0 BERNIDA ROAD

FUNCTIONAL SERVICING AND STORMWATER MANAGEMENT REPORT

MARCH 25, 2020
PROJECT 19-631

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Prepared by

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Eric Greck P. Eng., Principal

Limitations

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1.0 INTRODUCTION

Greck and Associates Limited (Greck) has been retained by George Paclik (The Client), to prepare a Functional Servicing and Stormwater Management Report for the proposed lot severance and development of two residential properties located at 0 Bernida Road, in the City of Mississauga, Ontario.

This report provides an overview of the current proposed development plans and examines their functional serviceability, including analysis and design works related to:

- General site grading;
- Water distribution
- Sanitary sewer servicing
- Major and minor stormwater drainage systems;
- Stormwater management (SWM); and
- Construction erosion and sediment control.

As part of the development's permit approval process, this functional servicing report has been prepared in accordance with engineering practices and criteria from the governing approval agencies including the Credit Valley Conservation Authority (CVC), the City of Mississauga (City), and Ministry of Environment, Conservation & Parks (MOECP). Following the submission and review of this document, detailed design plans, including supporting reports and drawings, will be prepared and submitted to the above noted agencies for review and approvals, as required.

1.1 BACKGROUND

1.1.1 SITE LOCATION AND DESCRIPTION

The subject property is located at 0 Bernida Road in the City of Mississauga. The property is approximately 1.62ha in size and bounded by Parkland Avenue and residential lots to the north, woodlands to the east and west, and Turtle Creek to the south. Lake Ontario is located approximately 360m south of the property where Turtle Creek outlets and Parkland Avenue terminates.

Access to the property is restricted by an existing publicly owned lot between lots 21 and 20 on Parkland Avenue. The lot is registered as "Bernida Road". Physically, Bernida Road does not exist.

The subject property includes an existing open space surrounded by trees and vegetation. The topography slopes in a south westerly direction towards Turtle Creek at

an approximate 6% slope. A topographic survey was completed by J.H. Gelbloom Surveying Limited, dated January 24, 2019. The subject site is in the Turtle Creek watershed which is regulated by CVC. The top of bank and dripline were staked by CVC on October 23rd, 2018. The staked top of bank, staked dripline and Regulatory floodline are presented on the Topographic Survey in **Appendix A**.

A geotechnical investigation was completed by Soils Engineers Ltd. on August 2019. The soil conditions within the limits of the proposed development consists of a surface layer of topsoil, varying in thickness from 130mm to 230mm. The topsoil is underlain by earth fill consisting of silty sand and silty clay, at a depth of 1.4m to 4.0m beneath the existing ground surface. Groundwater was encountered in all the 3 boreholes on site. The groundwater level ranged from 1.0m beneath the existing ground surface as measured at Borehole 3, to 2.4m beneath the existing ground surface as measured at Borehole 1. Please see **Appendix B** for the geotechnical investigation.

Please see **Figure 1** for the site location plan.

2.0 PROPOSED DEVELOPMENT

The proposed development area within the property is approximately 0.45ha in size and will consist of Bernida Road, and two (2) estate homes at the end of the cul-de-sac leading from Parkland Avenue. The proposed development is outside the Regulatory floodline with minor encroachments into the identified vegetated dripline and 30m setback from the top of bank staked by CVC. Given the site constraints, best efforts to minimize encroachments into the setbacks were taken by minimizing fill quantities and grading extents. This was done by grading the proposed Bernida Road with a steep 6% slope from the intersection with Parkland Avenue to the cul-de-sac. Prior to construction, a retained arborist is to obtain a tree removal permit from the City of Mississauga. Tree removal activities are to be completed in accordance to the recommendations made in the EIS report prepared by EcoTec. Please see **Appendix C** for the EIS.

The proposed development will be serviced by extending and utilizing municipal sanitary and water services that currently exist on Parkland Avenue. These services are regulated by the Region of Peel. Given the nature of the development and proposed design population of 9, the region has verbally confirmed through telephone correspondence that service capacity is available from Parkland Avenue.

