47 Bedford Road

Functional Servicing and Preliminary Stormwater Management Report

Project Location:

47 Bedford Road, Township of Guelph Eramosa
Ontario

Prepared for:

Marann Homes
449 Laird Road, Unit 6
Guelph, ON N1G 4W1

Prepared by:

MTE Consultants
520 Bingemans Centre Drive
Kitchener, ON N2B 3X9

July 28, 2023

MTE File No.: 51505-104

Engineers, Scientists, Surveyors.

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1.0 Introduction

1.1 Overview

MTE Consultants Inc. (MTE) was retained by Marann Homes, to prepare a *Functional Servicing and Preliminary Stormwater Management Report (FS-PSWMR)* for the proposed subdivision located at 47 Bedford Road, Township of Guelph-Eramosa, Ontario (the Site). This FS-PSWMR has been prepared in support of a Draft Plan of Subdivision for the Site.

The Site is zoned for residential development. This Report addresses pre-consultation comments received to date from Guelph-Eramosa Township. This FS-PSWMR outlines the proposed grading and servicing design and the stormwater management strategy to align with regulatory criteria and meet the development objectives. The purpose of this Report is to ensure the development meets Guelph-Eramosa Township, the Grand River Conservation Authority (GRCA), and the Ministry of the Environment, Conservation and Parks (MECP) criteria, and any recommendations from earlier relevant studies and reports.

The Site is 2.37ha in area and under existing conditions consists of a single detached residential home, auxiliary structures and a driveway. The Site is proposed to include five (5) residential lots with homes and septic systems, a stormwater management easement, and a municipal road right-of way. The Site is bound by residential rear lots of Blue Forest Drive to the north, a municipal park (Cross Creek Park) and stormwater management easement to the east and residential home lots to the south and west. The location of the Site is shown on **Figure 1 – 47 Bedford Road Site Location Plan.**

The Site represents further build-out of the Silver Meadows Subdivision, located to the east. The Silver Meadows Subdivision was originally designed by MTE in 1993. A stormwater management easement in the Silver Meadows Subdivision has been designed to accept runoff from the Site.

The *Draft Plan of Subdivision 47 Bedford Road* (GSP group, July 7, 2023) has been included in **Appendix A** for reference.

1.2 Background Information

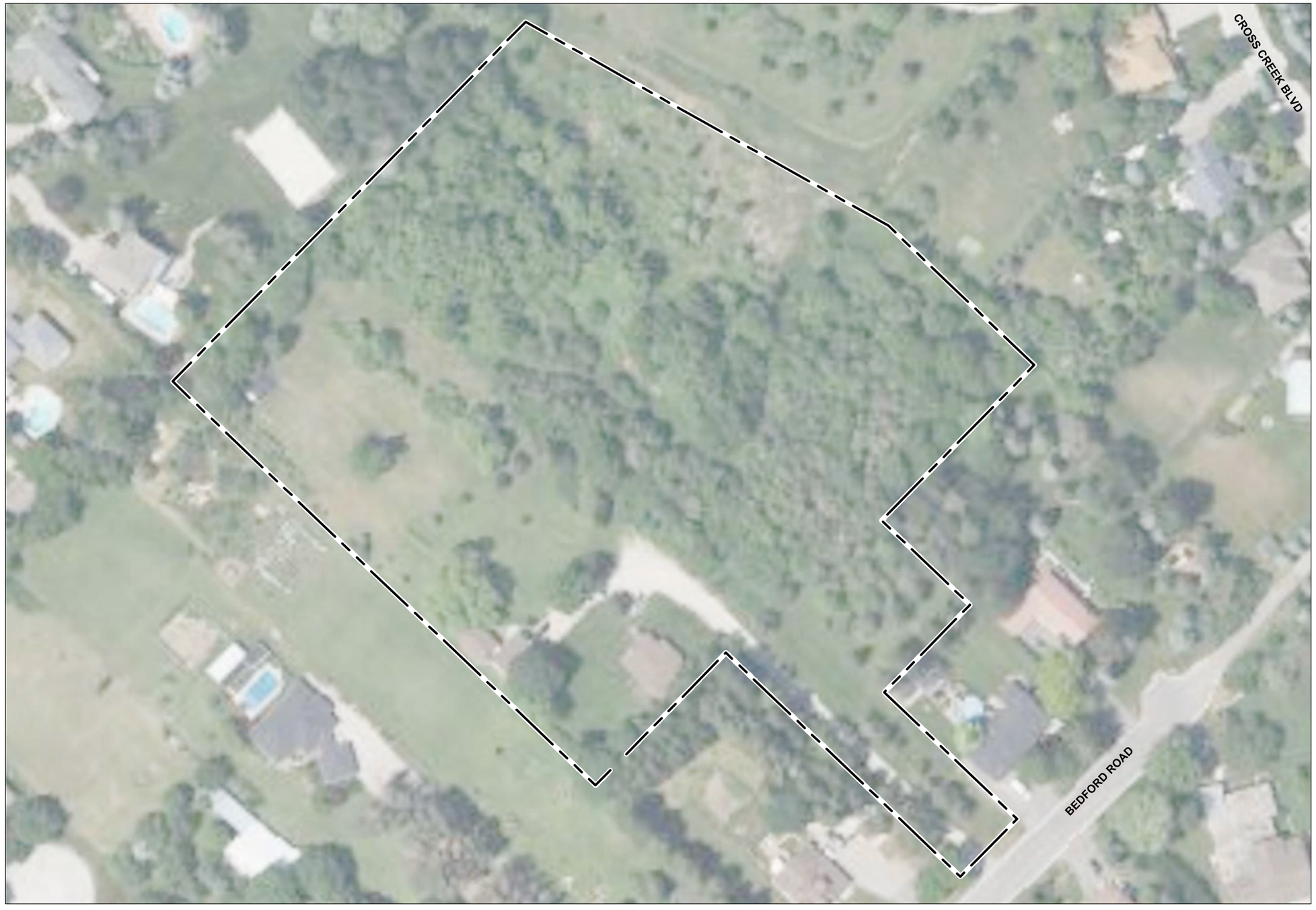
In preparation of this *FS-PSWMR*, the following pre-consultation comments were reviewed:

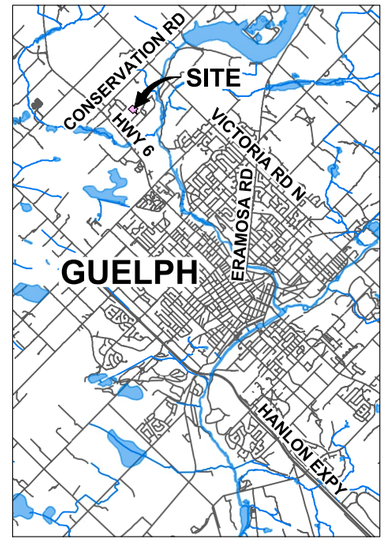
- 47 Bedford Road Comments (Danielle Walker, Wellington Source Water Protection, March 25, 2022)
- 47 Bedford – Engineering Pre-Consultation Comments (Chris Knechtel, Township Engineering, March 17, 2022)
- 47 Bedford Road, Guelph – Eramosa Township Comments (Harry Niemi, Township Engineering, April 20, 2022)
- Comments on Proposed Plan of Subdivision, 47 Bedford Road (Zach Price, Township Planning, May 12, 2022)
- Pre-Consultation Meeting Notes, 47 Bedford Road, (Zach Price, Township Planning, March 31, 2022)

In preparation of this *FS-PSWMR*, the following documents were reviewed:

- City of Guelph Development Charges Background Study (Watson and Associates Ltd., 2019, A-10)

- Corporation of the Township of Guelph / Eramosa Site (Virtual) Pre-consultation Meeting (Guelph Eramosa Township, March 17, 2022)
- Design Guidelines and Supplemental Specifications for Municipal Services (Region of Waterloo, 2022).
- Development Standards for the Township of Guelph / Eramosa (R.J. Burnside & Associates Limited, 2004)
- Draft Plan of Subdivision, 47 Bedford Road (GSP group, July 7, 2023)
- Drinking Water System Design Guidelines (MECP, 2008)
- Erosion & Sediment Control Guideline for Urban Construction (Toronto and Region Conservation Authority, 2019)
- Lot Servicing Report, Silver Meadows Subdivision, Township of Guelph, Draft Plan 23T-86017 (MTE Consultants, October 14, 1992)
- Low Impact Development Stormwater Management Planning and Design Guide (CVC and TRCA, 2010)
- Guelph Water/Wastewater Servicing Master Plan (EarthTech Canada, 2008)
- Proposed Residential Subdivision, Geotechnical Investigation Report (MTE Consultants, August 11, 2022)
- Ontario Building Code (Government of Ontario, 2012)
- Storm Drainage Area Plan, Silver Meadows Subdivision (MTE, March 1993)





KEY PLAN (nts)

N

SCALE IN METRES
0 20 40m
1:1,000

LEGEND

SITE BOUNDARY

REFERENCES

BING IMAGERY AS OF JULY 29 - 2022 (IMAGE DATE UNKNOWN);
MTE, EXISTING CONDITIONS PLAN, DWG No. EC1.1, JULY 6 - 2002; AND
LAND INFORMATION ONTARIO, ROAD AND WATER NETWORK © QUEEN'S PRINTER FOR ONTARIO, 2022 (key plan),

NOTES

THIS FIGURE IS SCHEMATIC ONLY AND TO BE READ IN CONJUNCTION WITH ACCOMPANYING TEXT.

BING IMAGERY USED FOR ILLUSTRATION PURPOSES ONLY AND NOT TO BE USED FOR MEASUREMENTS.

ALL LOCATIONS ARE APPROXIMATE.

MTE
Engineers, Scientists, Surveyors

PROJECT
FUNCTIONAL SERVICING AND STORMWATER MANAGEMENT REPORT
47 BEDFORD ROAD
GUELPH, ONTARIO

TITLE
SITE LOCATION PLAN

Drawn: DCH	Scale: AS SHOWN
Checked:	Project No.: 51505-104
Date: Oct 13/22	Rev No.: 0

FIGURE 1

Client: Marann Homes
Time: 09:53:28
Plot Date: 13 October 2022
Original Format in Tabloid (279mm x 432mm; 11" x 17")
25mm
0
CAD: P:\51505\104\GEO\2_PROD\51505-104-R02 FUNCTIONAL SERVICING AND STORMWATER MANAGEMENT\51505-104-R02001.DWG

2.0 Existing Conditions and Background Information

2.1 Site Topographic Information

The Site currently contain a single residential home, with a driveway and accessory structures. Approximately 50% of the lot (the east portion of the Site) has some tree cover. A topographic survey for the Site (MTE, 2022) confirmed the existing drainage conditions. The Site has a steep slope of approximately 8.75% from the west to east, with a grade change of approximately 13m. The elevation near the west property line is 357m and the elevation near the east property line is 344m. A hill is located in the treed area in the north-east area of the Site.

The existing topographic contours on-site are shown on the **MTE Drawing 51505-104-EC1.1 – Existing Conditions Plan** (MTE, 2022).

2.2 Site Existing Drainage Conditions

Under the existing drainage conditions, the majority of overland flow from the Site (both minor and major storm events) flows overland and outlets to the Silver Meadows subdivision stormwater management easement within Cross Creek Park to the east. The flow is accepted into the existing storm sewer network at DICBMH 22A, to the east of the Site. The existing storm sewer and swale in this location provide a minor and major overland flow route.

Based on review of GRCA Mapping contours, an external drainage catchment of approximately 0.45ha of the neighbouring property to the west flows overland onto the Site.

For more details of the existing drainage conditions, including existing drainage catchments and assigned runoff coefficients please see **Figure 2.2 – Pre-development Drainage Area Plan (MTE, 2022).** The external drainage catchments are not shown on this Figure as quantity control of external area is not required on-site, based on pre-consultation comments from Guelph-Eramosa Township.

The pre-development drainage catchments are summarized as follows:

- **Catchment 101** – This 2.287ha catchment area consists of the residential building, yard and treed area. Runoff produced over this catchment flows overland and outlets to the Silver Meadows subdivision stormwater management easement. Ultimately, this runoff outlets to the Speed River to the east. The grade change over this catchment is approximately 13m, with an overland flow slope of approximately 8.75%.
- **Catchment 102** – This 0.092ha drainage catchment is comprised of the driveway and front yard. Runoff produced over this catchment outlets south to Bedford Road. Ultimately, this runoff outlets east to the Silver Meadows subdivision, and the Speed River.

A hydrologic model was prepared in MIDUSS to simulate pre-development drainage conditions. Runoff was simulated under the 25mm-4hr, 5-year (minor) and 100-year (major) 3-hour Chicago design storms, using parameters from the Fergus Shand Dam Rain Gauge, following Township of Guelph-Eramosa Standards. The Chicago Storm Parameters are summarized in **Table 2.1** below, derived from the Environment Canada IDF curve.

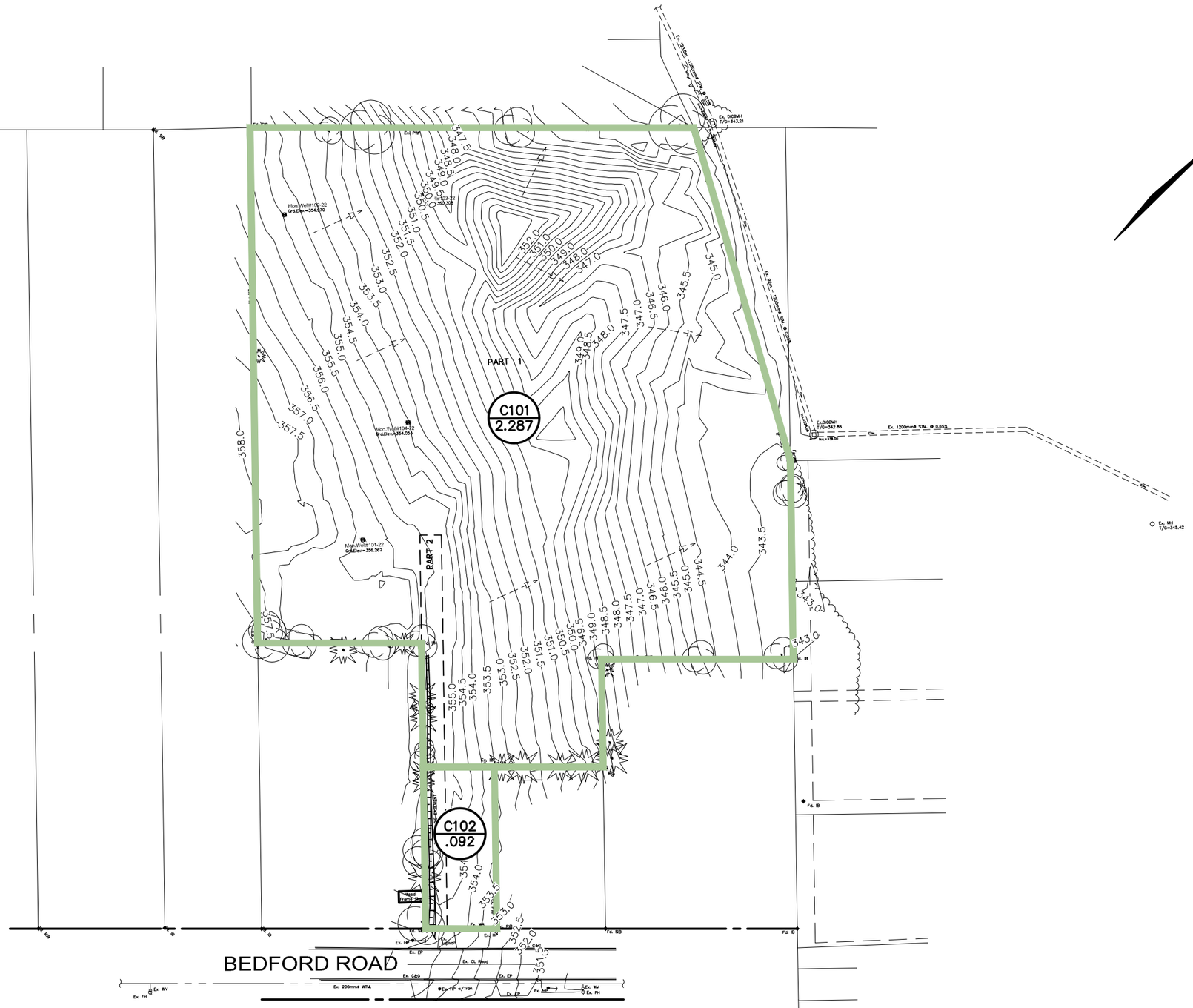
Table 2.1: Fergus Shad Dam, 3-hour Chicago Storm Parameters

Frequency	a	b	c
25 mm	508.50	6.00	0.799
5-year	1746.737	13.708	0.884
100-year	5061.200	22.167	0.958

For design purposes, the total flow off-site was considered to be the addition of flows from Catchment 101 and 102, as both Catchments ultimately outlet to the Speed River to the east. The results of the pre-development hydrologic model simulation are shown in **Table 2.2** below. For more details of the pre-development hydrologic model please see **Appendix C.**

Table 2.2: Total Pre-Development Peak Flows Off-Site (m^3/s)

Storm Event (yr.)	Flow Off-Site (m^3/s)
5-year	0.123
100-year	0.251



LEGEND

- SITE BOUNDARY
- EXISTING CONTOURS (326)
- DIRECTION OF EXISTING DRAINAGE
- EXISTING EMBANKMENT (SLOPE AS NOTED) (TOP) / (BOTTOM)
- PRE-DEVELOPMENT CATCHMENT
- C101 / 2.320 — CATCHMENT No. / AREA (Ha)

FIGURE 2.2

Date: OCT.21/22
Scale: 1:1250

PRE DEVELOPMENT DRAINAGE AREA PLAN

MTE
Engineers, Scientists, Surveyors

Project No.: 51505-104

December 21, 2022 — 10:51 a.m. — Plotted By: AHewson

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2.3 Adjacent Silver Meadows Subdivision Drainage Condition

The Silver Meadows Subdivision is immediately to the east of the Site. This subdivision consists of single-family residential homes along Cross Creek Boulevard, Christine Drive, Adam Court, Jason Drive and Township Rd. 6, as well as a municipal park known as Cross Creek Park. A swale easement is located adjacent to Jason Drive. The Silver Meadows Subdivisions is bound to the north by Township Road 6 and to the west by rear lots of Blue Forest Drive. To the east of the Silver Meadows Subdivision is a wetland area and the Speed River, which flows south and outlets to the Grand River. The storm water management of the Silver Meadows Subdivision was previously designed by MTE in 1993.

The *Storm Drainage Area Plan, Silver Meadows Subdivision* (MTE, March 1993) shows the designed drainage conditions for the Silver Meadows Subdivision. To confirm drainage conditions of this subdivision, MTE reviewed the available drawings and completed a site walk in July 2022.

Through this background review it was confirmed that the minor (5-year storm event) runoff across the Silver Meadows Subdivision is captured by a storm sewer network and directed north to the storm sewer along Township Road 6. This storm sewer then directs runoff west along Township Road 6 and then south along the stormwater management easement. This storm sewer network continues south on Cross Creek Boulevard and eventually outlets to the Speed River, to the east of the subdivision.

The lot grading of the Silver Meadows Subdivision was also reviewed to confirm overland flow routes. The major overland runoff (in excess of the 5-year storm event up to the 100-year storm event) is conveyed across the subdivision and outlets to the stormwater management easement. This stormwater management easement provides an overland flow route and extends south to Bedford Road. At Bedford Road the overland flow route continues east and then south on Cross Creek Boulevard and ultimately outlets to a second easement that directs the flow to the wetland and Speed River to the east.

Through this review it was noted that an external 1.71ha area, with an assigned runoff coefficient of 0.40, was designated for the 47 Bedford Road Site. This area outlets to the DICBMH 22A of the Silver Meadows storm sewer network. The storm sewer diameter at this manhole is 1200mm.

The minor flow storm sewer system and the major overland flow system are designed to capture and convey flow from this external area. The development of 47 Bedford Road represents the ultimate build-out of the Silver Meadows Subdivision. The drainage conditions of the Silver Meadows Subdivision are shown on **MTE Drawing 51505-104-MS1.1 – Storm Drainage Area Plan** (MTE, 2022). This drawing illustrates the location of the 47 Bedford Road lands relative to the Silver Meadows Subdivision.

2.4 Capacity of Downstream Drainage System

As discussed, the development of 47 Bedford Road represents the ultimate build-out of the Silver Meadows Subdivision. The storm sewer network of this subdivision and the major overland flow swale were both designed to accommodate 1.71ha of drainage area over the 47 Bedford Road Site, with an assigned runoff coefficient of 0.40.

The capacity of the Silver Meadows Subdivision storm sewer network was assessed to confirm that this storm sewer can accept minor flows from the Site. The drainage areas, runoff coefficients and storm sewer slopes and lengths were established referencing the *Storm Drainage Area Plan, Silver Meadows Subdivision* (MTE, 1993). Through runoff calculations, it was shown that the 1200mm diameter pipe at DICBMH 22A currently flows at 75% capacity under the 5-year (minor) storm event. The capacity of the downstream storm sewer (the 1200mm storm sewer at DICBMH22A) is 2.74m^3/s. This capacity calculation included the 1.71ha drainage area for the 47 Beford Road Site, with the assigned RC = 0.40. For calculations of this storm sewer network's capacity, please see the Storm Sewer Design Sheet in **Appendix B**.

A MIDUSS model was simulated for the 1.71ha area (RC=0.40) to confirm a minor flow of 0.07m^3/s. The total available flow for the 47 Bedford Road Site within the downstream storm sewer is 0.76m^3/s. This assessment concluded that the downstream storm system has capacity to accept minor flows from the 47 Bedford Road Site, as the pre-development flow rates (shown in **Table 2.3.2** above) are below the 5-year allowable flow rate for the Site (0.76m^3/s).

Pre-development flow rates are the target runoff rates for off-site post-development flows, following Guelph-Eramosa Township standards. By controlling the post-development flow rates to pre-development rates, the downstream storm sewer will flow below capacity.

2.5 Site Geotechnical and Hydrogeological Information

Site soil information is summarized in the *Proposed Residential Subdivision Geotechnical Investigation Report* (MTE, August 2022). As part of this Investigation, four (4) boreholes were drilled on-site, with depths ranging from 6.1 to 8.2m. Soil samples were recovered from the boreholes. In general, the soil found on-site contained a topsoil layer approximately 280mm in depth underlain by sand and silt to silt with trace sand, clay and gravel. Groundwater elevations found on-site ranged from 1.2 to 4.2mbgs.

The location of the boreholes is shown on **MTE Drawing 51505-104-EC1.1**, enclosed. Please refer to **Appendix E** for the *Proposed Residential Subdivision, Geotechnical Investigation Report* (MTE Consultants, August 11, 2022).

To confirm groundwater conditions on-site, the **MTE Drawing 51505-104-MS2.1 – Ground Water Contour Plan**, enclosed, was developed. The *Lot Servicing Report, Silver Meadows Subdivision, Township of Guelph, Draft Plan 23T-86017* (MTE Consultants, October 14, 1992) was reviewed because test-pits and groundwater elevations were confirmed on-site for that Report. This data allowed for approximation of groundwater contours across the 47 Bedford Road lands by interpolating between the borehole groundwater elevations on-site and the test-pit groundwater elevations east of the Site. As shown, the groundwater contours slope from 353.0m along the west boundary to 345.0m along the east boundary.

3.0 Site Grading Design

The **MTE Drawing 51505-104-AG1.1 – Finish Grade Plan**, enclosed, shows the grades established on-site. This plan shows home locations, septic system locations and infiltration gallery locations for each lot. As shown, embankments are located on the east and west property lines matching back into existing grades at the property line. Lot 1 has been designed as a 2 storey with the first storey being at street level and second storey matching into the rear yard grades. Lot 2 has been designed as a lookout and Lots 3 – 5 have been designed as walkouts to match existing grades at the rear yard and property line. A stormwater management easement is located between Lots 3 and 4 to direct overland drainage on-site to the major overland flow route to the east. This easement also provides a location for the on-site storm sewer system outlet.

4.0 Water Distribution Analysis

In existing conditions, a 200mm watermain fronts the 47 Bedford Road site. A fire hydrant is located at approximately Sta. 0+620 on Bedford Road (with the Site located at approximately Sta. 0+590). The water servicing design for the Site consists of a 150mm watermain along Steet A connecting to a new fire hydrant. The watermain will reduce to 50mm and loop along the cul-de-sac, back to the 150mm watermain.

MTE Drawing 51505-104- GP1.1 – General Plan of Services, enclosed, shows the subject land's water distribution network. A Water Distribution Analysis was completed to confirm that adequate pressure and water supply is available to support the proposed development.

4.1 Model Development

The Bentley water distribution system analysis program (WaterCAD CONNECT Edition) was utilized for the analysis of the local water distribution system for the Site, including the connection to the existing watermain along Bedford Road.

The network for the analysis was developed by assigning physical parameters to two nodes and two pipes. One node (J1) represents the connection from the existing watermain on Bedford Road into the Site. The second node (J2) represents the connection point from the Street A watermain to each individual home lot.

Water supply for the proposed development will be provided by the connection to the existing 200mm diameter watermain along Bedford Road.

4.1.1 System Pressure

The hydraulic grade line (HGL) boundary conditions were set referencing the Hamilton Drive Stand-pipe water levels on Wellington Road 38, provided by the Township of Guelph-Eramosa. The operating hydraulic grade lines at the watermain connection to the Site are as follows:

- High Water Level – 392.6m
- Low Water Level – 385.6m
- Fire Pressure – 381.0m

The WaterCAD model simulated these hydraulic grade-lines as a constant head reservoir level. The conditions simulated were the low water level and the fire scenario water level to produce a conservative assessment of the water distribution system.

4.1.2 Unit Count and Population

The density for the development is 3.33people/unit, based on the *City of Guelph Development Charges Background Study* (Watson and Associates Ltd., 2019, p. 37). The total population of the Site is 17 people.

4.2 Design Criteria

4.2.1 Model Scenarios

The model was run under four demand and one fire flow scenario, as follows: Average Day, Maximum Day, Minimum Hour, Peak Hour, and Fire Flow + Maximum Day.

4.2.2 System Demands

System demands for the proposed residential land use were based on water usage rates of 300L/cap/day, from the *Guelph Water/Wastewater Servicing Master Plan (*EarthTech Canada, 2008). The peaking factors applied were based on the *Drinking Water System Design Guidelines* (MECP, 2008), as the population is less than 500 people and therefore higher peaking factors apply. These peaking factors are shown in **Table 4.1** below. The demand for the proposed internal junction was calculated by combining the number of dwelling units with their corresponding unit flow rates. The unit densities, average usage rates, and demand calculations for each node are provided in **Appendix D**.

Table 4.1: Water Demand Peaking Factors

Demand Scenario	Factor
Average Day	1.0
Maximum Day	9.5
Peak Hour	0.1
Minimum Hour	14.3

4.2.3 Fire Flow Requirements

The fire flow demand for the development was determined from the *Ontario Building Code* (Government of Ontario, 2012). The calculations considered the building footprint and volume, proximity to other building, and building classification. Based on the calculation, the required water supply flow rate is 60L/s to the development.

4.2.4 Friction Factors

The *Drinking Water System Design Guidelines* (MECP, 2008) and the latest AWWA Manual for PVC Pipe were referenced for friction factors. As such, newly proposed pipe shall be designed using a Hazen-Williams C-factor of 150.

4.2.5 Minor Losses

Minor losses are caused by appurtenances and fittings along the length of pipe in the system. A standard minor loss of 1.0 was applied to the pipe in the proposed water distribution system design for the subdivision.

4.2.6 Pressure and Velocity Requirements

As outlined in Section 10.2 of the *Design Guidelines for Drinking Water Systems (MECP, 2008)*, the pressure guidelines exist for all demand scenarios. These pressure requirements are summarized in **Table 4.2** The final pressures of the system were compared to these values.

Table 4.2: Water Pressure Requirements

Scenario	Minimum Pressure (kPa)	Ideal Operating Pressure Range (kPa)
Average Day	275	350-550
Maximum Day	275	350-550
Peak Hour	275	350-550
Minimum Hour	275	350-550
Max Day + Fire	140	-

The *Design Guidelines for Drinking Water Systems (MECP, 2008)* recommends that velocities throughout the distribution system not exceed a maximum of 5.0 m/s under all flow conditions.

4.3 Water Analysis Results

The pipe sizes, system pressures, and available fire flows were reviewed according to the aforementioned design criteria, under the various demand and fire flow scenarios. Please see **Appendix D** for output results of the WaterCAD analysis. **Table 4.3** provides a summary of the model results, identifying the system pressures for each demand scenario and available fire flow.

Table 4.3: Water Analysis Modelling Results for Proposed Development

Node	Pressure (kPa)				Maximum Day + Fire Flow			
	Average Day	Max. Day	Min. Hour	Peak Hour	Fire Flow Required (L/s)	Available Fire Flow (L/s)	Residual Pressure (kPa)	Velocity (m/s)
J-2	318				60	80	140	4.5

Results show that pressure available under each modelled scenario does meet the minimum pressure requirements, and that the flow velocity is under the maximum allowable velocity. However, for each scenario the pressure available is outside the ideal operating pressure range, established by the *Design Guidelines and Supplemental Specifications for Municipal Services* (Region of Waterloo, 2022). Each home may require a pressure booster to bring the water pressure into the ideal operating range. Pressure booster requirements will be further assessed during the future detailed design stage.

5.0 Stormwater Management Strategy

5.1 Stormwater Management Criteria

The specific Stormwater Management criteria for the Site was determined referencing the *Pre-Consultation Comments and Notes*, and the *Development Standards for the Township of Guelph / Eramosa* (R.J. Burnside & Associates Limited, 2004).

5.1.1 Water Quantity Control

The Water Quantity Control Criteria for the Site requires control of post-development flows to pre-development flow rates. The 5-year and 100-year pre-development flow rate, identified in

Table 2.2, represent the allowable minor and major flow rates off-site. The stormwater management strategy on-site was designed to achieve these allowable flow rates in the post-development condition.

5.1.2 Water Quality Control

The water quality control required on-site is 80% Total Suspended Solids removal, to provide enhanced water quality control.

5.1.3 Water Balance

Water balance on-site is to be incorporated. Based on the geotechnical investigation, the subsurface soils are sand and silt to silt with trace sand, clay and gravel. The Percolation Time on-site was calculated to be 40min/cm. Infiltration will be provided on-site to meet the pre-development groundwater water balance.

5.2 Storm Sewer Network and Super Pipe

A storm sewer along Street A collects runoff produced on-site. This storm sewer continues on-Site in the proposed stormwater management easement and will connect into the existing storm sewer of the Silver Meadows Subdivision easement to the east. A new manhole will be placed within the existing storm sewer network to provide this connection.

The storm sewer was designed as a 375mm pipe to accept minor flow from the Site. Within the proposed stormwater management easement, the storm sewer will be a super pipe (1650mm diameter) to provide storage and peak flow attenuation. At the downstream manhole of this super pipe, a 100mm diameter orifice will attenuate the Site flows to pre-development levels. A design sheet of this proposed storm sewer network is included in **Appendix B.**

Performance of the super pipe was assessed using the MIDUSS modelling software. Through this analysis, the required super pipe diameter, such that adequate stormwater storage is provided, was determined. The design characteristics of the super pipe system is summarized in **Table 5.1** below.

Table 5.1: Super Pipe Design Characteristics

Parameter	Super Pipe Characteristic	Unit
Upstream Invert	345.34	masl
Downstream Invert	340.53	masl
Super Pipe Diameter	1650	mm
Super Pipe Length	67.00	m
Storage Available	148	m^3
Storage Used (100-year event)	144	m^3
Orifice Diameter	100	mm
Outlet Rate (5-year event)	0.033	m^3/s
Outlet Rate (100-year event)	0.059	m^3/s

For details of the storm sewer network please see the enclosed **MTE Drawing 51505-104-GP1.1 – General Plan of Services** and **MTE Drawing 51505-104-PP1.1- Storm Easement / Street A.**

5.3 Infiltration Galleries

Each lot will contain an infiltration gallery to collect roof water runoff. The design of the infiltration gallery follows the *Low Impact Development Stormwater Management Planning and Design Guide* (CVC and TRCA, 2010). Each infiltration gallery was sized to accommodate the 25mm event for each roof area produced over the roof tops. The on-site native soil percolation rate is approximately 40min/cm, based on the *Proposed Residential Subdivision Geotechnical Investigation Report* (MTE, August 2022) which corresponds to a typical infiltration rate of approximately 15mm/hr.

Roof runoff is considered clean and does not require any treatment (leaf screens on eavestroughs and downspouts are recommended) prior to being directed to infiltration galleries. Infiltration of road runoff is not recommended due to the presence of chlorides in runoff during winter months.

It was confirmed that the re-charge rate (outflow) from each gallery is greater than the inflow (the 25mm storm over a 4-hour period), indicating that storm events less than the 25mm can be accommodated without any overflow or surcharging. Any overflow from the gallery will be directed to the on-site storm sewer through an overflow connection.

It is recommended that prior to construction of each lot infiltration gallery on-site, the site specific native soil infiltration rate is tested and confirmed by an Engineer to verify that the designed subsurface soil infiltration rate is appropriate. Future design work will include detailed infiltration gallery sizing of each lot and will consider the actual house footprint area. **Table 5.2** below summarizes the Infiltration Gallery characteristics. For details of the infiltration gallery design, please see **Appendix B.**

Table 5.2: Design Characteristics of On-Site Infiltration Gallery for Each Lot

Parameter	Infiltration Trench Characteristic	Unit
Contributing Drainage Area	500	m^2
Design Storm	25	mm
Total Surface Area of Gallery	45.00	m^2
Length of Gallery	9.00	m
Width of Gallery	5.00	m
Height of Gallery	0.50	m
Subsurface Soil Infiltration Rate	15	mm / hr
Porosity of Granular Layer	40%	%
Draw-down	48	hr
Soil Cover	0.30	m

Note: Infiltration gallery sizing completed through MIDUSS Modeling and confirmed no surcharging during minor and major storm events.

5.4 Post-Development Drainage Conditions

The post-development drainage conditions on-site are shown on **Figure 3- Post-Development Drainage Area Plan.** As shown, runoff produced over Lot 1 and the front of Lots 2 – 5 drain overland to Street A. The minor flow is captured by the designed storm sewer network. The flow produced over the rear of Lots 2 – 5 drain overland to the stormwater management easement within Cross Creek Park to the east. The post-development drainage catchments are summarized as follows:

- **Catchment 200** – This 0.255ha drainage catchment consists of the roof-tops on-site. Runoff produced over each roof-top will be directed to an infiltration gallery via a downspout connection. Flow in excess of the infiltration gallery will be directed to the storm sewer via an overflow connection.
- **Catchment 201** – This 0.285ha drainage catchment consists of the rear yard of Lot 1. Runoff produced over this area will flow overland to the Street A right-of-way and be collected by the storm sewer system. Ultimately, this runoff will outlet to the Silver Meadows storm sewer to the east. The overland slope of this drainage catchment is approximately 3.60%.
- **Catchment 202** – This 0.491ha drainage catchment consists of Street A. Runoff produced over this catchment is directed to the storm sewer system. Ultimately, this runoff will outlet to the Silver Meadows storm sewer to the east. The slope of Street A is 0.75 – 1.00%.
- **Catchment 203** – This 0.628ha uncontrolled drainage catchment consists of the rear of Lots 2 and 3. Runoff produced over this catchment flows to the east and outlets to the Silver Meadows subdivision stormwater management easement. The overland slope of this drainage catchment is approximately 10.40%, including the embankment along the east property line.
- **Catchment 204** – This 0.594ha uncontrolled drainage catchment area consists of the rear of Lots 4 and 5. Runoff produced over this catchment flows to the east and outlets to the Silver Meadows subdivision stormwater management easement. The overland slope of this drainage catchment is approximately 15.34%, including the embankment along the east property line.
- **Catchment 205** – This 0.071ha catchment area consists on-site stormwater management easement (swale) between Lots 3 and 4. Runoff produced over this catchment is directed to the Silver Meadows stormwater management easement to the east. The slope of this swale is approximately 11.44%.
- **Catchment 206** – This 0.054ha uncontrolled catchment area consists of a portion of Street A that outlets runoff uncontrolled to the south to Bedford Road. Ultimately, runoff produced over this catchment flows to the east to the Silver Meadows Subdivision. The overland slope of this catchment is approximately 0.75%.

