318	0.5720	0.6099	0.6373
	0.6012	0.6228	0.6461	0.6687	0.6821
	0.7090	0.7365	0.7389	0.7739	0.8076
	0.8463	0.8841	0.9216	0.9604	1.0000
Width:					
	0.0063	0.0126	0.0189	0.0222	0.0249
	0.0275	0.0302	0.0329	0.0356	0.0383
	0.0409	0.0435	0.0464	0.0497	0.0531
	0.0564	0.0602	0.0640	0.0705	0.0791
	0.2712	0.3796	0.5492	0.5510	0.5529
	0.5547	0.5575	0.5610	0.5646	0.5707
	0.5779	0.5849	0.5909	0.6117	0.6645
	0.7097	0.7384	0.7652	0.7928	0.8321
	0.8552	0.8775	0.9309	0.9445	0.9593
	0.9678	0.9769	0.9860	0.9936	1.0000
Transect 2_26					
Area:					
	0.0005	0.0016	0.0029	0.0044	0.0060
	0.0079	0.0099	0.0121	0.0144	0.0168
	0.0194	0.0221	0.0249	0.0278	0.0309
	0.0342	0.0375	0.0410	0.0446	0.0484
	0.0524	0.0565	0.0607	0.0652	0.0702
	0.0764	0.0865	0.1080	0.1395	0.1710
	0.2028	0.2346	0.2666	0.2988	0.3311
	0.3637	0.3965	0.4295	0.4635	0.5008
	0.5412	0.5848	0.6307	0.6788	0.7290
	0.7817	0.8355	0.8900	0.9448	1.0000
Hrad:					
	0.0304	0.0709	0.1124	0.1503	0.1858
	0.2209	0.2585	0.2946	0.3295	0.3635
	0.3965	0.4289	0.4621	0.4934	0.5243
	0.5548	0.5849	0.6147	0.6442	0.6702
	0.6942	0.7185	0.7393	0.7563	0.6789
	0.6000	0.3380	0.1902	0.2447	0.2990
	0.3530	0.4068	0.4598	0.5122	0.5643
	0.6157	0.6666	0.7153	0.7594	0.7996

	0.8334	0.7234	0.7442	0.7661	0.7865
	0.8111	0.8552	0.9038	0.9527	1.0000
Width:					
	0.0160	0.0218	0.0252	0.0286	0.0320
	0.0352	0.0376	0.0401	0.0425	0.0450
	0.0474	0.0499	0.0521	0.0545	0.0570
	0.0594	0.0618	0.0642	0.0667	0.0695
	0.0725	0.0755	0.0790	0.0830	0.1002
	0.1242	0.2532	0.5662	0.5685	0.5707
	0.5729	0.5752	0.5783	0.5818	0.5852
	0.5892	0.5933	0.5989	0.6458	0.7000
	0.7575	0.8076	0.8469	0.8855	0.9267
	0.9636	0.9769	0.9847	0.9916	1.0000
Transect 2_27					
Area:					
	0.0023	0.0055	0.0095	0.0141	0.0194
	0.0256	0.0323	0.0399	0.0482	0.0573
	0.0671	0.0778	0.0893	0.1015	0.1145
	0.1283	0.1428	0.1582	0.1744	0.1915
	0.2093	0.2279	0.2474	0.2677	0.2887
	0.3107	0.3334	0.3568	0.3811	0.4062
	0.4320	0.4586	0.4859	0.5137	0.5417
	0.5700	0.5987	0.6277	0.6570	0.6866
	0.7166	0.7469	0.7775	0.8085	0.8397
	0.8712	0.9030	0.9351	0.9674	1.0000
Hrad:					
	0.0272	0.0507	0.0724	0.0930	0.1099
	0.1304	0.1472	0.1647	0.1815	0.1989
	0.2134	0.2297	0.2454	0.2644	0.2795
	0.2963	0.3131	0.3274	0.3434	0.3579
	0.3766	0.3914	0.4078	0.4227	0.4400
	0.4537	0.4728	0.4885	0.5059	0.5207
	0.5403	0.5551	0.5760	0.6019	0.6292
	0.6541	0.6789	0.7051	0.7281	0.7527
	0.7792	0.8012	0.8252	0.8509	0.8758
	0.8998	0.9231	0.9496	0.9763	1.0000
Width:					
	0.0861	0.1093	0.1309	0.1514	0.1768
	0.1961	0.2196	0.2423	0.2656	0.2880
	0.3144	0.3387	0.3639	0.3840	0.4096
	0.4330	0.4562	0.4831	0.5079	0.5350
	0.5559	0.5824	0.6066	0.6332	0.6562
	0.6847	0.7051	0.7305	0.7533	0.7801
	0.7995	0.8261	0.8435	0.8535	0.8609
	0.8715	0.8819	0.8902	0.9023	0.9122

0.9197	0.9322	0.9423	0.9502	0.9588
0.9683	0.9782	0.9847	0.9909	1.0000

Transect 2_28

Area:

0.0002	0.0008	0.0018	0.0030	0.0045
0.0062	0.0081	0.0101	0.0124	0.0148
0.0175	0.0203	0.0233	0.0266	0.0300
0.0336	0.0375	0.0417	0.0463	0.0516
0.0579	0.0651	0.0734	0.0832	0.0949
0.1082	0.1233	0.1402	0.1591	0.1798
0.2024	0.2270	0.2534	0.2818	0.3121
0.3444	0.3786	0.4148	0.4529	0.4930
0.5350	0.5791	0.6251	0.6730	0.7229
0.7748	0.8286	0.8844	0.9416	1.0000

Hrad:

0.0293	0.0585	0.0910	0.1291	0.1675
0.2038	0.2385	0.2722	0.3050	0.3373
0.3695	0.4012	0.4325	0.4636	0.4924
0.5162	0.5348	0.5525	0.5478	0.5197
0.5028	0.4916	0.4775	0.4527	0.4436
0.4472	0.4532	0.4568	0.4712	0.4877
0.5026	0.5217	0.5447	0.5637	0.5852
0.6083	0.6314	0.6555	0.6807	0.7052
0.7306	0.7550	0.7825	0.8089	0.8342
0.8609	0.8898	0.9180	0.9571	1.0000

Width:

0.0068	0.0135	0.0194	0.0235	0.0268
0.0301	0.0334	0.0367	0.0401	0.0434
0.0466	0.0499	0.0531	0.0564	0.0599
0.0641	0.0690	0.0744	0.0834	0.0982
0.1140	0.1312	0.1525	0.1827	0.2129
0.2410	0.2710	0.3060	0.3368	0.3679
0.4020	0.4345	0.4646	0.4992	0.5327
0.5656	0.5991	0.6323	0.6650	0.6988
0.7321	0.7668	0.7987	0.8319	0.8665
0.9000	0.9312	0.9634	0.9839	1.0000

Transect 2_29

Area:

0.0006	0.0019	0.0037	0.0058	0.0083
0.0110	0.0141	0.0176	0.0214	0.0255
0.0300	0.0347	0.0398	0.0453	0.0513
0.0577	0.0647	0.0725	0.0812	0.0912
0.1024	0.1151	0.1292	0.1446	0.1614
0.1796	0.1991	0.2201	0.2424	0.2662

	0.2916	0.3183	0.3465	0.3763	0.4074
	0.4399	0.4739	0.5093	0.5460	0.5841
	0.6235	0.6634	0.7038	0.7447	0.7863
	0.8283	0.8708	0.9134	0.9562	1.0000
Hrad:					
	0.0252	0.0535	0.0831	0.1124	0.1395
	0.1647	0.1887	0.2122	0.2371	0.2619
	0.2862	0.3101	0.3288	0.3463	0.3629
	0.3782	0.3846	0.3893	0.3822	0.3785
	0.3759	0.3772	0.3854	0.3965	0.4068
	0.4198	0.4330	0.4481	0.4650	0.4774
	0.4927	0.5117	0.5276	0.5449	0.5647
	0.5851	0.6028	0.6237	0.6443	0.6637
	0.6943	0.7292	0.7636	0.7963	0.8306
	0.8648	0.9044	0.9445	0.9764	1.0000
Width:					
	0.0237	0.0357	0.0445	0.0516	0.0589
	0.0667	0.0745	0.0825	0.0897	0.0968
	0.1039	0.1110	0.1200	0.1298	0.1401
	0.1514	0.1671	0.1849	0.2113	0.2397
	0.2714	0.3042	0.3343	0.3639	0.3959
	0.4269	0.4591	0.4905	0.5207	0.5570
	0.5913	0.6217	0.6564	0.6902	0.7213
	0.7518	0.7860	0.8165	0.8474	0.8801
	0.8980	0.9097	0.9216	0.9353	0.9466
	0.9579	0.9628	0.9669	0.9792	1.0000
Transect 2_3					
Area:					
	0.0001	0.0005	0.0011	0.0018	0.0027
	0.0038	0.0050	0.0064	0.0080	0.0098
	0.0120	0.0144	0.0169	0.0198	0.0229
	0.0262	0.0297	0.0334	0.0372	0.0413
	0.0457	0.0511	0.0602	0.0729	0.0893
	0.1104	0.1360	0.1683	0.2044	0.2408
	0.2774	0.3141	0.3508	0.3877	0.4246
	0.4617	0.4989	0.5362	0.5736	0.6111
	0.6487	0.6864	0.7243	0.7624	0.8008
	0.8395	0.8786	0.9181	0.9584	1.0000
Hrad:					
	0.0223	0.0456	0.0730	0.0984	0.1219
	0.1461	0.1698	0.1892	0.2098	0.2225
	0.2320	0.2573	0.2822	0.2946	0.3196
	0.3456	0.3711	0.3929	0.4184	0.4340
	0.4440	0.4526	0.4327	0.4124	0.3634
	0.3237	0.2722	0.2373	0.2523	0.2951

	0.3390	0.3829	0.4266	0.4703	0.5138
	0.5567	0.5998	0.6428	0.6857	0.7280
	0.7706	0.8132	0.8555	0.8971	0.9388
	0.9801	1.0210	1.0604	1.0979	1.0000
Width:					
	0.0056	0.0109	0.0145	0.0182	0.0221
	0.0257	0.0293	0.0337	0.0381	0.0440
	0.0514	0.0556	0.0598	0.0669	0.0714
	0.0756	0.0797	0.0846	0.0887	0.0949
	0.1026	0.1476	0.2515	0.3210	0.4280
	0.5186	0.6470	0.7965	0.8103	0.8163
	0.8184	0.8204	0.8224	0.8245	0.8265
	0.8295	0.8319	0.8342	0.8365	0.8395
	0.8418	0.8442	0.8488	0.8548	0.8604
	0.8683	0.8782	0.8886	0.9121	1.0000
Transect 2_30					
Area:					
	0.0007	0.0018	0.0034	0.0052	0.0074
	0.0099	0.0128	0.0162	0.0200	0.0242
	0.0289	0.0340	0.0397	0.0459	0.0527
	0.0600	0.0679	0.0764	0.0857	0.0959
	0.1072	0.1194	0.1326	0.1468	0.1622
	0.1789	0.1968	0.2161	0.2367	0.2588
	0.2822	0.3070	0.3333	0.3610	0.3901
	0.4204	0.4521	0.4854	0.5200	0.5561
	0.5937	0.6328	0.6735	0.7158	0.7598
	0.8053	0.8523	0.9006	0.9499	1.0000
Hrad:					
	0.0366	0.0684	0.1003	0.1294	0.1560
	0.1813	0.2068	0.2264	0.2469	0.2718
	0.2948	0.3148	0.3341	0.3526	0.3733
	0.3946	0.4154	0.4314	0.4417	0.4488
	0.4579	0.4710	0.4856	0.4996	0.5080
	0.5184	0.5327	0.5443	0.5577	0.5726
	0.5892	0.6022	0.6211	0.6389	0.6617
	0.6826	0.7014	0.7194	0.7409	0.7602
	0.7797	0.7995	0.8183	0.8349	0.8553
	0.8775	0.8990	0.9283	0.9623	1.0000
Width:					
	0.0187	0.0268	0.0332	0.0398	0.0469
	0.0542	0.0615	0.0707	0.0802	0.0883
	0.0971	0.1072	0.1179	0.1292	0.1402
	0.1511	0.1624	0.1761	0.1929	0.2126
	0.2329	0.2524	0.2720	0.2928	0.3182
	0.3440	0.3686	0.3961	0.4236	0.4511

0.4781	0.5090	0.5359	0.5645	0.5889
0.6153	0.6441	0.6743	0.7014	0.7311
0.7610	0.7912	0.8228	0.8571	0.8882
0.9176	0.9480	0.9702	0.9871	1.0000

Transect 2_31

Area:

0.0004	0.0014	0.0028	0.0046	0.0067
0.0091	0.0119	0.0149	0.0183	0.0220
0.0260	0.0303	0.0349	0.0398	0.0450
0.0505	0.0563	0.0625	0.0692	0.0766
0.0848	0.0943	0.1049	0.1169	0.1305
0.1458	0.1627	0.1815	0.2021	0.2245
0.2489	0.2752	0.3035	0.3335	0.3653
0.3987	0.4335	0.4698	0.5076	0.5469
0.5876	0.6296	0.6730	0.7177	0.7634
0.8097	0.8566	0.9041	0.9520	1.0000