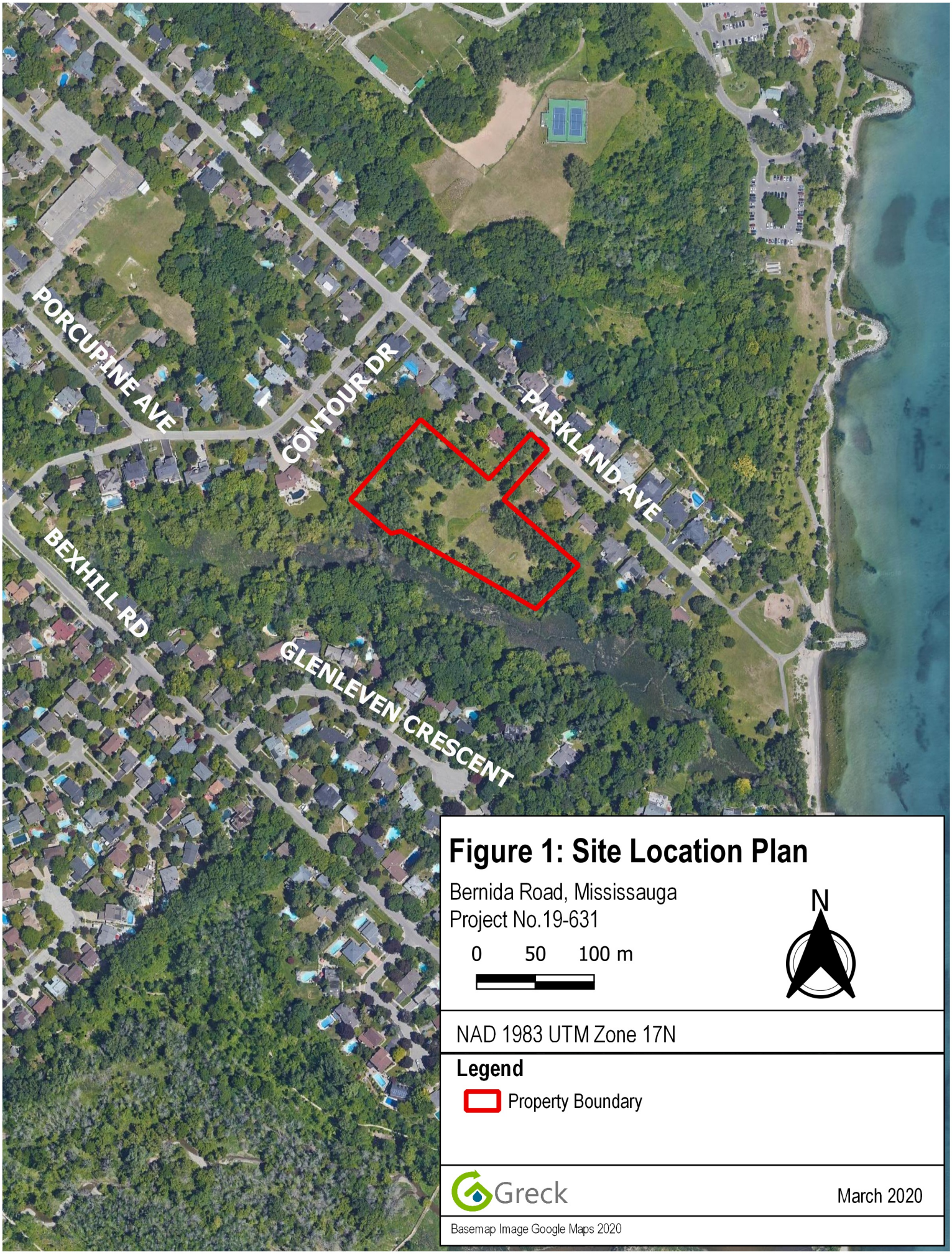


Figure 1: Site Location Plan

Bernida Road, Mississauga
Project No.19-631

0 50 100 m

N

NAD 1983 UTM Zone 17N

Legend

Property Boundary

Greck

March 2020

Basemap Image Google Maps 2020

2.1 ROAD ACCESS AND IMPROVEMENTS

Access to the proposed estate homes will be provided via the construction of Bernida Road which will connect from Parkland Avenue, heading west bound and terminating with a cul-de-sac. A vertical road curve was required to accommodate the existing steep slopes that exist on the property heading away from Parkland Avenue and adjacent to lots 21 and 20. In order to maintain drainage along the existing Parkland Avenue ditch, Bernida Road will include the construction of a new 450mm diameter HDPE culvert.