The post-development catchments were simulated in MIDUSS to assess the post-development flow produced on-site. **Table 5.3** below summarizes the proposed flow rates off-site and the allowable flow rates off-site (produced using the existing conditions hydrologic model). As shown, the infiltration galleries and super pipe provide the necessary attenuation such that the pre-development flow rates are not exceeded under post-development conditions. For more details of the Post-Development MIDUSS model, please see **Appendix C.**

Table 5.3: Post-Development Flow Rates On-Site (m^3/s)

Drainage Area	Pre-Development Flow Rates Off-Site (m^3/s)	
	5-year	100-year
Total Flow Off-Site	**0.123**	**0.251**
Drainage Area	**Post-Development Flow Rates Off-Site (m^3/s)**	
	5-year	**100-year**
200	0.072	0.125
201	0.008	0.031
202	0.080	0.151
Total Hydrograph to Control[1]	0.087	0.181
Total Routed outflow from super pipe with Orifice	0.033	0.059
203	0.018	0.067
204	0.018	0.066
205	0.002	0.008
206	0.010	0.019
	0.074	**0.196**

Note: 1. All flow rates over catchments are added as hydrographs – reduction in added flows is due to flow off-setting due to peak timing.

5.5 On-Site Stormwater Management Easement

The stormwater management easement between Lots 3 and 4 provides conveyance of the major overland flow off-site to the Silver Meadows Subdivision easement to the east. This capacity of this swale is 57.95m^3/s with a flow depth of 1.07m.

The drainage area to the stormwater management easement is 1.10ha, with a 100-year flow of 0.061m^3/s and a 5-year flow of 0.035m^3/s, based on the MIDUSS modelling. Therefore, the swale has capacity to convey the required flows. The design characteristics for this swale were confirmed in Flow Master. For more information on this swale sizing, please see **Appendix B**.

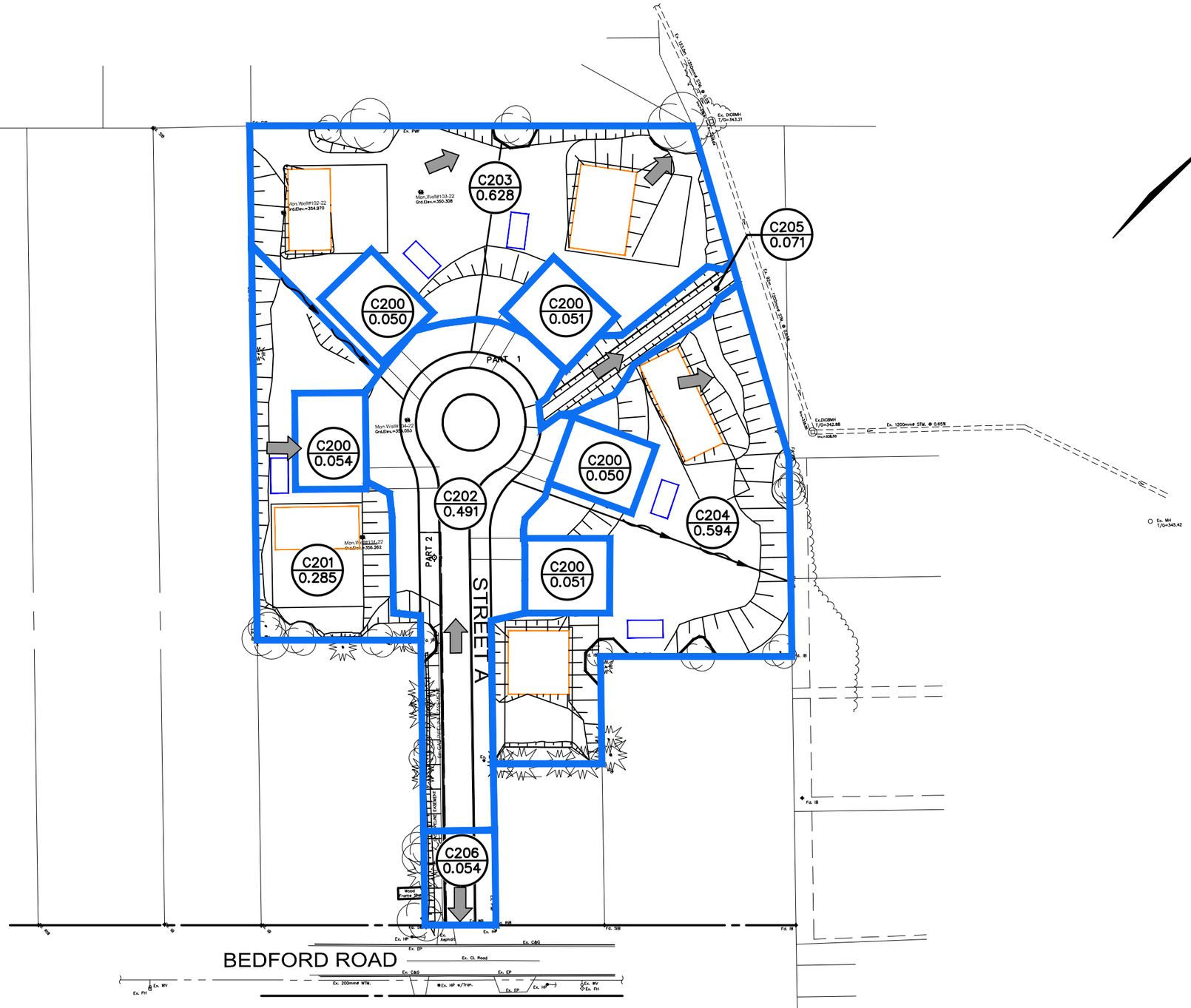
5.6 Water Quality Control

“Enhanced” quality control of stormwater runoff will be provided through a treatment train system, including on-site infiltration galleries, an Oil / Grit Separator and on-site swales. Each component of the treatment train will provide water quality treatment, such that overall TSS reduction of 80% is achieved on-site. The treatment train is summarized as follows:

- Infiltration Galleries - will accept rooftop runoff, reducing downstream flow rates, which will also reduce the interception of sediments on-site and transport of sediments downstream;
- Backyard / Side-yard Swales – will accept runoff from rear / side yards and provide an opportunity for sediment settling prior to runoff out-letting downstream;

- OGS – will accept runoff from Catchments 200 (home roof-tops), 201 (rear of Lot 1) and 202 (Street A). As this runoff is subject to vehicular traffic, total suspended solid loading is expected. The OGS has been sized as an EF06 model and will provide an estimated 87% TSS removal to contributing runoff.
- Stormwater Management Easement Swale – will provide an opportunity for settling of sediments and overall treatment of stormwater runoff, prior to on-site runoff out-letting downstream.

For more details of the OGS sizing, please see the design sheet in **Appendix B.**



LEGEND

- SITE BOUNDARY
- 407 — EXISTING CONTOURS
- 312.0 — PROPOSED FINISHED GRADE CONTOURS
- POST-DEVELOPMENT CATCHMENT
- DRAINAGE SWALE
- OVERLAND FLOW ROUTE
- C204 / 0.520 — CATCHMENT No. / AREA (Ha)

FIGURE 3.0

Date: NOV.07/22
Scale: 1:1250

POST DEVELOPMENT DRAINAGE AREA PLAN

MTE
Engineers, Scientists, Surveyors

Project No.: 51505-104

December 21, 2022 — 10:52 a.m. — Plotted By: AHewson

P:\P\51505\104\51505-104-F3-POST D.dwg

6.0 Wastewater System Design

A wastewater system was designed for each home lot to provide wastewater treatment following Part 8 of the Ontario Building Code (OBC). Conceptual sizing and grading for each on-site septic system was completed. The design of the septic system considers the expected on-site sewage flows, on-site grading constraints, separation to groundwater and other required setbacks.

For more details of the Septic System design please see the *Conceptual On-site Wastewater Treatment Design for 47 Bedford Road* (MTE, 2022) in **Appendix F.**

7.0 Erosion and Sediment Control Design

The following Erosion and Sediment Control (ESC) Plan has been prepared for the Site, to meet the *Development Standards for the Township of Guelph / Eramosa* (R.J. Burnside & Associates Limited, 2004).

This plan aims to protect the surrounding environment from sediment-laden runoff through interception of sediments on-site. The plan also aims to mitigate erosion on-site during construction activities through stabilization measures. To ensure the ESC measures implemented are satisfactory an inspection and reporting approach is outlined. The responsibilities of the contractor, consultant and home-builder in implementing the ESC Plan are also identified.

7.1 Site Specific Erosion Potential

The *Erosion & Sediment Control Guideline for Urban Construction* (Toronto and Region Conservation Authority, 2019) was used to determine the erosion potential for the Site, as a best management practice. The erosion potential was based on slope gradient, slope length and soil texture, and helped to determine the appropriate site-specific erosion control methods. The site characteristics relevant to erosion potential are as follows:

- Site Slopes: Steep (>10% slope on-site in areas);
- Slope Lengths: Short (<30m length of slope on-site in areas); and
- Erodibility Factor: Sandy silt till found on-site – High Soil Erodibility Rating.

Based on the guidelines, the Site has a high erosion risk classification. This classification was used to develop the ESC Plan.

7.2 On-Site ESC Implementation

Prior to any grading or servicing works commencing on-site, erosion and sediment control measures should be implemented. ESC measures should remain in place through to site stabilization (90% site build-out and vegetation establishment).

The ESC Measures have been designed to provide a multi-barrier approach. The following measures are to be implemented on-site:

- Construction access mud mat to provide opportunity for sediment deposition off truck wheels prior to leaving site.
- Application of 300mm of topsoil and seed to on-site designed embankments to reduce likelihood of slope erosion.

- Stabilization completed through application of 50mm topsoil and hydroseed in accordance with *OPSS572* (Ontario Provincial Standard Specification, November 2003) when an area is left exposed for a period of 30 days or greater. Following construction areas are to be re-vegetated as soon as possible to avoid on-going erosion.
- Temporary interceptor swales and rock check dams to provide sediment deposition opportunity.
- Sediment traps to collect runoff from Lot 1 and Street A, rear of Lots 2 and 3 and rear of Lot 5 to provide sediment deposition opportunity.
- Silt-sack barrier at downstream DICBMH 22A (receiving system) to provide protection from sediment-laden runoff.
- Perimeter silt fence (either light-duty or high-duty) surrounding the Site to create a barrier to off-site sediment deposition.

For more details of the on-site ESC measures, please see the enclosed **MTE Drawing 51505-104-ES1.1 – Erosion and Sediment Control Plan** and **MTE Drawing 51505-104-ES1.2 – Erosion and Sediment Details.**

7.3 ESC Implementation Roles and Responsibilities

7.3.1 Contractor Responsibilities

The contactor is responsible for construction and daily inspection / monitoring of ESC measures during the construction period. The contractor is also responsible for completing repairs to these measures, as directed by the GRCA, Township or engineering consultant. When a severe weather event is forecasted, the contractor should confirm that all ESC measures on-site are secure, relocate stockpile and materials to an appropriate location if required and cease dewatering operations. The contactor should continue to assess the ESC measures during and after the severe weather event, and if required pursue remedial action.

Furthermore, the contractor should keep additional ESC measures / materials on-site should an ESC breach occur, or site conditions deem that additional measures are necessary. Additional measures include straw bales, rock check dames, filter fabric, rip-rap, clean gravel and silt fence. In the event of emergency dewatering, gas powered pumps, appropriately sized hose, filtration hose socks and filter cloth should be available.

In the event of an ESC breach, the contractor should cease all construction related work and focus on stabilizing the site. The contractor should repair ESC measures, or apply the necessary additional measures, as soon as possible in an effort to stabilize the Site, as recommended by the consultant.

7.3.2 Consultant Responsibilities

The engineering consultant is responsible for regular inspections of the ESC measures during construction, with summary reports submitted to the Township for their review. Inspections should occur once / week during construction, after each rainfall in excess of 25mm and after a significant snowmelt. Daily inspections are required during extended rainfall or snow-melt periods. When there is no active construction on-site, the ESC inspections should occur monthly. An inspection should be competed prior to winter shut-down.

A permanent record of these inspections must be maintained on-site and be made available to the Township upon request. The consultant-led ESC inspections should document the following: Inspector’s name, any environmentally sensitive features in the area, any deficiencies on-site, recommended remedial approach and timeline, reference to construction drawings.

If an ESC breach occurs, or on-site conditions are identified which may cause erosion and sediment issues, the engineering consultant is responsible for recommending remedial action. Remedial action may include implementation of additional ESC measures on-site, and remediation should occur within 48 hours of identification.

Furthermore, the engineering consultant must develop a Contact List for the project and distribute this list at the start of construction. This list will identify point of contacts, with email addresses and phone numbers, should an ESC breach occur on-site. In the event of an ESC breach on-site, the contact list should be notified by the consultant. Within 2 business days a second email should be sent by the consultant to the contact list outlining measures taken to address the ESC breach and any details of the breach.

7.3.3 Home-Builder Responsibilities

The home-builders are responsible for any agreements with the project owner, including site and / or topsoil management.

For more details of ESC Plan roles and responsibilities, please see the Erosion and Sediment Control Notes and Details Drawing, **MTE Drawing 45774-104-ES1.1 and MTE Drawing 45774-104-ES1.2**, respectively. The Erosion and Sediment Control Notes and Details Drawing also provides more detail regarding the recommended procedure following identification of an ESC breach on-site.

7.3.4 Contact List

A contact list is to be established and distributed by the engineering consultant project manager at the initiation of construction and maintained throughout the project. The list is to consist of the following:

- Project Owner
- Engineering Consultant Project Manager
- Engineering Consultant Lead Construction Inspector
- Grand River Conservation Authority Resource Planner
- Township of Guelph-Eramosa Construction Inspector
- Grading / Servicing Contractor Site Supervisors (if applicable)
- On-call Contractor (if applicable)
- Home Builder Site Supervisor (if applicable).

8.0 Conclusions and Recommendations

Based on the foregoing analyses, it is concluded that:

i. The stormwater management strategy outlined herein will provide the 47 Bedford Site Subdivision with appropriate water quality, quantity, and erosion / sediment control.

ii. "Enhanced" quality control of stormwater runoff will be provided through a treatment train system, including on-site infiltration galleries, an on-site swale and an OGS.

iii. Water quantity control will be provided through infiltration galleries and a super-pipe system.

iv. Water pressure will be provided on-site through a looped watermain system, connected to the existing watermain on Bedford Road.

v. Wastewater produced over the Site will be serviced by private wastewater systems for each home lot.

vi. The designed erosion and sediment control plan will mitigate sediment loading to downstream receiving systems.

The findings of this report, and the above conclusions, lead to the following recommendations:

i. The on-site infiltration galleries, swale and super-pipe be constructed to provide the water quality / quantity control.

ii. The proposed watermain be constructed to provide adequate water servicing.

iii. The proposed wastewater systems be constructed to provide private wastewater treatment servicing for each lot in accordance with the Ontario Building Code.

iv. That erosion and sediment controls be implemented to protect downstream receiving systems.

All of which is respectfully submitted,

MTE Consultants Inc.

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Vice President
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CVP:sgd

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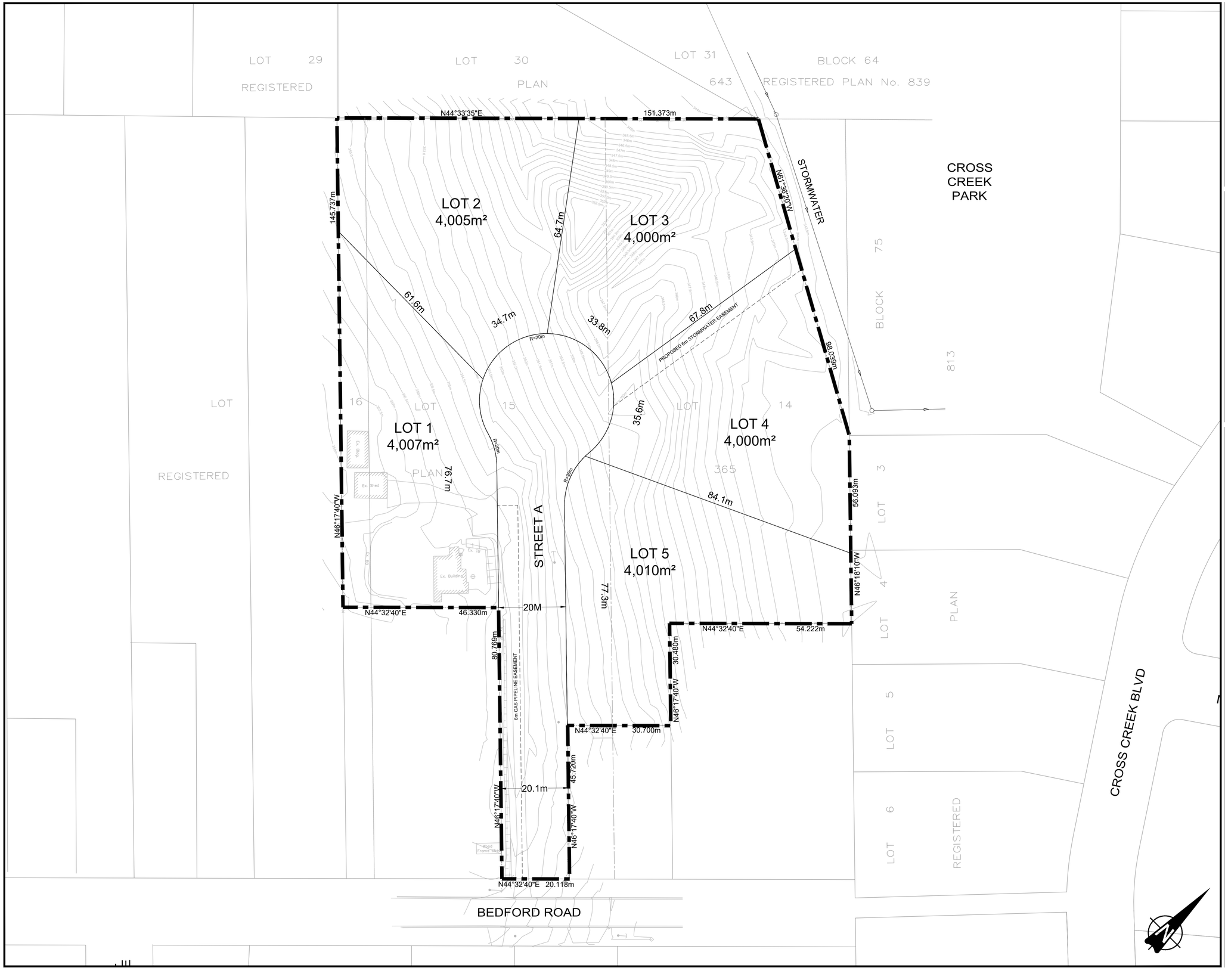
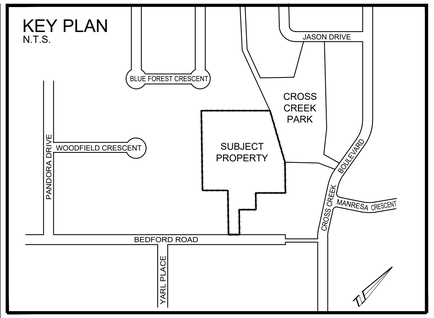
Appendix A

Legal Plans





DRAFT PLAN OF SUBDIVISION

47 BEDFORD ROAD

PART OF LOTS 14, 15, AND 16,
REGISTERED PLAN 365 (GEOGRAPHIC TOWNSHIP OF GUELPH)
TOWNSHIP OF GUELPH/ERAMOSA
COUNTY OF WELLINGTON

LAND USE SCHEDULE

DESCRIPTION	LOTS/BLKS.	UNITS	AREA (ha.)
SINGLE DETACHED	5	5	2.00ha
ROADS			0.37ha

NOTES

1. This plan is a minor modification to the original Draft Plan of Subdivision prepared by Astrid J. Clos Planning Consultants, dated August 22, 2022.

ADDITIONAL INFORMATION

(UNDER SECTION 51(17) OF THE PLANNING ACT)

INFORMATION REQUIRED BY CLAUSES a,b,c,d,e,f,g,j and l ARE AS SHOWN ON THE DRAFT PLAN.
h) Municipal water supply
k) All sanitary and storm sewers as required

OWNER'S CERTIFICATE

I AUTHORIZE THE GSP GROUP INC. TO PREPARE AND SUBMIT THIS DRAFT PLAN OF SUBDIVISION TO

OWNER _____ DATE _____

SURVEYOR'S CERTIFICATE

I CERTIFY THAT THE BOUNDARIES OF THE LAND TO BE SUBDIVIDED AND THEIR RELATIONSHIP TO THE ADJACENT LANDS ARE CORRECTLY SHOWN.

SURVEYOR _____ DATE _____

GSP group
PLANNING I URBAN DESIGN I LANDSCAPE ARCHITECTURE
gspgroup.ca

REVISIONS

Date: July 7, 2023	Drawn By: EF	Dwg. File Name:dp23039a.dwg
Scale: 1: 500	Project No.:23039	

Appendix B

SWM Calculations

47 Bedford Road
Guelph - Eramosa Township

STORM SEWER DESIGN SHEET

ENGINEERING AND PUBLIC WORKS

Project Number: 51505-104
Date: August 19, 2022
Design By: CVP
Checked By: JM
File: Q:\51505\104\swm assessment\51505-104_ swm assessment_existing conditions_20220819.xlsx

Drainage Area Plan No: 51505-104

Design Parameters

5 YEAR STORM

Q=kAIC, k=0.00278
Intensity (I) = a/(tc+b)^c
a = 1747
b = 13.7
c = 0.88442

Manning's "n" 0.013
Min. Velocity 0.60 m/s
Max. Velocity 6.00 m/s

AREA NUMBER	MANHOLE LOCATION FROM MH	MANHOLE LOCATION TO MH	STORMWATER FLOW 5 YEAR STORM: AREA (A)	RUNOFF COEFF. (C)	A x C	CUMUL. A x C	CONCENTRATION TIME: TOTAL	CONCENTRATION TIME: IN PIPE	RAIN INTENSITY (I)	FLOW (Q)	DESIGN: PIPE SIZE	Hydraulic Radius	LENGTH	SLOPE	CAPACITY	FULL FLOW VELOCITY	ACTUAL VELOCITY	PIPE FULL	Time to Flow
			ha		*ha*	*ha*	*min*	*min*	*mm/hr*	*L/s*	*mm*	*m*	*m*	*%*	*L/s*	*m/s*	*m/s*	*%*	
Leg 1																			
			0.377	0.50	0.19	0.19	15.00	2.81	89.69	47.00	300	0.08	14.00	4.00	193.40	2.74	0.66	0.00	0.35
											300	0.08	112.00	4.00	193.40	2.74	0.66	24.30	2.81
			1.752	0.40	0.70	0.89	17.81	1.94	82.59	204.17	525	0.13	110.00	0.50	304.10	1.40	0.94	67.14	1.94
			1.533	0.40	0.61	1.50	19.75		78.33	327.17									
			0.932	0.40	0.37	1.88	19.75	1.97	78.33	408.35	750	0.19	109.00	0.60	862.34	1.95	0.92	47.35	1.97
Leg 2																0.00			
			0.628	0.40	0.25	0.25	15.00	1.19	89.69	62.63	300	0.08	63.00	0.50	68.38	0.97	0.89	91.60	1.19
			0.059	0.50	0.03	0.03	15.00	6.41	89.69	7.36	300	0.08	40.00	0.50	68.38	0.97	0.10	10.76	6.41
						0.28	21.41	3.13	75.05	58.57	375	0.09	99.50	0.50	123.98	1.12	0.53	47.24	3.13
			0.185	0.50	0.09	0.37	24.53		69.60	72.21									
			0.157	0.50	0.08	0.45	24.53	1.94	69.60	87.40	375	0.09	92.00	3.00	303.68	2.75	0.79	28.78	1.94
			0.335	0.50	0.17	0.99	26.47		66.62	183.80									
			0.285	0.50	0.14	1.13	26.47	1.06	66.62	210.19	450	0.11	84.00	3.50	533.38	3.35	1.32	39.41	1.06
			0.855	0.40	0.34	1.48	27.53	2.28	65.10	267.31	675	0.17	102.00	0.40	531.63	1.49	0.75	50.28	2.28
Leg 3																0.00			
			0.348	0.50	0.17	0.17	15.00	0.88	89.69	43.38	300	0.08	32.50	2.50	152.90	2.16	0.61	28.37	0.88
						0.17	10.88	0.47	102.85	49.75	300	0.08	20.00	2.50	152.90	2.16	0.70	32.54	0.47
						0.17	11.36	3.18	101.13	48.92	375	0.09	84.50	1.50	214.73	1.94	0.44	22.78	3.18
			0.902	0.40	0.36	0.53	14.54	1.20	90.99	135.28	375	0.09	88.00	1.50	214.73	1.94	1.22	63.00	1.20
			2.293	0.40	0.92	1.45	15.73	1.24	87.71	354.05	750	0.19	59.50	0.50	787.21	1.78	0.80	44.98	1.24
						1.45	16.97	1.05	84.57	341.39	750	0.19	48.50	0.50	787.21	1.78	0.77	43.37	1.05
Leg 4																0.00			
			0.100	0.50	0.0500	0.0500	15.00	0.23	1746.74	242.8	300	0.08	48.40	2.00	136.8	1.93	3.4349	177.54	0.23
			addition of Leg 1 flow			1.9253	21.72	1.00	74.47	398.6	525	0.13	111.00	0.40	272.0	1.26	1.8413	146.54	1.00
			2.001	0.40	0.8004	0.8004	15.00	1.75	89.69	199.6	600	0.15	74.00	0.20	274.6	0.97	0.7058	72.68	1.75
						2.7257	22.72	1.49	72.65	550.5	975	0.24	66.00	0.30	1227.5	1.64	0.7373	44.85	1.49
			0.467	0.50	0.2335	2.9592	24.21	1.42	70.12	576.8	975	0.24	66.00	0.30	1227.5	1.64	0.7726	46.99	1.42
						2.9592	11.42	0.96	100.89	830.0	975	0.24	64.00	0.30	1227.5	1.64	1.1116	67.62	0.96
			addition of Leg 2 flow			4.4361	29.81	1.96	62.08	765.6	1050	0.26	104.00	0.30	1495.7	1.73	0.8842	51.19	1.96
addition of Leg 3 flow			0.100	0.50	0.0500	5.9381	31.77	1.67	59.71	985.7	1200	0.30	87.50	0.30	2135.4	1.89	0.8716	46.16	1.67
Leg 5																0.00			
			38.800	0.15	5.8200	5.8200	60.0		38.95	630.3									
			2.280	0.40	0.9120	6.7320	60.0		38.95	729.0									
			addition of Leg 4 flow			18.4901	60.00	0.54	38.95	2002.4	1350	0.34	45.50	0.50	3774.11	2.64	1.40	53.06	0.54
						18.4901	60.54	0.73	38.70	1989.4	1350	0.34	60.50	0.50	3774.11	2.64	1.39	52.71	0.73
Half of Blue Forest Rear Lots			2.310	0.40	0.9240	19.4141	60.5	1.16	38.70	2088.8	1350	0.34	101.50	0.50	3774.11	2.64	1.46	55.35	1.16
			1.029	0.40	0.4116	19.8257	61.7	1.12	38.18	2104.1	1350	0.34	99.00	0.50	3774.11	2.64	1.47	55.75	1.12
Half of Blue Forest Rear Lots			2.310	0.40	0.9240	20.7497	62.8	1.35	37.68	2173.6	1350	0.34	123.00	0.50	3774.11	2.64	1.52	57.59	1.35
			2.956	0.33	0.9755	21.7252	63.1	0.76	37.58	2269.8	1200	0.30	92.00	0.63	3094.52	2.74	2.01	73.35	0.76
			1.660	0.20	0.3320	22.0572	63.8	0.79	37.25	**2284.4**	1200	0.30	96.00	0.63	3094.52	2.74	2.02	73.82	0.79
Addition of the Site Flows			1.710	0.40	0.6840	22.7412	64.6	0.78	36.92	**2334.1**	1200	0.30	96.00	0.63	3094.52	2.74	2.06	75.43	0.78

Notes:
Rainfall data from Fergus Shad Dam rain gauge
Pipe lengths and slopes approximated from *Storm Drainage Area Plan, Silver Meadows Subdivision* (MTE, 1993)
Drainage areas from *Storm Drainage Plan, Silver Meadows Subdivision* (MTE, 1993)
Runoff Coefficient from *Storm Drainage Plan, Silver Meadows Subdivision* (MTE, 1993)
Use initial Time of Concentration of 15 min to represent single family homes and storm block / park area
The Park area (drainage area of 1.66 ha to represent block 75) was added referencing Paragon Cross-Creek Subdivision plan
The 38.00 ha drainage area to the North of the subdivision has a Time of Concentration of approximately 60 min, based on calculations.
Last leg of storm sewer assumed to be 96.00 m long, based on Google Earth measurements.

Flow in Pipe (Q_{pipe})
Q = C*I*A
C - Runoff coefficient
I = rainfall intensity (mm/hr.)
A = Drainage Area

Manning Equation for Full Flow Velocity (V_{full})
V = (1/n)*(R^1.5)*(S^0.5)
n = manning value
R = hydraulic radius of storm sewer (m)
S = slope in %

Equation for Pipe Capacity (Q_{cap})
Q = V * A
Q = V * PI * R^2

Actual Velocity (V_{act})
V = Q_{pipe} / A_{pipe}

% Pipe Full = Q_{pipe} / Q_{cap}

Time to Flow = V_{act} / Pipe Length

47 Bedford Road Subdivision
Township of Guelph - Eramosa

Project No.: 51505-104
Date: 4/11/2022
Design By: CVP
Checked By:

IDF Parameters
Design Storm Frequency: 5 year
a = 1746.737
b = 13.708
c = 0.884
Tc = 10 min

Table 1 - Storm Sewer Design

LOCATION					STORM FLOW								DESIGN							
CATCHMENT NO.	STREET NAME	FROM MH	TO MH	PIPE	AREA	IMPERVIOUS COVERAGE	RUNOFF COEFFICIENT	A x C	CUMM. A x C	TIME OF CONCEN.	RAIN INTENSITY	PEAK FLOW	PIPE DIAMETER	SLOPE	LENGTH	CAPACITY	FLOW VELOCITY	CAPACITY VELOCITY	TIME IN PIPE	% PIPE FULL
					(ha.)	(%)	"C"			(min.)	(mm/hr)	(m^3/sec)	(mm)	(%)	(m)	(m^3/sec)	(m/sec)	(m/sec)	(min.)	
C200, C201, C202, C205	STREET A				1.032	55.00	0.55	0.568	0.57	10.00	106.37	0.17								
		1	2	PIPE 1									375	2.28	60.0	0.26	1.52	2.40	0.417	63.38
									0.57	10.42	104.74	0.17								
		2	3	PIPE 2									375	8.50	21.7	0.51	1.50	4.63	0.078	32.32
									0.57	10.50	104.44	0.16								
		3	EF06	PIPE 3									375	7.20	3.5	0.47	1.49	4.26	0.014	35.02
									0.57	10.51	104.39	0.16								
		EF06	MH4	PIPE 4									375	7.20	3.6	0.47	1.49	4.26	0.014	35.00
		4	5	PIPE 5	0.071	2.00	0.02	0.001					1650	7.20	67.0	24.44	0.08	11.44	0.098	0.67
									0.57	10.61	104.02	0.16								
		5	6	PIPE 5									375	5.26	7.1	0.40	1.49	3.64	0.033	40.91

Notes:

Impervious area of each catchment measured from *47 Bedford Road Grading Plan* (MTE, 2022)

For design purposes, runoff coefficient was set equal to the impervious coverage.

Pipe characteristics confirmed with *47 Bedford Road Plan and Profile Drawing of Street A* (MTE, 2022)

Initial tc set to 10 min

Manning's n value is 0.013 to represent a concrete pipe

Minimum pipe velocity is 0.75 m/s, maximum pipe velocity is 4.5 m/s (Guelph Eramosa Township Development Standards, p. 38)

As per *47 Bedford Road Geotechnical Investigation* (MTE, 2022) no bedrock was found on-site

Equations:

Rainfall Intensity I = a / (t + b) ^c

Runoff Q = A*V

Velocity V = 1/ n * R^ 2/3 * S^0.5

A = drainage area (ha)

n = manning n value

R = hydraulic radius (m) (Area / Perimeter, equates to Diameter / 4)

S = gradient of pipe in m/m

47 Bedford Road - Infiltration Footprint Sizing
51505-104
4/11/2022
CVP

Table 1 - Required Cell Depth (m)

Native Soil Percolation Rate - P (mm/hr)	15.00
Void Ratio	0.40
Draw-down Time - T (hr)	48.00
Maximum Surface Ponding - dp (mm)	300
Maximum biocell depth - d cmax (mm)	1050

Table 2 - Imfilration Footprint Area per House (m^2)

Storm to be Infiltrated - DS (mm)	25
Drainage Area - A (ha)	0.05
Volume to be Infiltrated - V (m^3)	**12.5**
Native Soil Percoaltion Rate - P (mm/hr)	15.00
Retention Time - t (hr)	48.00
Void Ratio - n	0.40
Footprint Surface Area - A (m^2)	43.40
Footprint Length - L (m)	8.68
Footprint Width - W (m)	5.00

Table 3 - Infiltration Outflow (m^3/s)

Contact Area of Gallery - A (m^2)	43.40
Percolation Rate - P (mm/hr)	15.00
Gradiant - I - (gradient in m/m)	1.00
Outflow -Q - (m^3/s)	0.00018

Table 4 - Infiltration Inflow (m^3/s)

Contact Area of Gallery - A (m^2)	43.40
Inflow (mm/hr)	1.04
Gradiant - I - (gradient in m/m)	1.00
Inflow -I - (m^3/s)	0.0000126

Notes:
Percolation rate - based on hydrogeology of soil in area, from *47 Bedford Road Geotechnical Investigation* (MTE, 2022).
Assume we need to infiltrate the 25 mm event over the roof-top area
Bottom area of infiltration used as effective contact area for infiltration
Water Table - minimum seperation of 1 metre to groundwater (CVC LID Design Manual, 4-68)
Assume a 48-hr retention time for the 25 mm event (LID Design Manual, CVC, 4-57)
Q=K*A*I (Darcy's Law)

Equations used:

$$A = \frac{1{,}000\,V}{P\,n\,\Delta t}$$ Equation 4.3: Infiltration Trench Bottom Area

where V = 8 m³ (runoff volume to be infiltrated: 20 mm × 400 m² rooftop area for four units)
P = 50 mm/h (percolation rate of surrounding native soil)
n = 0.4 (porosity for clear stone)
Δt = 24 h (retention time)

Based on Equation 4.2, the maximum allowable soakaway pit depth is 1.2 m deep.