Hrad:

0.0242	0.0562	0.0864	0.1146	0.1421
0.1682	0.1952	0.2222	0.2476	0.2727
0.2986	0.3242	0.3497	0.3760	0.4019
0.4274	0.4474	0.4677	0.4677	0.4669
0.4634	0.4485	0.4467	0.4388	0.4355
0.4347	0.4380	0.4433	0.4528	0.4630
0.4729	0.4869	0.5013	0.5212	0.5402
0.5645	0.5881	0.6130	0.6363	0.6601
0.6858	0.7123	0.7387	0.7647	0.8010
0.8388	0.8742	0.9132	0.9567	1.0000

Width:

0.0164	0.0256	0.0329	0.0401	0.0469
0.0539	0.0605	0.0668	0.0734	0.0800
0.0863	0.0926	0.0989	0.1048	0.1108
0.1168	0.1244	0.1321	0.1465	0.1627
0.1818	0.2091	0.2339	0.2657	0.2992
0.3350	0.3715	0.4097	0.4468	0.4857
0.5274	0.5666	0.6070	0.6417	0.6783
0.7086	0.7397	0.7691	0.8007	0.8315
0.8600	0.8875	0.9148	0.9423	0.9563
0.9679	0.9819	0.9915	0.9958	1.0000

Transect 2_32

Area:

0.0005	0.0019	0.0037	0.0059	0.0083
0.0111	0.0141	0.0174	0.0209	0.0247
0.0289	0.0335	0.0386	0.0440	0.0500
0.0563	0.0633	0.0710	0.0797	0.0895

	0.1008	0.1134	0.1273	0.1427	0.1597
	0.1780	0.1980	0.2195	0.2426	0.2672
	0.2933	0.3208	0.3496	0.3798	0.4115
	0.4447	0.4793	0.5151	0.5518	0.5897
	0.6285	0.6679	0.7078	0.7481	0.7889
	0.8301	0.8718	0.9139	0.9566	1.0000
Hrad:					
	0.0212	0.0519	0.0805	0.1113	0.1400
	0.1672	0.1939	0.2202	0.2450	0.2694
	0.2856	0.2998	0.3168	0.3341	0.3519
	0.3692	0.3757	0.3779	0.3745	0.3694
	0.3669	0.3736	0.3792	0.3844	0.3965
	0.4077	0.4155	0.4300	0.4450	0.4605
	0.4792	0.4991	0.5171	0.5392	0.5547
	0.5745	0.5957	0.6227	0.6468	0.6735
	0.7040	0.7361	0.7730	0.8082	0.8419
	0.8776	0.9125	0.9451	0.9731	1.0000
Width:					
	0.0247	0.0364	0.0457	0.0522	0.0586
	0.0650	0.0712	0.0771	0.0834	0.0897
	0.0989	0.1092	0.1190	0.1289	0.1389
	0.1494	0.1649	0.1841	0.2089	0.2384
	0.2705	0.2989	0.3310	0.3663	0.3974
	0.4310	0.4707	0.5044	0.5387	0.5737
	0.6053	0.6356	0.6688	0.6970	0.7342
	0.7661	0.7964	0.8186	0.8445	0.8666
	0.8836	0.8981	0.9063	0.9163	0.9275
	0.9364	0.9457	0.9572	0.9731	1.0000
Transect 2_33					
Area:					
	0.0007	0.0019	0.0034	0.0053	0.0074
	0.0098	0.0125	0.0154	0.0184	0.0217
	0.0252	0.0291	0.0332	0.0378	0.0428
	0.0487	0.0551	0.0622	0.0708	0.0806
	0.0914	0.1030	0.1155	0.1290	0.1433
	0.1586	0.1750	0.1926	0.2110	0.2308
	0.2520	0.2755	0.3032	0.3347	0.3688
	0.4036	0.4393	0.4761	0.5135	0.5516
	0.5904	0.6301	0.6705	0.7120	0.7545
	0.7991	0.8468	0.8965	0.9475	1.0000
Hrad:					
	0.0346	0.0636	0.0948	0.1253	0.1540
	0.1830	0.2141	0.2441	0.2728	0.3007
	0.3218	0.3409	0.3590	0.3747	0.3661
	0.3678	0.3884	0.3829	0.3606	0.3651

	0.3866	0.4058	0.4249	0.4404	0.4622
	0.4746	0.4860	0.5085	0.5258	0.5363
	0.5470	0.5529	0.5532	0.4777	0.5096
	0.5474	0.5766	0.6128	0.6488	0.6844
	0.7200	0.7506	0.7792	0.8107	0.8371
	0.8773	0.9139	0.9478	0.9765	1.0000
Width:					
	0.0176	0.0258	0.0319	0.0371	0.0424
	0.0472	0.0511	0.0550	0.0589	0.0629
	0.0683	0.0743	0.0806	0.0878	0.1020
	0.1157	0.1241	0.1423	0.1725	0.1941
	0.2080	0.2234	0.2393	0.2580	0.2732
	0.2946	0.3176	0.3342	0.3543	0.3802
	0.4071	0.4818	0.5442	0.6206	0.6411
	0.6533	0.6751	0.6884	0.7013	0.7142
	0.7267	0.7439	0.7626	0.7784	0.7989
	0.8653	0.9087	0.9349	0.9590	1.0000
Transect 2_34					
Area:					
	0.0009	0.0025	0.0048	0.0077	0.0112
	0.0152	0.0200	0.0258	0.0325	0.0405
	0.0497	0.0600	0.0714	0.0842	0.0987
	0.1145	0.1313	0.1490	0.1674	0.1867
	0.2066	0.2274	0.2490	0.2714	0.2947
	0.3184	0.3426	0.3671	0.3919	0.4169
	0.4422	0.4677	0.4935	0.5195	0.5458
	0.5723	0.5991	0.6263	0.6539	0.6820
	0.7106	0.7397	0.7693	0.7994	0.8303
	0.8625	0.8959	0.9301	0.9649	1.0000
Hrad:					
	0.0233	0.0456	0.0651	0.0860	0.1065
	0.1231	0.1333	0.1455	0.1554	0.1651
	0.1819	0.1955	0.2094	0.2176	0.2281
	0.2484	0.2692	0.2913	0.3136	0.3366
	0.3582	0.3782	0.4001	0.4191	0.4424
	0.4691	0.4963	0.5253	0.5551	0.5849
	0.6143	0.6437	0.6730	0.7015	0.7293
	0.7571	0.7837	0.8078	0.8281	0.8477
	0.8693	0.8916	0.9109	0.9253	0.9309
	0.9267	0.9370	0.9502	0.9738	1.0000
Width:					
	0.0380	0.0558	0.0741	0.0900	0.1049
	0.1232	0.1498	0.1770	0.2094	0.2455
	0.2732	0.3066	0.3408	0.3869	0.4328
	0.4612	0.4879	0.5116	0.5340	0.5546

0.5769	0.6014	0.6225	0.6477	0.6661
0.6786	0.6901	0.6988	0.7058	0.7126
0.7197	0.7264	0.7330	0.7403	0.7480
0.7556	0.7641	0.7750	0.7893	0.8043
0.8173	0.8294	0.8443	0.8637	0.8918
0.9307	0.9562	0.9788	0.9908	1.0000

Transect 2_35

Area:

0.0003	0.0010	0.0019	0.0029	0.0047
0.0074	0.0107	0.0145	0.0188	0.0237
0.0292	0.0366	0.0490	0.0665	0.0867
0.1076	0.1289	0.1507	0.1730	0.1957
0.2187	0.2420	0.2655	0.2892	0.3130
0.3370	0.3610	0.3851	0.4093	0.4336
0.4581	0.4827	0.5074	0.5323	0.5573
0.5827	0.6083	0.6343	0.6605	0.6874
0.7149	0.7431	0.7720	0.8017	0.8322
0.8636	0.8958	0.9292	0.9635	1.0000

Hrad:

0.0247	0.0499	0.0744	0.0920	0.0744
0.0967	0.1148	0.1354	0.1578	0.1757
0.1931	0.2015	0.1893	0.1280	0.1616
0.1954	0.2290	0.2624	0.2953	0.3274
0.3619	0.3962	0.4303	0.4667	0.5030
0.5391	0.5750	0.6105	0.6460	0.6814
0.7158	0.7500	0.7843	0.8179	0.8486
0.8758	0.9029	0.9313	0.9562	0.9682
0.9823	1.0006	1.0121	1.0195	1.0288
1.0461	1.0483	1.0524	1.0567	1.0000

Width:

0.0137	0.0199	0.0248	0.0316	0.0636
0.0767	0.0928	0.1069	0.1192	0.1346
0.1510	0.2616	0.3853	0.5193	0.5369
0.5506	0.5631	0.5745	0.5858	0.5976
0.6044	0.6107	0.6170	0.6197	0.6223
0.6249	0.6277	0.6306	0.6335	0.6362
0.6398	0.6434	0.6468	0.6506	0.6565
0.6651	0.6735	0.6808	0.6905	0.7097
0.7276	0.7425	0.7626	0.7862	0.8088
0.8253	0.8544	0.8828	0.9117	1.0000

Transect 2_36

Area:

0.0005	0.0035	0.0087	0.0142	0.0203
0.0274	0.0353	0.0438	0.0532	0.0636

	0.0745	0.0864	0.1007	0.1166	0.1335
	0.1508	0.1683	0.1859	0.2036	0.2217
	0.2401	0.2588	0.2778	0.2972	0.3168
	0.3366	0.3565	0.3769	0.3980	0.4200
	0.4426	0.4657	0.4895	0.5149	0.5414
	0.5686	0.5965	0.6248	0.6536	0.6829
	0.7131	0.7436	0.7743	0.8053	0.8367
	0.8685	0.9008	0.9335	0.9666	1.0000
Hrad:					
	0.0151	0.0244	0.0545	0.0827	0.1065
	0.1218	0.1442	0.1672	0.1856	0.2135
	0.2408	0.2514	0.2396	0.2648	0.2602
	0.2916	0.3229	0.3536	0.3842	0.4077
	0.4371	0.4612	0.4865	0.5107	0.5412
	0.5715	0.5984	0.6089	0.6186	0.6316
	0.6526	0.6703	0.6700	0.6646	0.6745
	0.6938	0.7148	0.7362	0.7576	0.7802
	0.7890	0.8174	0.8454	0.8692	0.8907
	0.9102	0.9325	0.9558	0.9775	1.0000
Width:					
	0.0299	0.1483	0.1594	0.1722	0.1904
	0.2249	0.2446	0.2661	0.2949	0.3187
	0.3318	0.3837	0.4629	0.4822	0.5130
	0.5171	0.5211	0.5256	0.5300	0.5439
	0.5493	0.5611	0.5710	0.5819	0.5854
	0.5889	0.5957	0.6189	0.6434	0.6650
	0.6782	0.6947	0.7306	0.7747	0.8026
	0.8196	0.8345	0.8487	0.8626	0.8903
	0.9039	0.9097	0.9159	0.9264	0.9394
	0.9543	0.9660	0.9766	0.9888	1.0000
Transect 2_37					
Area:					
	0.0009	0.0029	0.0067	0.0125	0.0203
	0.0301	0.0418	0.0551	0.0694	0.0845
	0.1007	0.1187	0.1387	0.1611	0.1839
	0.2069	0.2298	0.2527	0.2757	0.2987
	0.3218	0.3448	0.3679	0.3910	0.4141
	0.4372	0.4604	0.4836	0.5068	0.5301
	0.5533	0.5766	0.5999	0.6233	0.6466
	0.6700	0.6934	0.7169	0.7403	0.7638
	0.7873	0.8109	0.8344	0.8580	0.8816
	0.9052	0.9289	0.9526	0.9763	1.0000
Hrad:					
	0.0134	0.0282	0.0329	0.0432	0.0546
	0.0671	0.0770	0.0952	0.1135	0.1314