In accordance with City of Mississauga Standard Drawing 2211.152, Bernida Road will feature a minimum 20.0m wide ROW, 8.0m wide asphalt roadway and 13m radius col-de-sac. Consistent with Parkland Avenue, no sidewalks or underground storm servicing is proposed. However, roadside curbs will be required to convey major and minor drainage towards the proposed stormwater facility. Please see **Appendix A** which includes the proposed Draft Plan and **Appendix G** for the proposed grading plan.

In accordance with City standards and geotechnical recommendations, the minimum pavement structure for the proposed road is as follows:

TABLE 1: PROPOSED PAVEMENT COMPOSITION FOR BERNIDA ROAD

Material	***Thickness (mm)***	***Compaction Requirements***
Asphalt		
Surface Course (HL3)	40	92% MRD
Basecourse (HL8)	65	92% MRD
Total Asphalt Depth	105	
Base		
Granular A Base (OPSS 1010)	200	100% SPMDD
Granular B Type 2 Sub-Base (OPSS 1010)	250	100% SPMDD
Total Roadway Depth	**255**	

Maximum Relative Density (MRD)
Standard Proctor Maximum Dry Density (SPMDD)

Refer to the Geotechnical Investigation in **Appendix B** for more details on pavement composition.

2.2 UTILITIES

The utilities for the proposed development will be provided by the following local service providers:

- Hydro: Alectra Utilities
- Natural gas: Enbridge Inc.
- Telephone: Bell Canada
- Cable: Rogers Communications
- Mail: Canada Post

These services are to be designed and installed within the ROW of Bernida Road under the supervision of a qualified utilities consultant.

3.0 SITE GRADING

In general, the subject development will require approximately 3450m^3 of engineered fill to provide positive drainage and meet minimum cover requirements for proposed subsurface infrastructure. The properties overall drainage path will be maintained and continue to drain south-west, towards Turtle Creek and Lake Ontario. Residential lots will feature rear lot walkouts to minimize fill requirements, tying into the existing topography.

The proposed grading plan follows municipal design standards, considering the following key design factors:

- Provide positive drainage from buildings
- Match external grades
- Meet minimum and maximum yard, driveway and swale grade criteria
- Meet municipal lot grading criteria
- Provide safe overland flow relief
- Provide sufficient cover for underground infrastructure
- Minimize requirements for retaining walls
- Minimize grading and earthworks where necessary

The proposed grading plan can be found on **Drawing C1**, see **Appendix G**. Detailed lot grading plans will be prepared and tailored with detailed architectural plans for each of the two residential homes.

4.0 WATER SERVICING

This section serves to provide a water servicing plan with anticipated water demands and required fire flow calculations in support of functional servicing. Water servicing for the proposed development will be supplied via a new 150mm watermain under Bernida Road that will connect to the existing 150mm watermain on Parkland Avenue. This watermain will feature a new fire hydrant and tee off to a 50mm copper watermain that will loop the cul-de-sac to service the dwellings, consistent with Region of Peel Standard Drawing 1-7-4. The continuous looped connection will maintain pressure and regulate disinfectant residuals. Water meters are to be purchased from the Region of Peel and will be installed in the basement of each estate lot with a remote readout device located on the exterior ground floor wall of the lot.

A new fire hydrant installed as per City of Mississauga standards, is proposed on the west boulevard of the Bernida Road cul-de-sac. The Region was contacted and confirmed that no pressure/hydrant testing was required for this development.

A preliminary watermain layout is depicted in **Drawing C1**, Conceptual Site Servicing and Grading Plan located in **Appendix G**.

4.1 DEVELOPMENT DEMANDS

The design criteria used to determine water demands were based on Region of Peel *Watermain Design Criteria* and the Fire Underwriters Survey, as required. The proposed development has a total area of 0.45ha. Average Day Demand (ADD), Maximum Day Demand (MDD) and Peak Hour Demand (PHD) factors were calculated using demand peaking factors and population values as per Table 2 in Section 2.3 of the Region of Peel *Watermain Design Criteria:*

Residential Average Day Demand:	409 L/cap/day
Maximum Day Factor:	2
Peak Hour Factor:	3

The estimated water system demands for the proposed development of 2 estate lots are:

- Average Day Demand (ADD): 3,395 L/day = 2.36 L/min;
- Maximum Day Demand (MDD): 6,789 L/day = 4.71 L/min; and
- Peak Hour Demand (PHD): 10,184 L/day = 7.07 L/min.