Maximum Allowable Soakaway Pit depth = P T Equation 4.2

where P = 50 mm/h (minimum percolation rate)
T = 24 h (drawdown time)

$$d_{c\,max} = i * (t_s - d_p / i) / V_r$$

Where:
$d_{c\,max}$ = Maximum bioretention cell depth (mm)
i = Infiltration rate for native soils (mm/hr)
V_r = Void space ratio for filter bed and gravel storage layer (assume 0.4)
t_s = Time to drain (design for 48 hour time to drain is recommended)
d_p = Maximum surface ponding depth (mm)

Worksheet for D/S SWM Easement

Project Description	
Friction Method	Manning Formula
Solve For	Discharge

Input Data		
Roughness Coefficient	0.030	
Channel Slope	0.114	m/m
Normal Depth	1,070.0	mm
Left Side Slope	3.000	H:V
Right Side Slope	3.000	H:V
Bottom Width	3.00	m

Results		
Discharge	57,947.57	L/s
Flow Area	6.6	m²
Wetted Perimeter	9.8	m
Hydraulic Radius	680.3	mm
Top Width	9.42	m
Critical Depth	1,940.3	mm
Critical Slope	0.009	m/m
Velocity	8.72	m/s
Velocity Head	3.88	m
Specific Energy	4.95	m
Froude Number	3.316	
Flow Type	Supercritical	

GVF Input Data		
Downstream Depth	0.0	mm
Length	0.0	m
Number Of Steps	0	

GVF Output Data		
Upstream Depth	0.0	mm
Profile Description	N/A	
Profile Headloss	0.00	m
Downstream Velocity	Infinity	m/s
Upstream Velocity	Infinity	m/s
Normal Depth	1,070.0	mm
Critical Depth	1,940.3	mm
Channel Slope	0.114	m/m
Critical Slope	0.009	m/m

Stormceptor®

FORTERRA

Stormceptor® EF Sizing Report

STORMCEPTOR®
ESTIMATED NET ANNUAL SEDIMENT (TSS) LOAD REDUCTION

01/03/2023

Province:	Ontario
City:	Guelph - Eramosa Township
Nearest Rainfall Station:	WATERLOO WELLINGTON AP
Climate Station Id:	6149387
Years of Rainfall Data:	34

Site Name:	

Drainage Area (ha):	1.03
% Imperviousness:	54.00

Runoff Coefficient 'c': 0.62

Particle Size Distribution:	Fine
Target TSS Removal (%):	80.0

Project Name:	47 Bedford Road
Project Number:	51505-104
Designer Name:	Claire Phelps
Designer Company:	MTE Consultants
Designer Email:	CPhelps@mte85.com
Designer Phone:	151-974-3650
EOR Name:	
EOR Company:	
EOR Email:	
EOR Phone:	

Required Water Quality Runoff Volume Capture (%):	90.00
Estimated Water Quality Flow Rate (L/s):	24.35
Oil / Fuel Spill Risk Site?	Yes
Upstream Flow Control?	No
Peak Conveyance (maximum) Flow Rate (L/s):	
Site Sediment Transport Rate (kg/ha/yr):	

Net Annual Sediment (TSS) Load Reduction Sizing Summary

Stormceptor Model	TSS Removal Provided (%)
EFO4	77
EFO6	87
EFO8	93
EFO10	96
EFO12	98

Recommended Stormceptor EFO Model: EFO6

Estimated Net Annual Sediment (TSS) Load Reduction (%): 87

Water Quality Runoff Volume Capture (%): > 90

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THIRD-PARTY TESTING AND VERIFICATION

►**Stormceptor® EF and Stormceptor® EFO** are the latest evolutions in the Stormceptor® oil-grit separator (OGS) technology series, and are designed to remove a wide variety of pollutants from stormwater and snowmelt runoff. These technologies have been third-party tested in accordance with the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators** and performance has been third-party verified in accordance with the **ISO 14034 Environmental Technology Verification (ETV)** protocol.

PERFORMANCE

►**Stormceptor® EF and EFO** remove stormwater pollutants through gravity separation and floatation, and feature a patent-pending design that generates positive removal of total suspended solids (TSS) throughout each storm event, including high-intensity storms. Captured pollutants include sediment, free oils, and sediment-bound pollutants such as nutrients, heavy metals, and petroleum hydrocarbons. Stormceptor is sized to remove a high level of TSS from the frequent rainfall events that contribute the vast majority of annual runoff volume and pollutant load. The technology incorporates an internal bypass to convey excessive stormwater flows from high-intensity storms through the device without resuspension and washout (scour) of previously captured pollutants. Proper routine maintenance ensures high pollutant removal performance and protection of downstream waterways.

PARTICLE SIZE DISTRIBUTION (PSD)

►The **Canadian ETV PSD** shown in the table below was used, or in part, for this sizing. This is the identical PSD that is referenced in the Canadian ETV ***Procedure for Laboratory Testing of Oil-Grit Separators*** for both sediment removal testing and scour testing. The Canadian ETV PSD contains a wide range of particle sizes in the sand and silt fractions, and is considered reasonably representative of the particle size fractions found in typical urban stormwater runoff.

Particle Size (µm)	Percent Less Than	Particle Size Fraction (µm)	Percent
1000	100	500-1000	5
500	95	250-500	5
250	90	150-250	15
150	75	100-150	15
100	60	75-100	10
75	50	50-75	5
50	45	20-50	10
20	35	8-20	15
8	20	5-8	10
5	10	2-5	5
2	5	<2	5

Stormceptor® EF Sizing Report

Rainfall Intensity (mm / hr)	Percent Rainfall Volume (%)	Cumulative Rainfall Volume (%)	Flow Rate (L/s)	Flow Rate (L/min)	Surface Loading Rate (L/min/m²)	Removal Efficiency (%)	Incremental Removal (%)	Cumulative Removal (%)
0.5	8.5	8.5	0.89	54.0	20.0	100	8.5	8.5
1	18.3	26.8	1.79	107.0	41.0	100	18.3	26.8
2	14.4	41.3	3.57	214.0	82.0	98	14.2	41.0
3	10.2	51.5	5.36	322.0	122.0	93	9.5	50.6
4	8.0	59.5	7.15	429.0	163.0	88	7.1	57.6
5	6.9	66.4	8.93	536.0	204.0	83	5.8	63.4
6	5.9	72.3	10.72	643.0	245.0	81	4.8	68.2
7	3.8	76.1	12.51	750.0	285.0	79	3.0	71.2
8	2.6	78.7	14.29	858.0	326.0	78	2.0	73.2
9	2.5	81.1	16.08	965.0	367.0	76	1.9	75.0
10	2.2	83.3	17.87	1072.0	408.0	74	1.6	76.6
11	2.5	85.8	19.65	1179.0	448.0	72	1.8	78.4
12	2.0	87.8	21.44	1286.0	489.0	70	1.4	79.8
13	1.6	89.4	23.23	1394.0	530.0	68	1.1	80.9
14	0.9	90.4	25.01	1501.0	571.0	66	0.6	81.6
15	1.6	91.9	26.80	1608.0	611.0	65	1.0	82.6
16	1.1	93.0	28.59	1715.0	652.0	64	0.7	83.3
17	1.0	94.0	30.37	1822.0	693.0	64	0.7	83.9
18	0.5	94.6	32.16	1930.0	734.0	64	0.3	84.3
19	0.2	94.8	33.95	2037.0	774.0	63	0.1	84.4
20	0.6	95.4	35.74	2144.0	815.0	63	0.4	84.8
21	0.6	96.1	37.52	2251.0	856.0	63	0.4	85.2
22	0.3	96.4	39.31	2359.0	897.0	62	0.2	85.4
23	0.8	97.2	41.10	2466.0	938.0	62	0.5	85.9
24	0.4	97.6	42.88	2573.0	978.0	62	0.3	86.2
25	0.2	97.8	44.67	2680.0	1019.0	61	0.1	86.3
30	0.9	98.7	53.60	3216.0	1223.0	56	0.5	86.8
35	0.8	99.5	62.54	3752.0	1427.0	52	0.4	87.2
40	0.2	99.7	71.47	4288.0	1631.0	45	0.1	87.3
45	0.3	100.0	80.40	4824.0	1834.0	40	0.1	87.4
Estimated Net Annual Sediment (TSS) Load Reduction =								**87 %**

Climate Station ID: 6149387 *Years of Rainfall Data*: 34

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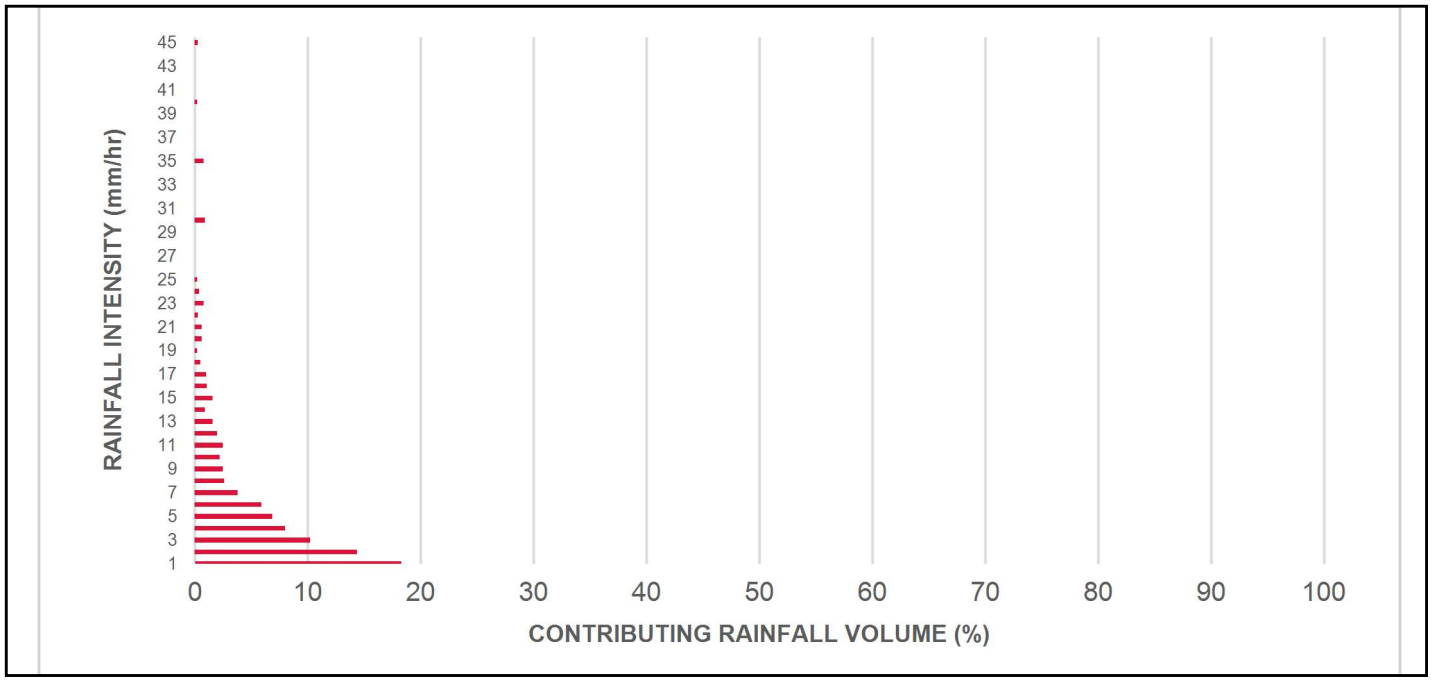
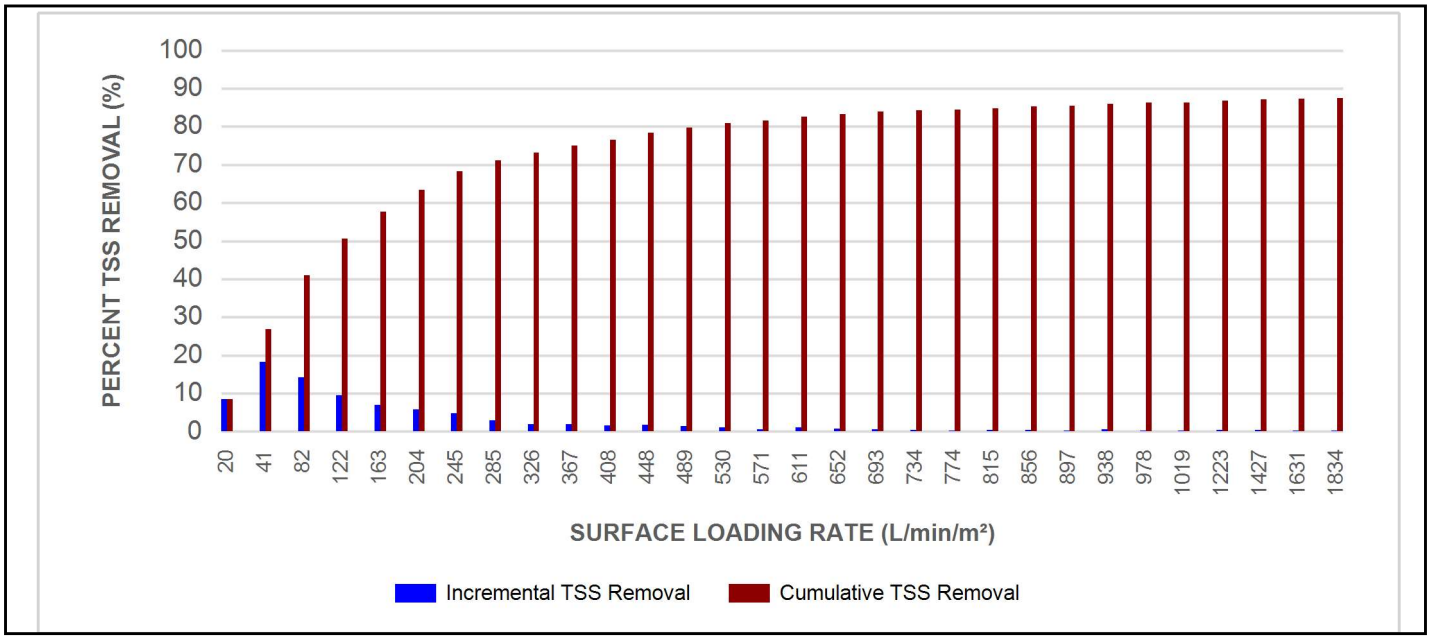
RAINFALL DATA FROM WATERLOO WELLINGTON AP RAINFALL STATION



INCREMENTAL AND CUMULATIVE TSS REMOVAL FOR THE RECOMMENDED STORMCEPTOR® MODEL



Maximum Pipe Diameter / Peak Conveyance

Stormceptor EF / EFO	Model Diameter		Min Angle Inlet / Outlet Pipes	Max Inlet Pipe Diameter		Max Outlet Pipe Diameter		Peak Conveyance Flow Rate	
	(m)	(ft)		(mm)	(in)	(mm)	(in)	(L/s)	(cfs)
EF4 / EFO4	1.2	4	90	609	24	609	24	425	15
EF6 / EFO6	1.8	6	90	914	36	914	36	990	35
EF8 / EFO8	2.4	8	90	1219	48	1219	48	1700	60
EF10 / EFO10	3.0	10	90	1828	72	1828	72	2830	100
EF12 / EFO12	3.6	12	90	1828	72	1828	72	2830	100

SCOUR PREVENTION AND ONLINE CONFIGURATION

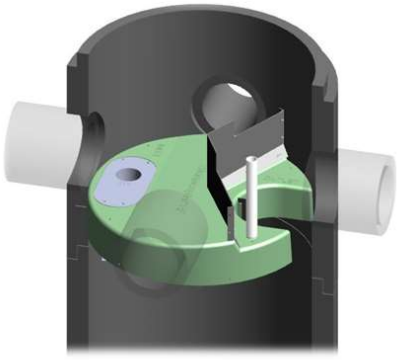
►**Stormceptor® EF and EFO** feature an internal bypass and superior scour prevention technology that have been demonstrated in third-party testing according to the scour testing provisions of the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators**, and the exceptional scour test performance has been third-party verified in accordance with the ISO 14034 ETV protocol. As a result, Stormceptor EF and EFO are approved for online installation, eliminating the need for costly additional bypass structures, piping, and installation expense.

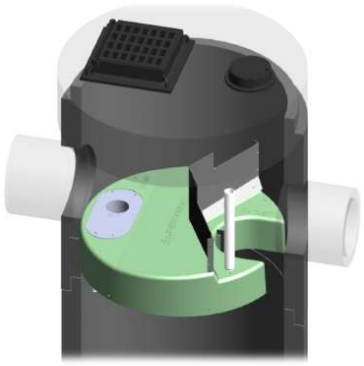
DESIGN FLEXIBILITY

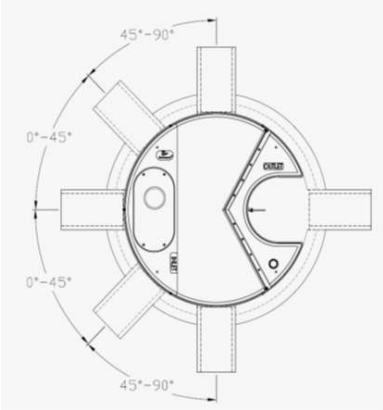
►**Stormceptor® EF** and **EFO** offers design flexibility in one simplified platform, accepting stormwater flow from a single inlet pipe or multiple inlet pipes, and/or surface runoff through an inlet grate. The device can also serve as a junction structure, accommodate a 90-degree inlet-to-outlet bend angle, and can be modified to ensure performance in submerged conditions.

OIL CAPTURE AND RETENTION

►While Stormceptor® EF will capture and retain oil from dry weather spills and low intensity runoff, **Stormceptor® EFO** has demonstrated superior oil capture and greater than 99% oil retention in third-party testing according to the light liquid re-entrainment testing provisions of the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators**. Stormceptor EFO is recommended for sites where oil capture and retention is a requirement.







INLET-TO-OUTLET DROP

Elevation differential between inlet and outlet pipe inverts is dictated by the angle at which the inlet pipe(s) enters the unit.

0° - 45° : The inlet pipe is 1-inch (25mm) higher than the outlet pipe.

45° - 90° : The inlet pipe is 2-inches (50mm) higher than the outlet pipe.

HEAD LOSS

The head loss through Stormceptor EF is similar to that of a 60-degree bend structure. The applicable K value for calculating minor losses through the unit is 1.1. For submerged conditions the applicable K value is 3.0.

Pollutant Capacity

Stormceptor EF / EFO	Model Diameter		Depth (Outlet Pipe Invert to Sump Floor)		Oil Volume		Recommended Sediment Maintenance Depth *		Maximum Sediment Volume *		Maximum Sediment Mass **	
	(m)	(ft)	(m)	(ft)	(L)	(Gal)	(mm)	(in)	(L)	(ft^3)	(kg)	(lb)
EF4 / EFO4	1.2	4	1.52	5.0	265	70	203	8	1190	42	1904	5250
EF6 / EFO6	1.8	6	1.93	6.3	610	160	305	12	3470	123	5552	15375
EF8 / EFO8	2.4	8	2.59	8.5	1070	280	610	24	8780	310	14048	38750
EF10 / EFO10	3.0	10	3.25	10.7	1670	440	610	24	17790	628	28464	78500
EF12 / EFO12	3.6	12	3.89	12.8	2475	655	610	24	31220	1103	49952	137875

*Increased sump depth may be added to increase sediment storage capacity

** Average density of wet packed sediment in sump = 1.6 kg/L (100 lb/ft^3)

Feature	Benefit	Feature Appeals To
Patent-pending enhanced flow treatment and scour prevention technology	Superior, verified third-party performance	Regulator, Specifying & Design Engineer
Third-party verified light liquid capture and retention for EFO version	Proven performance for fuel/oil hotspot locations	Regulator, Specifying & Design Engineer, Site Owner
Functions as bend, junction or inlet structure	Design flexibility	Specifying & Design Engineer
Minimal drop between inlet and outlet	Site installation ease	Contractor
Large diameter outlet riser for inspection and maintenance	Easy maintenance access from grade	Maintenance Contractor & Site Owner

STANDARD STORMCEPTOR EF/EFO DRAWINGS

For standard details, please visit http://www.imbriumsystems.com/stormwater-treatment-solutions/stormceptor-ef

STANDARD STORMCEPTOR EF/EFO SPECIFICATION

For specifications, please visit http://www.imbriumsystems.com/stormwater-treatment-solutions/stormceptor-ef

STANDARD PERFORMANCE SPECIFICATION FOR "OIL GRIT SEPARATOR" (OGS) STORMWATER QUALITY TREATMENT DEVICE

PART 1 – GENERAL

1.1 WORK INCLUDED

This section specifies requirements for selecting, sizing, and designing an underground Oil Grit Separator (OGS) device for stormwater quality treatment, with third-party testing results and a Statement of Verification in accordance with ISO 14034 Environmental Management – Environmental Technology Verification (ETV).

1.2 REFERENCE STANDARDS & PROCEDURES

ISO 14034:2016 Environmental management – Environmental technology verification (ETV)

Canadian Environmental Technology Verification (ETV) Program's **Procedure for Laboratory Testing of Oil-Grit Separators**

1.3 SUBMITTALS

1.3.1 All submittals, including sizing reports & shop drawings, shall be submitted upon request with each order to the contractor then forwarded to the Engineer of Record for review and acceptance. Shop drawings shall detail all OGS components, elevations, and sequence of construction.

1.3.2 Alternative devices shall have features identical to or greater than the specified device, including: treatment chamber diameter, treatment chamber wet volume, sediment storage volume, and oil storage volume.

1.3.3 Unless directed otherwise by the Engineer of Record, OGS stormwater quality treatment product substitutions or alternatives submitted within ten days prior to project bid shall not be accepted. All alternatives or substitutions submitted shall be signed and sealed by a local registered Professional Engineer, based on the exact same criteria detailed in Section 3, in entirety, subject to review and approval by the Engineer of Record.

PART 2 – PRODUCTS

2.1 OGS POLLUTANT STORAGE

The OGS device shall include a sump for sediment storage, and a protected volume for the capture and storage of petroleum hydrocarbons and buoyant gross pollutants. The minimum sediment & petroleum hydrocarbon storage capacity shall be as follows:

2.1.1	4 ft (1219 mm) Diameter OGS Units:	1.19 m^3 sediment / 265 L oil
	6 ft (1829 mm) Diameter OGS Units:	3.48 m^3 sediment / 609 L oil
	8 ft (2438 mm) Diameter OGS Units:	8.78 m^3 sediment / 1,071 L oil
	10 ft (3048 mm) Diameter OGS Units:	17.78 m^3 sediment / 1,673 L oil
	12 ft (3657 mm) Diameter OGS Units:	31.23 m^3 sediment / 2,476 L oil

PART 3 – PERFORMANCE & DESIGN

3.1 GENERAL

The OGS stormwater quality treatment device shall be verified in accordance with ISO 14034:2016 Environmental management – Environmental technology verification (ETV). The OGS stormwater quality treatment device shall

remove oil, sediment and gross pollutants from stormwater runoff during frequent wet weather events, and retain these pollutants during less frequent high flow wet weather events below the insert within the OGS for later removal during maintenance. The Manufacturer shall have at least ten (10) years of local experience, history and success in engineering design, manufacturing and production and supply of OGS stormwater quality treatment device systems, acceptable to the Engineer of Record.

3.2 SIZING METHODOLOGY

The OGS device shall be engineered, designed and sized to provide stormwater quality treatment based on treating a minimum of 90 percent of the average annual runoff volume and a minimum removal of an annual average 60% of the sediment (TSS) load based on the Particle Size Distribution (PSD) specified in the sizing report for the specified device. Sizing of the OGS shall be determined by use of a minimum ten (10) years of local historical rainfall data provided by Environment Canada. Sizing shall also be determined by use of the sediment removal performance data derived from the ISO 14034 ETV third-party verified laboratory testing data from testing conducted in accordance with the Canadian ETV protocol Procedure for Laboratory Testing of Oil-Grit Separators, as follows:

3.2.1 Sediment removal efficiency for a given surface loading rate and its associated flow rate shall be based on sediment removal efficiency demonstrated at the seven (7) tested surface loading rates specified in the protocol, ranging 40 L/min/m^2 to 1400 L/min/m^2, and as stated in the ISO 14034 ETV Verification Statement for the OGS device.

3.2.2 Sediment removal efficiency for surface loading rates between 40 L/min/m^2 and 1400 L/min/m^2 shall be based on linear interpolation of data between consecutive tested surface loading rates.

3.2.3 Sediment removal efficiency for surface loading rates less than the lowest tested surface loading rate of 40 L/min/m^2 shall be assumed to be identical to the sediment removal efficiency at 40 L/min/m^2. No extrapolation shall be allowed that results in a sediment removal efficiency that is greater than that demonstrated at 40 L/min/m^2.

3.2.4 Sediment removal efficiency for surface loading rates greater than the highest tested surface loading rate of 1400 L/min/m^2 shall assume zero sediment removal for the portion of flow that exceeds 1400 L/min/m^2, and shall be calculated using a simple proportioning formula, with 1400 L/min/m^2 in the numerator and the higher surface loading rate in the denominator, and multiplying the resulting fraction times the sediment removal efficiency at 1400 L/min/m^2.

The OGS device shall also have sufficient annual sediment storage capacity as specified and calculated in Section 2.1.

3.3 CANADIAN ETV or ISO 14034 ETV VERIFICATION OF SCOUR TESTING

The OGS device shall have Canadian ETV or ISO 14034 ETV Verification of third-party scour testing conducted in accordance with the Canadian ETV Program's **Procedure for Laboratory Testing of Oil-Grit Separators.**

3.3.1 To be acceptable for on-line installation, the OGS device must demonstrate an average scour test effluent concentration less than 10 mg/L at each surface loading rate tested, up to and including 2600 L/min/m^2.

3.4 LIGHT LIQUID RE-ENTRAINMENT SIMULATION TESTING

The OGS device shall have Canadian ETV or ISO 14034 ETV Verification of completed third-party Light Liquid Re-entrainment Simulation Testing in accordance with the Canadian ETV **Program's Procedure for Laboratory Testing of Oil-Grit Separators,** with results reported within the Canadian ETV or ISO 14034 ETV verification. This re-entrainment testing is conducted with the device pre-loaded with low density polyethylene (LDPE) plastic beads as a surrogate for light liquids such as oil and fuel. Testing is conducted on the same OGS unit tested for sediment removal to

assess whether light liquids captured after a spill are effectively retained at high flow rates.

3.4.1 For an OGS device to be an acceptable stormwater treatment device on a site where vehicular traffic occurs and the potential for an oil or fuel spill exists, the OGS device must have reported verified performance results of greater than 99% cumulative retention of LDPE plastic beads for the five specified surface loading rates (ranging 200 L/min/m^2 to 2600 L/min/m^2) in accordance with the Light Liquid Re-entrainment Simulation Testing within the Canadian ETV Program's **Procedure for Laboratory Testing of Oil-Grit Separators.** However, an OGS device shall not be allowed if the Light Liquid Re-entrainment Simulation Testing was performed with screening components within the OGS device that are effective at retaining the LDPE plastic beads, but would not be expected to retain light liquids such as oil and fuel.

Appendix C

Hydrologic Model

47 Bedford Road, Township of Guelph - Eramosa
Flow Determination
MIDUSS Model Development

Project Number: 51505-104
Date: 2022-11-04
Design By: CVP
File: 47 Bedford Road Subdivision

Table 1 - MIDUSS Model Parameters - Existing and Proposed Conditions

Catchment	Description	Catchment Parameters				Pervious Catchment Parameters	Impervious Catchment Parameters
		Drainage Area (ha)	Impervious Coverage (%)	Flow Length (m)	Overland Slope (%)	Manning N	Manning N
Existing Conditions							
101	Existing Site area to SWM easement	2.287	5.00	160.00	8.75	0.03	0.015
102	Existing Site area to Bedford Rd	0.092	16.00	34.00	6.85	0.03	0.015
Proposed Conditions							
200	Rooftop Areas on-site	0.256	99.00	25.00	30.00	0.03	0.015
201	Rear of Lot 1	0.285	2.00	51.00	3.58	0.03	0.015
202	Road-way (Street A)	0.491	60.00	128.00	1.41	0.03	0.015
203	Rear of Lots 2+3	0.628	2.00	80.00	10.40	0.03	0.015
204	Rear of Lots 4+5	0.594	2.00	60.00	15.34	0.03	0.015
205	Swale	0.071	2.00	71.00	11.44	0.03	0.015
206	Uncontrolled area to Bedford Road	0.054	70.00	25.00	0.75	0.03	0.015