	0.1434	0.1537	0.1674	0.1671	0.1907
	0.2142	0.2378	0.2613	0.2847	0.3082
	0.3316	0.3550	0.3784	0.4017	0.4250
	0.4483	0.4715	0.4948	0.5180	0.5412
	0.5643	0.5875	0.6106	0.6337	0.6567
	0.6798	0.7028	0.7258	0.7488	0.7717
	0.7947	0.8176	0.8405	0.8633	0.8861
	0.9090	0.9318	0.9545	0.9773	1.0000
Width:					
	0.0657	0.1014	0.2036	0.2889	0.3714
	0.4486	0.5429	0.5788	0.6186	0.6559
	0.7190	0.7992	0.8843	0.9637	0.9646
	0.9656	0.9665	0.9675	0.9684	0.9694
	0.9703	0.9713	0.9723	0.9733	0.9744
	0.9754	0.9764	0.9774	0.9785	0.9795
	0.9805	0.9815	0.9826	0.9836	0.9846
	0.9856	0.9867	0.9877	0.9887	0.9897
	0.9908	0.9918	0.9928	0.9938	0.9949
	0.9959	0.9969	0.9979	0.9990	1.0000
Transect 2_38					
Area:					
	0.0037	0.0080	0.0131	0.0189	0.0254
	0.0327	0.0407	0.0494	0.0588	0.0686
	0.0784	0.0883	0.0981	0.1092	0.1223
	0.1354	0.1486	0.1618	0.1775	0.1939
	0.2104	0.2268	0.2433	0.2604	0.2781
	0.2965	0.3156	0.3355	0.3561	0.3774
	0.3994	0.4221	0.4457	0.4699	0.4948
	0.5204	0.5468	0.5739	0.6017	0.6302
	0.6597	0.6931	0.7271	0.7618	0.7971
	0.8351	0.8754	0.9163	0.9578	1.0000
Hrad:					
	0.2948	0.5495	0.7797	0.9941	1.1881
	1.3867	1.5791	1.7667	1.9505	2.2566
	2.5744	2.8915	3.2078	2.6983	3.0151
	3.3313	3.6467	3.9613	3.5061	3.8211
	4.1354	4.4491	4.7122	4.8439	4.9778
	5.1138	5.2516	5.3422	5.4882	5.6351
	5.7829	5.8737	6.0283	6.1833	6.3387
	6.4943	6.5875	6.7486	6.9097	7.0708
	6.4481	6.6449	6.8404	7.0346	7.2276
	6.7563	6.9721	7.1862	7.3988	1.0000
Width:					
	0.0124	0.0146	0.0168	0.0190	0.0214
	0.0236	0.0258	0.0279	0.0301	0.0304

0.0304	0.0305	0.0306	0.0404	0.0405
0.0406	0.0407	0.0408	0.0506	0.0507
0.0508	0.0509	0.0516	0.0537	0.0558
0.0579	0.0600	0.0627	0.0648	0.0669
0.0690	0.0718	0.0739	0.0759	0.0780
0.0801	0.0829	0.0850	0.0870	0.0890
0.1022	0.1042	0.1062	0.1082	0.1102
0.1235	0.1255	0.1274	0.1294	1.0000

Transect 2_39

Area:

0.0001	0.0005	0.0011	0.0028	0.0050
0.0080	0.0118	0.0161	0.0212	0.0269
0.0335	0.0407	0.0490	0.0579	0.0676
0.0782	0.0895	0.1016	0.1147	0.1287
0.1432	0.1589	0.1753	0.1926	0.2106
0.2296	0.2490	0.2694	0.2911	0.3136
0.3369	0.3613	0.3868	0.4135	0.4412
0.4695	0.4991	0.5297	0.5613	0.5941
0.6278	0.6632	0.7000	0.7381	0.7774
0.8182	0.8603	0.9045	0.9511	1.0000

Hrad:

0.0255	0.0509	0.0582	0.0770	0.1001
0.1150	0.1525	0.1685	0.2009	0.2254
0.2527	0.2666	0.2943	0.3101	0.3390
0.3707	0.3897	0.4068	0.4391	0.4581
0.4940	0.4992	0.5310	0.5579	0.5707
0.6110	0.6376	0.6559	0.6668	0.6953
0.7222	0.7348	0.7557	0.7773	0.7992
0.8355	0.8427	0.8635	0.8801	0.9171
0.9260	0.9365	0.9569	0.9688	0.9857
0.9992	1.0133	1.0172	1.0123	1.0000

Width:

0.0050	0.0100	0.0196	0.0369	0.0495
0.0696	0.0772	0.0957	0.1058	0.1194
0.1324	0.1527	0.1664	0.1866	0.1996
0.2108	0.2297	0.2498	0.2612	0.2810
0.2899	0.3183	0.3302	0.3453	0.3690
0.3758	0.3906	0.4108	0.4365	0.4510
0.4665	0.4917	0.5119	0.5319	0.5520
0.5620	0.5922	0.6135	0.6378	0.6478
0.6780	0.7082	0.7315	0.7619	0.7887
0.8189	0.8490	0.8909	0.9396	1.0000

Transect 2_4

Area:

	0.0023	0.0082	0.0161	0.0255	0.0359
	0.0474	0.0608	0.0760	0.0919	0.1081
	0.1247	0.1414	0.1584	0.1758	0.1934
	0.2113	0.2295	0.2479	0.2666	0.2854
	0.3045	0.3237	0.3431	0.3627	0.3826
	0.4027	0.4230	0.4434	0.4642	0.4854
	0.5076	0.5305	0.5539	0.5779	0.6026
	0.6278	0.6532	0.6787	0.7044	0.7302
	0.7562	0.7823	0.8087	0.8353	0.8621
	0.8892	0.9166	0.9443	0.9721	1.0000
Hrad:					
	0.0159	0.0332	0.0524	0.0727	0.0918
	0.1089	0.1174	0.1356	0.1610	0.1857
	0.2112	0.2359	0.2588	0.2829	0.3059
	0.3292	0.3517	0.3756	0.3994	0.4228
	0.4463	0.4703	0.4934	0.5145	0.5373
	0.5585	0.5816	0.6040	0.6244	0.6324
	0.6440	0.6559	0.6686	0.6865	0.6960
	0.6930	0.7179	0.7426	0.7664	0.7877
	0.8114	0.8351	0.8523	0.8746	0.8943
	0.9126	0.9258	0.9506	0.9753	1.0000
Width:					
	0.1456	0.2484	0.3109	0.3540	0.3939
	0.4389	0.5221	0.5649	0.5756	0.5870
	0.5948	0.6037	0.6165	0.6255	0.6362
	0.6457	0.6563	0.6637	0.6710	0.6785
	0.6855	0.6914	0.6982	0.7078	0.7148
	0.7236	0.7297	0.7364	0.7488	0.7804
	0.8057	0.8291	0.8515	0.8670	0.8929
	0.9079	0.9118	0.9156	0.9207	0.9284
	0.9332	0.9379	0.9498	0.9558	0.9647
	0.9749	0.9906	0.9937	0.9969	1.0000
Transect 2_40					
Area:					
	0.0003	0.0011	0.0029	0.0053	0.0087
	0.0129	0.0179	0.0237	0.0303	0.0378
	0.0460	0.0550	0.0649	0.0756	0.0871
	0.0994	0.1125	0.1263	0.1410	0.1565
	0.1728	0.1899	0.2078	0.2265	0.2462
	0.2665	0.2877	0.3098	0.3327	0.3563
	0.3807	0.4060	0.4321	0.4590	0.4867
	0.5153	0.5446	0.5748	0.6057	0.6375
	0.6700	0.7034	0.7377	0.7727	0.8086
	0.8453	0.8828	0.9211	0.9601	1.0000
Hrad:					

	0.0191	0.0376	0.0558	0.0723	0.0916
	0.1127	0.1348	0.1547	0.1719	0.1948
	0.2140	0.2373	0.2520	0.2748	0.2959
	0.3151	0.3371	0.3570	0.3770	0.3970
	0.4169	0.4381	0.4570	0.4757	0.4953
	0.5171	0.5352	0.5548	0.5772	0.5971
	0.6171	0.6368	0.6585	0.6773	0.6960
	0.7160	0.7385	0.7585	0.7785	0.7985
	0.8185	0.8382	0.8579	0.8789	0.8979
	0.9154	0.9407	0.9609	0.9798	1.0000

Width:

	0.0134	0.0302	0.0514	0.0734	0.0949
	0.1149	0.1330	0.1531	0.1762	0.1939
	0.2150	0.2318	0.2576	0.2752	0.2945
	0.3154	0.3338	0.3539	0.3741	0.3942
	0.4144	0.4335	0.4547	0.4762	0.4970
	0.5154	0.5376	0.5585	0.5763	0.5967
	0.6170	0.6376	0.6562	0.6777	0.6993
	0.7198	0.7375	0.7577	0.7780	0.7983
	0.8185	0.8392	0.8599	0.8792	0.9005
	0.9234	0.9385	0.9586	0.9799	1.0000

Transect 2_5

Area:

	0.0015	0.0047	0.0085	0.0131	0.0188
	0.0254	0.0330	0.0416	0.0511	0.0623
	0.0746	0.0876	0.1018	0.1171	0.1330
	0.1494	0.1664	0.1839	0.2021	0.2208
	0.2399	0.2594	0.2793	0.2996	0.3205
	0.3421	0.3640	0.3864	0.4092	0.4323
	0.4558	0.4797	0.5040	0.5287	0.5538
	0.5793	0.6054	0.6322	0.6597	0.6881
	0.7175	0.7474	0.7777	0.8083	0.8392
	0.8704	0.9020	0.9342	0.9669	1.0000

Hrad:

	0.0192	0.0440	0.0672	0.0856	0.1029
	0.1187	0.1373	0.1548	0.1704	0.1748
	0.1965	0.2168	0.2296	0.2508	0.2749
	0.2984	0.3224	0.3434	0.3661	0.3901
	0.4149	0.4393	0.4639	0.4875	0.5015
	0.5252	0.5479	0.5710	0.5952	0.6193
	0.6428	0.6647	0.6856	0.7093	0.7321
	0.7500	0.7647	0.7749	0.7905	0.7908
	0.8048	0.8289	0.8519	0.8758	0.9005
	0.9214	0.9423	0.9566	0.9754	1.0000

Width:

0.0800	0.1067	0.1274	0.1545	0.1837
0.2154	0.2421	0.2701	0.3096	0.3583
0.3817	0.4067	0.4460	0.4697	0.4865
0.5037	0.5191	0.5387	0.5552	0.5691
0.5815	0.5938	0.6054	0.6179	0.6425
0.6547	0.6679	0.6803	0.6910	0.7016
0.7127	0.7252	0.7388	0.7490	0.7601
0.7761	0.7954	0.8197	0.8385	0.8744
0.8959	0.9055	0.9162	0.9257	0.9342
0.9465	0.9586	0.9775	0.9919	1.0000

Transect 2_6

Area:

0.0011	0.0054	0.0123	0.0200	0.0286
0.0380	0.0481	0.0589	0.0704	0.0826
0.0953	0.1087	0.1225	0.1367	0.1514
0.1665	0.1820	0.1979	0.2142	0.2309
0.2480	0.2656	0.2836	0.3020	0.3208
0.3400	0.3597	0.3798	0.4004	0.4215
0.4432	0.4655	0.4883	0.5119	0.5363
0.5616	0.5880	0.6158	0.6451	0.6758
0.7070	0.7384	0.7699	0.8017	0.8337
0.8660	0.8988	0.9319	0.9654	1.0000

Hrad:

0.0189	0.0294	0.0593	0.0871	0.1119
0.1372	0.1619	0.1857	0.2091	0.2329
0.2575	0.2821	0.3065	0.3322	0.3580
0.3836	0.4082	0.4325	0.4566	0.4794
0.5027	0.5255	0.5479	0.5702	0.5930
0.6150	0.6360	0.6556	0.6749	0.6918
0.7075	0.7251	0.7400	0.7483	0.7594
0.7649	0.7618	0.7595	0.7520	0.7641
0.7954	0.8250	0.8542	0.8830	0.9118
0.9350	0.9600	0.9827	1.0027	1.0000

Width:

0.0604	0.1839	0.2083	0.2306	0.2561
0.2774	0.2975	0.3178	0.3374	0.3554
0.3710	0.3858	0.4002	0.4122	0.4235
0.4346	0.4462	0.4578	0.4693	0.4819
0.4936	0.5055	0.5176	0.5296	0.5409
0.5527	0.5653	0.5790	0.5930	0.6089
0.6261	0.6416	0.6595	0.6837	0.7059
0.7339	0.7716	0.8106	0.8578	0.8844
0.8888	0.8949	0.9012	0.9078	0.9143
0.9261	0.9360	0.9481	0.9627	1.0000

Transect 2_7

Area:

0.0004	0.0014	0.0030	0.0055	0.0087
0.0131	0.0184	0.0249	0.0327	0.0429
0.0542	0.0663	0.0792	0.0932	0.1081
0.1235	0.1394	0.1561	0.1735	0.1917
0.2106	0.2305	0.2513	0.2734	0.2967
0.3207	0.3454	0.3707	0.3965	0.4227
0.4493	0.4760	0.5028	0.5298	0.5571
0.5845	0.6120	0.6398	0.6678	0.6960
0.7244	0.7531	0.7821	0.8114	0.8416
0.8725	0.9038	0.9356	0.9676	1.0000

Hrad:

0.0205	0.0367	0.0448	0.0624	0.0741
0.0890	0.0987	0.1128	0.1263	0.1272
0.1506	0.1725	0.1925	0.2090	0.2320
0.2568	0.2791	0.2962	0.3197	0.3349
0.3544	0.3678	0.3849	0.3888	0.4081
0.4288	0.4490	0.4709	0.4961	0.5214
0.5490	0.5784	0.6075	0.6349	0.6632
0.6923	0.7205	0.7453	0.7731	0.7999
0.8245	0.8477	0.8735	0.8924	0.8978
0.9093	0.9314	0.9545	0.9763	1.0000