A detailed breakdown of the calculated demands can be found in **Appendix D** and **Drawing C1**, Conceptual Site Servicing and Grading Plan in **Appendix G**. External demands will be considered in greater detail during detailed design.

Fire demands have been calculated using the *Water Supply for Public Fire Protection* (1999) prepared by Fire Underwriters Survey (FUS). Detailed fire flow calculations are provided in **Appendix D**, and the results are summarized as follows:

- Fire flow calculation: 6,000 L/min = 100.00 L/s

As such, the MDD plus fire flow is 100.08 L/s (100.00 L/s + 0.08 L/s).

Fire protection will be provided via. the proposed fire hydrant located on the west boulevard of the Bernida Road cul-de-sac.

5.0 SANITARY SERVICING

Sanitary servicing will be provided via two (2) independent 125mm diameter pressurized sanitary lines within the Bernida Road ROW, extending from each proposed dwelling. Each sanitary line will outlet into a proposed new manhole (MH2A) at the Parkland Avenue property line. From MH2A, flows will be gravity fed via a 250mm sanitary sewer to a new manhole (MH1A) located on Parkland Avenue which features and existing 250mm reinforced concrete sewer.

Each dwelling is to feature sanitary grinder pumps that will provide adequate storage and pumping capacity. The E/One DH071 grinder pump or approved equivalent is proposed for this development, to be reviewed and approved by a retained mechanical engineer during building construction. More information on the E/one DH071 grinder has been provided in **Appendix E**.

A total sanitary loading of 0.56L/s is estimated to be generated from the proposed development in accordance with Region of Peel Sanitary Sewer Design Criteria. The Region was contacted and confirmed that the existing sanitary sewer system on Parkland Avenue will likely be able to accommodate the proposed sanitary flows from the development. Detailed demand calculations can be found in **Appendix E**.

It should be recognized that the feasibility of a gravity-fed system was assessed however required significant fill and earthworks to accommodate existing topography and minimum sewer cover requirements. The increased fill height incurred greater encroachments into delineated driplines and wetland setbacks. As such, a pressurized sanitary system was proposed.

6.0 STORMWATER MANAGEMENT

This section outlines the proposed drainage strategy for the development including a comprehensive stormwater management plan in accordance with the City of Mississauga, CVC and the MOECP standards and guidelines.

6.1 EXISTING DRAINAGE

The entire 1.62ha property can be delineated into two drainage areas, see **Figure 2** for the pre-development drainage plan. Area A consists of the proposed development limits and Area B consists of undeveloped/undisturbed area and was excluded from further design calculations.

A summary of the pre-development land cover is provided below in **Table 2**.