Notes:
Drainage catchment areas and time of concentration to DICBMH 22A determined from *Storm Drainage Plan, Cross Creek Phase II Subdivision* (Paragon, 1996)
IDF rainfall data from Fergus Shand Dam parameters, Environment Canada
Hygrologic Soil group of area set as from Lot Servicing Report, Silver Meadows Subdivision (MTE, 1992). In boreholes subsurface layer was found to be Sand and Sand / Silt Till, set as Soil Group A
Catchment flow path lengths from preliminary grading plan (AG1.1)
Catchment areas measured from preliminary grading plan (AG1.1)
Impervious area measured from the preliminary grading plan (AG1.1)
Overland flow slope measured from preliminary grading plan (AG1.1)
Pervious Parameters determination:
Manning N set using Manning n for Channels Table (Chow, 1959). Pervious n set as 0.03 to represent grass and clean channel.
Impervious Parameters determination:
Manning N set using Manning n for Channels Table (Chow, 1959). Impervious n set as 0.015 to represent asphalt (pavement)

```
"                MIDUSS Output ------------------------------------------------>"
"                MIDUSS version                            Version 2.25  rev. 473"
"                MIDUSS created                          Sunday, February 7, 2010"
"           10   Units used:                                          ie METRIC"
"                Job folder:                        Q:\51505\104\swm assessment\"
"                                                      existing conditions model"
"                Output filename:             predevelopment site_5 yr_itr8.out"
"                Licensee name:                                              A"
"                Company                                                      "
"                Date & Time last used:                 11/11/2022 at 9:37:18 AM"
" 31          TIME PARAMETERS"
"        5.000   Time Step"
"      180.000   Max. Storm length"
"     1500.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"            1   Chicago storm"
"     1746.740   Coefficient A"
"       13.708   Constant B"
"        0.884   Exponent C"
"        0.400   Fraction R"
"      180.000   Duration"
"        1.000   Time step multiplier"
"             Maximum intensity           131.146    mm/hr"
"             Total depth                  49.832    mm"
"            6   005hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 101"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          101   Existing site area to SWM easement"
"        5.000   % Impervious"
"        2.287   Total Area"
"      160.000   Flow length"
"        8.750   Overland Slope"
"        2.173   Pervious Area"
"      160.000   Pervious length"
"        8.750   Pervious slope"
"        0.114   Impervious Area"
"      160.000   Impervious length"
"        8.750   Impervious slope"
"        0.030   Pervious Manning 'n'"
"       63.310   Pervious SCS Curve No."
"        0.209   Pervious Runoff coefficient"
"        0.034   Pervious Ia/S coefficient"
"        5.007   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.104   Impervious SCS Curve No."
"        0.882   Impervious Runoff coefficient"
"        0.106   Impervious Ia/S coefficient"
"        0.520   Impervious Initial abstraction"
```

```
"                    0.117     0.000     0.000     0.000 c.m/sec"
"             Catchment 101          Pervious   Impervious Total Area "
"             Surface Area           2.173      0.114      2.287      hectare"
"             Time of concentration  10.373     3.546      9.133      minutes"
"             Time to Centroid       110.645    91.320     107.137    minutes"
"             Rainfall depth         49.832     49.832     49.832     mm"
"             Rainfall volume        1082.68    56.98      1139.66    c.m"
"             Rainfall losses        39.404     5.878      37.728     mm"
"             Runoff depth           10.428     43.954     12.104     mm"
"             Runoff volume          226.57     50.26      276.83     c.m"
"             Runoff coefficient     0.209      0.882      0.243      "
"             Maximum flow           0.101      0.031      0.117      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.117     0.117     0.000     0.000"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                    0.117     0.117     0.117     0.000"
" 40          HYDROGRAPH   Combine    3"
"            6   Combine "
"            3   Node #"
"                Exisitng flow off-site"
"             Maximum flow                 0.117    c.m/sec"
"             Hydrograph volume          276.827    c.m"
"                    0.117     0.117     0.117     0.117"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                    0.117     0.000     0.117     0.117"
" 33          CATCHMENT 102"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          102   flow to Bedford Rd"
"       16.000   % Impervious"
"        0.092   Total Area"
"       34.000   Flow length"
"        6.850   Overland Slope"
"        0.077   Pervious Area"
"       34.000   Pervious length"
"        6.850   Pervious slope"
"        0.015   Impervious Area"
"       34.000   Impervious length"
"        6.850   Impervious slope"
"        0.030   Pervious Manning 'n'"
"       63.310   Pervious SCS Curve No."
"        0.208   Pervious Runoff coefficient"
"        0.034   Pervious Ia/S coefficient"
"        5.005   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.104   Impervious SCS Curve No."
```

```
"        0.887   Impervious Runoff coefficient"
"        0.106   Impervious Ia/S coefficient"
"        0.520   Impervious Initial abstraction"
"                     0.008     0.000     0.117     0.117 c.m/sec"
"             Catchment 102          Pervious   Impervious Total Area "
"             Surface Area           0.077      0.015      0.092      hectare"
"             Time of concentration  4.407      1.507      3.108      minutes"
"             Time to Centroid       103.347    88.232     96.577     minutes"
"             Rainfall depth         49.832     49.832     49.832     mm"
"             Rainfall volume        38.51      7.34       45.85      c.m"
"             Rainfall losses        39.456     5.631      34.044     mm"
"             Runoff depth           10.377     44.202     15.789     mm"
"             Runoff volume          8.02       6.51       14.53      c.m"
"             Runoff coefficient     0.208      0.887      0.317      "
"             Maximum flow           0.005      0.004      0.008      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.008     0.008     0.117     0.117"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                     0.008     0.008     0.008     0.117"
" 40          HYDROGRAPH   Combine    3"
"            6   Combine "
"            3   Node #"
"                Exisitng flow off-site"
"             Maximum flow                  0.123    c.m/sec"
"             Hydrograph volume           291.352    c.m"
"                     0.008     0.008     0.008     0.123"
" 38          START/RE-START TOTALS 102"
"            3   Runoff Totals on EXIT"
"             Total Catchment area                       2.379    hectare"
"             Total Impervious area                      0.129    hectare"
"             Total % impervious                         5.425"
" 19          EXIT"
```

```
"                MIDUSS Output ------------------------------------------------>"
"                MIDUSS version                            Version 2.25  rev. 473"
"                MIDUSS created                          Sunday, February 7, 2010"
"           10   Units used:                                          ie METRIC"
"                Job folder:                        Q:\51505\104\swm assessment\"
"                                                      existing conditions model"
"                Output filename:           predevelopment site_100 yr_itr8.out"
"                Licensee name:                                               A"
"                Company                                                       "
"                Date & Time last used:                 11/11/2022 at 9:24:32 AM"
" 31          TIME PARAMETERS"
"        5.000   Time Step"
"      180.000   Max. Storm length"
"     1500.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"            1   Chicago storm"
"     5061.200   Coefficient A"
"       22.167   Constant B"
"        0.958   Exponent C"
"        0.400   Fraction R"
"      180.000   Duration"
"        1.000   Time step multiplier"
"             Maximum intensity           214.014    mm/hr"
"             Total depth                  93.865    mm"
"            6   100hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 101"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          101   Existing site area to SWM easement"
"        5.000   % Impervious"
"        2.287   Total Area"
"      160.000   Flow length"
"        8.750   Overland Slope"
"        2.173   Pervious Area"
"      160.000   Pervious length"
"        8.750   Pervious slope"
"        0.114   Impervious Area"
"      160.000   Impervious length"
"        8.750   Impervious slope"
"        0.030   Pervious Manning 'n'"
"       45.670   Pervious SCS Curve No."
"        0.214   Pervious Runoff coefficient"
"        0.017   Pervious Ia/S coefficient"
"        5.000   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       96.286   Impervious SCS Curve No."
"        0.879   Impervious Runoff coefficient"
"        0.053   Impervious Ia/S coefficient"
"        0.520   Impervious Initial abstraction"
```

```
"                    0.241     0.000     0.000     0.000 c.m/sec"
"             Catchment 101          Pervious   Impervious Total Area "
"             Surface Area           2.173      0.114      2.287      hectare"
"             Time of concentration  8.396      2.919      7.424      minutes"
"             Time to Centroid       106.342    89.917     103.426    minutes"
"             Rainfall depth         93.865     93.865     93.865     mm"
"             Rainfall volume        2039.36    107.33     2146.70    c.m"
"             Rainfall losses        73.747     11.374     70.629     mm"
"             Runoff depth           20.118     82.491     23.236     mm"
"             Runoff volume          437.09     94.33      531.42     c.m"
"             Runoff coefficient     0.214      0.879      0.248      "
"             Maximum flow           0.209      0.054      0.241      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.241     0.241     0.000     0.000"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                    0.241     0.241     0.241     0.000"
" 40          HYDROGRAPH   Combine    3"
"            6   Combine "
"            3   Node #"
"                Exisitng flow off-site"
"             Maximum flow                 0.241    c.m/sec"
"             Hydrograph volume          531.417    c.m"
"                    0.241     0.241     0.241     0.241"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                    0.241     0.000     0.241     0.241"
" 33          CATCHMENT 102"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          102   flow to Bedford Rd"
"       16.000   % Impervious"
"        0.092   Total Area"
"       34.000   Flow length"
"        6.850   Overland Slope"
"        0.077   Pervious Area"
"       34.000   Pervious length"
"        6.850   Pervious slope"
"        0.015   Impervious Area"
"       34.000   Impervious length"
"        6.850   Impervious slope"
"        0.030   Pervious Manning 'n'"
"       44.900   Pervious SCS Curve No."
"        0.205   Pervious Runoff coefficient"
"        0.016   Pervious Ia/S coefficient"
"        5.018   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       96.280   Impervious SCS Curve No."
```

```
"        0.883   Impervious Runoff coefficient"
"        0.053   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.014     0.000     0.241     0.241 c.m/sec"
"             Catchment 102          Pervious   Impervious Total Area "
"             Surface Area           0.077      0.015      0.092      hectare"
"             Time of concentration  3.606      1.240      2.541      minutes"
"             Time to Centroid       100.907    87.557     94.895     minutes"
"             Rainfall depth         93.865     93.865     93.865     mm"
"             Rainfall volume        72.54      13.82      86.36      c.m"
"             Rainfall losses        74.607     11.027     64.434     mm"
"             Runoff depth           19.258     82.838     29.431     mm"
"             Runoff volume          14.88      12.19      27.08      c.m"
"             Runoff coefficient     0.205      0.883      0.314      "
"             Maximum flow           0.008      0.007      0.014      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.014     0.014     0.241     0.241"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                     0.014     0.014     0.014     0.241"
" 40          HYDROGRAPH   Combine    3"
"            6   Combine "
"            3   Node #"
"                Exisitng flow off-site"
"             Maximum flow                 0.251    c.m/sec"
"             Hydrograph volume          558.493    c.m"
"                     0.014     0.014     0.014     0.251"
" 38          START/RE-START TOTALS 102"
"            3   Runoff Totals on EXIT"
"             Total Catchment area                      2.379    hectare"
"             Total Impervious area                     0.129    hectare"
"             Total % impervious                        5.425"
" 19          EXIT"
```

```
"                MIDUSS Output ----------------------------------------------->"
"                MIDUSS version                          Version 2.25  rev. 473"
"                MIDUSS created                        Sunday, February 7, 2010"
"           10   Units used:                                          ie METRIC"
"                Job folder:                      Q:\51505\104\swm assessment\"
"                                                    proposed conditions model"
"                Output filename:       51505-104-post-development_5yr_v50.out"
"                Licensee name:                                              A"
"                Company                                                      "
"                Date & Time last used:               12/20/2022 at 3:04:29 PM"
" 31          TIME PARAMETERS"
"        5.000   Time Step"
"      180.000   Max. Storm length"
"     1500.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"            1   Chicago storm"
"     1746.737   Coefficient A"
"       13.708   Constant B"
"        0.884   Exponent C"
"        0.400   Fraction R"
"      180.000   Duration"
"        1.000   Time step multiplier"
"             Maximum intensity           131.146    mm/hr"
"             Total depth                  49.832    mm"
"            6   005hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 200"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          200   rooftop areas"
"       99.000   % Impervious"
"        0.255   Total Area"
"       25.000   Flow length"
"       30.000   Overland Slope"
"        0.003   Pervious Area"
"       25.000   Pervious length"
"       30.000   Pervious slope"
"        0.252   Impervious Area"
"       25.000   Impervious length"
"       30.000   Impervious slope"
"        0.030   Pervious Manning 'n'"
"       44.890   Pervious SCS Curve No."
"        0.111   Pervious Runoff coefficient"
"        0.016   Pervious Ia/S coefficient"
"        4.989   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       96.285   Impervious SCS Curve No."
"        0.786   Impervious Runoff coefficient"
"        0.053   Impervious Ia/S coefficient"
"        0.519   Impervious Initial abstraction"
"                     0.072     0.000     0.000     0.000 c.m/sec"
```

```
"             Catchment 200          Pervious   Impervious Total Area "
"             Surface Area           0.003      0.252      0.255      hectare"
"             Time of concentration  3.075      0.829      0.832      minutes"
"             Time to Centroid       102.694    89.050     89.069     minutes"
"             Rainfall depth         49.832     49.832     49.832     mm"
"             Rainfall volume        1.27       125.80     127.07     c.m"
"             Rainfall losses        44.316     10.640     10.976     mm"
"             Runoff depth           5.516      39.193     38.856     mm"
"             Runoff volume          0.14       98.94      99.08      c.m"
"             Runoff coefficient     0.111      0.786      0.780      "
"             Maximum flow           0.000      0.072      0.072      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.072     0.072     0.000     0.000"
" 57          TRENCH Design d/s of 200"
"        0.072   Peak inflow"
"       99.083   Hydrograph volume"
"      353.540   Ground elevation"
"      352.740   Downstream trench invert"
"        0.500   Trench height"
"      349.500   Water table elevation"
"       45.000   Trench top width"
"       45.000   Trench bottom width"
"       40.000   Voids ratio (%)"
"       15.000   Hydraulic conductivity"
"        0.200   Trench gradient (%)"
"       25.000   Trench length"
"        1.000   Include base width"
"          21.   Number of stages"
"                  Level Discharge    Volume"
"                352.740     0.000       0.0"
"                352.780     0.000      13.0"
"                352.820     0.000      26.0"
"                352.860     0.000      39.0"
"                352.900     0.000      52.0"
"                352.940     0.000      65.0"
"                352.980     0.000      78.0"
"                353.020     0.000      91.0"
"                353.060     0.000     104.0"
"                353.100     0.000     117.0"
"                353.140     0.000     130.0"
"                353.180     0.000     143.0"
"                353.220     0.000     156.0"
"                353.260     0.000     169.0"
"                353.300     0.000     182.0"
"                353.340     0.000     195.0"
"                353.380     0.000     200.0"
"                353.420     0.000     200.1"
"                353.460     0.000     200.2"
"                353.500     0.000     200.3"
"                353.540     0.000     200.3"
```

```
"           1.   MANHOLE"
"                 Access"
"               diameter"
"                  0.800"
"             Peak outflow                  0.000    c.m/sec"
"             Outflow volume                0.002    c.m"
"             Peak exfiltration             0.005    c.m/sec"
"             Exfiltration volume          99.148    c.m"
"             Maximum level               352.956    metre"
"             Maximum storage              70.080    c.m"
"             Centroidal lag                4.105   hours"
"             Infiltration area 2 sides   9.532   sq.metre"
"             Infiltration Base area      1125.000   sq.metre"
"                  0.072     0.072     0.000     0.005 c.m/sec"
" 40          HYDROGRAPH   Combine    1"
"            6   Combine "
"            1   Node #"
"                Controlled Flow"
"             Maximum flow                  0.000    c.m/sec"
"             Hydrograph volume             0.002    c.m"
"                     0.072     0.072     0.000     0.000"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                     0.072     0.000     0.000     0.000"
" 33          CATCHMENT 201"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          201   Rear of Lot 1"
"        2.000   % Impervious"
"        0.285   Total Area"
"       51.000   Flow length"
"        3.580   Overland Slope"
"        0.279   Pervious Area"
"       51.000   Pervious length"
"        3.580   Pervious slope"
"        0.006   Impervious Area"
"       51.000   Impervious length"
"        3.580   Impervious slope"
"        0.030   Pervious Manning 'n'"
"       44.890   Pervious SCS Curve No."
"        0.113   Pervious Runoff coefficient"
"        0.016   Pervious Ia/S coefficient"
"        4.989   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       96.285   Impervious SCS Curve No."
"        0.810   Impervious Runoff coefficient"
"        0.053   Impervious Ia/S coefficient"
"        0.519   Impervious Initial abstraction"
"                     0.008     0.000     0.000     0.000 c.m/sec"
"             Catchment 201          Pervious   Impervious Total Area "
```

```
"             Surface Area           0.279      0.006      0.285      hectare"
"             Time of concentration  8.924      2.406      8.089      minutes"
"             Time to Centroid       109.675    91.121     107.299    minutes"
"             Rainfall depth         49.832     49.832     49.832     mm"
"             Rainfall volume        139.18     2.84       142.02     c.m"
"             Rainfall losses        44.220     9.450      43.525     mm"
"             Runoff depth           5.612      40.383     6.308      mm"
"             Runoff volume          15.67      2.30       17.98      c.m"
"             Runoff coefficient     0.113      0.810      0.127      "
"             Maximum flow           0.007      0.001      0.008      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.008     0.008     0.000     0.000"
" 33          CATCHMENT 202"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          202   Road-way, Street A"
"       60.000   % Impervious"
"        0.491   Total Area"
"      128.000   Flow length"
"        1.410   Overland Slope"
"        0.196   Pervious Area"
"      128.000   Pervious length"
"        1.410   Pervious slope"
"        0.295   Impervious Area"
"      128.000   Impervious length"
"        1.410   Impervious slope"
"        0.030   Pervious Manning 'n'"
"       44.890   Pervious SCS Curve No."
"        0.113   Pervious Runoff coefficient"
"        0.016   Pervious Ia/S coefficient"
"        4.989   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       96.285   Impervious SCS Curve No."
"        0.820   Impervious Runoff coefficient"
"        0.053   Impervious Ia/S coefficient"
"        0.519   Impervious Initial abstraction"
"                     0.080     0.008     0.000     0.000 c.m/sec"
"             Catchment 202          Pervious   Impervious Total Area "
"             Surface Area           0.196      0.295      0.491      hectare"
"             Time of concentration  20.499     5.526      6.786      minutes"
"             Time to Centroid       123.716    95.559     97.929     minutes"
"             Rainfall depth         49.832     49.832     49.832     mm"
"             Rainfall volume        97.87      146.81     244.68     c.m"
"             Rainfall losses        44.203     8.995      23.078     mm"
"             Runoff depth           5.630      40.838     26.754     mm"
"             Runoff volume          11.06      120.31     131.36     c.m"
"             Runoff coefficient     0.113      0.820      0.537      "
"             Maximum flow           0.004      0.079      0.080      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
```

```
"            4   Add Runoff "
"                     0.080     0.087     0.000     0.000"
" 54          POND DESIGN"
"         0.087   Current peak flow    c.m/sec"
"         0.220   Target outflow    c.m/sec"
"         149.3   Hydrograph volume    c.m"
"           21.   Number of stages"
"       340.530   Minimum water level    metre"
"       352.000   Maximum water level    metre"
"       340.530   Starting water level    metre"
"             0   Keep Design Data: 1 = True; 0 = False"
"                   Level Discharge    Volume"
"                 340.530     0.000     0.000"
"                 341.103   0.01560     2.179"
"                 341.677   0.02278    11.154"
"                 342.250   0.02818    26.584"
"                 342.824   0.03271    43.623"
"                 343.397   0.03668    60.649"
"                 343.971   0.04026    77.694"
"                 344.544   0.04354    94.699"
"                 345.118   0.04660   111.806"
"                 345.691   0.04947   128.191"
"                 346.265   0.05218   139.310"
"                 346.839   0.05476   143.138"
"                 347.412   0.05722   143.723"
"                 347.986   0.05958   144.372"
"                 348.559   0.06184   145.020"
"                 349.133   0.06403   145.668"
"                 349.706   0.06615   146.316"
"                 350.280   0.06820   146.964"
"                 350.853   0.07019   147.612"
"                 351.427   0.07213   148.260"
"                 352.000   0.07401   148.908"
"             1.   ORIFICES"
"                  Orifice   Orifice   Orifice Number of"
"                   invert coefficie  diameter  orifices"
"                 340.530     0.630    0.1000     1.000"
"             1.   SUPERPIPES_1"
"             1.   Type 1 is Pipe"
"               Downstream      Pipe      Pipe      Pipe      Pipe Number of"
"                   Invert    Length     Width    Height   Grade %     Pipes"
"                 340.530    67.000     1.650     1.650     7.200     1.000"
"               Peak outflow                  0.033    c.m/sec"
"               Maximum level                342.899    metre"
"               Maximum storage               45.848    c.m"
"               Centroidal lag                 1.883   hours"
"                    0.080     0.087     0.033     0.000 c.m/sec"
" 40            HYDROGRAPH Next link "
"            5   Next link "
"                     0.080     0.033     0.033     0.000"
" 33            CATCHMENT 205"
```

```
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          205   Swale flow"
"        2.000   % Impervious"
"        0.071   Total Area"
"       71.000   Flow length"
"       11.440   Overland Slope"
"        0.070   Pervious Area"
"       71.000   Pervious length"
"       11.440   Pervious slope"
"        0.001   Impervious Area"
"       71.000   Impervious length"
"       11.440   Impervious slope"
"        0.030   Pervious Manning 'n'"
"       44.890   Pervious SCS Curve No."
"        0.113   Pervious Runoff coefficient"
"        0.016   Pervious Ia/S coefficient"
"        4.989   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       96.285   Impervious SCS Curve No."
"        0.814   Impervious Runoff coefficient"
"        0.053   Impervious Ia/S coefficient"
"        0.519   Impervious Initial abstraction"
"                     0.002     0.033     0.033     0.000 c.m/sec"
"             Catchment 205          Pervious   Impervious Total Area "
"             Surface Area           0.070      0.001      0.071      hectare"
"             Time of concentration  7.681      2.070      6.960      minutes"
"             Time to Centroid       108.250    90.620     105.985    minutes"
"             Rainfall depth         49.832     49.832     49.832     mm"
"             Rainfall volume        34.67      0.71       35.38      c.m"
"             Rainfall losses        44.219     9.286      43.520     mm"
"             Runoff depth           5.614      40.547     6.312      mm"
"             Runoff volume          3.91       0.58       4.48       c.m"
"             Runoff coefficient     0.113      0.814      0.127      "
"             Maximum flow           0.002      0.000      0.002      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.002     0.035     0.033     0.000"
" 52          CHANNEL DESIGN"
"        0.035   Current peak flow    c.m/sec"
"        0.035   Manning 'n'"
"           0.   Cross-section type: 0=trapezoidal; 1=general"
"        3.000   Basewidth    metre"
"        3.000   Left bank slope"
"        3.000   Right bank slope"
"        0.500   Channel depth    metre"
"       11.440   Gradient   %"
"             Depth of flow                 0.018    metre"
"             Velocity                      0.648    m/sec"
"             Channel capacity             11.108    c.m/sec"
```

```
"             Critical depth                0.024    metre"
" 53          ROUTE    Channel Route 68"
"        68.00      Channel Route 68 Reach length   ( metre)"
"        0.499   X-factor <= 0.5"
"       78.717   K-lag   ( seconds)"
"        0.000   Default(0) or user spec.(1) values used"
"        0.500   X-factor <= 0.5"
"       30.000   K-lag   ( seconds)"
"        0.500   Beta weighting factor"
"       75.000   Routing time step   ( seconds)"
"            1   No. of sub-reaches"
"             Peak outflow                  0.034    c.m/sec"
"                     0.002     0.035     0.034     0.000 c.m/sec"
" 40          HYDROGRAPH   Combine    1"
"            6   Combine "
"            1   Node #"
"                Controlled Flow"
"             Maximum flow                  0.034    c.m/sec"
"             Hydrograph volume           153.916    c.m"
"                     0.002     0.035     0.034     0.034"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                     0.002     0.000     0.034     0.034"
" 33          CATCHMENT 203"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          203   Rear of Lots 2+3"
"        2.000   % Impervious"
"        0.628   Total Area"
"       80.000   Flow length"
"       10.400   Overland Slope"
"        0.615   Pervious Area"
"       80.000   Pervious length"
"       10.400   Pervious slope"
"        0.013   Impervious Area"
"       80.000   Impervious length"
"       10.400   Impervious slope"
"        0.030   Pervious Manning 'n'"
"       44.890   Pervious SCS Curve No."
"        0.113   Pervious Runoff coefficient"
"        0.016   Pervious Ia/S coefficient"
"        4.989   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       96.285   Impervious SCS Curve No."
"        0.812   Impervious Runoff coefficient"
"        0.053   Impervious Ia/S coefficient"
"        0.519   Impervious Initial abstraction"
"                     0.018     0.000     0.034     0.034 c.m/sec"
"             Catchment 203          Pervious   Impervious Total Area "
"             Surface Area           0.615      0.013      0.628      hectare"
```

```
"             Time of concentration  8.490      2.289      7.696      minutes"
"             Time to Centroid       109.118    90.944     106.790    minutes"
"             Rainfall depth         49.832     49.832     49.832     mm"
"             Rainfall volume        306.69     6.26       312.95     c.m"
"             Rainfall losses        44.211     9.369      43.514     mm"
"             Runoff depth           5.621      40.463     6.318      mm"
"             Runoff volume          34.60      5.08       39.68      c.m"
"             Runoff coefficient     0.113      0.812      0.127      "
"             Maximum flow           0.016      0.003      0.018      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.018     0.018     0.034     0.034"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                     0.018     0.018     0.018     0.034"
" 40          HYDROGRAPH   Combine    1"
"            6   Combine "
"            1   Node #"
"                Controlled Flow"
"             Maximum flow                  0.050    c.m/sec"
"             Hydrograph volume           193.594    c.m"
"                     0.018     0.018     0.018     0.050"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                     0.018     0.000     0.018     0.050"
" 33          CATCHMENT 204"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          204   Rear of Lots 4+5"
"        2.000   % Impervious"
"        0.594   Total Area"
"       60.000   Flow length"
"       15.340   Overland Slope"
"        0.582   Pervious Area"
"       60.000   Pervious length"
"       15.340   Pervious slope"
"        0.012   Impervious Area"
"       60.000   Impervious length"
"       15.340   Impervious slope"
"        0.030   Pervious Manning 'n'"
"       44.890   Pervious SCS Curve No."
"        0.112   Pervious Runoff coefficient"
"        0.016   Pervious Ia/S coefficient"
"        4.989   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       96.285   Impervious SCS Curve No."
"        0.815   Impervious Runoff coefficient"
"        0.053   Impervious Ia/S coefficient"
"        0.519   Impervious Initial abstraction"
"                     0.018     0.000     0.018     0.050 c.m/sec"
```

```
"             Catchment 204          Pervious   Impervious Total Area "
"             Surface Area           0.582      0.012      0.594      hectare"
"             Time of concentration  6.358      1.714      5.757      minutes"
"             Time to Centroid       106.694    90.048     104.542    minutes"
"             Rainfall depth         49.832     49.832     49.832     mm"
"             Rainfall volume        290.08     5.92       296.00     c.m"
"             Rainfall losses        44.253     9.242      43.553     mm"
"             Runoff depth           5.579      40.590     6.279      mm"
"             Runoff volume          32.48      4.82       37.30      c.m"
"             Runoff coefficient     0.112      0.815      0.126      "
"             Maximum flow           0.016      0.003      0.018      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.018     0.018     0.018     0.050"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                     0.018     0.018     0.018     0.050"
" 40          HYDROGRAPH   Combine    1"
"            6   Combine "
"            1   Node #"
"                Controlled Flow"
"             Maximum flow                 0.068    c.m/sec"
"             Hydrograph volume          230.892    c.m"
"                     0.018     0.018     0.018     0.068"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                     0.018     0.000     0.018     0.068"
" 33          CATCHMENT 206"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          206   Flow to Bedford Road"
"       70.000   % Impervious"
"        0.054   Total Area"
"       25.000   Flow length"
"        0.750   Overland Slope"
"        0.016   Pervious Area"
"       25.000   Pervious length"
"        0.750   Pervious slope"
"        0.038   Impervious Area"
"       25.000   Impervious length"
"        0.750   Impervious slope"
"        0.030   Pervious Manning 'n'"
"       44.890   Pervious SCS Curve No."
"        0.112   Pervious Runoff coefficient"
"        0.016   Pervious Ia/S coefficient"
"        4.989   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       96.285   Impervious SCS Curve No."
"        0.810   Impervious Runoff coefficient"
"        0.053   Impervious Ia/S coefficient"
```

```
"        0.519   Impervious Initial abstraction"
"                     0.010     0.000     0.018     0.068 c.m/sec"
"              Catchment 206          Pervious   Impervious Total Area "
"              Surface Area           0.016      0.038      0.054      hectare"
"              Time of concentration  9.298      2.507      2.888      minutes"
"              Time to Centroid       110.143    91.293     92.352     minutes"
"              Rainfall depth         49.832     49.832     49.832     mm"
"              Rainfall volume        8.07       18.84      26.91      c.m"
"              Rainfall losses        44.228     9.478      19.903     mm"
"              Runoff depth           5.604      40.355     29.929     mm"
"              Runoff volume          0.91       15.25      16.16      c.m"
"              Runoff coefficient     0.112      0.810      0.601      "
"              Maximum flow           0.000      0.010      0.010      c.m/sec"
" 40           HYDROGRAPH Add Runoff "
"             4   Add Runoff "
"                     0.010     0.010     0.018     0.068"
" 40           HYDROGRAPH Copy to Outflow"
"             8   Copy to Outflow"
"                     0.010     0.010     0.010     0.068"
" 40           HYDROGRAPH   Combine    1"
"             6   Combine "
"             1   Node #"
"                 Controlled Flow"
"              Maximum flow                  0.074    c.m/sec"
"              Hydrograph volume           247.053    c.m"
"                     0.010     0.010     0.010     0.074"
" 38           START/RE-START TOTALS 206"
"             3   Runoff Totals on EXIT"
"              Total Catchment area                      2.378    hectare"
"              Total Impervious area                     0.616    hectare"
"              Total % impervious                       25.921"
" 19           EXIT"
```

```
"                MIDUSS Output ------------------------------------------------>"
"                MIDUSS version                          Version 2.25  rev. 473"
"                MIDUSS created                        Sunday, February 7, 2010"
"           10   Units used:                                          ie METRIC"
"                Job folder:                       Q:\51505\104\swm assessment\"
"                                                     proposed conditions model"
"                Output filename:      51505-104-post-development_100yr_v51.out"
"                Licensee name:                                              A"
"                Company                                                      "
"                Date & Time last used:                12/20/2022 at 3:11:24 PM"
" 31          TIME PARAMETERS"
"        5.000   Time Step"
"      180.000   Max. Storm length"
"     1500.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"            1   Chicago storm"
"     5061.200   Coefficient A"
"       22.167   Constant B"
"        0.958   Exponent C"
"        0.400   Fraction R"
"      180.000   Duration"
"        1.000   Time step multiplier"
"             Maximum intensity           214.014    mm/hr"
"             Total depth                  93.865    mm"
"            6   100hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 200"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          200   rooftop areas"
"       99.000   % Impervious"
"        0.255   Total Area"
"       25.000   Flow length"
"       30.000   Overland Slope"
"        0.003   Pervious Area"
"       25.000   Pervious length"
"       30.000   Pervious slope"
"        0.252   Impervious Area"
"       25.000   Impervious length"
"       30.000   Impervious slope"
"        0.030   Pervious Manning 'n'"
"       44.890   Pervious SCS Curve No."
"        0.207   Pervious Runoff coefficient"
"        0.016   Pervious Ia/S coefficient"
"        4.989   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       96.285   Impervious SCS Curve No."
"        0.835   Impervious Runoff coefficient"
"        0.053   Impervious Ia/S coefficient"
"        0.519   Impervious Initial abstraction"
"                     0.125     0.000     0.000     0.000 c.m/sec"
```

```
"             Catchment 200          Pervious   Impervious Total Area "
"             Surface Area           0.003      0.252      0.255      hectare"
"             Time of concentration  1.925      0.662      0.665      minutes"
"             Time to Centroid       98.446     87.172     87.200     minutes"
"             Rainfall depth         93.865     93.865     93.865     mm"
"             Rainfall volume        2.39       236.96     239.36     c.m"
"             Rainfall losses        74.413     15.510     16.099     mm"
"             Runoff depth           19.453     78.355     77.766     mm"
"             Runoff volume          0.50       197.81     198.30     c.m"
"             Runoff coefficient     0.207      0.835      0.828      "
"             Maximum flow           0.000      0.125      0.125      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.125     0.125     0.000     0.000"
" 57          TRENCH Design d/s of 200"
"        0.125   Peak inflow"
"      198.303   Hydrograph volume"
"      353.540   Ground elevation"
"      352.740   Downstream trench invert"
"        0.500   Trench height"
"      349.500   Water table elevation"
"       45.000   Trench top width"
"       45.000   Trench bottom width"
"       40.000   Voids ratio (%)"
"       15.000   Hydraulic conductivity"
"        0.200   Trench gradient (%)"
"       25.000   Trench length"
"        1.000   Include base width"
"          21.   Number of stages"
"                  Level Discharge    Volume"
"                352.740     0.000       0.0"
"                352.780     0.000      13.0"
"                352.820     0.000      26.0"
"                352.860     0.000      39.0"
"                352.900     0.000      52.0"
"                352.940     0.000      65.0"
"                352.980     0.000      78.0"
"                353.020     0.000      91.0"
"                353.060     0.000     104.0"
"                353.100     0.000     117.0"
"                353.140     0.000     130.0"
"                353.180     0.000     143.0"
"                353.220     0.000     156.0"
"                353.260     0.000     169.0"
"                353.300     0.000     182.0"
"                353.340     0.000     195.0"
"                353.380     0.000     200.0"
"                353.420     0.000     200.1"
"                353.460     0.000     200.2"
"                353.500     0.000     200.3"
"                353.540     0.000     200.3"
```

```
"           1.   MANHOLE"
"                 Access"
"               diameter"
"                  0.800"
"             Peak outflow                  0.000    c.m/sec"
"             Outflow volume                0.004    c.m"
"             Peak exfiltration             0.005    c.m/sec"
"             Exfiltration volume         198.316    c.m"
"             Maximum level               353.233    metre"
"             Maximum storage             160.061    c.m"
"             Centroidal lag                6.594   hours"
"             Infiltration area 2 sides    23.376   sq.metre"
"             Infiltration Base area      1125.000   sq.metre"
"                  0.125     0.125     0.000     0.005 c.m/sec"
" 40          HYDROGRAPH   Combine    1"
"            6   Combine "
"            1   Node #"
"                Controlled Flow"
"             Maximum flow                  0.000    c.m/sec"
"             Hydrograph volume             0.004    c.m"
"                     0.125     0.125     0.000     0.000"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                     0.125     0.000     0.000     0.000"
" 33          CATCHMENT 201"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          201   Rear of Lot 1"
"        2.000   % Impervious"
"        0.285   Total Area"
"       51.000   Flow length"
"        3.580   Overland Slope"
"        0.279   Pervious Area"
"       51.000   Pervious length"
"        3.580   Pervious slope"
"        0.006   Impervious Area"
"       51.000   Impervious length"
"        3.580   Impervious slope"
"        0.030   Pervious Manning 'n'"
"       44.890   Pervious SCS Curve No."
"        0.208   Pervious Runoff coefficient"
"        0.016   Pervious Ia/S coefficient"
"        4.989   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       96.285   Impervious SCS Curve No."
"        0.888   Impervious Runoff coefficient"
"        0.053   Impervious Ia/S coefficient"
"        0.519   Impervious Initial abstraction"
"                     0.030     0.000     0.000     0.000 c.m/sec"
"             Catchment 201          Pervious   Impervious Total Area "
```

```
"             Surface Area           0.279      0.006      0.285      hectare"
"             Time of concentration  5.587      1.922      5.294      minutes"
"             Time to Centroid       103.098    88.433     101.924    minutes"
"             Rainfall depth         93.865     93.865     93.865     mm"
"             Rainfall volume        262.17     5.35       267.52     c.m"
"             Rainfall losses        74.306     10.534     73.030     mm"
"             Runoff depth           19.559     83.331     20.835     mm"
"             Runoff volume          54.63      4.75       59.38      c.m"
"             Runoff coefficient     0.208      0.888      0.222      "
"             Maximum flow           0.028      0.003      0.030      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.030     0.030     0.000     0.000"
" 33          CATCHMENT 202"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          202   Road-way, Street A"
"       60.000   % Impervious"
"        0.491   Total Area"
"      128.000   Flow length"
"        1.410   Overland Slope"
"        0.196   Pervious Area"
"      128.000   Pervious length"
"        1.410   Pervious slope"
"        0.295   Impervious Area"
"      128.000   Impervious length"
"        1.410   Impervious slope"
"        0.030   Pervious Manning 'n'"
"       44.890   Pervious SCS Curve No."
"        0.209   Pervious Runoff coefficient"
"        0.016   Pervious Ia/S coefficient"
"        4.989   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       96.285   Impervious SCS Curve No."
"        0.893   Impervious Runoff coefficient"
"        0.053   Impervious Ia/S coefficient"
"        0.519   Impervious Initial abstraction"
"                     0.151     0.030     0.000     0.000 c.m/sec"
"             Catchment 202          Pervious   Impervious Total Area "
"             Surface Area           0.196      0.295      0.491      hectare"
"             Time of concentration  12.835     4.415      5.552      minutes"
"             Time to Centroid       111.718    91.918     94.592     minutes"
"             Rainfall depth         93.865     93.865     93.865     mm"
"             Rainfall volume        184.35     276.53     460.88     c.m"
"             Rainfall losses        74.232     10.033     35.713     mm"
"             Runoff depth           19.633     83.832     58.152     mm"
"             Runoff volume          38.56      246.97     285.53     c.m"
"             Runoff coefficient     0.209      0.893      0.620      "
"             Maximum flow           0.016      0.141      0.151      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
```

```
"            4   Add Runoff "
"                     0.151     0.181     0.000     0.000"
" 54          POND DESIGN"
"         0.181   Current peak flow    c.m/sec"
"         0.220   Target outflow    c.m/sec"
"         344.9   Hydrograph volume    c.m"
"           21.   Number of stages"
"       340.530   Minimum water level    metre"
"       352.000   Maximum water level    metre"
"       340.530   Starting water level    metre"
"             0   Keep Design Data: 1 = True; 0 = False"
"                   Level Discharge    Volume"
"                 340.530     0.000     0.000"
"                 341.103   0.01560     2.179"
"                 341.677   0.02278    11.154"
"                 342.250   0.02818    26.584"
"                 342.824   0.03271    43.623"
"                 343.397   0.03668    60.649"
"                 343.971   0.04026    77.694"
"                 344.544   0.04354    94.699"
"                 345.118   0.04660   111.806"
"                 345.691   0.04947   128.191"
"                 346.265   0.05218   139.310"
"                 346.839   0.05476   143.138"
"                 347.412   0.05722   143.723"
"                 347.986   0.05958   144.372"
"                 348.559   0.06184   145.020"
"                 349.133   0.06403   145.668"
"                 349.706   0.06615   146.316"
"                 350.280   0.06820   146.964"
"                 350.853   0.07019   147.612"
"                 351.427   0.07213   148.260"
"                 352.000   0.07401   148.908"
"             1.   ORIFICES"
"                  Orifice   Orifice   Orifice Number of"
"                   invert coefficie  diameter  orifices"
"                 340.530     0.630    0.1000     1.000"
"             1.   SUPERPIPES_1"
"             1.   Type 1 is Pipe"
"               Downstream      Pipe      Pipe      Pipe      Pipe Number of"
"                   Invert    Length     Width    Height   Grade %     Pipes"
"                 340.530    67.000     1.650     1.650     7.200     1.000"
"               Peak outflow                  0.059    c.m/sec"
"               Maximum level                347.741    metre"
"               Maximum storage              144.096    c.m"
"               Centroidal lag                 2.121   hours"
"                    0.151     0.181     0.059     0.000 c.m/sec"
" 40            HYDROGRAPH Next link "
"            5   Next link "
"                     0.151     0.059     0.059     0.000"
" 33            CATCHMENT 205"
```

```
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          205   Swale flow"
"        2.000   % Impervious"
"        0.071   Total Area"
"       71.000   Flow length"
"       11.440   Overland Slope"
"        0.070   Pervious Area"
"       71.000   Pervious length"
"       11.440   Pervious slope"
"        0.001   Impervious Area"
"       71.000   Impervious length"
"       11.440   Impervious slope"
"        0.030   Pervious Manning 'n'"
"       44.890   Pervious SCS Curve No."
"        0.209   Pervious Runoff coefficient"
"        0.016   Pervious Ia/S coefficient"
"        4.989   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       96.285   Impervious SCS Curve No."
"        0.888   Impervious Runoff coefficient"
"        0.053   Impervious Ia/S coefficient"
"        0.519   Impervious Initial abstraction"
"                     0.008     0.059     0.059     0.000 c.m/sec"
"             Catchment 205          Pervious   Impervious Total Area "
"             Surface Area           0.070      0.001      0.071      hectare"
"             Time of concentration  4.809      1.654      4.557      minutes"
"             Time to Centroid       102.165    88.038     101.036    minutes"
"             Rainfall depth         93.865     93.865     93.865     mm"
"             Rainfall volume        65.31      1.33       66.64      c.m"
"             Rainfall losses        74.285     10.480     73.009     mm"
"             Runoff depth           19.580     83.385     20.856     mm"
"             Runoff volume          13.62      1.18       14.81      c.m"
"             Runoff coefficient     0.209      0.888      0.222      "
"             Maximum flow           0.007      0.001      0.008      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.008     0.061     0.059     0.000"
" 52          CHANNEL DESIGN"
"        0.061   Current peak flow    c.m/sec"
"        0.035   Manning 'n'"
"           0.   Cross-section type: 0=trapezoidal; 1=general"
"        3.000   Basewidth    metre"
"        3.000   Left bank slope"
"        3.000   Right bank slope"
"        0.500   Channel depth    metre"
"       11.440   Gradient   %"
"             Depth of flow                 0.025    metre"
"             Velocity                      0.805    m/sec"
"             Channel capacity             11.108    c.m/sec"
```

```
"             Critical depth                0.034    metre"
" 53          ROUTE    Channel Route 68"
"        68.00      Channel Route 68 Reach length   ( metre)"
"        0.499   X-factor <= 0.5"
"       63.388   K-lag   ( seconds)"
"        0.000   Default(0) or user spec.(1) values used"
"        0.500   X-factor <= 0.5"
"       30.000   K-lag   ( seconds)"
"        0.500   Beta weighting factor"
"       60.000   Routing time step   ( seconds)"
"            1   No. of sub-reaches"
"             Peak outflow                  0.060    c.m/sec"
"                     0.008     0.061     0.060     0.000 c.m/sec"
" 40          HYDROGRAPH   Combine    1"
"            6   Combine "
"            1   Node #"
"                Controlled Flow"
"             Maximum flow                  0.060    c.m/sec"
"             Hydrograph volume           360.009    c.m"
"                     0.008     0.061     0.060     0.060"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                     0.008     0.000     0.060     0.060"
" 33          CATCHMENT 203"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          203   Rear of Lots 2+3"
"        2.000   % Impervious"
"        0.628   Total Area"
"       80.000   Flow length"
"       10.400   Overland Slope"
"        0.615   Pervious Area"
"       80.000   Pervious length"
"       10.400   Pervious slope"
"        0.013   Impervious Area"
"       80.000   Impervious length"
"       10.400   Impervious slope"
"        0.030   Pervious Manning 'n'"
"       44.890   Pervious SCS Curve No."
"        0.209   Pervious Runoff coefficient"
"        0.016   Pervious Ia/S coefficient"
"        4.989   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       96.285   Impervious SCS Curve No."
"        0.888   Impervious Runoff coefficient"
"        0.053   Impervious Ia/S coefficient"
"        0.519   Impervious Initial abstraction"
"                     0.067     0.000     0.060     0.060 c.m/sec"
"             Catchment 203          Pervious   Impervious Total Area "
"             Surface Area           0.615      0.013      0.628      hectare"
```

```
"             Time of concentration  5.316      1.829      5.037      minutes"
"             Time to Centroid       102.785    88.299     101.628    minutes"
"             Rainfall depth         93.865     93.865     93.865     mm"
"             Rainfall volume        577.68     11.79      589.47     c.m"
"             Rainfall losses        74.270     10.506     72.995     mm"
"             Runoff depth           19.595     83.359     20.870     mm"
"             Runoff volume          120.60     10.47      131.07     c.m"
"             Runoff coefficient     0.209      0.888      0.222      "
"             Maximum flow           0.062      0.006      0.067      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.067     0.067     0.060     0.060"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                     0.067     0.067     0.067     0.060"
" 40          HYDROGRAPH   Combine    1"
"            6   Combine "
"            1   Node #"
"                Controlled Flow"
"             Maximum flow                  0.112    c.m/sec"
"             Hydrograph volume           491.074    c.m"
"                     0.067     0.067     0.067     0.112"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                     0.067     0.000     0.067     0.112"
" 33          CATCHMENT 204"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          204   Rear of Lots 4+5"
"        2.000   % Impervious"
"        0.594   Total Area"
"       60.000   Flow length"
"       15.340   Overland Slope"
"        0.582   Pervious Area"
"       60.000   Pervious length"
"       15.340   Pervious slope"
"        0.012   Impervious Area"
"       60.000   Impervious length"
"       15.340   Impervious slope"
"        0.030   Pervious Manning 'n'"
"       44.890   Pervious SCS Curve No."
"        0.207   Pervious Runoff coefficient"
"        0.016   Pervious Ia/S coefficient"
"        4.989   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       96.285   Impervious SCS Curve No."
"        0.886   Impervious Runoff coefficient"
"        0.053   Impervious Ia/S coefficient"
"        0.519   Impervious Initial abstraction"
"                     0.066     0.000     0.067     0.112 c.m/sec"
```

```
"             Catchment 204          Pervious   Impervious Total Area "
"             Surface Area           0.582      0.012      0.594      hectare"
"             Time of concentration  3.981      1.369      3.771      minutes"
"             Time to Centroid       101.248    87.707     100.160    minutes"
"             Rainfall depth         93.865     93.865     93.865     mm"
"             Rainfall volume        546.41     11.15      557.56     c.m"
"             Rainfall losses        74.439     10.697     73.164     mm"
"             Runoff depth           19.426     83.168     20.701     mm"
"             Runoff volume          113.08     9.88       122.96     c.m"
"             Runoff coefficient     0.207      0.886      0.221      "
"             Maximum flow           0.062      0.006      0.066      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.066     0.066     0.067     0.112"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                     0.066     0.066     0.066     0.112"
" 40          HYDROGRAPH   Combine    1"
"            6   Combine "
"            1   Node #"
"                Controlled Flow"
"             Maximum flow                  0.179    c.m/sec"
"             Hydrograph volume           614.040    c.m"
"                     0.066     0.066     0.066     0.179"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                     0.066     0.000     0.066     0.179"
" 33          CATCHMENT 206"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          206   Flow to Bedford Road"
"       70.000   % Impervious"
"        0.054   Total Area"
"       25.000   Flow length"
"        0.750   Overland Slope"
"        0.016   Pervious Area"
"       25.000   Pervious length"
"        0.750   Pervious slope"
"        0.038   Impervious Area"
"       25.000   Impervious length"
"        0.750   Impervious slope"
"        0.030   Pervious Manning 'n'"
"       44.890   Pervious SCS Curve No."
"        0.208   Pervious Runoff coefficient"
"        0.016   Pervious Ia/S coefficient"
"        4.989   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       96.285   Impervious SCS Curve No."
"        0.887   Impervious Runoff coefficient"
"        0.053   Impervious Ia/S coefficient"
```

```
"        0.519   Impervious Initial abstraction"
"                     0.019     0.000     0.066     0.179 c.m/sec"
"              Catchment 206          Pervious   Impervious Total Area "
"              Surface Area           0.016      0.038      0.054      hectare"
"              Time of concentration  5.822      2.003      2.352      minutes"
"              Time to Centroid       103.406    88.552     89.910     minutes"
"              Rainfall depth         93.865     93.865     93.865     mm"
"              Rainfall volume        15.21      35.48      50.69      c.m"
"              Rainfall losses        74.308     10.598     29.711     mm"
"              Runoff depth           19.558     83.267     64.154     mm"
"              Runoff volume          3.17       31.47      34.64      c.m"
"              Runoff coefficient     0.208      0.887      0.683      "
"              Maximum flow           0.002      0.018      0.019      c.m/sec"
" 40           HYDROGRAPH Add Runoff "
"             4   Add Runoff "
"                     0.019     0.019     0.066     0.179"
" 40           HYDROGRAPH Copy to Outflow"
"             8   Copy to Outflow"
"                     0.019     0.019     0.019     0.179"
" 40           HYDROGRAPH   Combine    1"
"             6   Combine "
"             1   Node #"
"                 Controlled Flow"
"              Maximum flow                  0.196    c.m/sec"
"              Hydrograph volume           648.683    c.m"
"                     0.019     0.019     0.019     0.196"
" 38           START/RE-START TOTALS 206"
"             3   Runoff Totals on EXIT"
"              Total Catchment area                      2.378    hectare"
"              Total Impervious area                     0.616    hectare"
"              Total % impervious                       25.921"
" 19           EXIT"
```

Appendix D

Water Servicing Design

47 Bedford Road

Guelph-Eramosa Township

Project No: 51505-104

Date: December 22, 2022

By: CVP

Table 1 - Domestic Water Demand Calculations

Usage	Single Family Residential Homes			Water Demand (Q)							
	No. of Units[1]	No. of Person [2]	Water Demand Criteria [3]	Average Day Demand (AAD) - Base Demand		Maximum Day Demand (MDD) @ MDD Factor of 9.5 [4]		Minimum Hour Demand (MnHD) @ PHD factor = 0.1 [5]		Peak Hour Demand (PHD) @ PHD factor = 14.3 [5]	
		cap	L/cap/day	(L/s)	L/day	(L/s)	L/day	(L/s)	L/day	(L/s)	L/day
5 Residential Homes	5	17	300	0.06	4980.00	0.55	47310.00	0.01	498.00	0.82	71214.00

Notes:

1. Number of units in development from 47 Bedford Road Draft Plan of Subdivision (Astrid J. Clos, 2019).

2. People per residential unit (3.33) based on 20-year forecast from the City of Guelph Development Charges Background Study (Watson and Associates Ltd., 2019, A-10).