Width:

0.0215	0.0373	0.0663	0.0874	0.1178
0.1469	0.1862	0.2206	0.2669	0.3372
0.3600	0.3846	0.4116	0.4462	0.4661
0.4810	0.4997	0.5272	0.5429	0.5725
0.5945	0.6269	0.6531	0.7035	0.7273
0.7482	0.7695	0.7876	0.7995	0.8110
0.8185	0.8230	0.8277	0.8345	0.8400
0.8442	0.8493	0.8584	0.8637	0.8700
0.8786	0.8884	0.8954	0.9092	0.9374
0.9595	0.9704	0.9802	0.9912	1.0000

Transect 2_8

Area:

0.0009	0.0023	0.0041	0.0065	0.0093
0.0125	0.0160	0.0200	0.0248	0.0308
0.0379	0.0460	0.0559	0.0677	0.0809
0.0946	0.1091	0.1246	0.1411	0.1584
0.1764	0.1950	0.2142	0.2339	0.2543
0.2757	0.2983	0.3218	0.3462	0.3714
0.3976	0.4246	0.4524	0.4809	0.5099
0.5391	0.5686	0.5985	0.6286	0.6590
0.6897	0.7208	0.7528	0.7857	0.8198

Hrad:	0.8547	0.8903	0.9266	0.9630	1.0000
	0.0294	0.0556	0.0698	0.0944	0.1170
	0.1370	0.1580	0.1751	0.1843	0.1725
	0.1899	0.1974	0.1814	0.2048	0.2235
	0.2510	0.2735	0.2878	0.3119	0.3350
	0.3595	0.3862	0.4115	0.4361	0.4555
	0.4702	0.4808	0.5020	0.5205	0.5385
	0.5589	0.5790	0.5975	0.6253	0.6537
	0.6849	0.7151	0.7454	0.7749	0.8045
	0.8355	0.8510	0.8656	0.8858	0.8874
	0.9050	0.9230	0.9514	0.9822	1.0000
Width:	0.0313	0.0407	0.0591	0.0689	0.0792
	0.0908	0.1014	0.1144	0.1387	0.1787
	0.1994	0.2329	0.3082	0.3307	0.3617
	0.3770	0.3989	0.4330	0.4525	0.4729
	0.4907	0.5049	0.5204	0.5362	0.5581
	0.5862	0.6203	0.6410	0.6651	0.6898
	0.7114	0.7333	0.7572	0.7691	0.7799
	0.7870	0.7951	0.8028	0.8111	0.8191
	0.8254	0.8470	0.8696	0.9008	0.9238
	0.9444	0.9646	0.9739	0.9804	1.0000
Transect 2_9					
Area:	0.0008	0.0022	0.0040	0.0065	0.0096
	0.0138	0.0186	0.0244	0.0313	0.0393
	0.0485	0.0587	0.0701	0.0823	0.0955
	0.1096	0.1243	0.1396	0.1555	0.1720
	0.1891	0.2071	0.2274	0.2502	0.2742
	0.2991	0.3250	0.3517	0.3790	0.4065
	0.4342	0.4620	0.4900	0.5181	0.5464
	0.5749	0.6035	0.6323	0.6612	0.6903
	0.7196	0.7492	0.7790	0.8092	0.8396
	0.8704	0.9019	0.9340	0.9667	1.0000
Hrad:	0.0224	0.0467	0.0640	0.0777	0.0932
	0.1042	0.1194	0.1304	0.1435	0.1555
	0.1682	0.1838	0.2013	0.2192	0.2371
	0.2576	0.2805	0.3032	0.3252	0.3464
	0.3661	0.3717	0.3545	0.3605	0.3794
	0.3983	0.4185	0.4410	0.4675	0.4985
	0.5293	0.5599	0.5902	0.6200	0.6492
	0.6791	0.7093	0.7390	0.7677	0.7962
	0.8240	0.8488	0.8731	0.8984	0.9234

Width:	0.9396	0.9537	0.9700	0.9799	1.0000
	0.0358	0.0472	0.0634	0.0841	0.1091
	0.1337	0.1576	0.1890	0.2199	0.2549
	0.2908	0.3226	0.3513	0.3790	0.4067
	0.4295	0.4472	0.4647	0.4825	0.5012
	0.5214	0.5624	0.6475	0.7006	0.7297
	0.7581	0.7840	0.8051	0.8182	0.8226
	0.8270	0.8315	0.8361	0.8412	0.8468
	0.8513	0.8553	0.8595	0.8649	0.8702
	0.8761	0.8850	0.8942	0.9023	0.9105
	0.9274	0.9465	0.9634	0.9868	1.0000

Transect 3_1

Area:	0.0020	0.0114	0.0223	0.0338	0.0459
	0.0586	0.0718	0.0855	0.0996	0.1141
	0.1291	0.1445	0.1604	0.1766	0.1933
	0.2104	0.2279	0.2459	0.2642	0.2829
	0.3019	0.3212	0.3409	0.3608	0.3811
	0.4017	0.4226	0.4439	0.4655	0.4874
	0.5096	0.5321	0.5550	0.5782	0.6018
	0.6258	0.6500	0.6747	0.6997	0.7251
	0.7509	0.7771	0.8036	0.8305	0.8578
	0.8855	0.9136	0.9421	0.9710	1.0000

Hrad:	0.0111	0.0322	0.0586	0.0840	0.1090
	0.1327	0.1564	0.1809	0.2042	0.2273
	0.2494	0.2710	0.2931	0.3140	0.3353
	0.3558	0.3762	0.3972	0.4178	0.4395
	0.4604	0.4827	0.5036	0.5243	0.5452
	0.5650	0.5850	0.6054	0.6255	0.6452
	0.6647	0.6833	0.7033	0.7208	0.7383
	0.7575	0.7752	0.7914	0.8092	0.8264
	0.8432	0.8599	0.8771	0.8930	0.9082
	0.9242	0.9405	0.9559	0.9768	1.0000

Width:	0.1935	0.3581	0.3837	0.4062	0.4253
	0.4457	0.4633	0.4767	0.4917	0.5061
	0.5215	0.5371	0.5508	0.5662	0.5801
	0.5949	0.6093	0.6225	0.6357	0.6468
	0.6588	0.6684	0.6797	0.6909	0.7016
	0.7134	0.7248	0.7355	0.7463	0.7573
	0.7685	0.7805	0.7908	0.8038	0.8167
	0.8274	0.8398	0.8537	0.8659	0.8785
	0.8914	0.9045	0.9169	0.9307	0.9451

	0.9586	0.9719	0.9859	0.9942	1.0000
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Transect 3_2

Area:

0.0005	0.0021	0.0043	0.0071	0.0105
0.0143	0.0187	0.0237	0.0290	0.0350
0.0425	0.0540	0.0698	0.0890	0.1085
0.1281	0.1479	0.1678	0.1879	0.2082
0.2288	0.2495	0.2704	0.2915	0.3129
0.3345	0.3564	0.3788	0.4016	0.4250
0.4490	0.4734	0.4982	0.5234	0.5490
0.5751	0.6017	0.6289	0.6567	0.6851
0.7142	0.7440	0.7744	0.8053	0.8368
0.8689	0.9015	0.9342	0.9670	1.0000

Hrad:

0.0142	0.0361	0.0555	0.0758	0.0968
0.1178	0.1325	0.1518	0.1699	0.1856
0.1934	0.1933	0.1833	0.1518	0.1838
0.2155	0.2469	0.2781	0.3082	0.3374
0.3670	0.3969	0.4264	0.4540	0.4820
0.5090	0.5324	0.5550	0.5761	0.5919
0.6133	0.6358	0.6581	0.6812	0.7038
0.7210	0.7390	0.7550	0.7739	0.7879
0.8000	0.8162	0.8343	0.8520	0.8689
0.8860	0.9117	0.9411	0.9706	1.0000

Width:

0.0351	0.0582	0.0779	0.0945	0.1093
0.1222	0.1418	0.1566	0.1717	0.1898
0.2871	0.4104	0.5427	0.5887	0.5925
0.5966	0.6012	0.6055	0.6117	0.6191
0.6251	0.6302	0.6357	0.6436	0.6505
0.6585	0.6707	0.6837	0.6983	0.7192
0.7332	0.7456	0.7580	0.7693	0.7809
0.7984	0.8149	0.8337	0.8492	0.8702
0.8933	0.9121	0.9287	0.9457	0.9635
0.9812	0.9891	0.9929	0.9964	1.0000

Transect 3_3

Area:

0.0012	0.0049	0.0101	0.0162	0.0228
0.0302	0.0382	0.0471	0.0566	0.0669
0.0778	0.0894	0.1016	0.1144	0.1280
0.1422	0.1572	0.1728	0.1891	0.2061
0.2237	0.2419	0.2608	0.2804	0.3007
0.3215	0.3428	0.3647	0.3871	0.4101
0.4336	0.4576	0.4823	0.5076	0.5336

	0.5601	0.5874	0.6153	0.6438	0.6729
	0.7025	0.7328	0.7637	0.7953	0.8274
Hrad:	0.8603	0.8939	0.9284	0.9637	1.0000

	0.0206	0.0385	0.0646	0.0945	0.1203
	0.1471	0.1674	0.1903	0.2149	0.2340
	0.2576	0.2792	0.3030	0.3225	0.3413
	0.3617	0.3818	0.4033	0.4232	0.4437
	0.4646	0.4847	0.5054	0.5221	0.5438
	0.5681	0.5897	0.6125	0.6350	0.6561
	0.6790	0.6996	0.7169	0.7346	0.7565
	0.7769	0.7905	0.8133	0.8325	0.8517
	0.8714	0.8912	0.9099	0.9288	0.9493
Width:	0.9623	0.9753	0.9925	1.0011	1.0000

	0.0571	0.1268	0.1557	0.1710	0.1899
	0.2052	0.2283	0.2476	0.2636	0.2857
	0.3020	0.3201	0.3353	0.3546	0.3749
	0.3932	0.4117	0.4286	0.4469	0.4645
	0.4814	0.4992	0.5160	0.5370	0.5529
	0.5658	0.5813	0.5955	0.6096	0.6250
	0.6386	0.6541	0.6728	0.6910	0.7054
	0.7209	0.7432	0.7566	0.7733	0.7900
	0.8063	0.8223	0.8394	0.8563	0.8716
	0.8940	0.9165	0.9354	0.9626	1.0000

Transect 3_4

Area:	0.0047	0.0139	0.0255	0.0377	0.0507
	0.0643	0.0785	0.0931	0.1081	0.1236
	0.1393	0.1555	0.1720	0.1888	0.2060
	0.2235	0.2414	0.2596	0.2782	0.2971
	0.3163	0.3359	0.3558	0.3760	0.3965
	0.4174	0.4385	0.4599	0.4815	0.5033
	0.5254	0.5477	0.5703	0.5930	0.6161
	0.6395	0.6632	0.6873	0.7115	0.7360
	0.7608	0.7858	0.8113	0.8371	0.8632
	0.8897	0.9167	0.9441	0.9718	1.0000

Hrad:	0.0171	0.0356	0.0607	0.0846	0.1083
	0.1311	0.1543	0.1781	0.2001	0.2239
	0.2480	0.2692	0.2923	0.3144	0.3371
	0.3573	0.3790	0.4004	0.4209	0.4419
	0.4612	0.4813	0.5025	0.5238	0.5430
	0.5633	0.5848	0.6057	0.6275	0.6491
	0.6699	0.6921	0.7144	0.7332	0.7508