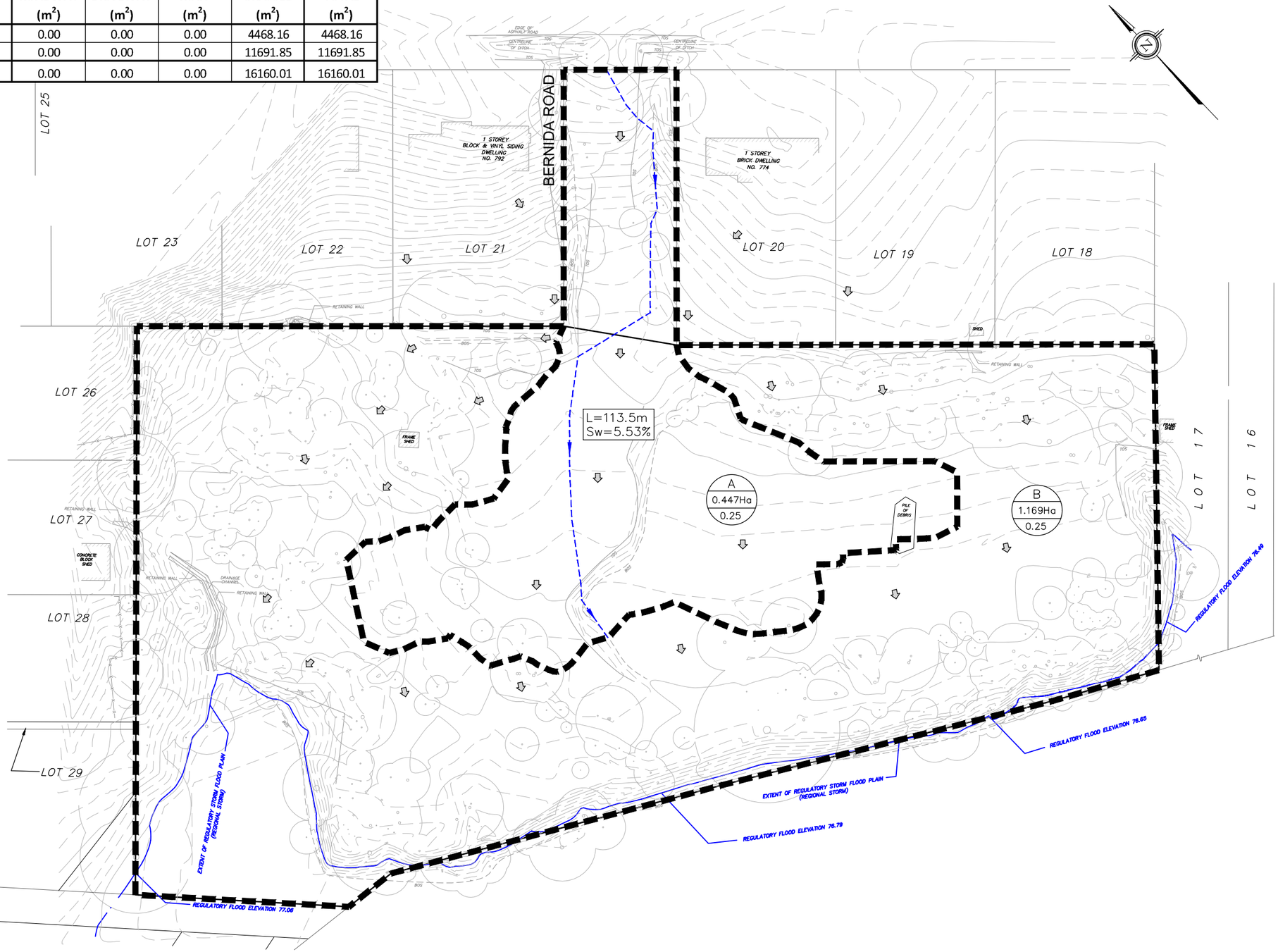
TABLE 2: PRE-DEVELOPMENT LAND-USE SUMMARY

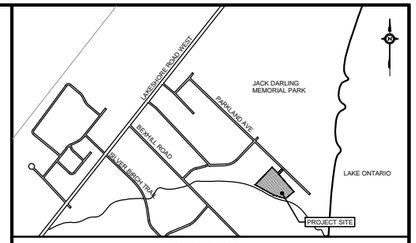
Surface	Runoff Coefficient	Area A (m^2)	Area B (m^2)	Coverage (%)
Roof	0.90	0	0	0
Driveway	0.90	0	0	0
Road	0.90	0	0	0
Vegetated	0.25	4468	11692	100
Total	0.25	4468	11692	100

The overall runoff coefficient of the existing site was calculated to be 0.25 based on the City of Mississauga Development Requirements Manual. For more details, please see **Appendix F**.

EXISTING CONDITIONS

	ASPHALT ROADWAY (m^2)	ASPHALT DRIVEWAY (m^2)	ROOF (m^2)	GRASSED (m^2)	TOTAL (m^2)
AREA A	0.00	0.00	0.00	4468.16	4468.16
AREA B	0.00	0.00	0.00	11691.85	11691.85
TOTAL (m^2)	0.00	0.00	0.00	16160.01	16160.01





KEY PLAN
N.T.S.

LEGEND

- MAJOR OVERLAND FLOW DIRECTION
- MAJOR CONTOUR LABEL – EXISTING
- MINOR CONTOUR LABEL – EXISTING
- STORM DRAINAGE BOUNDARY/LIMIT OF DEVELOPMENT
- EASEMENT
- LIMIT OF RIGHT-OF-WAY
- LOT LINE
- PROPERTY LINE
- EX. FENCE LINE
- EX. CURB/SIDEWALK
- EX. BUILDING
- MH1A — EX. SANITARY MANHOLE
- MH1 — EX. STORM MANHOLE
- EX. SANITARY SEWER
- EX. WATERMAIN
- LONGEST TRAVEL PATH
- 3 / 0.023Ha / 100 — DENOTES AREA NUMBER / DENOTES AREA IN HECTARES / DENOTES RUNOFF COEFFICIENT
- EX. TREE