3. Water use of 300 L per cap per day, basde on 2031 population projection, following the Guelph Water/Wastewater Servicing Master Plan (EarthTech Canada Inc., vii, 2008).

4. Maximum day factor of 9.5 from MECP Drinking Water System Design Guidelines, Table 3-3 (MECP, 2008)

5. Minimum hour demand of 0.1 and peak hour demand of 14.3 factors from the Drinking Water Guidelines, Table 3-3 (MECP, 2008).

6. Pressures (HWL, LWL and Fire) from the Guelph-Eramosa Township Engineering Department (2022), coverted to water level using online unit converter.

7. LWL elevation taken for design as a conservative approach.

47 Bedford Road
FIRE FLOW ANALYSIS
Guelph-Eramosa Township, Ontario

Project Number: 51505-104
Date: 04-07-2023
Design By: CVP

File: Q:\51505\104\water design\51505-104-Site Fire Flow Analysis_20230704.xlsx

Step 1: Determining Water Supply Coefficient

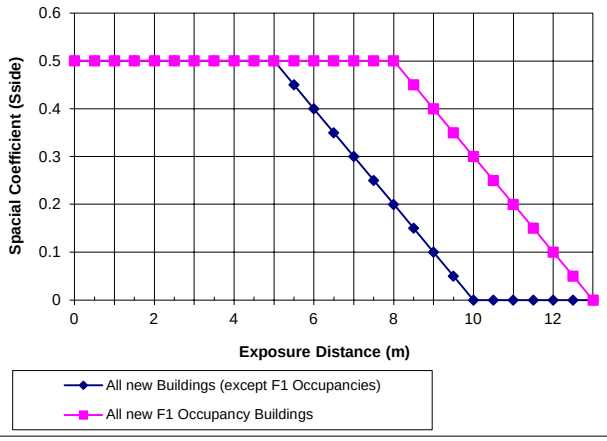
	Table 1 from OBC 2012 A3.2.5.7											
	Type of Construction	**Classification by group or division in Accordance with Table 3.1.2.1 of the Ontario Building Code**										
		A2	**B1**	**B2**	**B3**	**C**	**D**	**A4**	**F3**	**A1**	**A3**	**E**	**F2**	**F1**
1	Building is of Noncombustible construction with fire separation and fire-resistance ratings provided in accordance with Subsection 3.2.2 of the OBC, including loadbearing walls, columns and arches						10	12		14		17		23
2	Building is of Noncombustible construction or of heavy timber construction conforming to Article 3.1.4.6 of the OBC. Floor assemblies are fire separations but no fire-resistance rating. Roof assemblies, mezzanines, loadbearing walls, columns and arches do not have a fire-resistance rating.						16	19		22		27		37
3	Building is of Combustible Construction with fire separations and fire-resistance ratings provided in accordance with Subsection 3.2.2 of the OBC, including loadbearing walls, columns and arches. Noncombustible construction may be used in lieu of fire resistance rating where permitted in subsection 3.2.2 of the OBC						18	22		25		31		41
4	Building is of combustible construction. Floor assemblies are fire separations but with no fire-resistance rating. Roof assemblies, mezzanines, loadbearing walls, columns and arches do not have a fire-resistance rating.						23	28		32		39		53

Type of Construction	**Building Classification**	**Water Supply Coefficient (K)**
4	C	**23**

Step 2: Determine the Spacial Coefficient

	Distance	**S_{side}**
Exposure Distance 1 (m)	8.50	0.15
Exposure Distance 2 (m)	10.00	0.00
Exposure Distance 3 (m)	10.00	0.00
Exposure Distance 4 (m)	10.00	0.00
Exposure Distance 5 (m)		
	S_{tot}	**1.15**

Figure 1 - Spatial Coefficient vs Exposure Distance



Step 3: Determine Volume of Building

Building Length(m)	Building Width (m)	Building Height to the underside of roof deck (m)	Volume (m^3)
25.00	20.00	10.00	5000.00

Number of Stories	3

Step 4: Calculate Minimum Water Supply

$$Q = KVS_{tot}$$

Minimum Water Supply (L)	132250.00

Step 5: Calculate Minimum Supply Flow Rate

Table 2 from OBC 2012 A3.2.5.7			
Minimum Water Supply Flow Rates			
Building Code, Part 3 Buildings	Required Minimum Water Supply Flow Rate (L/min)		
One Storey Building with building area not exceeding 600 m2 (excluding F1 occupancy)	1800		
All Other Buildings	if Q> and	Q<=	
		108000	2700
	108000	135000	3600
	135000	162000	4500
	162000	190000	5400
	190000	270000	6300
	270000		9000

Minimum Water Supply Flow Rate (L/min)	3600
Minimum Water Supply Flow Rate (L/s)	60

Step 6: Is a private fire reservoir required? **No**

47 Bedford Road

Guelph-Eramosa Township

Project No: 51505-104

Date: December 20, 2022

By: CVP

Table 4 - Water Cad Outputs

Node	Pressure (kPa)[1]				Maximum Day + Fire Flow[2]		
	Average Day	Maximum Day	Minimum Hour	Peak Hour	Fire Flow Required (L/s)	Available Fire Flow (L/s)	Pressure (kPa)
J-2	318	318	318	318	60	80	140

Notes:

1. Starting HGL at reservoir considered to be low-water level, to produce conservative pressure estimate.

2. Sarting HGL at reservoir considered to be fire-flow scenario, to simulate fire flow design.

Appendix E

Geotechnical Investigation

Proposed Residential Subdivision

Geotechnical Investigation Report

Project Location:
47 Bedford Road, Guelph, ON

Prepared for:
Marann Homes
449 Laird Road, Unit 6
Guelph, ON N1G 4W1

Prepared by:
MTE Consultants Inc.
365 Home Street
Stratford, ON N5A 2A5

August 11, 2022

MTE File No.: 51505-104

Engineers, Scientists, Surveyors.

Contents

Tables

Appendices

1.0 Introduction

MTE Consultants Inc. (MTE) was retained by Marann homes to conduct a geotechnical investigation for the proposed residential development of the property located at 47 Bedford Road in the Township of Guelph-Eramosa, Ontario as shown on **Figure 1 in Appendix A**.

The property (the site) comprises a 2.4 ha parcel that is currently occupied by a single residential dwelling and separate garage structure. The site is currently serviced by a septic bed and a well. The site generally slopes down to the east at an average inclination of 10% from Elevation 357m near the existing garage to Elevation 344m along the east property line.

It is understood that the proposed residential development will comprise five (5) residential lots with one (1) municipal road connected to the existing Bedford Road. The lots will be a minimum of 0.4 ha and it is anticipated that each dwelling will be serviced with a private sewage septic system. It is understood that a storm outlet for the site exists in Cross Creek Park, a municipal park located west of the proposed site. It is also noted that a 200mm watermain is available for the proposed site to connect to. The site will be zoned for Rural Residential purposes.

The purpose of this geotechnical investigation is to determine the soil and groundwater conditions in the area of the proposed residential development and provide geotechnical engineering recommendations for site grading, site servicing, foundations, basements, pavement design, subdrainage requirements, and percolation time analysis for design of the septic systems.

2.0 Field and Laboratory Program

The fieldwork for this investigation was carried out on June 10, 2022 and involved the drilling of four (4) boreholes (Boreholes MW101-22 to MW104-22) to depths ranging from 6.1 to 8.2 m. The locations of the boreholes are shown on the Site Plan, **Figure 1 in Appendix A**.

Private and public utility companies were contacted prior to the start of drilling activities in order to isolate underground utilities near the boring locations.

The boreholes were advanced with a GT8 track mounted drill rig equipped with continuous flight hollow stem augers, supplied and operated by Landshark Drilling Inc.

Representative soil samples were recovered throughout the depths explored. Standard Penetration Tests (SPT) were carried out during sampling operations in the boreholes using conventional split spoon equipment. The SPT N-values recorded are plotted on the borehole logs in **Appendix B**.

Upon completion of drilling, 50 mm diameter monitoring wells were installed in each borehole location to allow measurement of stabilized groundwater levels and groundwater sampling and testing. The installations comprised 1.5 m filtered screens and bentonite seals above the screens. Details of the installation and groundwater observations and measurements are provided on the appended borehole logs.

The monitoring wells were installed in accordance to Ontario Regulation 468/10. The construction, maintenance and abandonment of the wells are regulated under the province's Water Resources Act. The monitoring well network located on the site must be maintained or decommissioned in accordance with regulatory requirements.

The fieldwork was monitored throughout by a member of our geotechnical engineering staff, who directed the drilling procedures; recorded SPT values; documented the soil stratigraphies; monitored the groundwater conditions and monitoring well installations; and transported the recovered soil samples to our office for further classification.

The geodetic ground surface elevations at the borehole locations were surveyed by MTE.

All of the soil samples collected were submitted for moisture content testing with the results provided on the borehole logs in **Appendix B**. Additionally, four soil samples were submitted for particle size distribution analyses. The laboratory results are provided in **Appendix C**. The remaining soil samples will be stored for a period of 1 month and will be discarded of at that time without prior request from the client to extend storage time.

3.0 Soil Conditions

Reference is provided to the appended borehole logs for soil stratigraphy details, SPT N-values, moisture content profiles, and groundwater observations and measurements. Soil conditions encountered in the boreholes typically include topsoil overlying native glacial till deposits.

3.1 Topsoil

Topsoil was encountered surficially in all the boreholes and ranged from 250 to 300 mm thick with an average thickness of 280 mm. The composition of the topsoil was typically dark brown sandy silt and was very moist at the time of the fieldwork.

3.2 Glacial Till

Glacial till was encountered beneath the topsoil in all of the boreholes and extends to the termination depth of each borehole. The till was brown to grey in colour and typically ranges in composition from sand and silt to silt with trace sand, clay, and gravel. Cobbles were encountered throughout the till. The results of particle size distribution analyses conducted on samples of the till are provided in **Appendix C** and summarized in the following table;

Table 1 - Results of Glacial Till Particle Size Distribution Analyses

Borehole Number	Sample Depth (mbgs)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)
MW101-22	0.8 - 1.4	9	42	40	9
MW102-22	0.8 - 1.4	10	41	41	8
MW103-22	0.8 - 1.4	31	29	32	8
MW104-22	0.8 - 1.4	15	40	37	8

SPT N-values measured in the till range from 4 to above 50 blows per 300 mm penetration of the split spoon sampler indicating loose to very dense conditions. It is noted, the loose conditions were generally encountered within the upper portions of the till.

Insitu moisture contents in the till range from 6 to 19% indicating moist to saturated conditions.

4.0 Groundwater Conditions

Groundwater observations and measurements were carried out in the open boreholes at the time of drilling and are summarized on the borehole logs. Saturated soil conditions encountered at the time of drilling are summarized in the following table;

Table 2 - Saturated Soil Conditions

Borehole Number	Saturated Soil Type	Depth of Saturated Soil (mbgs)	Elevation of Saturated Soil (masl)
MW101-22	150 mm Saturated Silty Sand Seam within Silt Till	4.9	351.4
MW102-22	Sandy Silt Till	7.9	347.0
MW103-22	Sandy Silt Till	3.0	347.4
MW104-22	Dry		

Monitoring wells were installed at each borehole location to facilitate the collection of groundwater samples and measurement of groundwater elevation. Water level measurements taken on June 30, 2022 are summarized in the following table;

Table 3 - Water Level Measurements Taken on June 30, 2022

Monitoring Well Number	Monitoring Well Ground Surface Elevation (masl)	Groundwater Depth (mbgs)	Groundwater Elevation (masl)
MW101-22	356.3	3.1	353.2
MW102-22	354.9	4.2	350.7
MW103-22	350.4	1.2	349.2
MW104-22	353.8	3.3	350.5

It should be noted that the groundwater levels can vary and are subject to seasonal fluctuations and local variations.

5.0 Discussion and Recommendations

5.1 General

The project will involve the proposed residential development of the property located at 47 Bedford Road in the Township of Guelph-Eramosa, Ontario. The site comprises a 2.4 ha parcel that is currently occupied by a single residential dwelling and separate garage structure. The site is currently serviced by a septic bed and a well.

It is understood that the proposed residential development will comprise five (5) residential lots with one (1) municipal road connected to the existing Bedford Road. The lots will be a minimum of 0.4 ha and it is anticipated that each dwelling will be serviced with a private sewage septic system. It is understood that a storm outlet for the site exists in Cross Creek Park, a municipal park located west of the proposed site. It is also noted that a 200mm watermain is available for the proposed site to connect to. The site will be zoned for Rural Residential purposes.

The subsurface stratigraphy at the site comprises topsoil overlying native glacial till deposits. Saturated soil conditions were encountered within the sandy silt till in Boreholes MW102-22 and MW103-22 at depths of 7.9 m and 3.0 m (Elevation 347.0 m and 347.4 m), respectively. A 150 mm saturated silty sand seam was also encountered within the silt till in Borehole MW101-22 at a depth of 4.9 m (Elevation 351.4 m).

Groundwater was measured in the installed monitoring wells at depths of 1.2 to 4.2 m (Elevation 349.2 to 353.2 m) on June 30, 2022.

Based on the results of this geotechnical investigation the site is suitable for the proposed residential development; however, the groundwater level may affect design and construction. The following subsections of this report contain geotechnical recommendations pertaining to development of the property including site grading, site servicing, foundations, basements, pavement design and subdrainage requirements, and percolation time analysis for design of the septic systems.

5.2 Site Preparation

The first construction activity that will be required for the proposed development will be removing the existing house and garage located at the south corner of the site (including old foundations and slabs). The fill surrounding the existing house and garage should also be removed; however, the depth of the fill was not confirmed at the time of this report. The depth of fill should be confirmed during demolition of the house basement based on visual inspection by qualified geotechnical personnel.

Prior to carrying out any engineering fill operations, all fill (from the existing structures), topsoil, trees, vegetation, and deleterious material should be removed from the development area. Topsoil was encountered surficially in all boreholes and ranged from 250 to 300 mm thick with an average thickness of 280 mm. It is recommended that the average depth of topsoil and/or fill should be increased by 50 to 100 mm when calculating stripping volumes to account for uncertainty and overstripping. The topsoil and fill could be used in landscaping areas to raise grades.

It is noted that the movement of excess soil from a project site is regulated under O.Reg. 406/19 and the associated Rules for Soil Management and Excess Soil Quality Standards. The Regulation and Rules have been enacted with various phase in dates between January 2021 and 2025. Depending on the proposed timing and final design of the project, excess soil management may be captured under the Regulation and associated Rules.

It is envisioned that a cut-fill program will be conducted at the site and it is anticipated that the upper native materials will be utilized. Following topsoil stripping, the subgrade should be inspected and proof rolled in the presence of qualified geotechnical personnel to verify if the subgrade will provide support as intended in the original design.

The primary purpose of the inspection is to identify poorly performing areas which should be sub-excavated as well as to ensure that all organic material (topsoil and roots) has been stripped. Particular attention should be paid in the lower lying portions of the site to ensure that any loose soils encountered will properly support the structural fill.

Structural fill used for raising grades beneath the proposed buildings footings should comprise granular material such as OPSS 1010 Granular 'B'. Subgrade fill material beneath the proposed pavement areas and services should meet the requirements of OPSS 1010 Select Subgrade Material. Any imported fill should be tested and verified by qualified geotechnical personnel prior to placement. Alternatively, if the onsite native soils are utilized as structural fill at the site, the moisture content of the materials will need to be closely monitored to ensure proper compaction is able to be achieved.

Native materials that are wet, especially the fine grained (silty) native soils, may need to be spread and scarified to dry out prior to compaction onsite. Additionally, the lift thicknesses may need to be reduced to a thickness of 150 to 200 mm to ensure proper compaction is achieved. Any cutting and filling using the fine grained (silty) native soils as structural fill must occur during the summer months in order for the wetter portions of the materials to be able to dry.

Structural fill pads must extend a minimum 0.3 m beyond the edge of the footing envelope of any building and down to subgrade at an angle of 45 degrees to the horizontal. Full time testing by geotechnical personnel is required during fill placement and compaction to monitor material quality, lift thickness, and verify the compaction by in-situ density testing (as per the 2012 Ontario Building Code).

All engineered fill should be placed in maximum 300 mm thick lifts and compacted to the following percentages;

Table 4 - Engineered Fill Requirements

Fill Use	Minimum Compaction Required
Structural fill to support buildings	100% SPMDD
Subgrade fill beneath pavements or services	95% SPMDD
Bulk fill in landscape areas	90% SPMDD

The native subgrade soils are very susceptible to disturbance due to the silt content and it is recommended that construction traffic on the subgrade be minimized.

In order to minimize the effects of weather and groundwater, fill operations onsite should be carried out in the dry summer months.

5.3 Site Servicing

5.3.1 Excavations and Dewatering

It is understood that each proposed unit within the development will be provided with a private sewage septic system and a watermain will be extended off of Bedford Road to service the development.

Temporary excavations to conventional depths for installation of underground pipes at this site must comply with the Ontario Occupational Health and Safety Act and Regulations for Construction Projects. The topsoil and loose glacial till soils encountered in the boreholes would be classified as Type 3 soils (O. Reg. 213/91, s. 226 (4)). Temporary side slopes must be cut at an inclination of 1.0 horizontal to 1.0 vertical or less from the base of the excavation for open cut pipe installation. The compact to very dense glacial till soils encountered at the site are classified as Type 2 soils and temporary side slopes for can be cut near vertical at 1.2 m above the base of excavation and then at an inclination of 1.0 horizontal to 1.0 vertical or less above this level, exclusive of groundwater effects. Where wet to saturated conditions are encountered, excavation side slopes should be expected to slough to flatter inclinations, potentially 3.0 horizontal to 1.0 vertical or flatter.

Trench side slopes must be continuously inspected especially after periods of heavy rainfall or snow melt to identify areas of instability. Surface water should be directed away from entering the trench.

Minor to moderate groundwater inflow should be expected where excavations extend into the groundwater regime at the site. Groundwater was measured in the installed monitoring wells at depths of 1.2 to 4.2 m (Elevation 349.2 to 353.2 m). It is envisioned that conventional sump pump techniques will be sufficient to control the inflow with excessive pumping needed in some areas.

It will be necessary to flatten or support the excavation side slopes where groundwater seepage is occurring to ensure stability. Every excavation that a worker may be required to enter shall be kept reasonably free of water (O. Reg. 213/91, s. 230).

It should be noted that an Environmental Activity and Sector Registry (EASR) or Permit to Take Water (PTTW), issued by the Ministry of Environment, Conservation and Parks, will be required if the dewatering system/sumps result in a water taking of more than 50,000 L/day or 400,000 L/day, respectively. The design of the dewatering system should be left to the contractor's discretion to control groundwater at least 0.5 m below the invert level in order to provide stable excavation base. The contractor shall notify the prime consultant in the event that they feel that an EASR/PTTW will be needed.

5.3.2 Pipe Bedding

It is anticipated invert elevation of the pipes will be at conventional 2 to 3 m depths below ground surface. No bearing problems are anticipated for pipes set on properly dewatered native inorganic subsoil or imported structural fill. The bedding material may need to be thickened if excavations encounter soft or spongy soil from the base of the service trench.

Pipe bedding for sewer services should be conventional Class 'B' pipe bedding comprising a minimum 150 mm thick layer of OPSS 1010 Granular 'A' aggregate below the pipe invert. Granular 'A' type aggregate should be provided around the pipe to at least 300 mm above the pipe and the bedding aggregate should be compacted to a minimum 100% Standard Proctor Maximum Dry Density (SPMDD), as per the Region of Waterloo and Area Municipalities Design Guidelines and Supplemental Specifications for Municipal Services Document (DGSSMS), dated January 2021.

A well-graded clear stone such as Coarse Aggregate for HL4 Asphaltic Concrete (OPSS 1003) could be used in the sewer trenches as bedding below the spring line of the pipe to facilitate sump pump dewatering, if necessary. The clear stone should be compacted with a plate tamper and fully wrapped with a non-woven filter cloth to prevent the migration of fine particles from the saturated soils.

5.3.3 Trench Backfilling

The trenches above the specified pipe bedding should be backfilled with inorganic onsite soils placed in 300 mm thick lifts and compacted to at least 98% SPMDD. Where trenches enter the proposed residential buildings the backfill should be compacted to 100% SPMDD or 5 MPa lean-mix concrete may be used. Wet or saturated native soils are not considered suitable for reuse as trench backfill. Any additional material required to be imported at the site should meet OPSS Select Subgrade Material specifications.

To minimize potential problems, backfilling operations should follow closely after excavation so that only a minimal length of trench is exposed. Care should be taken to protect side slopes of excavations by diverting surface run-off away from the excavations. If construction extends into the winter, then additional steps should be taken to minimize frost and ensure that frozen material is not used as backfill.

5.4 Pavement Structure

It is understood that a new municipal road will be constructed to access the development. The existing topsoil, trees, vegetation, and deleterious material in the vicinity of the roadway should be removed. Depending on finished grades at the site, the subgrade soils will consist of native soils or approved engineered fill.

It is understood that the roadway would be classified as a local roadway. The pavement component thicknesses in the following table are recommended based on the proposed pavement usage and the frost-susceptibility and strength of the subgrade soils and The City of Guelph Linear Infrastructure Standards 2021, dated March 3, 2021;

Table 5 - Pavement Design

Pavement Component	Thickness
HL3 Surface Hot Mix Asphalt	40 mm
HL8 Binder Hot Mix Asphalt	50 mm
OPSS 1010 Granular ‘A’ Base	175 mm
OPSS 1010 Granular ‘B’ Subbase	350 mm

Samples of aggregates should be checked for conformance to OPSS 1010 prior to utilization on site and during construction. The Granular 'B' subbase and Granular 'A' base courses must be compacted to 100% SPMDD, as verified by insitu density testing.

The asphaltic concrete paving materials should conform to the requirements of OPSS 1150. The asphalt should be placed and compacted in accordance with OPSS 310. The Performance Graded Asphalt Cement (PG-AC) designation for the asphaltic concrete is 58-28.

The asphaltic concrete should comprise 40 mm of the HL3 surface over 50 mm of HL4 or HL8 binder.

The pavement design is based on the assumption that construction will be carried out during the drier time of the year and that the subgrade soil is stable as determined by proof-rolling inspected by qualified geotechnical personnel. If the subgrade is wet and unstable, additional granular subbase may be required.

All materials and construction services required for the work should be in accordance with the relevant sections of the Ontario Provincial Standard Specifications.

It is recommended to install subdrains beneath the low lying areas of the pavement structure and connected to catchbasins. The purpose of the subdrains is to remove excess subsurface water in order to improve overall pavement serviceability and increase the pavement life.

The work of subdrain installation shall be in accordance with OPSS 405 and OPSD 216.021. The subdrain shall be 100 or 150 mm diameter perforated pipe conforming to OPSS 1801 or 1840, and wrapped with geotextile conforming to OPSS 1860.

5.5 Curbs and Gutter and Sidewalks

The concrete for curbs, gutters and sidewalks should be proportioned, mixed, placed and cured in accordance with the requirements of Standard Specifications SS-16 Curb and Gutter and SS-17 Sidewalks, from the City of Guelph Linear Infrastructure Standards 2021, dated March 3, 2021.

During cold weather any freshly placed concrete for curbs, gutter, and sidewalks must be covered with insulating blankets to protect against freezing as per OPSS 904. Three cylinders from each day's pour should be taken for compressive strength testing. Air entrainment, temperature and slump tests should be conducted on the same batch of concrete from the test cylinders made.

5.6 Residential Foundation Design

It is understood that five (5) residential lots will be constructed, it is anticipated that the residential buildings will be constructed with conventional strip and/or pad footing and will be provided with full basements.

In general, the undisturbed native soils are considered suitable to support the proposed residential buildings foundations. Conventional spread footings founded on the undisturbed native soils or approved structural fill may be designed as per Part 9 of the 2012 Ontario Building Code.

The founding native soils are very susceptible to disturbance by construction activity, especially during wet weather and care should be taken to preserve the integrity of the material as bearing strata. A mud mat following excavation and approval of the native soils is recommended if foundations cannot be poured the same day.

The footing areas must be inspected by qualified geotechnical personnel to ensure that the soil conditions encountered at the time of construction are suitable to support the design resistances prior to pouring concrete. Any loose, disturbed, organic and deleterious material identified during the inspection should be removed from the footing areas and replaced with concrete.

All exterior floor slabs and footings in unheated areas must be provided with a minimum 1.2 m of earth cover or equivalent insulation after final grading in order to minimize the potential of damage due to frost action, as per Ontario Provincial Standard Drawing, OPSD 3090.101, dated November 2010. If construction is undertaken during the winter, the subgrade soil and concrete should be protected from freezing.

A modulus of subgrade reaction of 20 to 30 MPa/m should be used in the design of the floor slab.

A minimum 150 mm thick layer of Granular 'A' material uniformly compacted to 100% SPMDD should be provided directly beneath the floor slab for leveling and support purposes.

Where spread footings are constructed at different elevations, the difference in elevation in the individual footing should not be greater than one half of the clear distance between the footings. The lower footing should be constructed first so that if it is necessary to construct the lower footings at a greater depth than anticipated, the elevation of the upper footings can be adjusted accordingly. Stepped strip footings should be constructed in accordance with OBC Section 9.15.3.8.

A Site Classification 'D' should be used for earthquake load and effects in accordance with Table 4.1.8.4.A. of the 2012 Ontario Building Code.

All excavations at the site should be carried out in conformance with the Ontario Occupational Health and Safety Act and Regulations for Construction Projects. The topsoil and loose glacial till soils encountered at the site are classified as Type 3 soils, and temporary side slopes through this material must be cut at an inclination of 1.0 horizontal to 1.0 vertical or less from the base of the excavation. The compact to very dense glacial till soils encountered at the site are classified as Type 2 soils and temporary side slopes can be cut near vertical to 1.2 m above the base of excavation and then at an inclination of 1.0 horizontal to 1.0 vertical or less above this level, exclusive of groundwater effects.

Where wet to saturated conditions are encountered, excavation side slopes should be expected to slough to flatter inclinations, potentially 3.0 horizontal to 1.0 vertical or flatter.

5.6.1 Basements

It is anticipated that conventional basements will be constructed for the proposed residential buildings and they are anticipated to be constructed at typical 2 to 3 m depths.

Groundwater measured in the installed monitoring wells at depths of 1.2 to 4.2 m (Elevation 349.2 to 353.2 m) on June 30, 2022. MTE recommends the basement floor levels be designed a minimum 0.5 m above the seasonal high groundwater elevations. MTE recommends to complete groundwater monitoring at the site to determine the seasonal high groundwater elevations.

Basements at this site must be provided with perimeter weeping tile systems as per the Ontario Building Code (Section 9.14). The drain tile or pipe should be laid on undisturbed or well-compacted soil so that the top of the tile or pipe (minimum 100 mm diameter) is below the bottom of the basement floor slab. The top and sides of the drain tile or pipe shall be surrounded with not less than 150 mm of crushed stone or other clean coarse granular material containing no more than 10% of material that will pass the 4 mm sieve. The crushed stone should be wrapped with filter cloth. The weeping tile must drain to a suitable frost-free outlet or sump equipped with an automatic pump that will discharge water into a storm sewer service.

The portion of the exterior basement wall and floor slab below finished ground level must be waterproofed as per the Ontario Building Code (Subsection 9.13.3). Free-draining sand materials should be used for basement wall backfill. The basement wall backfill should be graded to allow drainage away from the foundation.

The basement walls should be designed to resist the lateral earth pressure. For calculating the lateral earth pressure, the coefficient of earth pressure (K) may be assumed as 0.50 for cohesionless sandy soils and 1.0 for silt and clay (Section 24.12.3.3 Canadian Foundation Engineering Manual). The bulk unit weight of the retained backfill may be taken as 21 kN/m3 for well-compacted soil. An appropriate factor of safety should be employed.

The subgrade for the basement floor slabs should comprise undisturbed native soil or well-compacted fill. A minimum 100 mm thick layer of coarse clean granular material containing not more than 10% material that will pass a 4 mm sieve shall be placed beneath slabs in houses as per Subsection 9.16.2 of the Ontario Building Code. Based on the measured groundwater levels, it is recommended that subfloor weeping tiles be placed and connected to the sump pit.

If a moisture-sensitive floor finish is to be applied to the slab, then we recommend that a 15 mil polyethylene moisture vapour barrier be installed directly beneath the slab as per Article 9.13.2.7 of the Ontario Building Code. The purpose of the vapour barrier is to reduce moisture transfer by diffusion as per Article 5.5.1.2 of the Ontario Building Code. Joints in the vapour barrier should be lapped not less than 100 mm.

Concrete testing should be performed onsite to determine the slump, temperature, and air entrainment; and concrete cylinders should be cast for compressive strength testing.

5.7 Percolation Time Analysis

For the design of the on-site wastewater treatment and disposal systems, percolation times (T-times) were assessed based on the soil types determined from the particle size distribution results. It is understood each lot will be provided with an on-site wastewater treatment and disposal system. The T-time results are summarized in the following table;

Table 6 - Estimated T-Times of Native Soils

Borehole Number	Sample Depth (mbgs)	Sample Elevation (masl)	Soil Type	Estimated T-Time (min/cm)
MW101-22	0.8 - 1.4	355.5	Sand and Silt	40
MW102-22	0.8 - 1.4	354.1	Sand and Silt	40
MW103-22	0.8 - 1.4	349.6	Gravelly Sandy Silt	30
MW104-22	0.8 - 1.4	353.0	Sand and Silt	40

5.8 Construction Inspection and Testing

MTE recommends that geotechnical inspection and testing procedures be conducted throughout the various phases of the project.

Engineer site visits should be conducted to confirm geotechnical bearing resistances for footings. Soil compaction testing should be carried out on structural fill beneath the proposed residential buildings, foundation wall backfill, subslab granular fill, and trench backfill. Laboratory and field testing of the pavement structure components (granulars and asphaltic concrete) should be conducted, as well as concrete testing for foundations, curbs, and sidewalks.

MTE offers soil compaction, concrete, and asphalt testing, as well as soil inspection services through our Stratford, Kitchener, and London offices.

6.0 Limitations of Report

Services performed by MTE Consultants Inc. (MTE) were conducted in a manner consistent with the level of care and skill ordinarily exercised by members of the Geotechnical Engineering & Consulting profession practicing under similar conditions in the same geographic area were the services are provided. No other warranty or representation expressed or implied as to the accuracy of the information, conclusions or recommendations is included or intended in this report.

This report was completed for the sole use of the Client. This report is not intended to be exhaustive in scope or to imply a risk-free site. As such, this report may not deal with all issues potentially applicable to the site and may omit aspects which are or may be of interest to the reader.

In addition, it should be recognized that a soil sample result represents one distinct portion of a site at the time it is collected, and that the findings of this report are based on conditions as they existed during the time period of the investigation. The material in the report reflects our best judgment using the information available at the time the report was written. The soil and groundwater conditions between and beyond the test holes may differ from those encountered in the test holes. Should subsurface conditions arise that are different from those in the test holes MTE should be notified to determine whether or not changes should be made as a result of these conditions.

It should be recognized that the passage of time may affect the views, conclusions and recommendations (if any) provided in this report because groundwater conditions of a property can change, along with regulatory requirements. All design details were not known at the time of submission of this report and it is recommended MTE should be retained to review the final design documents prior to construction to confirm they are consistent with our report recommendations. Should additional or new information become available, MTE recommends that it be brought to our attention in order that we may determine whether it affects the contents of this report.