	0.7678	0.7868	0.8061	0.8267	0.8473
	0.8654	0.8826	0.8972	0.9101	0.9296
	0.9435	0.9541	0.9690	0.9838	1.0000
Width:					
	0.2779	0.3918	0.4201	0.4456	0.4682
	0.4906	0.5086	0.5224	0.5403	0.5519
	0.5618	0.5776	0.5885	0.6006	0.6112
	0.6257	0.6371	0.6484	0.6610	0.6723
	0.6859	0.6979	0.7082	0.7180	0.7303
	0.7410	0.7498	0.7593	0.7674	0.7754
	0.7843	0.7915	0.7982	0.8088	0.8206
	0.8329	0.8429	0.8526	0.8607	0.8687
	0.8791	0.8903	0.9042	0.9197	0.9286
	0.9430	0.9607	0.9743	0.9878	1.0000
Transect 3_5					
Area:					
	0.0022	0.0066	0.0124	0.0195	0.0278
	0.0372	0.0474	0.0586	0.0705	0.0831
	0.0965	0.1104	0.1251	0.1403	0.1562
	0.1728	0.1899	0.2076	0.2261	0.2452
	0.2648	0.2852	0.3061	0.3274	0.3490
	0.3710	0.3933	0.4159	0.4389	0.4622
	0.4859	0.5098	0.5342	0.5589	0.5839
	0.6092	0.6349	0.6610	0.6874	0.7142
	0.7412	0.7687	0.7965	0.8246	0.8531
	0.8819	0.9111	0.9405	0.9702	1.0000
Hrad:					
	0.0193	0.0392	0.0564	0.0751	0.0945
	0.1136	0.1326	0.1516	0.1724	0.1916
	0.2122	0.2319	0.2506	0.2708	0.2881
	0.3071	0.3269	0.3439	0.3611	0.3796
	0.3975	0.4130	0.4347	0.4572	0.4804
	0.5026	0.5245	0.5467	0.5672	0.5897
	0.6109	0.6322	0.6519	0.6732	0.6944
	0.7136	0.7336	0.7538	0.7725	0.7934
	0.8137	0.8317	0.8515	0.8713	0.8889
	0.9095	0.9286	0.9491	0.9746	1.0000
Width:					
	0.1120	0.1686	0.2205	0.2609	0.2954
	0.3287	0.3590	0.3883	0.4108	0.4359
	0.4567	0.4783	0.5014	0.5204	0.5445
	0.5650	0.5835	0.6064	0.6289	0.6487
	0.6692	0.6937	0.7072	0.7189	0.7292
	0.7408	0.7523	0.7632	0.7761	0.7860
	0.7974	0.8085	0.8213	0.8320	0.8425

0.8553	0.8670	0.8782	0.8911	0.9013
0.9120	0.9252	0.9362	0.9471	0.9603
0.9702	0.9815	0.9913	0.9956	1.0000

Transect 3_6

Area:

0.0025	0.0071	0.0130	0.0202	0.0288
0.0386	0.0495	0.0616	0.0748	0.0891
0.1045	0.1210	0.1386	0.1571	0.1763
0.1959	0.2159	0.2361	0.2566	0.2773
0.2983	0.3196	0.3412	0.3631	0.3852
0.4076	0.4301	0.4530	0.4760	0.4992
0.5226	0.5462	0.5700	0.5939	0.6181
0.6424	0.6669	0.6915	0.7163	0.7413
0.7664	0.7916	0.8170	0.8425	0.8683
0.8942	0.9204	0.9468	0.9733	1.0000

Hrad:

0.0182	0.0360	0.0527	0.0677	0.0840
0.0991	0.1154	0.1303	0.1459	0.1610
0.1757	0.1898	0.2056	0.2222	0.2425
0.2649	0.2875	0.3106	0.3333	0.3559
0.3776	0.3985	0.4192	0.4417	0.4639
0.4854	0.5076	0.5276	0.5505	0.5730
0.5951	0.6171	0.6392	0.6612	0.6816
0.7040	0.7267	0.7482	0.7699	0.7925
0.8149	0.8370	0.8586	0.8792	0.8987
0.9174	0.9369	0.9577	0.9789	1.0000

Width:

0.1400	0.1964	0.2461	0.2991	0.3426
0.3892	0.4289	0.4731	0.5130	0.5537
0.5949	0.6376	0.6741	0.7072	0.7273
0.7398	0.7510	0.7602	0.7700	0.7791
0.7901	0.8021	0.8140	0.8221	0.8305
0.8397	0.8475	0.8585	0.8646	0.8712
0.8782	0.8851	0.8918	0.8983	0.9068
0.9125	0.9177	0.9243	0.9304	0.9354
0.9405	0.9457	0.9516	0.9583	0.9661
0.9747	0.9824	0.9886	0.9944	1.0000

Transect 5_1

Area:

0.0033	0.0096	0.0176	0.0269	0.0373
0.0488	0.0612	0.0745	0.0888	0.1041
0.1203	0.1374	0.1555	0.1742	0.1933
0.2126	0.2322	0.2520	0.2720	0.2923
0.3127	0.3335	0.3544	0.3756	0.3970

	0.4186	0.4405	0.4625	0.4848	0.5073
	0.5300	0.5529	0.5760	0.5993	0.6229
	0.6466	0.6706	0.6947	0.7191	0.7436
	0.7684	0.7934	0.8185	0.8439	0.8694
	0.8951	0.9211	0.9472	0.9735	1.0000
Hrad:					
	0.0169	0.0353	0.0539	0.0727	0.0908
	0.1084	0.1262	0.1430	0.1599	0.1760
	0.1916	0.2077	0.2238	0.2443	0.2675
	0.2905	0.3133	0.3363	0.3590	0.3816
	0.4032	0.4253	0.4473	0.4690	0.4904
	0.5119	0.5333	0.5547	0.5759	0.5969
	0.6175	0.6384	0.6592	0.6799	0.7009
	0.7200	0.7404	0.7611	0.7819	0.8015
	0.8211	0.8412	0.8616	0.8816	0.9014
	0.9211	0.9403	0.9601	0.9800	1.0000
Width:					
	0.1981	0.2731	0.3272	0.3704	0.4110
	0.4498	0.4850	0.5214	0.5555	0.5915
	0.6280	0.6619	0.6947	0.7132	0.7226
	0.7320	0.7411	0.7494	0.7578	0.7660
	0.7758	0.7842	0.7924	0.8009	0.8096
	0.8178	0.8260	0.8340	0.8419	0.8499
	0.8583	0.8660	0.8739	0.8815	0.8887
	0.8981	0.9058	0.9129	0.9198	0.9278
	0.9359	0.9432	0.9501	0.9573	0.9645
	0.9718	0.9795	0.9866	0.9934	1.0000
Transect 5_2					
Area:					
	0.0008	0.0029	0.0117	0.0240	0.0374
	0.0514	0.0659	0.0811	0.0971	0.1138
	0.1312	0.1490	0.1671	0.1857	0.2045
	0.2237	0.2431	0.2628	0.2827	0.3029
	0.3233	0.3439	0.3648	0.3858	0.4071
	0.4285	0.4501	0.4719	0.4938	0.5159
	0.5382	0.5607	0.5834	0.6063	0.6294
	0.6527	0.6763	0.7000	0.7239	0.7480
	0.7723	0.7968	0.8216	0.8465	0.8716
	0.8969	0.9225	0.9482	0.9740	1.0000
Hrad:					
	0.0121	0.0285	0.0260	0.0488	0.0710
	0.0941	0.1157	0.1356	0.1539	0.1729
	0.1939	0.2160	0.2368	0.2584	0.2800
	0.3011	0.3230	0.3449	0.3668	0.3883
	0.4099	0.4313	0.4532	0.4740	0.4956

	0.5176	0.5402	0.5626	0.5836	0.6042
	0.6246	0.6450	0.6652	0.6852	0.7052
	0.7250	0.7447	0.7643	0.7838	0.8032
	0.8225	0.8417	0.8607	0.8797	0.8986
	0.9174	0.9361	0.9557	0.9779	1.0000
Width:					
	0.0621	0.1004	0.4517	0.4932	0.5273
	0.5462	0.5699	0.5985	0.6310	0.6585
	0.6769	0.6900	0.7060	0.7186	0.7306
	0.7430	0.7529	0.7620	0.7709	0.7802
	0.7889	0.7975	0.8050	0.8141	0.8216
	0.8281	0.8335	0.8389	0.8463	0.8540
	0.8618	0.8695	0.8772	0.8850	0.8927
	0.9005	0.9082	0.9160	0.9237	0.9314
	0.9392	0.9469	0.9547	0.9624	0.9702
	0.9779	0.9856	0.9923	0.9961	1.0000

NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.

Analysis Options

Flow Units CMS

Process Models:

Rainfall/Runoff YES
RDII NO
Snowmelt YES
Groundwater YES
Flow Routing YES
Ponding Allowed YES
Water Quality NO
Infiltration Method MODIFIED_GREEN_AMPT
Flow Routing Method DYNWAVE
Starting Date JUN-01-2005 00:00:00
Ending Date MAY-31-2006 23:00:00
Antecedent Dry Days 0.0
Report Time Step 01:00:00
Wet Time Step 00:01:00
Dry Time Step 00:01:00
Routing Time Step 10.00 sec
Variable Time Step YES

Maximum Trials 8
 Number of Threads 1
 Head Tolerance 0.001500 m

*****	Volume	Depth
Runoff Quantity Continuity	hectare-m	mm
*****	-----	-----
Initial Snow Cover	0.000	0.000
Total Precipitation	566.777	984.300
Evaporation Loss	85.146	147.869
Infiltration Loss	267.012	463.710
Surface Runoff	214.626	372.733
Snow Removed	0.000	0.000
Final Snow Cover	0.000	0.000
Final Storage	0.000	0.000
Continuity Error (%)	-0.001	

*****	Volume	Depth
Groundwater Continuity	hectare-m	mm
*****	-----	-----
Initial Storage	3659.363	6355.077
Infiltration	267.012	463.710
Upper Zone ET	172.128	298.928
Lower Zone ET	0.000	0.000
Deep Percolation	6.149	10.679
Groundwater Flow	115.937	201.343
Final Storage	3632.995	6309.285
Continuity Error (%)	-0.021	

*****	Volume	Volume
Flow Routing Continuity	hectare-m	10^6 ltr
*****	-----	-----
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	214.626	2146.285
Groundwater Inflow	115.937	1159.377
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	323.300	3233.032
Flooding Loss	0.000	0.000
Evaporation Loss	2.463	24.632
Exfiltration Loss	3.215	32.154
Initial Stored Volume	19.410	194.099
Final Stored Volume	20.991	209.916

Continuity Error (%) 0.001

Time-Step Critical Elements

None

Highest Flow Instability Indexes

All links are stable.

Routing Time Step Summary

Minimum Time Step : 9.50 sec
Average Time Step : 10.00 sec
Maximum Time Step : 10.00 sec
Percent in Steady State : 0.00
Average Iterations per Step : 2.00
Percent Not Converging : 0.00

Subcatchment Runoff Summary

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff CMS	Runoff Coeff
1	984.30	0.00	148.06	445.98	390.29	30.91	0.22	0.397
10	984.30	0.00	146.93	462.69	374.69	147.29	1.05	0.381
10a	984.30	0.00	19.93	913.64	50.73	0.58	0.01	0.052
11	984.30	0.00	153.91	445.98	384.42	112.12	0.80	0.391
11B	984.30	0.00	152.46	437.62	394.24	27.82	0.20	0.401
12	984.30	0.00	143.21	471.05	370.06	35.65	0.25	0.376
13	984.30	0.00	156.57	445.98	381.76	95.06	0.68	0.388
13a	984.30	0.00	19.93	913.64	50.73	0.20	0.00	0.052
13SWMF	984.30	0.00	130.42	496.13	357.83	6.70	0.05	0.364
14	984.30	0.00	144.31	479.41	360.59	144.93	1.03	0.366
14-EXT	984.30	0.00	138.47	496.13	349.71	7.93	0.06	0.355

15	984.30	0.00	154.51	437.62	392.18	87.24	0.63	0.398
15a	984.30	0.00	20.51	913.64	50.15	2.25	0.02	0.051
16	984.30	0.00	152.43	437.62	394.27	84.17	0.60	0.401
16a	984.30	0.00	76.15	705.14	203.03	3.15	0.02	0.206
17	984.30	0.00	143.91	462.69	377.72	19.59	0.14	0.384
17a	984.30	0.00	19.90	913.64	50.76	0.20	0.00	0.052
18	984.30	0.00	154.95	429.25	400.11	8.07	0.06	0.406
18a	984.30	0.00	19.95	913.64	50.71	0.84	0.01	0.052
18SWMF	984.30	0.00	130.01	496.13	358.27	2.24	0.02	0.364
1a	984.30	0.00	149.59	429.25	405.50	1.62	0.01	0.412
2	984.30	0.00	138.21	487.77	358.34	121.29	0.85	0.364
2_EXT	984.30	0.00	117.95	496.13	370.24	2.77	0.02	0.376
201	984.30	0.00	146.83	445.98	391.52	7.12	0.05	0.398
202	984.30	0.00	151.00	420.89	412.48	2.35	0.02	0.419
203	984.30	0.00	72.54	721.83	189.94	30.54	0.18	0.193
204	984.30	0.00	20.25	913.64	50.41	0.15	0.00	0.051
205	984.30	0.00	51.15	796.92	136.25	0.41	0.00	0.138
206	984.30	0.00	19.95	913.64	50.71	0.70	0.01	0.052
2a	984.30	0.00	129.99	496.13	358.30	2.48	0.02	0.364
3	984.30	0.00	161.10	420.89	402.33	80.90	0.58	0.409
3_EXT	984.30	0.00	135.82	496.13	352.36	4.72	0.03	0.358
3a	984.30	0.00	140.12	462.69	381.54	6.01	0.04	0.388
4	984.30	0.00	151.92	454.34	378.05	467.91	3.35	0.384
5	984.30	0.00	198.85	295.30	490.16	198.37	1.47	0.498
5_EXT	984.30	0.00	137.97	496.13	350.21	5.79	0.04	0.356
6	984.30	0.00	142.67	471.05	370.59	53.98	0.38	0.377
7	984.30	0.00	156.22	429.25	398.84	34.52	0.25	0.405
7a	984.30	0.00	180.34	337.17	466.81	49.42	0.36	0.474
8	984.30	0.00	152.43	445.98	385.90	63.09	0.45	0.392
8a	984.30	0.00	19.93	913.64	50.73	0.52	0.01	0.052
8b	984.30	0.00	19.93	913.64	50.73	0.12	0.00	0.052
8c	984.30	0.00	20.67	913.64	49.99	2.24	0.02	0.051
8d	984.30	0.00	19.97	913.64	50.69	0.08	0.00	0.051
8e	984.30	0.00	143.37	454.34	386.63	6.45	0.05	0.393
8-EXT	984.30	0.00	139.07	496.13	349.11	6.99	0.05	0.355
9	984.30	0.00	147.87	471.05	365.39	114.85	0.82	0.371
9a	984.30	0.00	19.95	913.64	50.71	0.21	0.00	0.052
Rainsong_P2	984.30	0.00	161.10	420.89	402.33	63.73	0.46	0.409