BENCHMARK

BENCHMARK No. 710
ELEVATION = 93.663m
LOCATION: CITY OF MISSISSAUGA
DESCRIPTION:

COMPLETED BY:
J. H. GELBLOOM SURVEYING LIMITED – ONTARIO LAND SURVEYORS
476 MORDEN ROAD, UNIT 102, OAKVILLE, ON L6K 3W4 (905) 336-8210

COMPLETED ON: JANUARY 20, 2019

Greck
5770 Highway 7, Woodbridge, Ontario, L4L 1T8 www.greck.ca

CLIENT NAME:
GEORGE PACLIK

PROJECT NAME:

BERNIDA ROAD SUBDIVISION

0 BERNIDA ROAD MISSISSAUGA, ON

DRAINAGE PLAN
EXISTING CONDITIONS

DESIGNED BY: J.N.	SCALES:		PROJECT No. 19-631
CHECKED BY: E.G.	HORIZONTAL:	1:500	DRAWING No. FIG. 02
DRAWN BY: J.N.	VERTICAL:		SHEET No.
DATE: MAR 16, 2020	SHEET SIZE:	11"x17"	

6.2 PROPOSED DRAINAGE

To account for proposed conditions, Area A (0.45ha) was further delineated into two drainage areas:

- Area A1 – Major and minor drainage will be conveyed via the roadway to the proposed stormwater management facility and includes all roadway and driveway spaces that receive vehicular traffic.
- Area A2 – Major and Minor drainage will drain uncontrolled to Turtle Creek via sheet flow through the existing vegetated area.

A summary of the post-development land cover is provided below in **Table 3**.

TABLE 3: POST-DEVELOPMENT LAND-USE SUMMARY

Surface	Runoff Coefficient	Area A1 (m^2)	Area A2 (m^2)	Coverage (%)
Roof	0.90	619	0	14
Driveway	0.90	210	0	5
Road	0.90	975	0	22
Vegetated	0.25	1336	1329	60
Total	0.51	3140	1329	100

Please see **Figure 3** for the post-development drainage plan.

The proposed development will not include an underground minor storm sewer system. Given the size of the development, sheet flow is expected to be minimal for the 25mm through to the 100yr event and the proposed stormwater management facility will be capable of receiving and treating all directed surface runoff as required.

As per **Table 3**, the overall composite runoff coefficient of the proposed development (Area A1 and A2) was calculated to be 0.51 based on the City of Mississauga Development Requirements Manual. For more details please see **Appendix F**.

In accordance with the City of Mississauga Development Requirements, flows are to be calculated using the Rational Method as shown below:

Q = 2.78 ACI/1000.

Where:

- A = Area (ha);
- C = Runoff coefficient
- I = Rainfall intensity (mm/hr)

IDF curves from the City of Mississauga Standard Drawing 2111.010 were used to generate the rainfall intensity for the 2-year and 100-year storm event. These IDF curves are a function of the time of concentration. Depending on the runoff coefficient of the drainage area, the Bransby or the Airport method is used to calculate the time of concentration. Intensity and time of concentration calculations are provided in **Appendix F**.

The calculated pre-development and post-development flows generated from Areas A1 and A2 are summarized in **Table 4** below. **Table 4** quantifies the increase in post-development runoff flows due to the increased runoff coefficient. For the 100-year event, a runoff coefficient correction factor of 1.25 was applied to incorporate the more saturated soil conditions that would occur during a significant rainfall event, as per MTO and City standards. Detailed flow calculations are provided in **Appendix F**.

TABLE 4: PRE-DEVELOPMENT AND POST-DEVELOPMENT FLOWS

Existing		Proposed	
2-year flow (L/s)	100-year flow (L/s)	2-year flow (L/s)	100-year flow (L/s)
17.4	51.0	71.1	205.9