Any use which another party makes of this report, or any reliance on, or decisions to be made based upon it, are the responsibility of such parties. MTE accepts no responsibility for liabilities incurred by or damages, if any, suffered by another party as a result of decisions made or actions taken, based upon this report. Others with interest in the site should undertake their own investigations and studies to determine how or if the condition affects them or their plans. The contractors bidding on this project or undertaking the construction should make their own interpretation of the factual information and draw their own conclusions as to how subsurface conditions may affect their work.

The benchmark and elevations provided in this report are primarily established to identify differences between the test hole locations and should not be used for other purposes such as, planning, development, grading, and excavation.

All of which is respectfully submitted,

MTE Consultants Inc.

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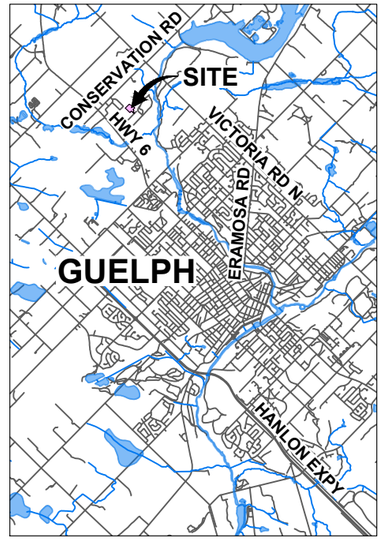
Appendix A

Figures

Figure 1 - Site Plan



KEY PLAN (nts)

N

SCALE IN METRES
0 20 40m
1:1,000

LEGEND

- SITE BOUNDARY
- BOREHOLE/MONITORING WELL
- **(353.8m)** ELEVATION (m AMSL)

REFERENCES

BING IMAGERY AS OF JULY 29 - 2022 (IMAGE DATE UNKNOWN);
MTE, EXISTING CONDITIONS PLAN, DWG No. EC1.1, JULY 6 - 2002; AND
LAND INFORMATION ONTARIO, ROAD AND WATER NETWORK © QUEEN'S PRINTER FOR ONTARIO, 2022 (key plan),

NOTES

THIS FIGURE IS SCHEMATIC ONLY AND TO BE READ IN CONJUNCTION WITH ACCOMPANYING TEXT.

BING IMAGERY USED FOR ILLUSTRATION PURPOSES ONLY AND NOT TO BE USED FOR MEASUREMENTS.

ALL LOCATIONS ARE APPROXIMATE.

MTE
Engineers, Scientists, Surveyors

PROJECT
GEOTECHNICAL INVESTIGATION
47 BEDFORD ROAD
GUELPH, ONTARIO

TITLE
SITE PLAN

Drawn DCH	Scale AS SHOWN	**FIGURE 1**
Checked	Project No. 51505-104	
Date July 29/22	Rev No. 0	

Client: Marann Homes
Plot Date: 29 July 2022 Time: 10:18:44
CAD: P:\51505\104\GEO\2_PROD\51505-104-R01 GEOTECHNICAL INVESTIGATION\51505-104-R01001.DWG
25mm Original Format in Tabloid (279mm x 432mm; 11" x 17")
0

Appendix B

Borehole Logs

Abbreviations and Symbols

MTE Boreholes MW101-22 to MW104-22

The following are abbreviations and symbols commonly used on borehole logs, figures and reports.

Sample Types

AS	Auger Sample
CS	Chunk Sample
BS	Bulk Sample
GS	Grab Sample
WS	Wash Sample
SS	Split Spoon
RC	Rock Core
SC	Soil Core
TW	Thinwall, Open
TP	Thinwall, Piston

Soil Tests

PP	Pocket Penetrometer
FV	Field Vane
SPT	Standard Penetration Test
CPT	Cone Penetration Test
WC	Water Content
WL	Water Level

Penetration Resistance

Standard Penetration Test, N (ASTM D1586)	The number of blows by a 63.5 kg (140 lb) hammer dropped 760 mm (30 in.) required to drive a 50 mm (2 in.) open spilt spoon sampler for a distance of 300 mm (12 in.).
Dynamic Cone Penetration Resistance	The number of blows by a 63.5 kg (140 lb) hammer dropped 760 mm (30 in.) required to drive an uncased 50 mm (2 in.) diameter, 60o cone attached to “A” size drill rods for a distance of 300 mm (12 in.).

Soil Description

Cohesive Soils	Undrained Shear Strength (Cu)	
Consistency	kPa	psf
Very Soft	0 to 12	0 to 250
Soft	12 to 25	250 to 500
Firm	25 to 50	500 to 1,000
Stiff	50 to 100	1,000 to 2,000
Very Stiff	100 to 200	2,000 to 4,000
Hard	Above 200	Above 4,000

Cohesionless Soils	
Relative Density	SPT N Value
Very Loose	0 to 4
Loose	4 to 10
Compact	10 to 30
Dense	30 to 50
Very Dense	Above 50

WH	Sampler advanced by static weight of hammer
WR	Sampler advanced by static weight of drilling rods
PH	Sampler advanced by hydraulic force
PM	Sampler advanced by manual force

DTPL	Drier than Plastic Limit
APL	About Plastic Limit
WTPL	Wetter than Plastic Limit
mbgs	Metres below Ground Surface

ID No.: MW101-22

Project Name: 47 Bedford Road Residential Subdivison

MTE File No.: 51505-104

Client: Marann Homes

Site Location: 47 Bedford Road, Guelph, ON

Date Completed: 6/10/2022

Drilling Contractor: Landshark

Drill Rig: GT8 Track Mounted

Drill Method: Hollow Stem Augers

Protective Cover: Monument Casing

Depth (ft / m)	Soil Description	Elevation (masl) / Depth (m)	Sample Number	Sample Type	Standard Penetration (Dynamic Cone)	Shear Strength (PP) kPa / Shear Strength (FV) kPa	Water Content %
	Ground Surface	356.3					
0 / 0	**TOPSOIL** dark brown sandy silt, trace organics, very moist (280mm)	0.0 / 356.0 / 0.3	1	SS	6		21
2 /	**SAND AND SILT TILL** loose brown sand and silt, trace to some gravel, trace clay, moist to very moist	355.5 / 0.8	2	SS	19		9
4 /	compact to dense, occasional cobbles		3	SS	39		10
6 / 2		353.9	4	SS	76/50mm		12
8 /	**SANDY SILT TILL** very dense light brown sandy silt, some gravel, trace clay, occasional cobbles, very moist	2.4 / 353.3	5	SS	96/75mm		6
10 /	**SAND AND SILT TILL** very dense light brown sand and silt, trace gravel and clay, occasional cobbles, very moist	3.0 / 351.6	6	SS	62/125mm		14
12 / 4	**SILT TILL** very dense grey/brown silt, trace sand, gravel, and clay, very moist	4.7	7	SS	50/100mm		19
14 /	occasional cobbles, 150mm saturated silty sand seam						
16 /							
18 /							
20 / 6		350.1					
22 /	Drilling Terminated	6.2					
24 /							

Groundwater Observations and Standpipe Details: Concrete; Bentonite; Sand Pack; 51mm PVC Riser; 51mm Slotted Screen

Field Technician: A. Challis

Drafted by: M. Bourque

Reviewed by: B. Heinbuch

Sheet: 1 of 1

Notes:
Water encountered at 4.9mbgs (Elevation 351.4masl) during drilling.
Water measured at 3.1mbgs (Elevation 353.2masl) on June 30, 2022.

ID No.: MW102-22

Project Name: 47 Bedford Road Residential Subdivison

MTE File No.: 51505-104

Client: Marann Homes

Site Location: 47 Bedford Road, Guelph, ON

Date Completed: 6/10/2022

Drilling Contractor: Landshark

Drill Rig: GT8 Track Mounted

Drill Method: Hollow Stem Augers

Protective Cover: Monument Casing

Depth (ft)	Depth (m)	Soil Description	Elevation (masl) / Depth (m)	Sample Number	Sample Type	Standard Penetration (Dynamic Cone)	Shear Strength (PP) kPa	Shear Strength (FV) kPa	Water Content %
		Ground Surface	354.9						
0	0	**TOPSOIL** dark brown sandy silt, trace organics, very moist (250mm)	0.0	1	SS	5			12
			354.1						
2		**SAND AND SILT TILL** loose brown sand and silt, some gravel, trace clay, very moist	0.8	2	SS	13			11
4		compact, occasional cobbles	353.4						
6	2	**SILT TILL** loose brown silt, some sand, trace clay and gravel, very moist	1.5	3	SS	8			12
			352.6						
8		**SANDY SILT TILL** dense to very dense light brown sandy silt, trace to some gravel and clay, occasional cobbles, moist to very moist	2.3	4	SS	30			10
10				5	SS	45			10
12	4								
14									
16				6	SS	86/75mm			10
18									
20	6	grey	348.8 6.1	7	SS	74/125mm			11
22									
24									
26	8	saturated	347.0 7.9	8	SS	55			19
28		Drilling Terminated							

Groundwater Observations and Standpipe Details: Concrete; Bentonite; 51mm PVC Riser; Sand Pack; 51mm Slotted Screen

Field Technician: A. Challis

Drafted by: M. Bourque

Reviewed by: B. Heinbuch

Sheet: 1 of 1

Notes:
Water encountered at 7.9mbgs (Elevation 347.0masl) during drilling.
Water measured at 4.2mbgs (Elevation 350.7masl) on June 30, 2022.

ID No.: MW103-22

Project Name: 47 Bedford Road Residential Subdivison

MTE File No.: 51505-104

Client: Marann Homes

Site Location: 47 Bedford Road, Guelph, ON

Date Completed: 6/10/2022

Drilling Contractor: Landshark

Drill Rig: GT8 Track Mounted

Drill Method: Hollow Stem Augers

Protective Cover: Monument Casing

Depth (ft / m)	Soil Description	Elevation (masl) / Depth (m)	Sample Number	Sample Type	Standard Penetration (Dynamic Cone)	Shear Strength (PP) kPa	Shear Strength (FV) kPa	Water Content %
	Ground Surface	350.4						
0 / 0	**TOPSOIL** dark brown sandy silt, trace organics, very moist (300mm)	0.0 / 350.1 / 0.3	1	SS	4			12
2 / 4 / 6 / 2	**GRAVELLY SANDY SILT TILL** loose brown gravelly sandy silt, trace clay, very moist		2	SS	7			11
			3	SS	7			12
		348.1						
8 / 10 / 4	**SANDY SILT TILL** compact light brown sandy silt, trace gravel and clay, occasional cobbles, very moist to wet	2.3 / 347.4	4	SS	16			12
	saturated	3.0	5	SS	12			18
		345.8						
12 / 14 / 16 / 6	**SILT TILL** dense grey silt, trace sand, clay, and gravel, saturated	4.6	6	SS	32			17
18 / 20 / 22 / 24	Drilling Terminated	344.3 / 6.1						

Groundwater Observations and Standpipe Details: Concrete; Bentonite; Sand Pack; 51mm PVC Riser; 51mm Slotted Screen

Field Technician: A. Challis

Drafted by: M. Bourque

Reviewed by: B. Heinbuch

Sheet: 1 of 1

Notes:
Water encountered at 3.0mbgs (Elevation 347.4masl) during drilling.
Water measured at 1.2mbgs (Elevation 349.2masl) on June 30, 2022.

ID No.: MW104-22

Project Name: 47 Bedford Road Residential Subdivison

MTE File No.: 51505-104

Client: Marann Homes

Site Location: 47 Bedford Road, Guelph, ON

Date Completed: 6/10/2022

Drilling Contractor: Landshark

Drill Rig: GT8 Track Mounted

Drill Method: Hollow Stem Augers

Protective Cover: Monument Casing

Depth (ft / m)	Soil Description	Elevation (masl) / Depth (m)	Sample Number	Sample Type	Dynamic Cone – Standard Penetration	Shear Strength (PP) kPa / Shear Strength (FV) kPa	Water Content %	Groundwater Observations and Standpipe Details
	Ground Surface	353.8						
0	**TOPSOIL** dark brown sandy silt, trace organics, very moist (280mm)	0.0 / 353.5 / 0.3	1	SS	5		14	Concrete
2	**SANDY SILT TILL** loose brown sandy silt, trace gravel and clay, very moist	353.0 / 0.8	2	SS	11		11	
4	**SAND AND SILT TILL** compact brown sand and silt, some gravel, trace clay, occasional cobbles, very moist		3	SS	16		10	
6			4	SS	29		16	Bentonite
8		351.1 / 2.7						
10	**SILT TILL** compact to very dense light brown silt, trace to some sand and clay, trace gravel, occasional cobbles, moist to very moist		5	SS	26/125mm		10	
12								
14		349.2 / 4.6						
16	grey		6	SS	54		7	Sand Pack
18								
20			7	SS	49		12	51mm PVC Riser
22	Drilling Terminated	347.1 / 6.7						51mm Slotted Screen
24								

Field Technician: A. Challis

Drafted by: M. Bourque

Reviewed by: B. Heinbuch

Sheet: 1 of 1

Notes:
Borehole dry upon drilling completion. Water measured at 3.3mbgs (Elevation 350.5masl) on June 30, 2022.

Appendix C

Laboratory Testing Results

Table 101

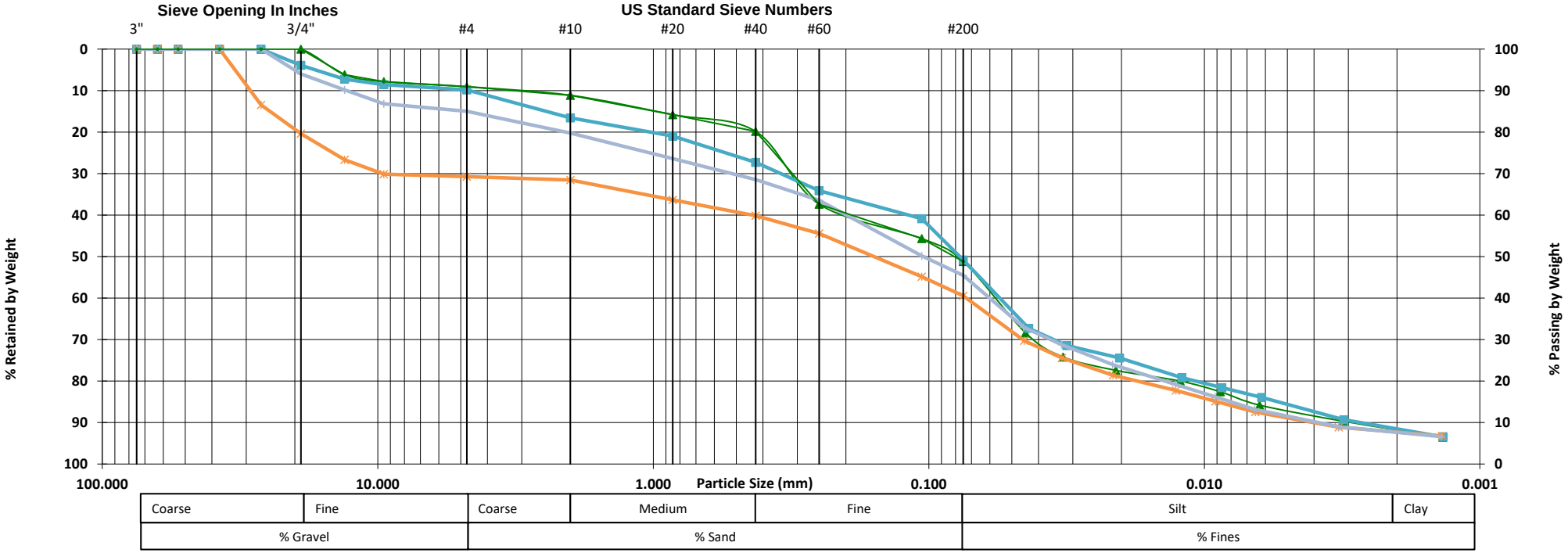
Particle Size Distribution Analysis Test Results

Project Name: 47 Bedford Road Residential Subdvision
Client: Marann Homes
Project Location: 47 Bedford Road, Guelph, ON

Date Sampled: June 10, 2022
Date Tested: June 13-16, 2022

MTE File No.: 51505-104
Table No: 101

Unified Soil Classification



Symbol	Borehole ID	Sample #	Sample Depth	Description
▲	MW101-22	SS-2	0.8-1.4 mbgs	SAND and SILT, trace Gravel and Clay
■	MW102-22	SS-2	0.8-1.4 mbgs	SAND and SILT, some Gravel, trace Clay
✳	MW103-22	SS-2	0.8-1.4 mbgs	Gravelly Sandy SILT, trace Clay
+	MW104-22	SS-2	0.8-1.4 mbgs	SAND and SILT, some Gravel, trace Clay

CERTIFIED BY CCIL Canadian Council of Independent Laboratories
For specific tests as listed on www.ccil.com

NOTES:

Appendix F

Septic System Memo

Technical Memorandum

Project Name: 47 Bedford Road

MTE File No.: C51505-104

To: Martin Knowles
Marann Homes

Date: December 15, 2022

From: Nick Romero, P. Eng.

Cc: Ken Hanes, MTE
Claire Phelps, MTE

RE: Conceptual On-site Wastewater Treatment Design for 47 Bedford Road

1.0 Background

MTE Consultants Inc. (MTE) was retained by Marann Homes to undertake the assessment of the on-site sewage treatment systems servicing the proposed development on 47 Bedford Road in Guelph, Ontario. The 2.37-hectare (ha) area (Site) currently consists of a single detached residential home, auxiliary structures, and a driveway, which will be removed prior to development. The Site is proposed to include five lots with residential dwellings and individual on-site wastewater treatment systems. The Site is bounded by residential rear lots of Blue Forest Drive to the north, a municipal park, and stormwater management easement to the east, and residential lots to the south and west.

Each lot within the proposed subdivision will be serviced by individual on-site wastewater treatment systems following Part 8 of the Ontario Building Code (OBC), as the daily flows within each lot are anticipated to be below 10,000 L/day. For this review, conceptual sizing, and grading for the on-site wastewater treatment system of each lot was completed. This technical memorandum is a preliminary conceptual brief intended to support the subdivision approvals and provide direction for space requirements related to the individual on-site wastewater treatment system for each lot.

2.0 Investigations

2.1 Geotechnical Investigation

A geotechnical investigation of the Site was completed by MTE on June 10, 2022 (MTE, 2022, Geotechnical Investigation). The fieldwork for this investigation involved the drilling of four boreholes to depths of 6.1 m to 8.2 m. All the soil samples collected were submitted for moisture content testing and four soil samples were submitted for particle size distribution analyses. Four soil samples analyzed for particle distribution indicated sand and silt soils content, with a T-time of 40 min/cm representative for the native soil conditions of the Site. Groundwater elevations depths ranged from 1.2 to 4.2 metres below ground surface. As such, to maintain the required vertical clearance from the groundwater table, the disposal beds in some lots will have to be raised.

3.0 On-site Wastewater Conceptual Design

In support of the subdivision Draft Plan of Subdivision for this Site, MTE completed a conceptual design to establish on-site wastewater treatment system area requirements and demonstrate that the lots are appropriately sized to support development of a typical residence. A conceptual design was completed on each lot; however, lot specific detailed designs have not been completed, and will be required during the later stages of the project.

3.1 Daily Design Sewage Flow

For the conceptual sizing of the on-site wastewater treatment system, the following have been assumed for the proposed residences on each lot:

- Four bedrooms;
- 500 m^2 of living space; and
- 3.5 bathrooms, kitchen, and laundry, assuming the following fixture count:
    - Four toilets;
    - Two showers;
    - Two bath tubs;
    - One kitchen sink;
    - Five sinks (individual traps per sink);
    - One washing machine;
    - One bar sink; and
    - One dishwasher.

Following these assumptions, the design flow was calculated to be 4,750 L/day, which was used for the conceptual on-site wastewater system sizing.

It is noted that should the number of bedrooms, bathrooms and/or square footage increase, the design flow will also increase, thus requiring a larger footprint for the on-site wastewater treatment system.

3.2 Wastewater Treatment System

It is assumed that a shallow buried trench system with Level IV treatment will be required for each lot due to the native soils and daily design flows. Since these lots are intended to be developed into residential properties, a system with Bureau de normalisation du Québec (BNQ) 3680-600 (CAN/BNQ 3680-600) certification is required for each lot. It is anticipated that each lot will require between two to three tanks for Level IV treatment.

It is recommended that, at a minimum, a 10 m by 5 m area be allocated for the on-site wastewater treatment system and tankage. Tankage requirements will be confirmed during the detailed design phase of the project once a on-site wastewater treatment system has been selected.

This area includes space for the treatment tanks only – refer to **Section 3.3** for the disposal space requirements.

3.3 Shallow Buried Trench Leaching Beds

Based on Part 8 of the OBC, for a site with a T-time between 20 to 50 min/cm and the total length of shallow buried trenching required is determined by the following formula:

$$L = \frac{Q}{50}$$

Where *L* is the shallow buried trenching length (m) and *Q* is the daily wastewater design flow (L/d).

Therefore, a minimum of 95 m of shallow buried trenching is required. Due to the anticipated groundwater level conditions in some locations through the site (high groundwater table), a 15 m mantle at the end of the distribution piping will also be required, as some disposal beds will need to be raised to achieve the minimum vertical clearance from the groundwater table. As such, the estimated footprint for a shallow buried trench disposal bed complete with mantle is approximately 645 m^2 (minimum), depending on orientation and number of runs.

Due to the high groundwater table in some locations, some disposal beds will likely require to be raised. As such, sufficient area around the distribution piping of the raised disposal beds must be allocated to allow for a 4:1 (max) slopes. The conceptual layout is shown on **Figure F1.1.**

3.4 Setback Requirements

The following setback distances are required for all on-site wastewater treatment systems:

Table 1: Setback Distance Requirements

Clearance From	Minimum Distance	
	Septic Tank / Treatment System	Distribution Piping
Building	1.5 m	5 m
Potable Wells	15 m	15 m / 30 m[1]
Water Body	15 m	15 m
Property Line	3 m	3 m

Note: [1] 15 m required to any watertight well casing with depth >6m. 30m required to any other well.

The setbacks have been identified in **Figure F1.1** for the conceptual layout. All the proposed on-site wastewater treatment works will conform to the required clearance distances. It is understood that the Site will be serviced by municipal water, and no drinking wells will be installed on-site. As such, setbacks to lot specific wells are not applicable.

4.0 Conclusion

Based on the information provided, it is concluded that:

- A shallow buried trench system complete with Level IV treatment will be required for each lot.
- A minimum groundwater separation of 1.0 m from the disposal bed will be required.
- Lots will be serviced by municipal water, therefore, setbacks to lot specific wells are not applicable.
- Based on the assumptions identified in this assessment, the lots within the Site have sufficient area allocated to accommodate a shallow buried trench system with Level IV treatment.
- Based on the assumption of a 500 m^2 residential dwelling, four bedrooms and 3.5 bathrooms, a minimum 645 m^2 area should be allocated in each individual lot for the disposal bed. Tankage requirements will be pending wastewater treatment system selection; however, it is recommended that at this stage of the project, a 10 m by 5 m area be allocated for the wastewater treatment system (at a minimum).

5.0 Recommendations

It is therefore recommended that:

- Space be provided on each lot for both the treatment system and the disposal bed as per the conceptual design, including setback limits.
- This conceptual assessment should be submitted in support of the Draft Plan of Subdivision application.

All of which is respectfully submitted,

MTE Consultants Inc.

Nick Romero, P.Eng.
Design Engineer
519-204-2223 ext. 2223
NRomero@mte85.com

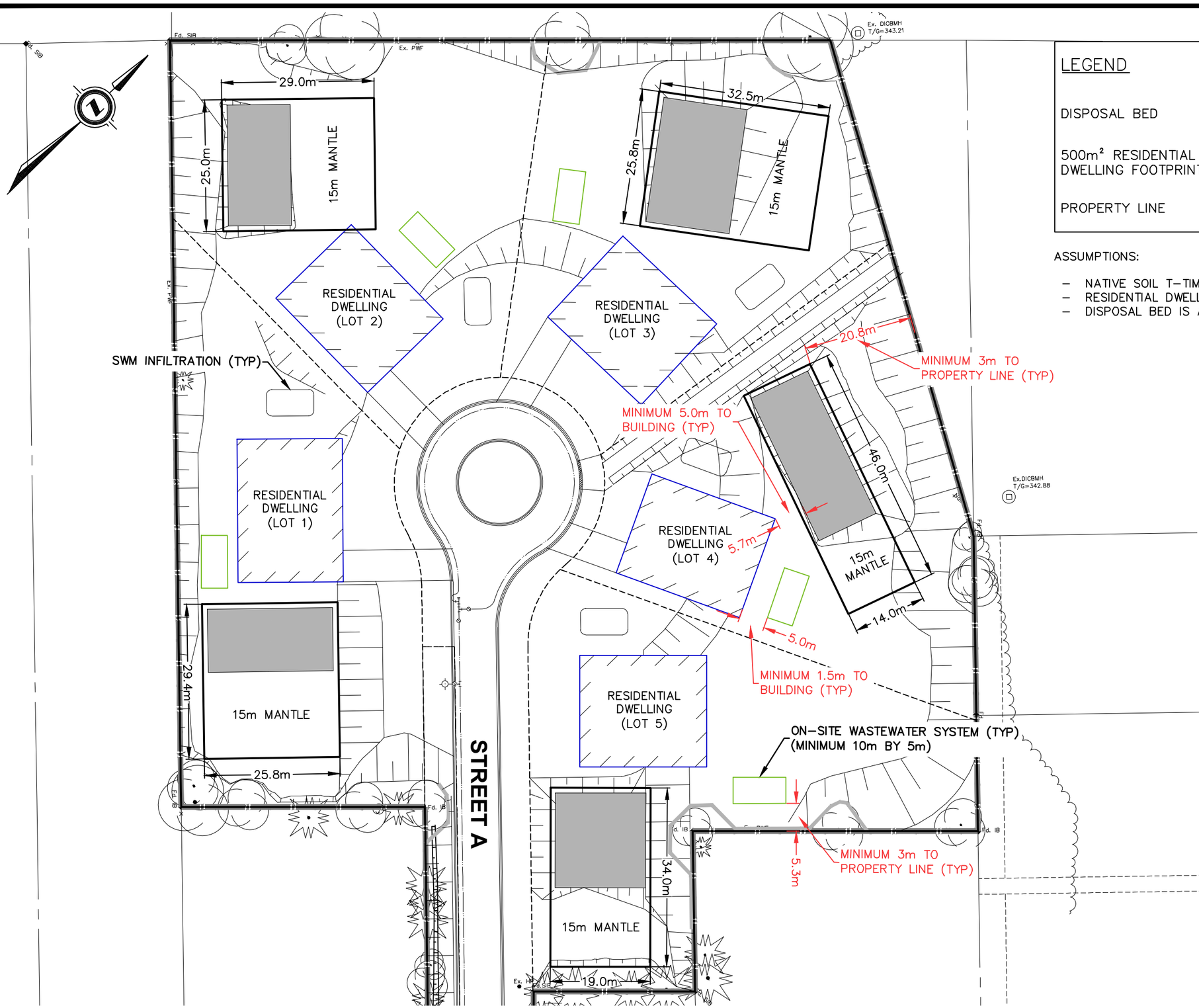
NXR:zeg

Encl: Attachment 1: Figure F1.1 – Conceptual On-site Wastewater Treatment Design

\\mte85.local\mte\des\51505\104\WW\47 Bedford - Conceptual Memo - Sanitary Conceptual Design.docx

FIGURES

- Figure 1.1 – Conceptual On-site Wastewater Treatment



LEGEND

DISPOSAL BED		DISTRIBUTION PIPE AREA	
500m² RESIDENTIAL DWELLING FOOTPRINT		ON-SITE WASTEWATER SYSTEM	
PROPERTY LINE		LOT LINE	

ASSUMPTIONS:

- NATIVE SOIL T-TIME OF 40 min/cm
- RESIDENTIAL DWELLINGS ASSUMED TO HAVE 4 BEDROOMS AND 3.5 BATHROOMS
- DISPOSAL BED IS A RAISED SHALLOW BURIED TRENCH c/w MANTLE

PART 8 – ONTARIO BUILDING CODE

MINIMUM CLEARANCE REQUIREMENTS:

TANK

- STRUCTURE – 1.5m
- PROPERTY LINE – 3m
- WELL – 15m

DISTRIBUTION PIPING

- STRUCTURE – 5m
- PROPERTY LINE – 3m
- WELL – 15m

F1.1

Date: Dec-22
Scale: 1:750

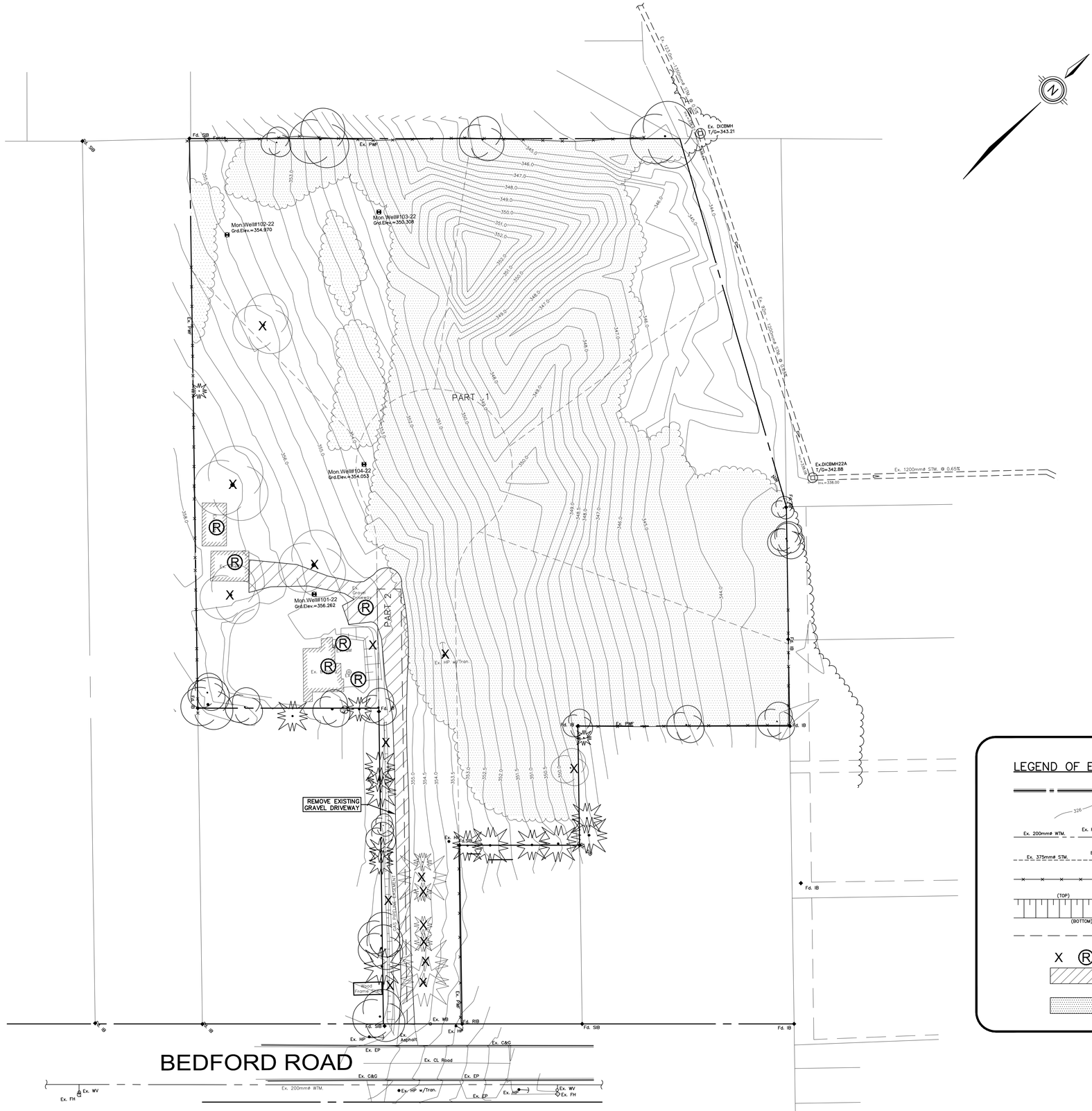
CONCEPTUAL ON-SITE WASTEWATER DESIGN FOR 47 BEDFORD ROAD SUBDIVISION

MTE
Engineers, Scientists, Surveyors

Project No.: 51505-104

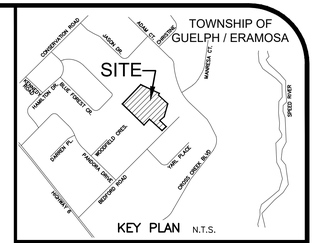
P:\P\51505\104\51505-104-F4.dwg

Drawings



LEGEND OF EXISTING FEATURES

- SITE BOUNDARY
- EXISTING CONTOURS
- EXISTING WATERMAIN
- EXISTING STORM SEWER
- EXISTING FENCE
- EXISTING EMBANKMENT (SLOPE AS NOTED)
- EASEMENT
- REMOVALS
- CLEARING AND GRUBBING



GEODETIC BM ELEV. = m

SITE BENCHMARK ELEV. = m

NOTE TO CONTRACTOR :

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No.	REVISION	BY	YYYY-MM-DD
8.			
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4.			
3.			
2.			
1.	ISSUED FOR DRAFT PLAN APPROVAL	KDH	2023-07-28

MTE
Engineers, Scientists, Surveyors
519-743-6500

OWNER

MARANN HOMES

449 LAIRD ROAD Guelph

PROJECT

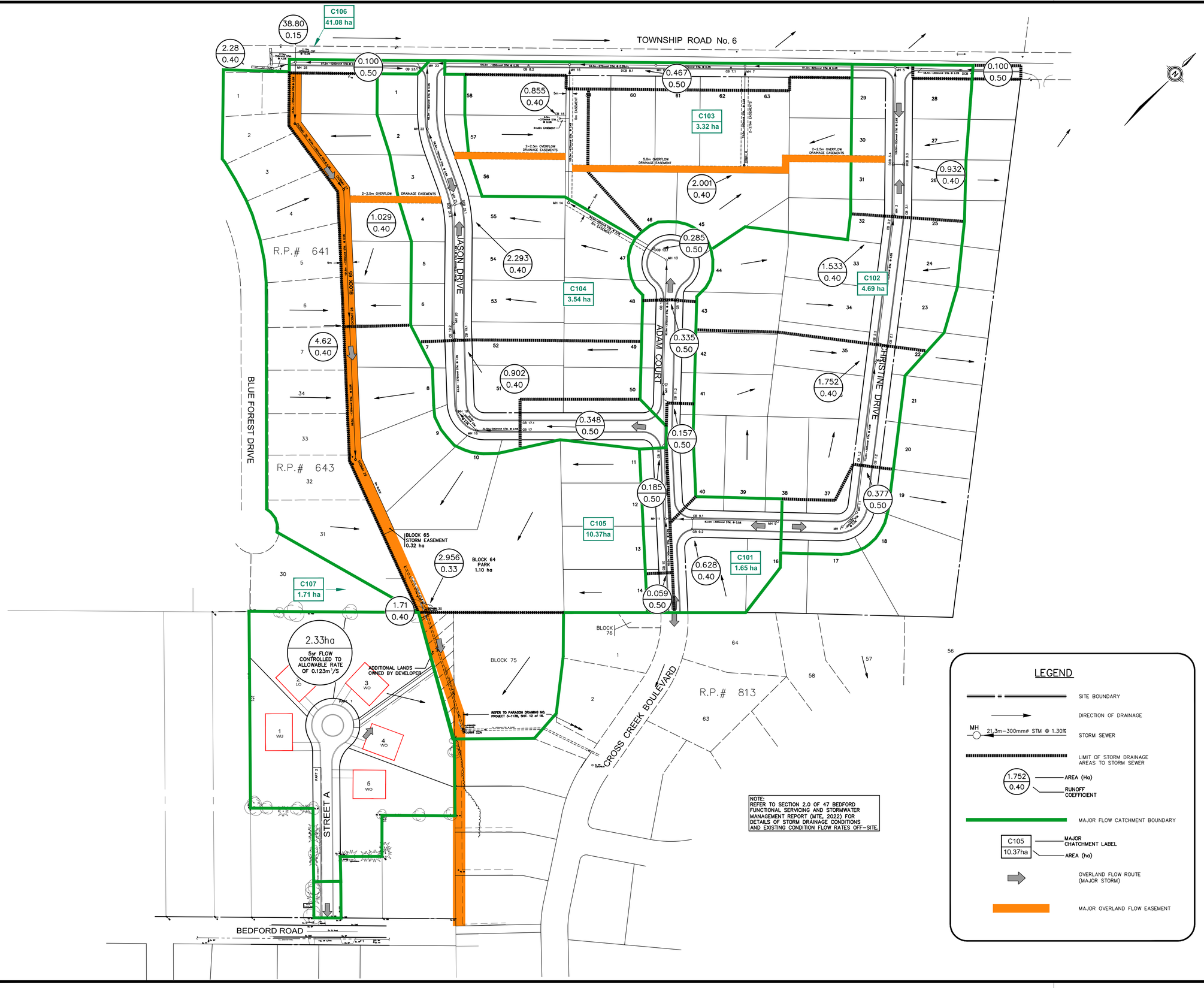
47 BEDFORD ROAD SUBDIVISION

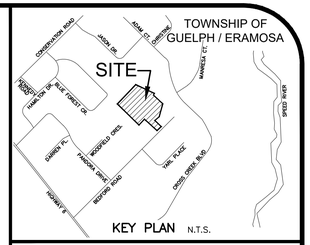
47 Bedford Road Guelph/Eramosa Township

DRAWING

EXISTING CONDITIONS AND REMOVALS PLAN

Project Manager K.HANES	Project No. 51505-104
Design By KDH	Checked By
Drawn By BDS	Checked By
Surveyed By MTE	Drawing No. EC1.1
Date Jul.06/22	
Scale 1:500	Sheet of