Groundwater Summary

Total Total Maximum Average Average Final Final

Subcatchment	Total Infil mm	Total Evap mm	Lower Seepage mm	Lateral Outflow mm	Lateral Outflow CMS	Upper Moist.	Water Table m	Upper Moist.	Water Table m
1	445.98	252.69	7.40	245.16	0.69	0.32	251.39	0.38	251.39
10	462.69	297.23	12.00	0.00	0.00	0.30	243.48	0.33	243.45
10a	913.64	827.30	9.42	0.00	0.00	0.29	242.15	0.31	242.13
11	445.98	282.63	11.45	0.00	0.00	0.30	249.26	0.33	249.22
11B	437.62	278.91	13.44	0.00	0.00	0.20	251.66	0.25	251.69
12	471.05	254.25	9.97	0.00	0.00	0.12	248.33	0.17	248.32
13	445.98	280.69	9.97	0.00	0.00	0.21	245.67	0.25	245.70
13a	913.64	801.78	10.92	0.00	0.00	0.18	248.96	0.23	248.98
13SWMF	496.13	269.83	10.91	0.00	0.00	0.12	245.67	0.17	245.65
14	479.41	302.74	12.24	0.00	0.00	0.10	242.98	0.13	242.96
14-EXT	496.13	266.82	14.87	0.00	0.00	0.12	245.99	0.18	245.97
15	437.62	277.46	9.41	0.00	0.00	0.20	249.99	0.22	249.97
15a	913.64	826.73	0.00	4475.89	114.49	0.20	239.25	0.20	239.25
16	437.62	278.93	11.00	0.00	0.00	0.10	248.33	0.11	248.32
16a	705.14	576.88	0.00	5716.90	38.13	0.10	229.49	0.10	229.49
17	462.69	251.11	12.21	-5.64	0.03	0.12	248.68	0.17	248.69
17a	913.64	594.29	12.23	0.00	0.00	0.13	248.95	0.20	248.94
18	429.25	272.30	8.74	525.67	0.40	0.20	246.49	0.23	246.48
18a	913.64	827.28	8.74	526.17	0.33	0.18	246.49	0.22	246.47
18SWMF	496.13	270.00	10.91	0.00	0.00	0.12	245.48	0.17	245.47
1a	429.25	264.28	3.96	258.34	0.05	0.31	251.53	0.38	251.54
2	487.77	296.76	2.67	345.56	5.94	0.31	246.20	0.38	246.23
2_EXT	496.13	330.18	5.84	0.00	0.00	0.31	245.90	0.37	246.06
201	445.98	280.40	1.73	348.61	0.33	0.31	246.63	0.38	246.63
202	420.89	270.03	0.00	466.48	14.15	0.30	247.00	0.34	247.00
203	721.83	596.00	0.00	3502.81	403.76	0.20	238.50	0.21	238.50
204	913.64	826.98	0.00	2433.98	7.39	0.19	247.00	0.21	247.00
205	796.92	688.06	11.89	281.46	0.03	0.19	257.64	0.23	257.64
206	913.64	827.28	9.34	1251.05	0.66	0.19	250.99	0.21	250.97
2a	496.13	319.06	0.59	318.83	0.11	0.31	249.62	0.38	249.63
3	420.89	238.38	7.39	138.69	0.70	0.32	251.39	0.38	251.39
3_EXT	496.13	279.46	7.40	174.73	0.05	0.33	251.39	0.38	251.39
3a	462.69	282.83	8.47	170.55	0.12	0.31	251.53	0.38	251.54
4	454.34	288.75	13.19	0.00	0.00	0.30	243.74	0.33	243.70
5	295.30	163.63	10.31	0.00	0.00	0.20	249.80	0.22	249.78
5_EXT	496.13	322.70	13.99	0.00	0.00	0.20	252.95	0.25	252.98
6	471.05	305.26	12.11	0.00	0.00	0.20	243.14	0.23	243.11
7	429.25	271.45	13.64	105.49	0.69	0.31	245.55	0.36	245.57
7a	337.17	200.15	12.03	0.00	0.00	0.20	241.31	0.22	241.29
8	445.98	283.71	15.82	257.34	1.34	0.11	252.18	0.18	252.17
8a	913.64	801.99	14.87	0.00	0.00	0.18	250.58	0.23	250.60
8b	913.64	708.48	14.87	0.00	0.00	0.10	250.59	0.17	250.57

8c	913.64	801.25	14.87	0.00	0.00	0.18	250.58	0.23	250.60
8d	913.64	645.09	15.78	249.69	0.01	0.32	252.31	0.38	252.33
8e	454.34	295.31	15.19	152.42	0.14	0.30	252.30	0.37	252.33
8-EXT	496.13	321.68	15.82	257.82	0.16	0.11	252.18	0.19	252.17
9	471.05	300.99	13.47	0.00	0.00	0.20	246.24	0.22	246.21
9a	913.64	802.02	15.75	0.00	0.00	0.18	250.58	0.23	250.60
Rainsong_P2	420.89	238.38	7.39	138.69	0.55	0.32	251.39	0.38	251.39

Node Depth Summary

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min	Reported Max Depth Meters
J1	JUNCTION	0.01	0.21	251.74	0 00:16	0.06
J10	JUNCTION	0.10	0.79	246.11	0 00:44	0.24
J11	JUNCTION	0.00	0.09	246.72	0 00:07	0.01
J12	JUNCTION	0.00	0.00	251.87	13 22:29	0.00
J13	JUNCTION	0.00	0.05	251.92	285 10:00	0.01
J14	JUNCTION	0.00	0.02	255.79	13 20:07	0.01
J15	JUNCTION	0.00	0.01	249.12	13 19:31	0.00
J16	JUNCTION	0.00	0.01	247.65	13 19:38	0.00
J17	JUNCTION	0.00	0.00	252.62	13 23:18	0.00
J18	JUNCTION	0.01	0.06	247.44	13 19:44	0.02
J19	JUNCTION	0.00	0.02	251.69	13 20:07	0.01
J2	JUNCTION	0.01	0.23	251.60	0 00:05	0.06
J20	JUNCTION	0.00	0.00	258.46	0 00:00	0.00
J21	JUNCTION	0.02	0.26	251.65	0 00:49	0.07
J22	JUNCTION	0.03	0.28	251.28	0 01:06	0.09
J23	JUNCTION	0.04	0.30	251.12	0 01:22	0.09
J24	JUNCTION	0.03	0.25	250.89	0 01:09	0.06
J25	JUNCTION	0.02	0.25	250.25	0 01:13	0.06
J26	JUNCTION	0.04	0.27	249.48	0 01:18	0.06
J27	JUNCTION	0.05	0.39	248.87	0 01:26	0.10
J28	JUNCTION	0.04	0.44	248.59	0 01:37	0.13
J29	JUNCTION	0.05	0.40	248.46	0 01:57	0.12
J3	JUNCTION	0.03	0.43	250.96	0 00:15	0.12
J30	JUNCTION	0.05	0.36	248.34	0 02:07	0.11
J31	JUNCTION	0.04	0.33	247.85	0 01:53	0.09
J32	JUNCTION	0.03	0.33	247.44	0 01:57	0.09
J33	JUNCTION	0.04	0.38	246.88	0 02:02	0.10
J34	JUNCTION	0.04	0.35	246.40	0 02:10	0.10

J35	JUNCTION	0.09	0.43	245.89	0	02:19	0.13
J36	JUNCTION	0.00	0.02	246.62	13	22:47	0.01
J37	JUNCTION	0.00	0.01	247.86	13	19:40	0.00
J38	JUNCTION	0.01	0.10	257.91	13	19:45	0.03
J39	JUNCTION	0.02	0.10	258.72	13	19:43	0.03
J4	JUNCTION	0.03	0.37	250.54	0	00:21	0.10
J40	JUNCTION	0.00	0.01	248.94	13	19:34	0.00
J41	JUNCTION	0.02	0.07	253.25	13	23:01	0.02
J42	JUNCTION	0.02	0.08	252.08	13	23:06	0.02
J43	JUNCTION	0.03	0.13	251.88	13	23:12	0.04
J44	JUNCTION	0.01	0.06	251.56	13	23:19	0.02
J45	JUNCTION	0.02	0.08	251.18	13	23:27	0.03
J46	JUNCTION	0.03	0.12	250.83	13	23:34	0.04
J47	JUNCTION	0.04	0.20	250.52	14	00:00	0.06
J48	JUNCTION	0.09	0.31	250.49	14	00:07	0.10
J49	JUNCTION	0.09	0.30	250.48	14	00:09	0.09
J5	JUNCTION	0.02	0.28	249.88	0	00:25	0.08
J50	JUNCTION	0.09	0.29	250.46	14	00:13	0.09
J51	JUNCTION	0.08	0.26	250.44	14	00:18	0.08
J52	JUNCTION	0.06	0.21	250.38	14	00:24	0.06
J53	JUNCTION	0.02	0.10	250.27	14	00:30	0.03
J54	JUNCTION	0.04	0.17	249.50	168	03:57	0.05
J55	JUNCTION	0.03	0.09	248.74	14	02:14	0.03
J56	JUNCTION	0.04	0.19	246.31	13	22:29	0.06
J6	JUNCTION	0.03	0.33	248.96	0	00:21	0.09
J62	JUNCTION	0.00	0.00	256.00	0	00:00	0.00
J63	JUNCTION	0.00	0.00	253.13	0	00:00	0.00
J64	JUNCTION	0.02	0.11	255.01	13	20:20	0.03
J65	JUNCTION	0.01	0.05	254.05	13	20:25	0.01
J66	JUNCTION	0.01	0.07	251.89	13	20:37	0.02
J67	JUNCTION	0.01	0.16	251.65	0	00:49	0.04
J68	JUNCTION	0.00	0.24	252.57	0	00:18	0.07
J69	JUNCTION	0.02	0.40	252.56	0	00:18	0.12
J7	JUNCTION	0.04	0.47	248.00	0	00:28	0.11
J70	JUNCTION	0.02	0.41	252.40	0	00:16	0.12
J71	JUNCTION	0.02	0.42	252.23	0	00:21	0.12
J72	JUNCTION	0.02	0.41	252.05	0	00:27	0.12
J73	JUNCTION	0.03	0.43	251.90	0	00:30	0.12
J8	JUNCTION	0.06	0.35	247.27	0	00:38	0.10
J9	JUNCTION	0.07	0.55	246.69	0	00:05	0.16
H07	OUTFALL	0.00	0.00	0.00	0	00:00	0.00
H08	OUTFALL	0.08	0.43	245.75	0	02:19	0.13
H09	OUTFALL	0.00	0.00	0.00	0	00:00	0.00
H10	OUTFALL	0.00	0.00	257.66	0	00:00	0.00
H11	OUTFALL	0.00	0.00	0.00	0	00:00	0.00
H11a	OUTFALL	0.00	0.00	0.00	0	00:00	0.00