GEODETIC BM ELEV. = m

SITE BENCHMARK ELEV. = m

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MTE

Engineers, Scientists, Surveyors

519-743-6500

OWNER

MARANN HOMES

449 LAIRD ROAD Guelph

PROJECT

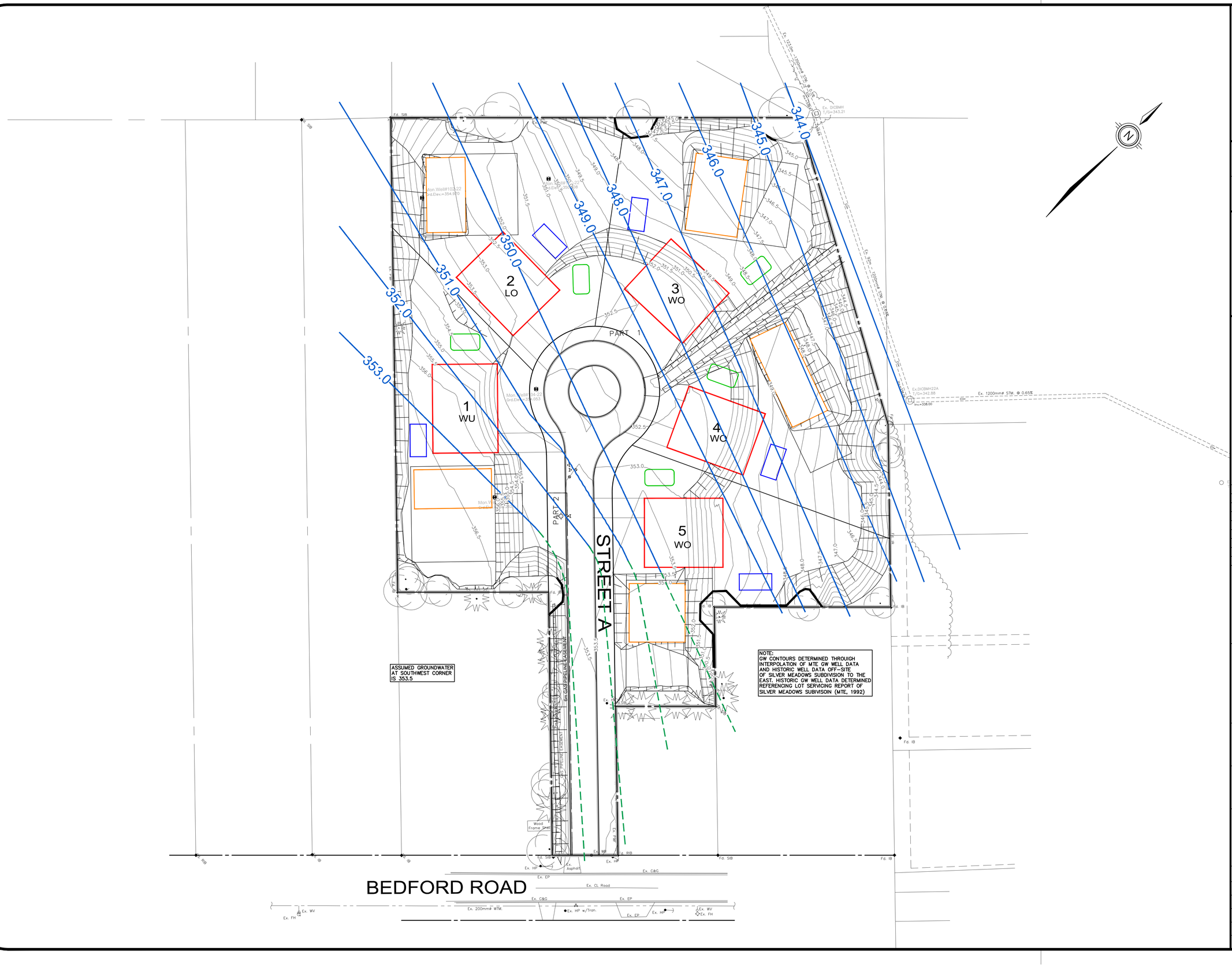
47 BEDFORD ROAD SUBDIVISION

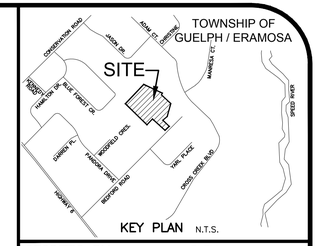
47 Bedford Road Guelph/Eramosa Township

DRAWING

STORM DRAINAGE AREA PLAN

Project Manager	K.HANES	Project No.	51505-104
Design By	CVP	Checked By	
Drawn By	ACH	Checked By	
Surveyed By	MTE	Drawing No.	MS1.1
Date	Aug.17/22		
Scale	1:1250	Sheet	of





GEODETIC BM ELEV. = m

SITE BENCHMARK ELEV. = m

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LEGEND

- SITE BOUNDARY
- FINISHED GRADE CONTOURS (353)
- INTERPOLATED GW COUNTOUR ELEVATION
- EXTRAPOLATED GW COUNTOUR ELEVATION

No.	REVISION	BY	DATE
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1.	ISSUED FOR DRAFT PLAN APPROVAL	KDH	2023-07-28

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519-743-6500

OWNER
MARANN HOMES
449 LAIRD ROAD Guelph

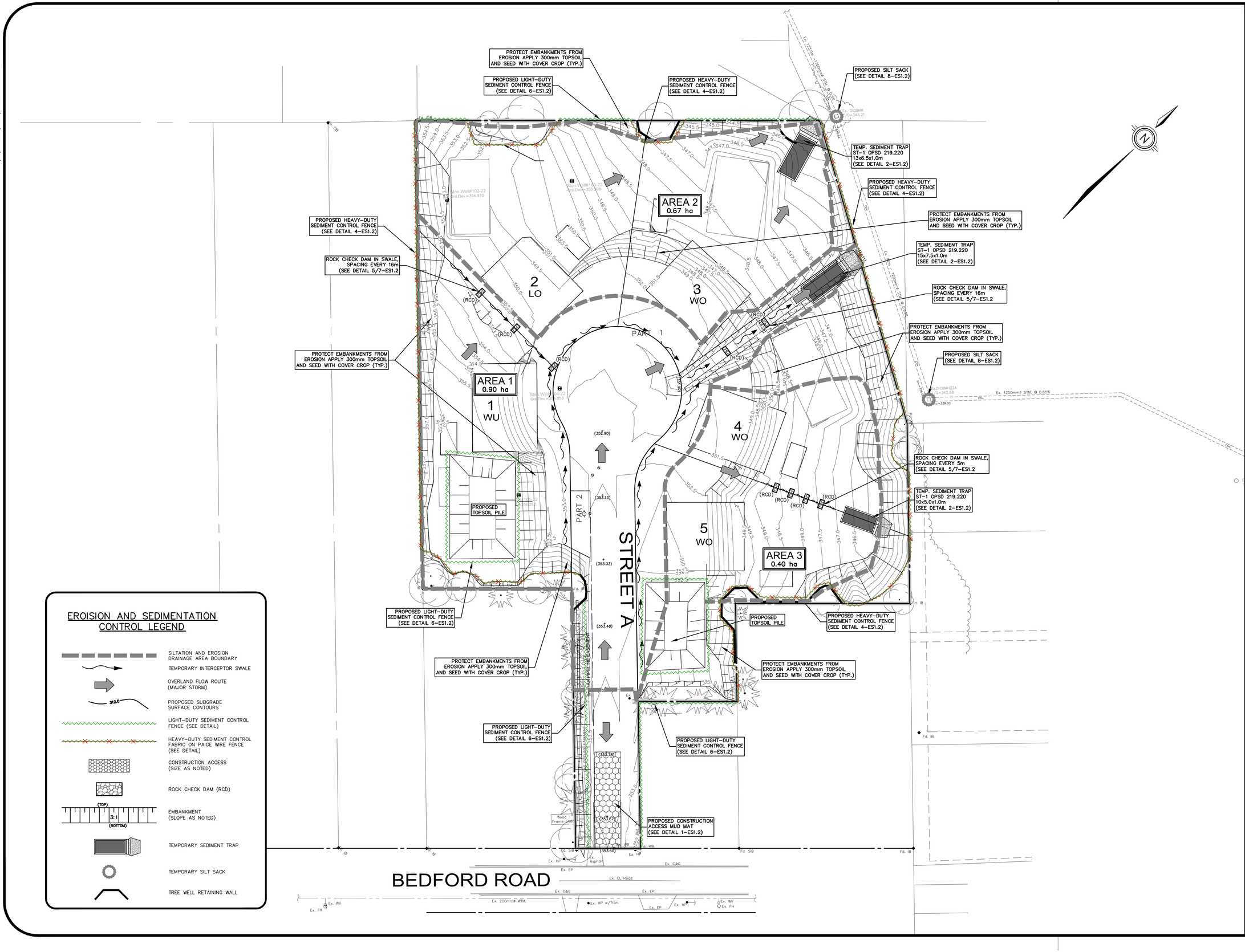
PROJECT
47 BEDFORD ROAD SUBDIVISION
47 Bedford Road Guelph/Eramosa Township

DRAWING
GROUND WATER CONTOUR PLAN

Project Manager K.HANES	Project No. 51505-104
Design By CVP	Checked By
Drawn By ACH	Checked By
Surveyed By MTE	Drawing No. MS2.1
Date Oct.19/22	
Scale 1:500	Sheet of

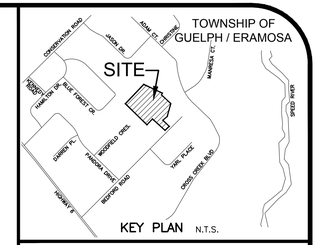
MTE FILE PATH: P:\P\51505\104\51505-104-MS2

July 27, 2023 - 3:33:57 PM - Plotted By: Adam Hewson



EROSION AND SEDIMENTATION CONTROL LEGEND

- SILTATION AND EROSION DRAINAGE AREA BOUNDARY
- TEMPORARY INTERCEPTOR SWALE
- OVERLAND FLOW ROUTE (MAJOR STORM)
- 312.0 — PROPOSED SUBGRADE SURFACE CONTOURS
- LIGHT-DUTY SEDIMENT CONTROL FENCE (SEE DETAIL)
- HEAVY-DUTY SEDIMENT CONTROL FABRIC ON PAIGE WIRE FENCE (SEE DETAIL)
- CONSTRUCTION ACCESS (SIZE AS NOTED)
- ROCK CHECK DAM (RCD)
- EMBANKMENT (SLOPE AS NOTED)
- TEMPORARY SEDIMENT TRAP
- TEMPORARY SILT SACK
- TREE WELL RETAINING WALL



GEODETIC BM	ELEV. = m
SITE BENCHMARK	ELEV. = m

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No.	REVISION	BY	DATE
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2.			
1.	ISSUED FOR DRAFT PLAN APPROVAL	KDH	2023-07-28

MTE
Engineers, Scientists, Surveyors
519-743-6500

OWNER

MARANN HOMES

449 LAIRD ROAD Guelph

PROJECT

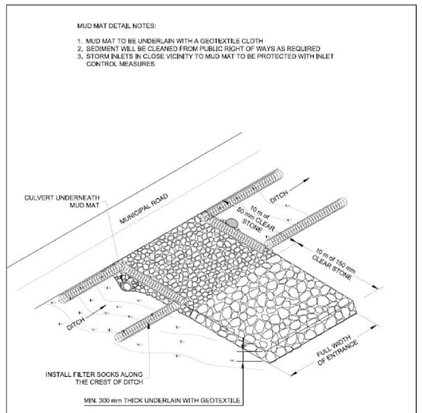
47 BEDFORD ROAD SUBDIVISION

47 Bedford Road Guelph/Eramosa Township

DRAWING

EROSION AND SEDIMENT CONTROL PLAN

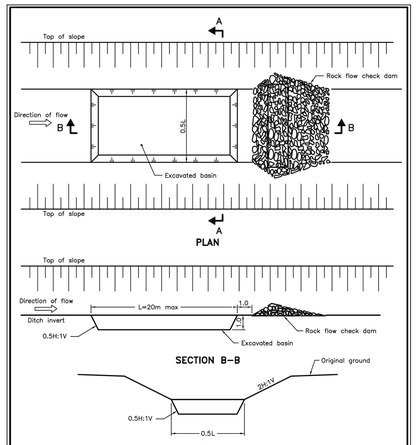
Project Manager K.HANES	Project No. 51505-104
Design By CVP	Checked By
Drawn By ACH	Checked By
Surveyed By MTE	Drawing No. ES1.1
Date Dec.05/22	
Scale 1:500	Sheet of



NOTE: THIS DETAILS REPRESENTS AN IDEAL SCENARIO. SITE CONDITIONS VARY AND EROSION AND SEDIMENT CONTROL MEASURES SHOULD BE TAILORED FOR EACH SITE AND PROJECT

Toronto and Region Conservation Authority	TRCA ESC DESIGN DETAIL	SCALE N.T.S.	REV 1	DATE MARCH 2019
	DRAWING TITLE MUD MAT			DWG NO 05

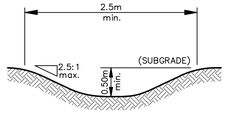
DETAIL 1



NOTES:
A Ditch cross-section upstream or downstream of sediment trap may be flat bottom or V-shaped. Flat bottom shown.
B This OPSD shall be read in conjuction with OPSD 219.210 or 219.211.
C All dimensions are in metres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2015	Rev 2
SEDIMENT TRAP IN DITCH		OPSD 219.220

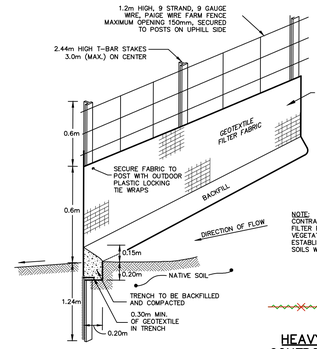
DETAIL 2



TEMPORARY DIVERSION SWALE
N.T.S.

(AS SHOWN ON DRAWINGS)

DETAIL 3

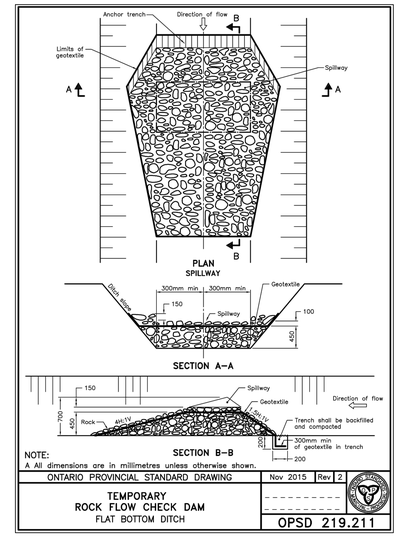


NOTE:
CONTRACTOR TO MAINTAIN FILTER FABRIC FENCE UNTIL VEGETATION HAS BEEN ESTABLISHED ON ALL EXPOSED SOILS WITHIN CATCHMENT AREA.

HEAVY DUTY SEDIMENT CONTROL FENCE ON PAIGE WIRE FENCE N.T.S.

NOTES:
1. SEDIMENT ACCUMULATIONS TO BE REMOVED BY SUBDIVIDER/BUILDER WHEN SEDIMENT DEPOSITS REACH TO WITHIN 0.15m OF TOP OF FILTER FABRIC
2. FENCE TO BE INSPECTED ON A REGULAR BASIS AND MAINTAINED BY SUBDIVIDER/BUILDER IN PROPER CONDITION

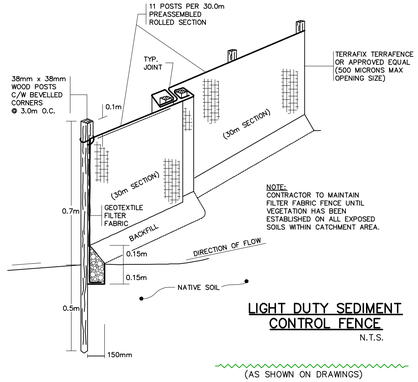
DETAIL 4



NOTE:
A All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2015	Rev 2
TEMPORARY ROCK FLOW CHECK DAM FLAT BOTTOM DITCH		OPSD 219.211

DETAIL 5

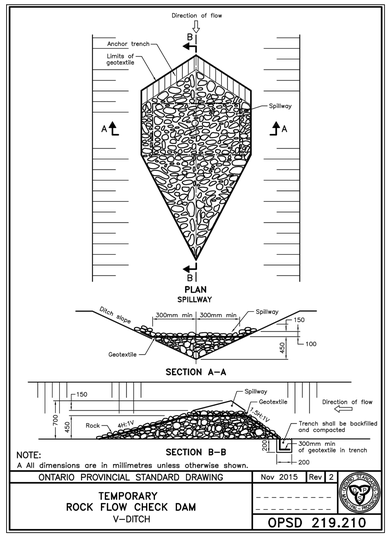


NOTE:
CONTRACTOR TO MAINTAIN FILTER FABRIC FENCE UNTIL VEGETATION HAS BEEN ESTABLISHED ON ALL EXPOSED SOILS WITHIN CATCHMENT AREA.

LIGHT DUTY SEDIMENT CONTROL FENCE
N.T.S.

(AS SHOWN ON DRAWINGS)

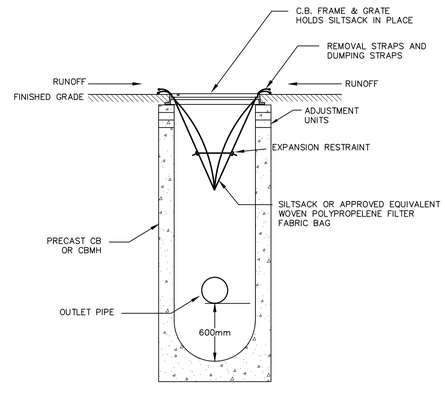
DETAIL 6



NOTE:
A All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2015	Rev 2
TEMPORARY ROCK FLOW CHECK DAM V-DITCH		OPSD 219.210

DETAIL 7



MAINTENANCE SCHEDULE

–INSPECT AFTER EVERY MAJOR RAIN EVENT.
–INSPECT EVERY 3 WEEKS MINIMUM.
–SILTSACK SHOULD NEVER BE OVER HALF FULL.
–FULL BAG CAN BE REMOVED, DUMPED, CLEANED AND REUSED
(TO REMOVE INSERT 25mm REBAR INTO REMOVAL FLAP POCKETS)
(TO DUMP INSERT 25mm REBAR INTO BOTH DUMPING STRAPS)

TEMPORARY SILTSACK SILTATION CONTROL IN CB
N.T.S.

DETAIL 8

EROSION AND SEDIMENT CONTROL PLAN

CONTACTS

A CONTACT LIST IS TO BE ESTABLISHED AND DISTRIBUTED BY THE ENGINEERING CONSULTANT PROJECT MANAGER AT THE INITIATION OF CONSTRUCTION; AND MAINTAINED THROUGHOUT THE PROJECT. COMPLETE WITH PHONE NUMBERS AND EMAIL ADDRESSES FOR EACH. LIST TO CONSIST OF:

1. PROJECT OWNER
2. ENGINEERING CONSULTANT PROJECT MANAGER
3. ENGINEERING CONSULTANT LEAD CONSTRUCTION INSPECTOR
4. GRAND RIVER CONSERVATION AUTHORITY RESOURCE PLANNER
5. TOWNSHIP OF GUELPH-ERAMOSA CONSTRUCTION INSPECTOR
6. GRADING CONTRACTOR SITE SUPERVISOR (IF APPLICABLE)
7. SERVICING CONTRACTOR SITE SUPERVISOR (IF APPLICABLE)
8. ON-CALL CONTRACTOR (IF/WHEN APPLICABLE)
9. HOME BUILDER SITE SUPERVISOR (ALL HOME BUILDERS IF MORE THAN ONE) (IF APPLICABLE)

RESPONSIBILITIES

THE CONTRACTOR(S), THROUGH THE CONTRACT DOCUMENTS AND AS INDICATED ON THE APPLICABLE DESIGN DRAWINGS, WILL BE RESPONSIBLE FOR CONSTRUCTION, DAILY INSPECTION, AND DAILY MONITORING OF ESC MEASURES DURING THEIR CONSTRUCTION PERIOD (WHICH STARTS UPON CONTRACT AWARD AND FINISHES AT SUBSTANTIAL COMPLETION OF THE CONTRACT OR WHEN ALL EQUIPMENT HAS LEFT THE SITE, WHICHEVER IS LATER). SIMILARLY THE CONTRACTOR WILL ALSO BE RESPONSIBLE FOR COMPLETING ANY NECESSARY REPAIRS TO THESE MEASURES. CONTRACTOR TO KEEP ADDITIONAL ESC MEASURES MATERIALS ON STAND-BY SHOULD AN ESC BREACH OCCUR. ADDITIONAL MATERIALS INCLUDE STRAW BALES, ROCK CHECK DAMS, FILTER FABRIC, RIP-RAP, CLEAN GRAVEL AND SILT FENCE, GAS POWERED PUMPS, APPROPRIATELY SIZED HOSES, FILTRATION HOSE SOCKS AND FILTER CLOTH. WHEN A SEVERE WEATHER EVENT IS FORECASTED, THE CONTRACTOR SHOULD CONFIRM THAT ALL ESC MEASURES ON-SITE ARE SECURE, RELOCATE STOCKPILE AND MATERIALS TO AN APPROPRIATE LOCATION IF REQUIRED AND CEASE DEWATERING OPERATIONS.

CONSULTANT IS RESPONSIBLE FOR REGULAR ESC INSPECTIONS AND REPORTS DURING CONSTRUCTION. DURING ACTIVE CONSTRUCTION THE CONSULTANT SHALL INSPECT SEDIMENT AND EROSION CONTROL MEASURES AND PROVIDE REPORTS WEEKLY, AND AFTER EVERY RAINFALL EVENT IN EXCESS OF 25mm, REPORTS ARE TO BE SUBMITTED WEEKLY TO THE TOWNSHIP INSPECTOR. DURING PERIODS OF EXTENDED RAIN AND/OR SNOW MELT, DAILY INSPECTIONS ARE REQUIRED. DURING PERIODS OF NO CONSTRUCTION, INSPECTIONS SHOULD OCCUR MONTHLY. AN ESC INSPECTION SHOULD BE COMPLETED PRIOR TO WINTER SHUT-DOWN.

THE ENGINEERING CONSULTANT WILL BE RESPONSIBLE FOR RECOMMENDING THE IMPLEMENTATION OF ANY ADDITIONAL ESC MEASURES (BEYOND THOSE INCLUDED IN CONTRACT DOCUMENTS) TO THE PROJECT OWNER. COMMUNICATION WILL CONSIST OF AN E-MAIL ISSUED AS SOON AS POSSIBLE FOLLOWING DISCOVERY OF AN ISSUE (FAILURE, BREACH, OR OTHER ESC PERFORMANCE ISSUE THAT CAUSED OR COULD POTENTIALLY CAUSE AN ENVIRONMENTAL IMPACT) TO THE COMPLETE CONTACT LIST FROM THE ENGINEERING CONSULTANT PROJECT MANAGER. A SECOND E-MAIL WILL FOLLOW WITHIN 2 BUSINESS DAYS OF DISCOVERY OUTLINING ANY ADDITIONAL DETAILS REGARDING THE EVENT (LIKELY REASON FOR FAILURE, ETC), AS WELL AS ANY MITIGATION MEASURES IMPLEMENTED FOLLOWING THE EVENT OR PLANNED FOR IMPLEMENTATION. ESC MITIGATION ACTIONS WOULD BE TRIGGERED WHEN THE REVIEW IDENTIFIES REPAIR OR REPLACEMENT OF A SPECIFIED MEASURE IS REQUIRED, OR WHEN THE PROJECT TEAM'S DETAILED REVIEW FOLLOWING AN IDENTIFIED ESC ISSUE IDENTIFIES THAT ADDITIONAL MANAGEMENT MEASURES ARE REQUIRED.

PROJECT OWNER – ULTIMATE RESPONSIBILITY FOR IMPLEMENTATION, INCLUDING COSTS OF REMEDIAL MEASURES.
CONTRACTOR(S) – RESPONSIBILITY AS OUTLINED IN CONTRACT DOCUMENTS (CONSTRUCTION OF MEASURES, MATERIALS AND WORKMANSHIP DURING MONITORING PERIOD, INSPECTION AND MONITORING OF ESC MEASURES, ETC), TIMELY REPAIRS AND IMPLEMENTATION OF REMEDIAL MEASURES.
ENGINEERING CONSULTANT – COMMUNICATION TO THE CONTACT LIST, RECOMMENDING THE IMPLEMENTATION OF ANY PROVISIONAL MEASURES INCLUDED IN THE CONTRACT DOCUMENTS OR MEASURES BEYOND THOSE INCLUDED IN CONTRACT DOCUMENTS TO THE PROJECT OWNER.
HOME BUILDER(S) – RESPONSIBILITY AS OUTLINED IN AGREEMENTS WITH PROJECT OWNER (SITE MANAGEMENT, TOPSOIL MANAGEMENT, ETC).

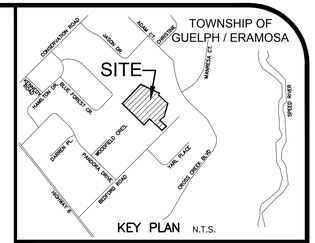
SEQUENCE OF REMEDIAL ACTIONS IN CASE OF ESC BREACH

THE SEQUENCE OF MEASURES AND THE TIMING OF IMPLEMENTATION IS DESCRIBED ABOVE, AND IS SUMMARIZED AS FOLLOWS:

1. IN THE EVENT OF A FAILURE, THE CONTRACTOR SHOULD CEASE ALL CONSTRUCTION RELATED WORK AND FOCUS ON ESC TO STABILIZE THE SITE WHERE THE FAILURE HAS OCCURRED OR WHERE A FAILURE IS IMMINENT. ADDITIONAL ESC MEASURES SHOULD BE APPLIED AS NECESSARY TO STABILIZE THE SITE, AND AS RECOMMENDED BY THE CONSULTANT.
2. COMMUNICATION TO CONTACT LIST AS SOON AS POSSIBLE FOLLOWING THE DISCOVERY OF AN ISSUE.
3. REPAIRS TO EXISTING MEASURES TO BE COMPLETED AS SOON AS REASONABLY POSSIBLE.
4. IMPLEMENTATION OF ANY REQUIRED ADDITIONAL MEASURES (BEYOND EXISTING/SPECIFIED MEASURES) AS SOON AS APPROPRIATE APPROVAL FROM TOWNSHIP AND GRCA ARE OBTAINED.
5. COMMUNICATION TO CONTACT LIST WITHIN 2 BUSINESS DAYS OF DISCOVERY OF ISSUE OUTLINING ANY ADDITIONAL DETAILS REGARDING THE EVENT, AS WELL AS ANY MITIGATION MEASURES IMPLEMENTED FOLLOWING THE EVENT OR PLANNED FOR IMPLEMENTATION.

NOTES:

1. CONTRACTOR AND DEVELOPER'S CONSULTANT TO REVIEW SITE PRIOR TO CONSTRUCTION TO DETERMINE THE NEED FOR MODIFICATIONS TO THIS SCHEDULE AND PLAN.
2. CONTRACTOR IS NOT TO REMOVE OR MODIFY ANY EROSION OR SEDIMENT CONTROL FACILITIES UNTIL DIRECTED TO DO SO BY THE ENGINEER.
3. ALL AREAS WHERE ACTIVE CONSTRUCTION IS NOT EXPECTED FOR 30 DAYS SHALL BE REVEGETATED WITH 50mm TOPSOIL AND HYDROSEEDED IN ACCORDANCE WITH OPSS572.
4. SEDIMENT CONTROL FENCE TO BE PLACED AROUND EACH STOCKPILE, AND AT PROPERTY LIMITS, AS SHOWN ON THE PLAN.
5. CONTRACTOR SHALL INSTALL ADDITIONAL ESC MEASURES TO SATISFACTION OF CONTRACT ADMINISTRATOR, SITE ENGINEER AND TOWNSHIP AS REQUIRED.
6. EROSION AND SEDIMENT CONTROL MEASURES SHALL BE CONSTRUCTED, MAINTAINED AND REMOVED TO THE SATISFACTION OF CONSERVATION AUTHORITY GUIDELINES AND CONTRACT DOCUMENTS.
7. THE CONTRACTOR IS RESPONSIBLE FOR REMOVING SEDIMENTS FROM EXTERNAL ROADWAY AT END OF EACH WORK DAY.
8. CONSTRUCTION MUD MATS TO BE LOCATED WHERE CONSTRUCTION VEHICLES EXIT THE SITE. THE CONSTRUCTION MAT SHALL BE 300mm THICK 30m LONG AND 5m WIDE. THE FIRST 10m FROM ROAD SHALL USE 50mm DIAMETER CLEAR STONE. THE REMAINING LENGTH SHOULD USE 150mm DIAMETER CLEAR STONE.
9. ESC MEASURES ARE TO BE INSTALLED PRIOR TO GRADING OPERATIONS AND REMAIN IN PLACE UNTIL SITE STABILIZATION IS COMPLETE (90% VEGETATION ESTABLISHMENT AND SITE BUILD-OUT).
10. ALL COLLECTED SEDIMENT TO BE DISPOSED OF AT AN APPROVED LOCATION.
11. ALL DEWATERING TO BE DISPOSED OF AT AN APPROVED SEDIMENTATION BASIN.
12. ALL CATCHBASINS, MANHOLES AND PIPE ENDS TO BE PROTECTED WITH A GEOTEXTILE.
13. TEMPORARY DIVERSION SWALES TO BE IMPLEMENTED AS SHOWN ON PLAN TO DIRECT RUNOFF TO SEDIMENT SETTLING MEASURE.
14. STOCKPILES NOT TO EXCEED 8.0m, SIDE SLOPES SHOULD NOT EXCEED 2:1. LIMIT OF TOPSOIL TO BE LOCATED 15m FROM A ROADWAY OR WATERBODY, AND 8m FROM PROPERTY LINE. IF STOCKPILE IS LEFT IN PLACE FOR OVER 30 DAYS, SHOULD BE COVERED WITH A TARP/VEGETATIVE COVER. A SEDIMENT TRAP V CHANNEL SHOULD BE PROVIDED AT THE TOE OF STOCKPILE SIDE SLOPE TO INTERCEPT SEDIMENT.
15. THE CONTRACTOR IS RESPONSIBLE FOR ALL CLEAN-UP RESTORATION, INCLUDING ALL COSTS, DUE TO RELEASE OF SEDIMENT FROM THE SITE.
16. ROCK CHECK DAMS TO BE INSTALLED PERPENDICULAR TO FLOW FROM TEMPORARY DIVERSION SWALE, AND BE CONSTRUCTED ACCORDING TO DETAIL.
17. ON-SITE DESIGNED EMBANKMENTS AS INDICATED ON THE ESC PLAN ARE TO BE APPLIED WITH 300mm OF TOPSOIL AND SEEDED WITH A COVER CROP.
18. SEDIMENT TRAP IN DITCH TO BE INSTALLED AT RUNOFF OUTLET LOCATION, PERPENDICULAR TO FLOW, AND CONSTRUCTED ACCORDING TO DETAIL.
19. EXISTING DOWNSTREAM DICBMH TO BE PROTECTED WITH TEMPORARY SILT SACK, AS INDICATED ON PLAN AND ACCORDING TO DETAIL.
20. HEAVY AND LIGHT DUTY SEDIMENT CONTROL FENCE TO BE INSTALLED ALONG SITE PERIMETER AND AT TOE OF SLOPE OF STOCKPILES, AS INDICATED ON THE PLAN AND ACCORDING TO DETAIL.



GEODETIC BM	ELEV. = m
SITE BENCHMARK	ELEV. = m

NOTE TO CONTRACTOR :

DO NOT SCALE DRAWINGS.

CONTRACTORS MUST CHECK AND VERIFY ALL DIMENSIONS AND REPORT ANY DISCREPANCIES TO THE ENGINEER BEFORE PROCEEDING WITH THE WORK.

No.	REVISION	BY	DATE
8.			
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1.	ISSUED FOR DRAFT PLAN APPROVAL	KDH	2023-07-28

MTE
Engineers, Scientists, Surveyors
519-743-6500

OWNER

MARANN HOMES

449 LAIRD ROAD Guelph

PROJECT

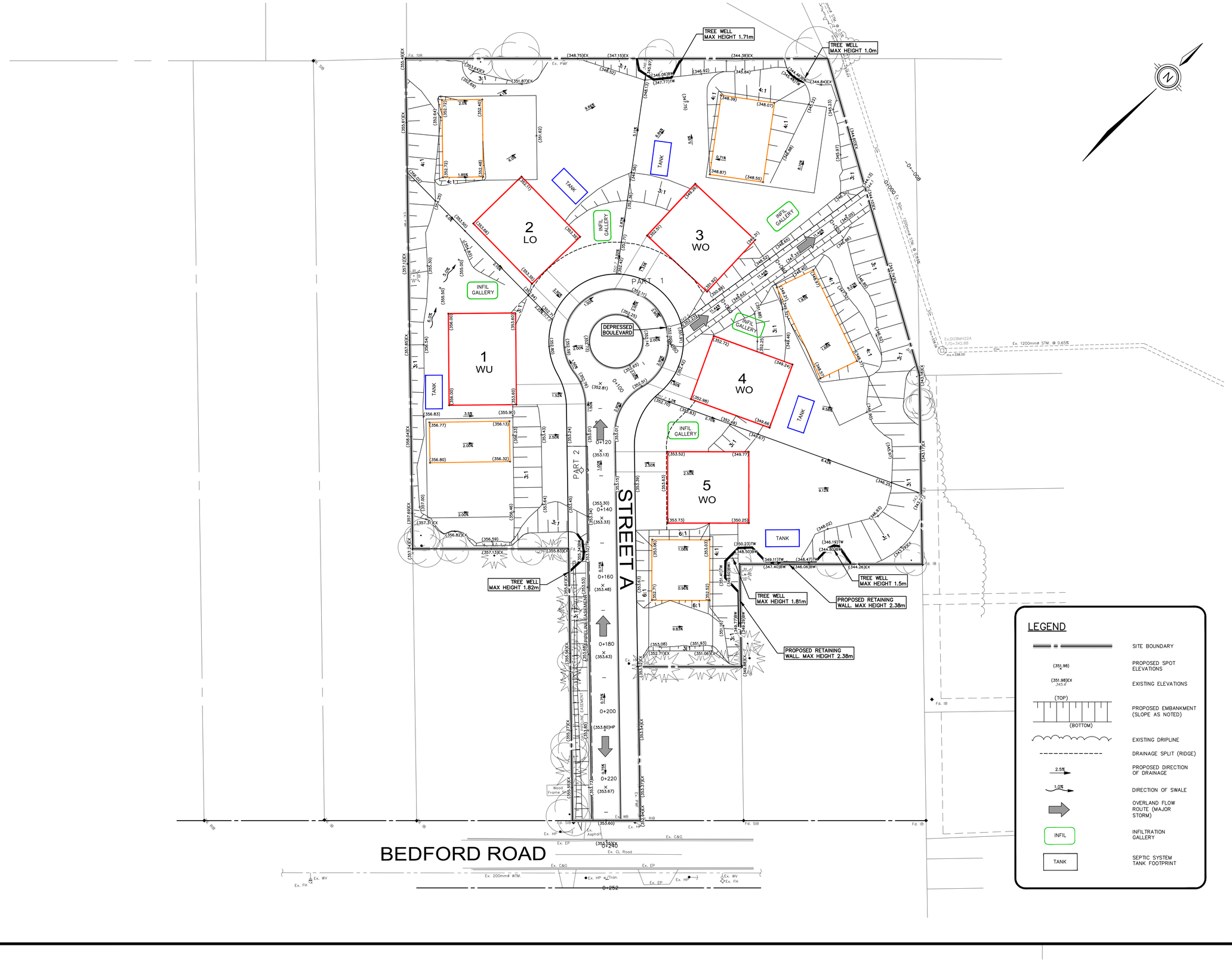
47 BEDFORD ROAD SUBDIVISION

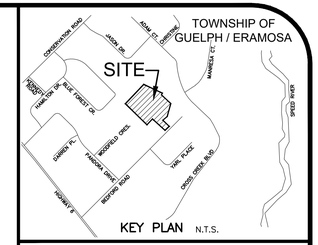
47 Bedford Road Guelph/Eramosa Township

DRAWING

EROSION AND SEDIMENT CONTROL DETAILS

Project Manager	K.HANES	Project No.	51505-104
Design By	CVP	Checked By	
Drawn By	ACH	Checked By	
Surveyed By	MTE	Drawing No.	ES1.2
Date	Dec.05/22		
Scale	1:500	Sheet	of





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SITE BENCHMARK ELEV. = m

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No.	REVISION	BY	DATE
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1.	ISSUED FOR DRAFT PLAN APPROVAL	KDH	2023-07-28

MTE
Engineers, Scientists, Surveyors
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OWNER

MARANN HOMES

449 LAIRD ROAD Guelph

PROJECT

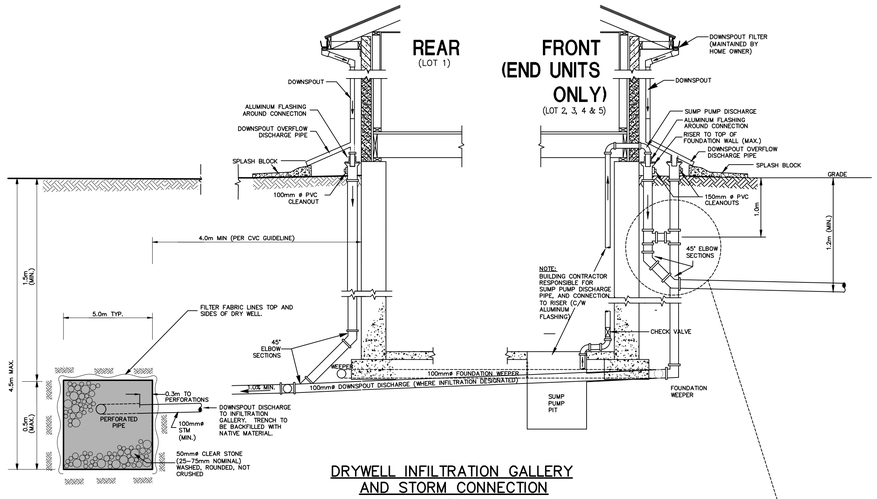
47 BEDFORD ROAD SUBDIVISION

47 Bedford Road Guelph/Eramosa Township

DRAWING

FINISH GRADE PLAN

Project Manager K.HANES	Project No. 51505-104
Design By CVP	Checked By
Drawn By ACH	Checked By
Surveyed By MTE	Drawing No. AG1.1
Date Aug.23/22	
Scale 1:500	Sheet of



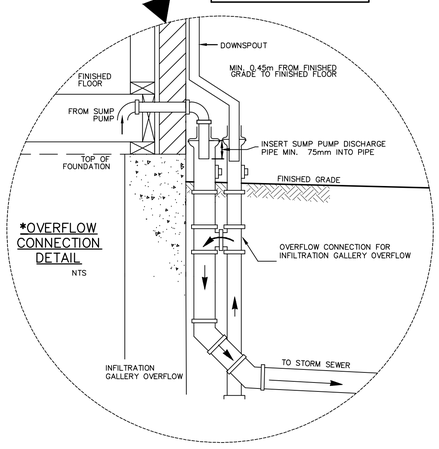
DRYWELL INFILTRATION GALLERY AND STORM CONNECTION

N.T.S.

NOTES REGARDING INSTALLATION OF FOUNDATION WEEPERS, DOWNSPOUTS, AND DRYWELL INFILTRATION GALLERIES

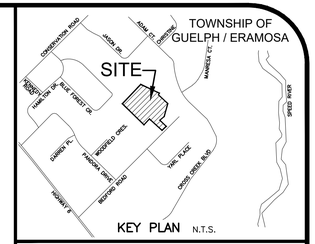
1. FOUNDATION WEEPERS TO BE CONNECTED TO SUMP PUMP PIT, WITH PUMPED DISCHARGE OVER THE FOUNDATION WALL INTO THE STORM SERVICE CONNECTION (PER DETAILS).
2. FOUNDATION WEEPERS TO BE PERFORATED, WITH GEOTEXTILE SOCK, AND BEDDED/COVERED WITH CLEAR STONE.
3. WHERE A SPECIFIC LOT IS DESIGNATED TO HAVE A DRYWELL INFILTRATION GALLERY, PER GENERAL LOT GRADING PLANS, ALL DOWNSPOUTS FROM THE ROOF ARE TO BE CONNECTED TO THE DRYWELL.
4. EACH LOT DESIGNATED TO HAVE A DRYWELL SHALL HAVE THE DRYWELL SIZING CALCULATIONS, REQUIRED CONSTRUCTION DIMENSIONS, AND PREFERRED LOCATION INDICATED BY THE BUILDER ON THE SPECIFIC LOT GRADING PLAN. STANDARD SETBACKS TO BE MAINTAINED, AS NOTED IN TYPICAL LOT PLAN DETAIL. SIZING AND LOCATION OF DRYWELL TO BE CONFIRMED AT TIME OF SPECIFIC LOT GRADING REVIEW. WHERE LOT CONFIGURATION DOES NOT PHYSICALLY ALLOW FOR A DRYWELL TO BE INSTALLED (i.e., NO SUITABLE LOCATION AT REQUIRED MINIMUM SETBACK CRITERIA), THIS SHALL BE STATED WITH RELATED REASONS ON THE SPECIFIC LOT GRADING PLAN.
5. DRYWELL INFILTRATION GALLERIES TO BE SIZED AS FOLLOWS:
   DRYWELL SIZE
   LENGTH x WIDTH x DEPTH OF DRYWELL TO SUIT VOLUME OF STONE REQUIRED
   AND DESIGN DETAILS ON THIS PAGE.
   DETAILED VOLUME CALCULATION
   VOLUME OF RAINFALL CAPTURE(cu.m.) = ROOF AREA(sq.m.) x RAINFALL CAPTURE DEPTH(USE 0.025m)
   VOLUME OF DRYWELL STONE(cu.m.) = (RAINFALL VOLUME(cu.m.) / STONE POROSITY(USE 0.3333 OR 33% VOIDS)) x 1.15(15% UPSIZE FACTOR)
6. TEST PIT(s) FOR DRYWELL TO BE EXCAVATED AT TIME OF FOUNDATION EXCAVATION, AND INSPECTED BY A GEOTECHNICAL CONSULTANT TO DETERMINE SUITABILITY FOR DRYWELL INSTALLATION.
7. DRYWELLS SHALL BE INSTALLED REGARDLESS OF SOIL PERMEABILITY AS PER THE FOLLOWING, AND SHALL BE A MINIMUM OF 1.0m ABOVE THE GROUNDWAER TABLE;
   a. FOR SOIL CONDITIONS HAVING A PERMEABILITY OF 15 mm/hr OR $1x10^{-3}$ cm/sec AND GREATER, STANDARD DRYWELL INSTALLATION WILL APPLY.
   b. FOR SOIL CONDITIONS HAVING A PERMEABILITY OF 15 mm/hr OR LESS OR $3x10^{-4}$ cm/sec, DRYWELL INSTALLATION WITH AN OVERFLOW CONNECTION TO THE STORM SEWER WILL APPLY.
8. EACH LOT DESIGNATED TO HAVE A DRYWELL, AND WHICH IS SUBSEQUENTLY DEEMED NOT SUITABLE, SHALL BE DOCUMENTED WITH DETAILS IN AN INSPECTION ASSESSMENT REPORT BY THE GEOTECHNICAL CONSULTANT IN-SITU PERMEABILITY TESTING RESULTS AT SEVERAL LOCATIONS AND DEPTHS MAY BE REQUESTED BY THE DEVELOPERS ENGINEER TO SUPPPORT SUCH AN ASSESSMENT.
9. ASSESSMENT REPORTS FOR ALL DRYWELLS SHALL BE PROMPTLY SUBMITTED AFTER TEST-PIT INSPECTION TO THE DEVELOPERS ENGINEER FOR CONFIRMATION (MTE Consultants), AND SHALL INCLUDE RECOMMENDATIONS FOR OR AGAINST DRYWELL INSTALLATION (PER DETAILS/NOTES ON THIS PAGE).

NOTE:*OVERFLOW CONNECTION ONLY REQUIRED FOR LOTS WITH INFILTRATION GALLERIES WHERE SOIL CONDITIONS HAVE A PERMEABILITY OF 15mm/hr OR LESS.



*OVERFLOW CONNECTION DETAIL

NTS



GEODETIC BM ELEV. = m

SITE BENCHMARK ELEV. = m

NOTE TO CONTRACTOR :

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No.	REVISION	BY	DATE
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1.	ISSUED FOR DRAFT PLAN APPROVAL	KDH	2023-07-28

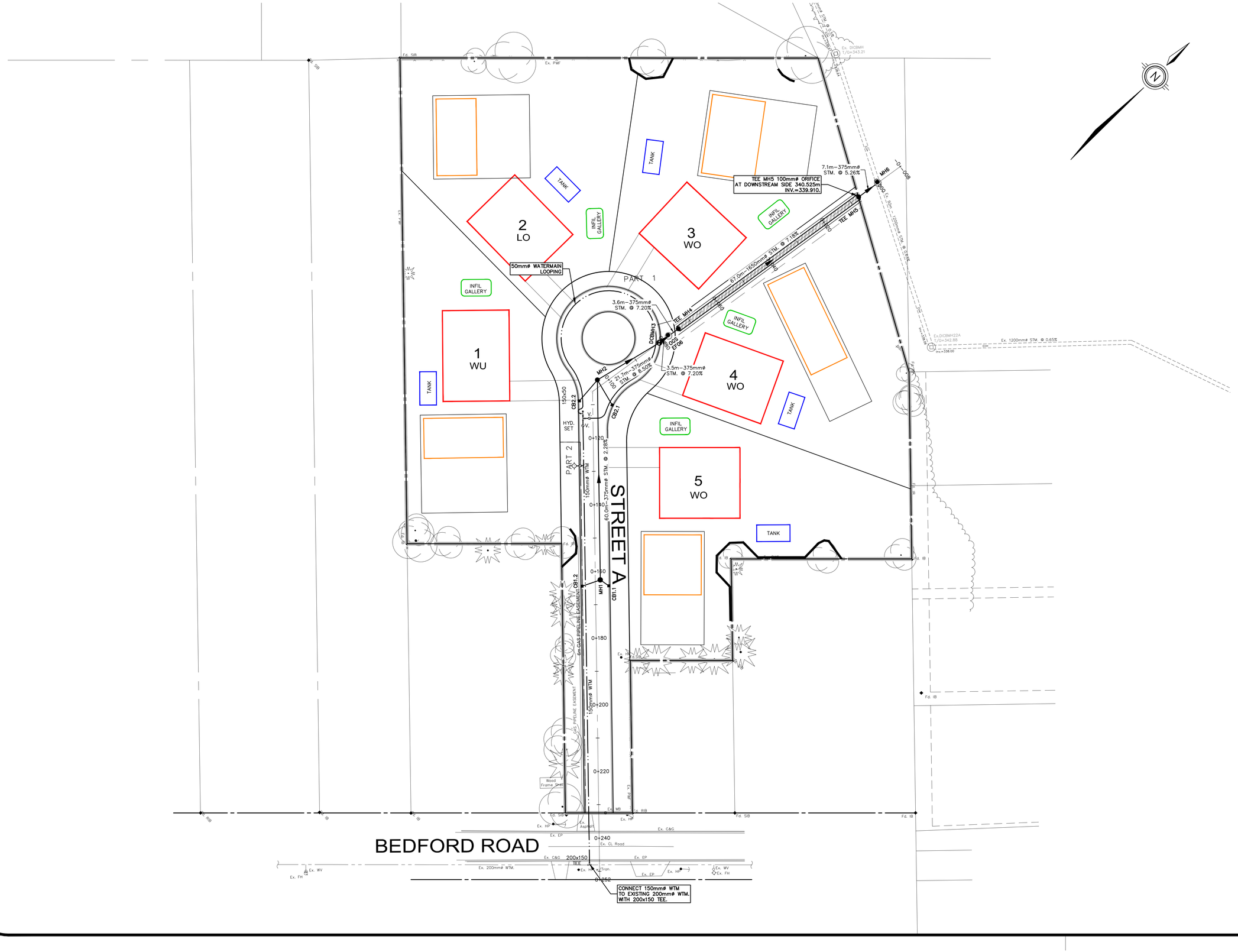
MTE
Engineers, Scientists, Surveyors
519-743-6500

OWNER
MARANN HOMES
449 LAIRD ROAD Guelph

PROJECT
47 BEDFORD ROAD SUBDIVISION
47 Bedford Road Guelph/Eramosa Township

DRAWING
LOT GRADING DETAIL PLAN

Project Manager K.HANES	Project No. 51505-104
Design By CVP	Checked By
Drawn By ACH	Checked By
Surveyed By MTE	Drawing No. AG1.2
Date Aug.23/22	
Scale N.T.S.	Sheet of



TOWNSHIP OF GUELPH / ERAMOSA

KEY PLAN N.T.S.

GEODETIC BM ELEV. = m

SITE BENCHMARK ELEV. = m

NOTE TO CONTRACTOR :

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ALL DRAWINGS REMAIN THE PROPERTY OF THE ENGINEER AND SHALL NOT BE REPRODUCED OR REUSED WITHOUT THE ENGINEER'S WRITTEN PERMISSION.

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LEGEND

- SITE BOUNDARY
- EXISTING WATERMAIN (Ex. 200mmø WTM. — Ex. HYD. SET)
- EXISTING STORM SEWER (Ex. 375mmø STM. — Ex. MH)
- STORM SEWER (MH — 21.3m–300mmø STM @ 1.30%)
- WATERMAIN (200mmø WTM — V. — HYD. SET — TEE)

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449 LAIRD ROAD Guelph

PROJECT

47 BEDFORD ROAD SUBDIVISION

47 Bedford Road Guelph/Eramosa Township

DRAWING

GENERAL PLAN OF SERVICES

Project Manager K.HANES	Project No. 51505-104
Design By CVP	Checked By
Drawn By ACH	Checked By
Surveyed By MTE	Drawing No. GP1.1
Date Oct.17/22	
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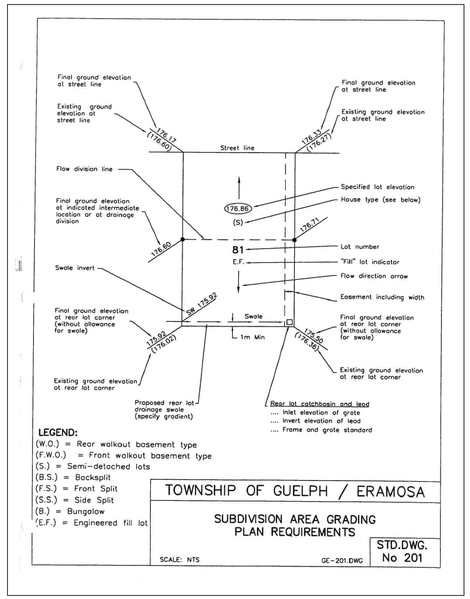
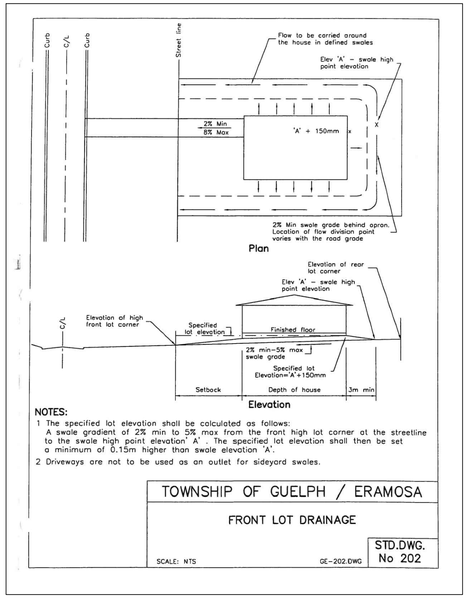


TOWNSHIP OF GUELPH / ERAMOSA

SUBDIVISION AREA GRADING PLAN REQUIREMENTS

SCALE: NTS | GE-201.DWG | STD.DWG. No 201

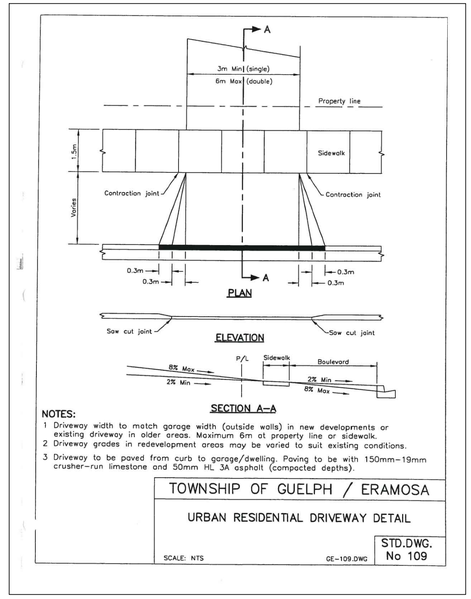


NOTES:
1 The specified lot elevation shall be calculated as follows:
A swale gradient of 2% min to 5% max from the front high lot corner at the streetline to the swale high point elevation' A' . The specified lot elevation shall then be set a minimum of 0.15m higher than swale elevation 'A'.
2 Driveways are not to be used as an outlet for sideyard swales.

TOWNSHIP OF GUELPH / ERAMOSA

FRONT LOT DRAINAGE

SCALE: NTS | GE-202.DWG | STD.DWG. No 202

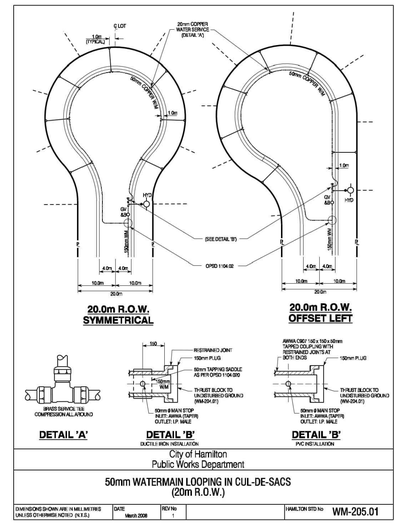


NOTES:
1 Driveway width to match garage width (outside walls) in new developments or existing driveway in older areas. Maximum 6m at property line or sidewalk.
2 Driveway grades in redevelopment areas may be varied to suit existing conditions.
3 Driveway to be paved from curb to garage/dwelling. Paving to be with 150mm-19mm crusher-run limestone and 50mm HL 3A asphalt (compacted depths).

TOWNSHIP OF GUELPH / ERAMOSA

URBAN RESIDENTIAL DRIVEWAY DETAIL

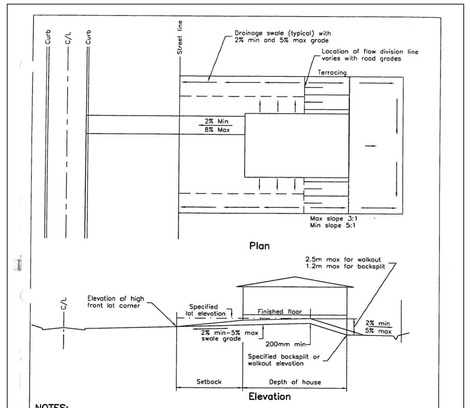
SCALE: NTS | GE-109.DWG | STD.DWG. No 109



City of Hamilton
Public Works Department

50mm WATERMAIN LOOPING IN CUL-DE-SACS (20m R.O.W.)

DIMENSIONS SHOWN ARE IN MILLIMETRES UNLESS OTHERWISE NOTED (N.T.S.) | DATE March 2008 | REV No. 1 | HAMILTON STD No. WM-205.01

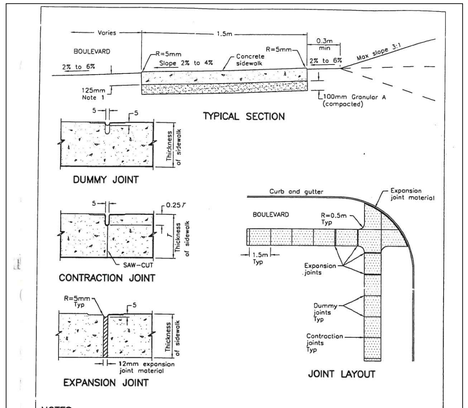


NOTES:
1 The specified lot elevation shall be calculated as follows:
A swale gradient of 2% min to 5% max from the front high lot corner at the streetline to the swale high point elevation' A' . The specified lot elevation shall then be set a minimum of 0.15m higher than swale elevation 'A'.
2 Driveways are not to be used as an outlet for sideyard swales.

TOWNSHIP OF GUELPH / ERAMOSA

SPLIT LOT DRAINAGE FOR WALKOUT OR BACKSPLIT

SCALE: NTS | GE-204.DWG | STD.DWG. No 204

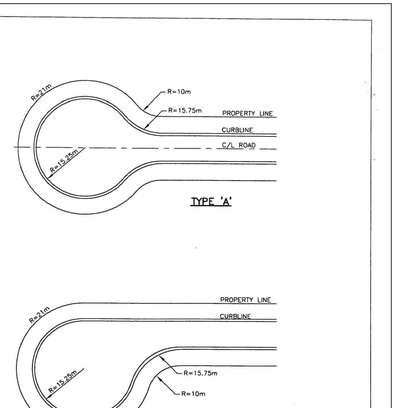


NOTES:
1 Sidewalk thickness at residential driveways and adjacent to curb shall be 150mm. At commercial and industrial driveways, the thickness shall be 200mm.
2 Contraction joints shall be used every 3 bays, at the edges of driveways, and at the centre of any manholes or valves.

TOWNSHIP OF GUELPH / ERAMOSA

CONCRETE SIDEWALK

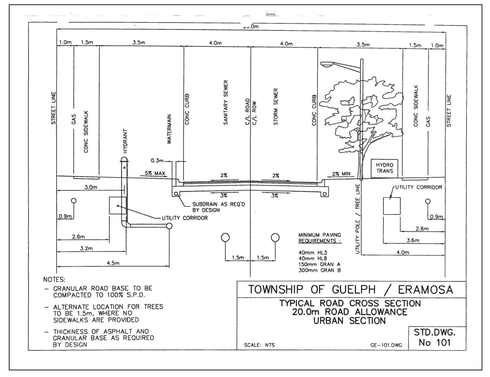
SCALE: NTS | GE-103.DWG | STD.DWG. No 103



TOWNSHIP OF GUELPH / ERAMOSA

TURNING BASIN

SCALE: NTS | GE-104.DWG | STD.DWG. No 104

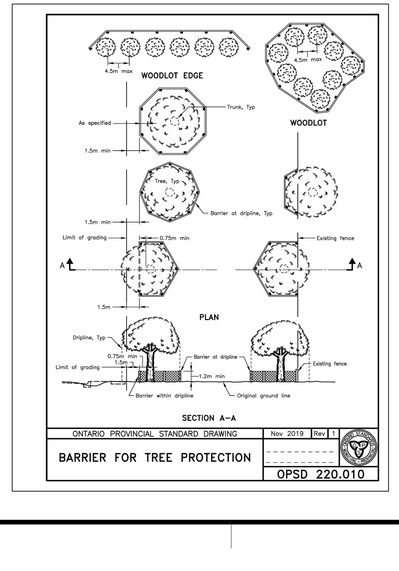


NOTES:
- GRANULAR ROAD BASE TO BE COMPACTED TO 100% S.P.D.
- ALTERNATE LOCATION FOR TREES TO BE 1.5m, WHERE NO SIDEWALKS ARE PROVIDED
- THICKNESS OF ASPHALT AND GRANULAR BASE AS REQUIRED BY DESIGN

TOWNSHIP OF GUELPH / ERAMOSA

TYPICAL ROAD CROSS SECTION
20.0m ROAD ALLOWANCE
URBAN SECTION

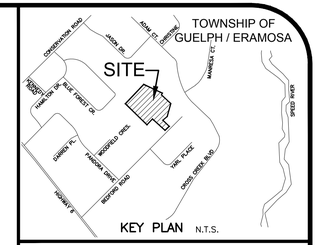
SCALE: NTS | GE-101.DWG | STD.DWG. No 101



ONTARIO PROVINCIAL STANDARD DRAWING | Nov 2019 | Rev 1

BARRIER FOR TREE PROTECTION

OPSD 220.010



GEODETIC BM ELEV. = m

SITE BENCHMARK ELEV. = m

NOTE TO CONTRACTOR :

DO NOT SCALE DRAWINGS.

CONTRACTORS MUST CHECK AND VERIFY ALL DIMENSIONS AND REPORT ANY DISCREPANCIES TO THE ENGINEER BEFORE PROCEEDING WITH THE WORK.

THE OWNER/ARCHITECT/CONTRACTOR IS ADVISED THAT M.T.E. CONSULTANTS INC. CANNOT CERTIFY ANY COMPONENT OF THE SITE WORKS NOT INSPECTED DURING CONSTRUCTION. IT IS THE RESPONSIBILITY OF THE GENERAL CONTRACTOR TO NOTIFY M.T.E. CONSULTANTS INC. PRIOR TO COMMENCEMENT OF CONSTRUCTION TO ARRANGE FOR INSPECTION.

No.	REVISION	BY	DATE
8.			
7.			
6.			
5.			
4.			
3.			
2.			
1.	ISSUED FOR DRAFT PLAN APPROVAL	KDH	2023-07-28

MTE
Engineers, Scientists, Surveyors
519-743-6500

OWNER

MARANN HOMES

449 LAIRD ROAD Guelph

PROJECT

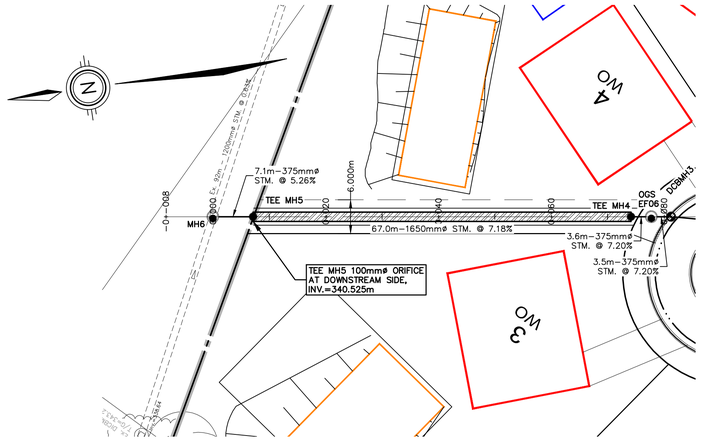
47 BEDFORD ROAD SUBDIVISION

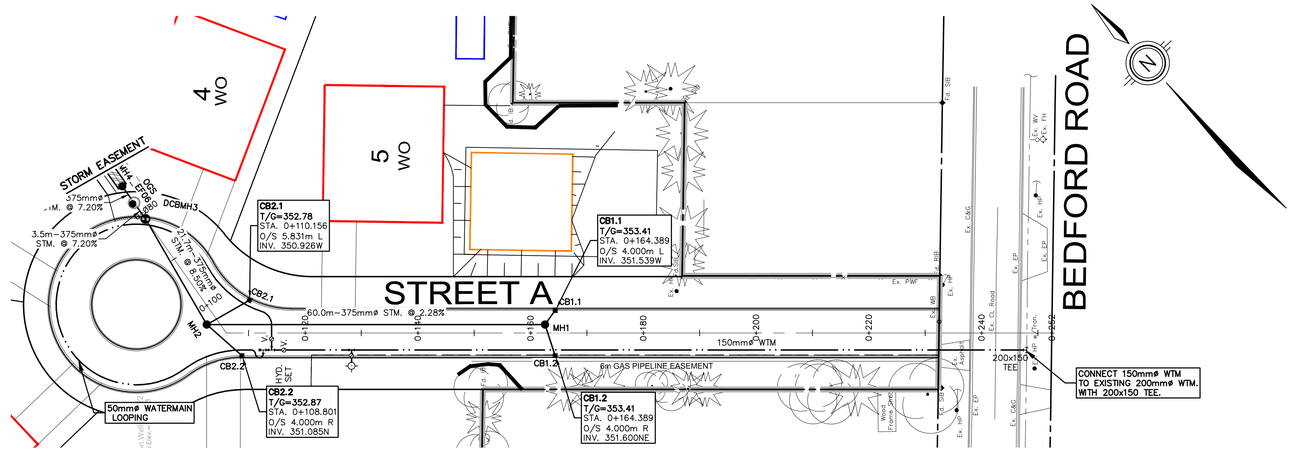
47 Bedford Road Guelph/Eramosa Township

DRAWING

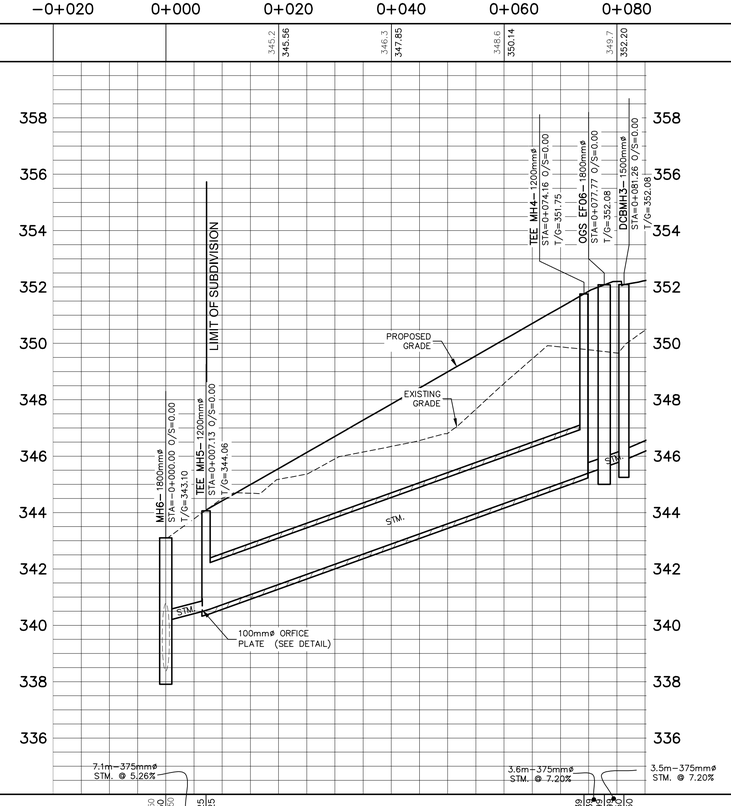
GENERAL NOTES AND DETAILS

Project Manager K.HANES	Project No. 51505-104
Design By CVP	Checked By
Drawn By ACH	Checked By
Surveyed By MTE	Drawing No. GP2.1
Date Nov.01/22	
Scale N.T.S.	Sheet of

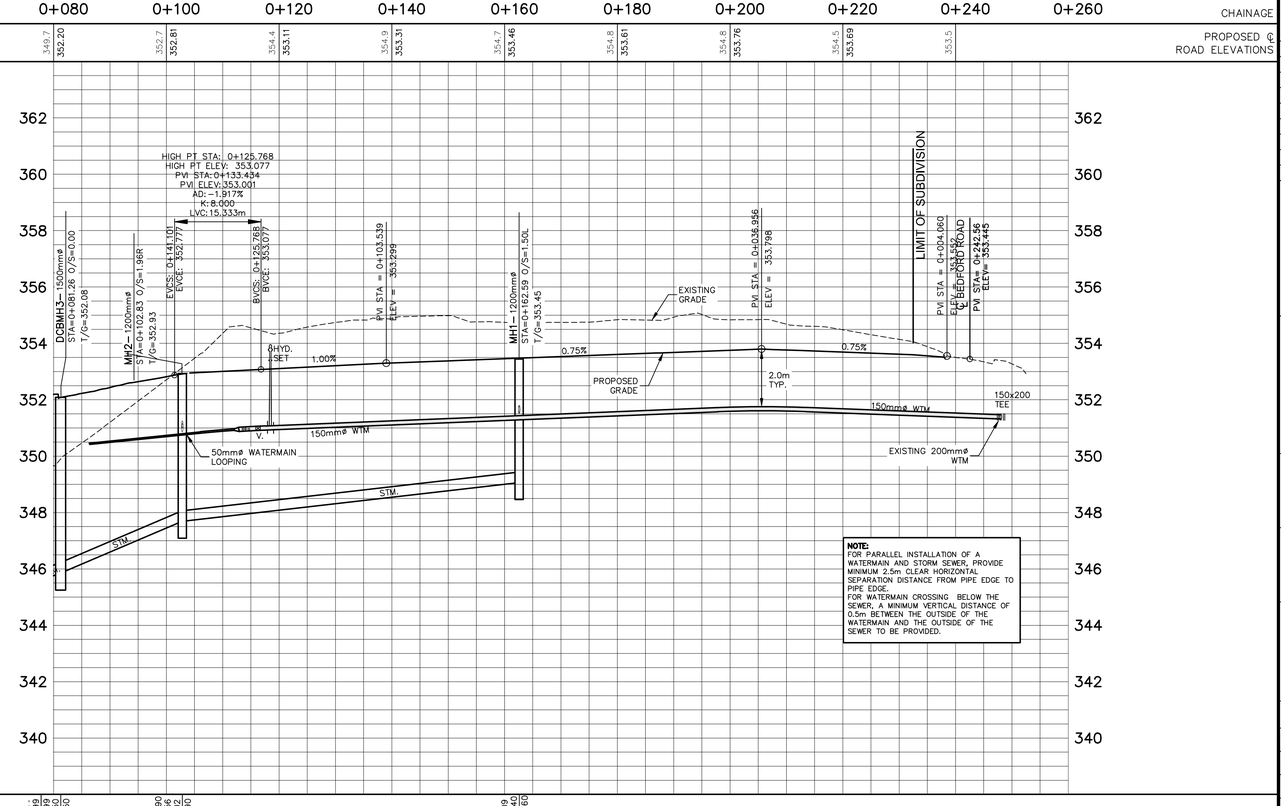


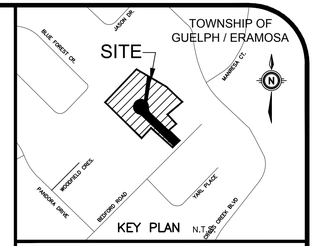


STORM EASEMENT



STREET A





GEODETIC BM ELEV. = m

SITE BENCHMARK ELEV. = m

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47 BEDFORD ROAD SUBDIVISION
47 Bedford Road Guelph/Eramosa Township

DRAWING
STORM EASEMENT / STREET A
STA 0+000 TO STA 0+248

Project Manager K.HANES	Project No. 51505-104
Design By CVP	Checked By
Drawn By ACH	Checked By
Surveyed By MTE	Drawing No. PP1.1
Date Oct.18/22	
Scale V–1:100 H–1:500	Sheet of

MTE FILE PATH: P:\P\51505\104\51505-104-PP1

July 27, 2023 – 3:41:32 PM – Plotted By: Adam Hewson