L01	OUTFALL	0.00	0.00	260.01	0	00:00	0.00
L02	OUTFALL	0.00	0.00	246.63	0	00:00	0.00
L03	OUTFALL	0.10	0.79	246.08	0	00:43	0.24
L04	OUTFALL	0.00	0.00	0.00	0	00:00	0.00
L05	OUTFALL	0.00	0.00	251.07	0	00:00	0.00
L06	OUTFALL	0.00	0.00	266.00	0	00:00	0.00
S12	OUTFALL	0.04	0.19	246.19	13	22:29	0.06
S13	OUTFALL	0.00	0.02	243.92	13	22:47	0.01
S14	OUTFALL	0.00	0.00	251.00	0	00:00	0.00
S15	OUTFALL	0.00	0.01	246.51	13	19:34	0.00
SU1	STORAGE	0.85	1.13	264.58	285	09:23	0.34
SWMF1	STORAGE	2.04	2.74	253.57	13	22:28	0.84
SWMF10	STORAGE	1.54	2.09	248.70	13	19:40	0.64
SWMF11	STORAGE	1.56	2.31	254.02	13	22:59	0.70
SWMF12	STORAGE	1.53	2.01	251.44	13	22:37	0.61
SWMF13	STORAGE	1.59	2.40	247.90	13	20:04	0.73
SWMF14	STORAGE	1.55	2.01	251.91	13	22:46	0.61
SWMF15	STORAGE	1.53	2.05	258.55	13	19:41	0.62
SWMF16	STORAGE	1.54	2.24	261.74	13	19:39	0.68
SWMF17	STORAGE	1.03	1.54	247.50	13	19:32	0.47
SWMF18	STORAGE	1.51	1.77	249.35	13	19:32	0.54
SWMF2	STORAGE	1.53	2.00	250.00	13	19:30	0.61
SWMF3	STORAGE	1.53	1.84	252.87	13	19:45	0.56
SWMF4	STORAGE	1.55	2.12	248.26	13	19:43	0.65
SWMF5	STORAGE	1.35	2.02	257.45	13	20:07	0.62
SWMF6	STORAGE	1.53	2.11	249.98	13	19:30	0.64
SWMF7	STORAGE	1.53	1.95	248.56	13	19:37	0.59
SWMF8	STORAGE	2.10	2.99	254.24	13	23:17	0.91
SWMF9	STORAGE	1.54	2.11	252.54	13	20:02	0.64

Node Inflow Summary

Node	Type	Maximum Lateral Inflow CMS	Maximum Total Inflow CMS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 ltr	Total Inflow Volume 10^6 ltr	Flow Balance Error Percent
J1	JUNCTION	0.167	0.167	0 00:01	11.4	11.4	-0.082
J10	JUNCTION	0.000	4.959	0 00:41	0	929	0.015
J11	JUNCTION	0.000	0.619	0 00:05	0	124	0.002
J12	JUNCTION	0.000	0.011	13 22:29	0	30.8	-0.019
J13	JUNCTION	0.000	0.272	285 10:00	0	111	0.001

J14	JUNCTION	0.000	0.109	13	20:07	0	203	0.000
J15	JUNCTION	0.000	0.037	13	19:30	0	53.9	-0.012
J16	JUNCTION	0.000	0.053	13	19:37	0	83.5	0.000
J17	JUNCTION	0.000	0.012	13	23:17	0	69.7	0.001
J18	JUNCTION	0.000	0.417	13	19:43	0	465	0.001
J19	JUNCTION	0.000	0.064	13	20:02	0	114	0.003
J2	JUNCTION	1.995	2.001	0	00:01	71.6	259	0.003
J20	JUNCTION	0.000	0.000	0	00:00	0	0	0.000 ltr
J21	JUNCTION	0.000	0.922	0	00:33	0	327	0.002
J22	JUNCTION	0.000	0.995	0	00:54	0	439	0.022
J23	JUNCTION	0.000	0.872	0	01:06	0	438	0.011
J24	JUNCTION	0.000	0.891	0	01:09	0	437	0.005
J25	JUNCTION	0.000	1.095	0	01:11	0	437	0.004
J26	JUNCTION	0.000	1.248	0	01:15	0	436	-0.005
J27	JUNCTION	0.000	1.552	0	01:20	0	436	0.001
J28	JUNCTION	0.000	1.164	0	01:29	0	435	0.017
J29	JUNCTION	0.000	0.899	0	01:41	0	488	0.010
J3	JUNCTION	0.000	1.474	0	00:07	0	223	0.010
J30	JUNCTION	0.010	0.822	0	01:57	0.576	489	0.006
J31	JUNCTION	0.000	0.862	0	01:52	0	488	0.001
J32	JUNCTION	0.000	1.034	0	01:55	0	488	0.003
J33	JUNCTION	0.000	1.174	0	01:59	0	488	0.003
J34	JUNCTION	0.000	1.036	0	02:06	0	487	0.012
J35	JUNCTION	0.686	1.090	0	02:09	9.13	775	-0.012
J36	JUNCTION	0.000	0.058	13	22:46	0	152	0.001
J37	JUNCTION	0.000	0.096	13	19:40	0	147	0.000
J38	JUNCTION	0.000	0.061	13	19:41	0	87	0.001
J39	JUNCTION	0.000	0.042	13	19:40	0	84	0.001
J4	JUNCTION	0.000	1.277	0	00:18	0	223	0.016
J40	JUNCTION	0.000	0.006	13	19:32	0	10.3	-0.712
J41	JUNCTION	0.000	0.044	13	22:59	0	139	0.002
J42	JUNCTION	0.000	0.044	13	23:01	0	139	0.004
J43	JUNCTION	0.000	0.044	13	23:06	0	139	0.010
J44	JUNCTION	0.000	0.044	13	23:14	0	139	0.004
J45	JUNCTION	0.000	0.044	13	23:20	0	138	0.006
J46	JUNCTION	0.000	0.043	13	23:27	0	138	0.003
J47	JUNCTION	0.000	0.043	13	23:34	0	138	0.007
J48	JUNCTION	0.000	0.043	13	23:47	0	138	0.020
J49	JUNCTION	0.000	0.056	13	23:43	0	173	0.009
J5	JUNCTION	0.114	1.362	0	00:23	4.68	227	0.002
J50	JUNCTION	0.000	0.056	13	23:54	0	173	0.011
J51	JUNCTION	0.004	0.056	14	00:07	0.202	173	0.006
J52	JUNCTION	0.004	0.056	14	00:16	0.203	173	0.016
J53	JUNCTION	0.000	0.056	14	00:25	0	173	0.006
J54	JUNCTION	0.000	0.056	14	00:30	0	173	0.004
J55	JUNCTION	0.031	0.056	14	00:37	-0.292	193	0.007

J56	JUNCTION	0.000	0.119	13	22:25	0	293	0.003
J6	JUNCTION	0.000	1.334	0	00:25	0	227	-0.005
J62	JUNCTION	0.000	0.000	0	00:00	0	0	0.000 ltr
J63	JUNCTION	0.000	0.000	0	00:00	0	0	0.000 ltr
J64	JUNCTION	0.000	0.109	13	20:08	0	203	0.017
J65	JUNCTION	0.000	0.109	13	20:22	0	202	0.008
J66	JUNCTION	0.000	0.109	13	20:26	0	201	0.012
J67	JUNCTION	0.000	0.473	0	00:37	0	200	0.019
J68	JUNCTION	0.151	0.315	0	00:05	9.5	9.55	0.050
J69	JUNCTION	1.510	1.510	0	00:01	47.2	150	-0.009
J7	JUNCTION	0.000	1.360	0	00:22	0	226	0.006
J70	JUNCTION	0.000	0.849	0	00:13	0	126	0.005
J71	JUNCTION	0.000	0.882	0	00:17	0	125	0.004
J72	JUNCTION	0.032	0.901	0	00:23	3.09	128	0.005
J73	JUNCTION	0.000	0.878	0	00:27	0	128	0.014
J8	JUNCTION	0.000	1.635	0	00:33	0	690	0.002
J9	JUNCTION	5.944	5.944	0	00:01	117	1.05e+003	0.004
H07	OUTFALL	403.759	403.759	0	00:01	594	594	0.000
H08	OUTFALL	0.000	0.979	0	02:19	0	726	0.000
H09	OUTFALL	7.392	7.392	0	00:01	7.18	7.18	0.000
H10	OUTFALL	0.032	0.032	0	00:01	1.27	1.27	0.000
H11	OUTFALL	114.495	114.495	0	00:01	203	290	0.000
H11a	OUTFALL	38.133	38.133	0	00:01	91.7	176	0.000
L01	OUTFALL	0.000	0.000	0	00:00	0	0	0.000 ltr
L02	OUTFALL	0.326	0.326	0	00:01	13.5	13.5	0.000
L03	OUTFALL	0.000	4.926	0	00:43	0	929	0.000
L04	OUTFALL	14.154	14.154	0	00:01	5.02	5.02	0.000
L05	OUTFALL	0.000	0.000	0	00:00	0	0	0.000 ltr
L06	OUTFALL	0.000	0.000	0	00:00	0	0	0.000 ltr
S12	OUTFALL	0.000	0.119	13	22:29	0	293	0.000
S13	OUTFALL	0.000	0.058	13	22:47	0	151	0.000
S14	OUTFALL	0.659	0.659	0	00:01	18.1	18.1	0.000
S15	OUTFALL	0.732	0.732	0	00:01	20.1	30.3	0.000
SU1	STORAGE	0.460	0.460	13	19:00	63.7	63.7	0.001
SWMF1	STORAGE	0.219	0.219	13	19:00	30.9	32.2	0.000
SWMF10	STORAGE	1.047	1.047	13	19:00	147	160	0.000
SWMF11	STORAGE	1.002	1.002	13	19:00	140	151	0.000
SWMF12	STORAGE	0.252	0.252	13	19:00	35.7	38.2	0.000
SWMF13	STORAGE	0.728	0.728	13	19:00	102	108	0.000
SWMF14	STORAGE	1.085	1.085	13	19:00	153	176	0.000
SWMF15	STORAGE	0.625	0.625	13	19:00	87.2	94.6	0.000
SWMF16	STORAGE	0.601	0.601	13	19:00	84.2	89.4	0.000
SWMF17	STORAGE	0.138	0.138	13	19:00	19.6	20.3	0.000
SWMF18	STORAGE	0.073	0.073	13	19:00	10.3	11.7	0.000
SWMF2	STORAGE	0.871	0.871	13	19:00	124	136	0.000
SWMF3	STORAGE	0.617	0.617	13	19:00	85.6	100	0.000

SWMF4	STORAGE	3.348	3.348	13	19:00	468	520	0.000
SWMF5	STORAGE	1.510	1.510	13	19:00	204	219	0.000
SWMF6	STORAGE	0.381	0.381	13	19:00	54	56.7	0.000
SWMF7	STORAGE	0.608	0.608	13	19:00	83.9	94.9	0.000
SWMF8	STORAGE	0.501	0.501	13	19:00	70.1	76.2	0.000
SWMF9	STORAGE	0.818	0.818	13	19:00	115	125	0.000

Node Surcharge Summary

No nodes were surcharged.

Node Flooding Summary

No nodes were flooded.

Storage Volume Summary

Storage Unit	Average Volume 1000 m3	Avg Pcnt Full	Evap Pcnt Loss	Exfil Pcnt Loss	Maximum Volume 1000 m3	Max Pcnt Full	Time of Max Occurrence days hr:min	Maximum Outflow CMS
SU1	5.496	65	0	50	7.346	87	285 09:23	0.227
SWMF1	1.371	14	0	0	3.043	32	13 22:28	0.011
SWMF10	13.350	28	0	0	20.230	43	13 19:40	0.096
SWMF11	11.369	26	0	0	19.683	46	13 22:59	0.044
SWMF12	2.642	15	0	0	4.601	27	13 22:37	0.013
SWMF13	6.564	22	0	0	13.137	43	13 20:04	0.063
SWMF14	24.241	32	0	0	33.176	44	13 22:46	0.058
SWMF15	7.530	26	0	0	11.418	40	13 19:41	0.061
SWMF16	5.425	25	0	0	9.434	44	13 19:39	0.042
SWMF17	0.777	14	0	0	1.697	31	13 19:32	0.009
SWMF18	1.418	15	0	0	1.893	20	13 19:32	0.006
SWMF2	12.041	25	0	0	17.867	37	13 19:30	0.086
SWMF3	14.784	27	0	0	19.066	35	13 19:45	0.066
SWMF4	53.897	34	0	0	77.852	49	13 19:43	0.417
SWMF5	15.590	29	0	0	25.819	48	13 20:07	0.109

SWMF6	2.828	19	0	0	5.091	34	13	19:30	0.037
SWMF7	11.274	29	0	0	15.444	40	13	19:37	0.053
SWMF8	6.600	30	0	0	11.857	53	13	23:17	0.012
SWMF9	10.203	29	0	0	15.510	44	13	20:02	0.064

 Outfall Loading Summary

Outfall Node	Flow Freq Pcnt	Avg Flow CMS	Max Flow CMS	Total Volume 10^6 ltr
H07	11.79	0.160	403.759	593.819
H08	100.00	0.023	0.979	725.577
H09	1.94	0.012	7.392	7.182
H10	6.15	0.001	0.032	1.268
H11	76.38	0.012	114.495	289.642
H11a	73.50	0.008	38.133	175.698
L01	0.00	0.000	0.000	0.000
L02	23.25	0.002	0.326	13.452
L03	100.00	0.029	4.926	928.843
L04	20.08	0.001	14.154	5.017
L05	0.00	0.000	0.000	0.000
L06	0.00	0.000	0.000	0.000
S12	98.32	0.009	0.119	292.778
S13	95.09	0.005	0.058	151.412
S14	2.59	0.022	0.659	18.069
S15	46.62	0.002	0.732	30.259
System	40.98	0.285	579.683	3233.018

 Link Flow Summary

Link	Type	Maximum Flow CMS	Time of Max Occurrence days hr:min	Maximum Veloc m/sec	Max/ Full Flow	Max/ Full Depth
C1	CONDUIT	0.619	0 00:05	0.19	0.01	0.31
C1_10	CHANNEL	4.959	0 00:41	0.72	0.04	0.38

C1_11	CHANNEL	4.926	0	00:43	0.33	0.11	0.44
C1_2	CHANNEL	0.118	0	00:15	0.20	0.00	0.13
C1_20	CHANNEL	0.000	0	00:00	0.00	0.00	0.00
C1_21	CHANNEL	0.000	0	00:00	0.00	0.00	0.02
C1_22	CHANNEL	0.109	13	20:22	0.27	0.00	0.04
C1_23	CHANNEL	0.109	13	20:26	0.21	0.00	0.02
C1_24	CHANNEL	0.109	13	20:37	0.12	0.00	0.03
C1_25	CHANNEL	0.473	0	00:37	0.14	0.00	0.09
C1_3	CHANNEL	1.474	0	00:07	0.55	0.01	0.22
C1_4	CHANNEL	1.277	0	00:18	0.49	0.01	0.14
C1_5	CHANNEL	1.274	0	00:23	0.54	0.00	0.10
C1_6	CHANNEL	1.334	0	00:25	0.58	0.00	0.12
C1_7	CHANNEL	1.360	0	00:22	0.61	0.01	0.22
C1_8	CHANNEL	1.635	0	00:33	0.55	0.01	0.21
C1_9	CHANNEL	1.423	0	00:38	0.46	0.01	0.25
C10	CONDUIT	0.096	13	19:40	0.09	0.00	0.22
C11	CONDUIT	0.061	13	19:45	1.71	0.05	0.16
C12	CONDUIT	0.042	13	19:43	1.21	0.04	0.13
C13	CONDUIT	0.058	13	22:47	0.85	0.00	0.02
C14	CONDUIT	0.006	13	19:34	0.17	0.00	0.01
C2	CONDUIT	0.011	13	22:29	0.12	0.00	0.12
C2_1	CHANNEL	0.995	0	00:54	0.37	0.00	0.10
C2_10	CHANNEL	0.862	0	01:52	0.47	0.01	0.15
C2_11	CHANNEL	1.034	0	01:55	0.42	0.01	0.12
C2_12	CHANNEL	1.174	0	01:59	0.52	0.01	0.15
C2_13	CHANNEL	1.036	0	02:06	0.44	0.00	0.10
C2_14	CHANNEL	0.896	0	02:11	0.45	0.00	0.13
C2_15	CHANNEL	0.979	0	02:19	>50.00	0.00	0.15
C2_18	CHANNEL	0.044	13	23:01	0.25	0.00	0.04
C2_19	CHANNEL	0.044	13	23:06	0.12	0.00	0.05
C2_2	CHANNEL	0.872	0	01:06	0.28	0.00	0.11
C2_20	CHANNEL	0.044	13	23:14	0.18	0.00	0.07
C2_21	CHANNEL	0.044	13	23:20	0.13	0.00	0.05
C2_22	CHANNEL	0.043	13	23:27	0.15	0.00	0.05
C2_23	CHANNEL	0.043	13	23:34	0.19	0.00	0.07
C2_24	CHANNEL	0.043	13	23:47	0.11	0.00	0.10
C2_25	CHANNEL	0.043	14	00:00	0.11	0.00	0.12
C2_26	CHANNEL	0.056	13	23:54	0.08	0.01	0.13
C2_27	CHANNEL	0.056	14	00:07	0.10	0.01	0.15
C2_28	CHANNEL	0.056	14	00:16	0.13	0.01	0.13
C2_29	CHANNEL	0.056	14	00:25	0.14	0.00	0.05
C2_3	CHANNEL	0.891	0	01:09	0.30	0.00	0.10
C2_30	CHANNEL	0.056	14	00:30	0.23	0.00	0.05
C2_31	CHANNEL	0.056	14	00:37	0.31	0.00	0.04
C2_32	CHANNEL	0.052	14	02:14	0.36	0.00	0.04
C2_33	CHANNEL	0.119	13	22:29	0.28	0.00	0.07

C2_34	CHANNEL	0.000	0	00:00	0.00	0.00	0.03
C2_35	CHANNEL	0.187	0	00:06	0.14	0.00	0.09
C2_36	CHANNEL	0.849	0	00:13	0.37	0.00	0.11
C2_37	CHANNEL	0.882	0	00:17	0.38	0.00	0.11
C2_38	CHANNEL	0.901	0	00:23	0.39	0.00	0.11
C2_39	CHANNEL	0.878	0	00:27	0.37	0.00	0.11
C2_4	CHANNEL	1.095	0	01:11	0.45	0.00	0.09
C2_40	CHANNEL	0.922	0	00:33	0.53	0.00	0.09
C2_5	CHANNEL	1.248	0	01:15	0.50	0.00	0.09
C2_6	CHANNEL	1.552	0	01:20	43.24	0.00	0.08
C2_7	CHANNEL	1.164	0	01:29	0.37	0.01	0.16
C2_8	CHANNEL	0.899	0	01:41	0.36	0.01	0.21
C2_9	CHANNEL	0.822	0	01:57	0.26	0.01	0.17
C3	CONDUIT	0.272	285	10:00	0.46	0.01	0.12
C4	CONDUIT	0.109	13	20:08	0.18	0.00	0.06
C5	CONDUIT	0.037	13	19:31	0.11	0.00	0.20
C6	CONDUIT	0.053	13	19:38	0.04	0.00	0.22
C7	CONDUIT	0.012	13	23:18	0.09	0.00	0.20
C8	CONDUIT	0.417	13	19:44	0.27	0.01	0.18
C9	CONDUIT	0.064	13	20:07	0.13	0.00	0.14
OR1	ORIFICE	0.086	13	19:30			1.00
OR10	ORIFICE	0.096	13	19:40			1.00
OR11	ORIFICE	0.061	13	19:41			1.00
OR12	ORIFICE	0.042	13	19:40			1.00
OR13	ORIFICE	0.044	13	22:59			1.00
OR14	ORIFICE	0.013	13	22:37			1.00
OR15	ORIFICE	0.021	13	20:04			1.00
OR16	ORIFICE	0.058	13	22:46			1.00
OR17	ORIFICE	0.006	13	19:32			1.00
OR18	ORIFICE	0.009	13	19:32			1.00
OR2	ORIFICE	0.011	13	22:29			1.00
OR3	ORIFICE	0.066	13	19:46			1.00
OR4	ORIFICE	0.109	13	20:07			1.00
OR5	ORIFICE	0.037	13	19:30			1.00
OR6	ORIFICE	0.053	13	19:37			1.00
OR7	ORIFICE	0.012	13	23:17			1.00
OR8	ORIFICE	0.344	13	19:43			1.00
OR9	ORIFICE	0.064	13	20:02			1.00
OR19	WEIR	0.226	285	09:24			0.43
W1	WEIR	0.000	0	00:00			0.00
W10	WEIR	0.000	0	00:00			0.00
W11	WEIR	0.000	0	00:00			0.00
W12	WEIR	0.000	0	00:00			0.00
W13	WEIR	0.000	0	00:00			0.00
W14	WEIR	0.000	0	00:00			0.00
W15	WEIR	0.042	13	20:04			0.07

W16	WEIR	0.000	0	00:00	0.00
W17	WEIR	0.000	0	00:00	0.00
W18	WEIR	0.000	0	00:00	0.00
W2	WEIR	0.000	0	00:00	0.00
W3	WEIR	0.000	0	00:00	0.00
W4	WEIR	0.000	0	00:00	0.00
W5	WEIR	0.000	0	00:00	0.00
W6	WEIR	0.000	0	00:00	0.00
W7	WEIR	0.000	0	00:00	0.00
W8	WEIR	0.072	13	19:43	0.04
W9	WEIR	0.000	0	00:00	0.00

Flow Classification Summary

Conduit	Adjusted /Actual Length	Fraction of Time in Flow Class								
		Dry	Up Dry	Down Dry	Sub Crit	Sup Crit	Up Crit	Down Crit	Norm Ltd	Inlet Ctrl
C1	1.00	0.00	0.02	0.00	0.98	0.00	0.00	0.00	1.00	0.00
C1_10	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	0.00
C1_11	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.03	0.00
C1_2	1.00	0.00	0.03	0.00	0.97	0.00	0.00	0.00	0.91	0.00
C1_20	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C1_21	1.00	0.02	0.98	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C1_22	1.00	0.02	0.00	0.00	0.98	0.00	0.00	0.00	0.00	0.00
C1_23	1.00	0.02	0.00	0.00	0.98	0.00	0.00	0.00	0.97	0.00
C1_24	1.00	0.00	0.02	0.00	0.98	0.00	0.00	0.00	0.74	0.00
C1_25	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.99	0.00
C1_3	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	0.00
C1_4	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.20	0.00
C1_5	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.02	0.00
C1_6	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	0.00
C1_7	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	0.00
C1_8	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.94	0.00
C1_9	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.89	0.00
C10	1.00	0.00	0.04	0.00	0.96	0.00	0.00	0.00	0.98	0.00
C11	1.00	0.02	0.00	0.00	0.00	0.00	0.00	0.98	0.00	0.00
C12	1.00	0.02	0.00	0.00	0.00	0.00	0.00	0.98	0.00	0.00
C13	1.00	0.02	0.00	0.00	0.14	0.83	0.00	0.00	0.36	0.00
C14	1.00	0.15	0.00	0.00	0.85	0.00	0.00	0.00	0.64	0.00
C2	1.00	0.00	0.20	0.00	0.80	0.00	0.00	0.00	0.98	0.00
C2_1	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	0.00

C2_10	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
C2_11	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
C2_12	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	0.00
C2_13	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.95	0.00
C2_14	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	0.00
C2_15	1.00	0.00	0.00	0.00	0.99	0.01	0.00	0.00	0.12	0.00
C2_18	1.00	0.02	0.00	0.00	0.98	0.00	0.00	0.00	0.26	0.00
C2_19	1.00	0.02	0.00	0.00	0.98	0.00	0.00	0.00	0.97	0.00
C2_2	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.99	0.00
C2_20	1.00	0.02	0.00	0.00	0.98	0.00	0.00	0.00	0.00	0.00
C2_21	1.00	0.02	0.00	0.00	0.98	0.00	0.00	0.00	0.97	0.00
C2_22	1.00	0.02	0.00	0.00	0.98	0.00	0.00	0.00	0.97	0.00
C2_23	1.00	0.02	0.00	0.00	0.98	0.00	0.00	0.00	0.97	0.00
C2_24	1.00	0.02	0.00	0.00	0.98	0.00	0.00	0.00	0.88	0.00
C2_25	1.00	0.02	0.00	0.00	0.98	0.00	0.00	0.00	0.08	0.00
C2_26	1.00	0.02	0.00	0.00	0.98	0.00	0.00	0.00	0.00	0.00
C2_27	1.00	0.02	0.00	0.00	0.98	0.00	0.00	0.00	0.01	0.00
C2_28	1.00	0.02	0.00	0.00	0.98	0.00	0.00	0.00	0.00	0.00
C2_29	1.00	0.02	0.00	0.00	0.98	0.00	0.00	0.00	0.00	0.00
C2_3	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
C2_30	1.00	0.02	0.00	0.00	0.98	0.00	0.00	0.00	0.97	0.00
C2_31	1.00	0.00	0.02	0.00	0.98	0.00	0.00	0.00	0.32	0.00
C2_32	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.73	0.00
C2_33	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.40	0.00
C2_34	1.00	0.35	0.65	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C2_35	1.00	0.00	0.35	0.00	0.65	0.00	0.00	0.00	0.97	0.00
C2_36	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.35	0.00
C2_37	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.36	0.00
C2_38	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.56	0.00
C2_39	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.72	0.00
C2_4	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
C2_40	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.27	0.00
C2_5	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	0.00
C2_6	1.00	0.00	0.00	0.00	0.86	0.14	0.00	0.00	0.78	0.00
C2_7	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.14	0.00
C2_8	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.98	0.00
C2_9	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.86	0.00
C3	1.00	0.00	0.02	0.00	0.98	0.00	0.00	0.00	0.97	0.00
C4	1.00	0.02	0.00	0.00	0.97	0.00	0.00	0.00	0.98	0.00
C5	1.00	0.00	0.18	0.00	0.82	0.00	0.00	0.00	0.98	0.00
C6	1.00	0.00	0.04	0.00	0.96	0.00	0.00	0.00	0.98	0.00
C7	1.00	0.00	0.03	0.00	0.97	0.00	0.00	0.00	0.98	0.00
C8	1.00	0.00	0.02	0.00	0.98	0.00	0.00	0.00	0.98	0.00
C9	1.00	0.00	0.02	0.00	0.98	0.00	0.00	0.00	0.98	0.00

Conduit Surcharge Summary

No conduits were surcharged.

Analysis begun on: Thu Jun 24 14:24:09 2021
Analysis ended on: Thu Jun 24 14:30:43 2021
Total elapsed time: 00:06:34