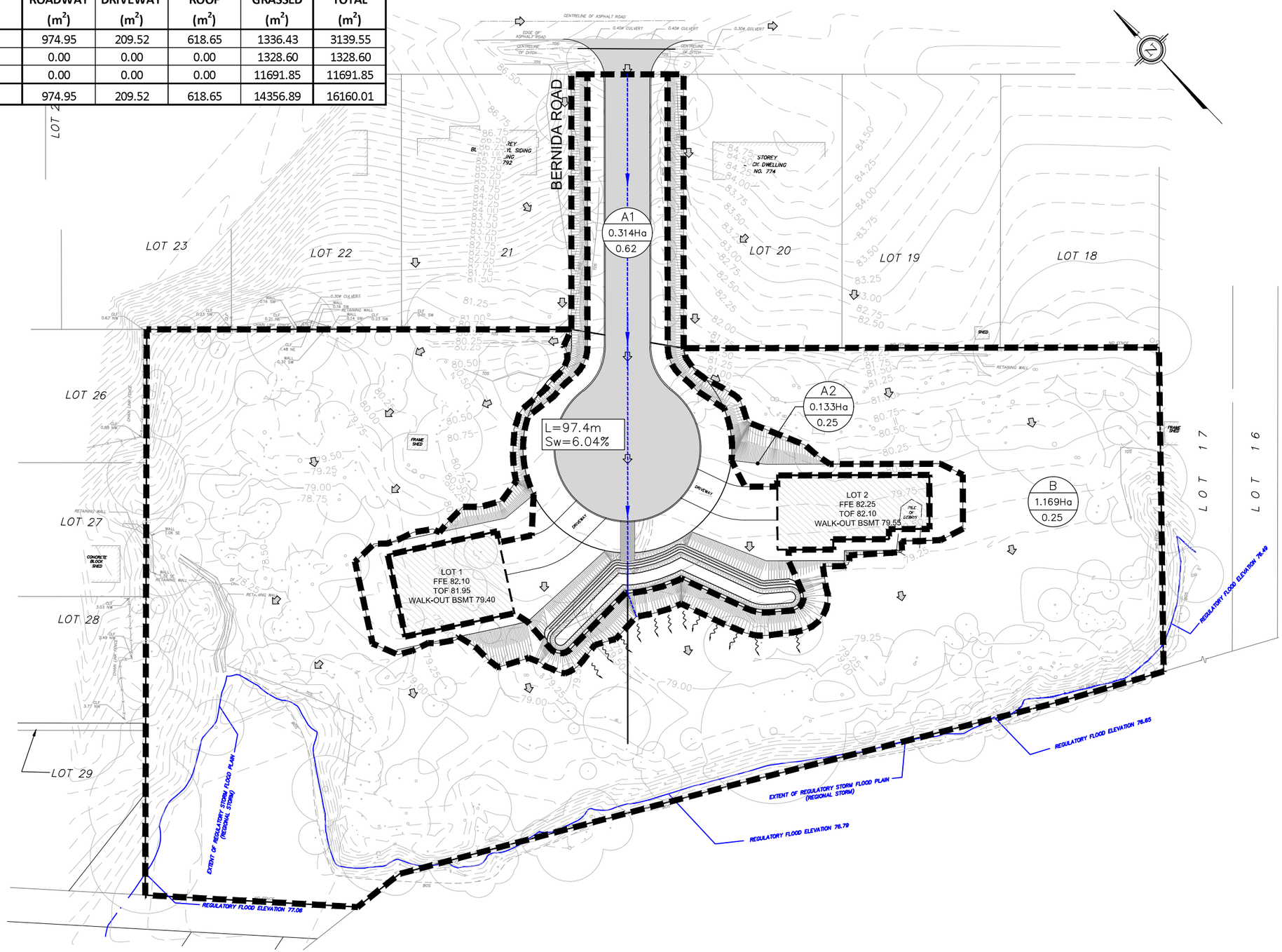
From **Table 4**, comparing proposed and existing scenarios, the post-development flows are greater than pre-development flows. This can be attributed primarily due the proposed increase to impervious cover. These flow rates were used for reference to characterize and calculate erosion, as well as minor and major flow conveyance, please see **Appendix F**.

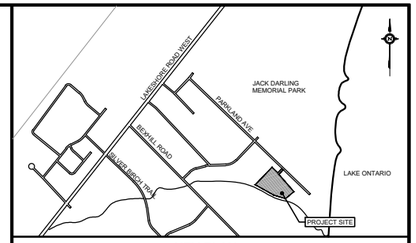
The proposed Bernida Road will convey minor and major flows generated from Area A1. Runoff is conveyed to a 2.5m wide concrete channel via a 2.5m wide curb cut at the south end of the Bernida Road cul-de-sac. The concrete channel ends at the limits of the ROW and discharges flows via sheet flow towards the stormwater management facility. The 3:1 slope from the outlet of the concrete channel to the top of the stormwater management facility will be protected with 300mm of 150mm clear stone, top dressed with 200mm of topsoil.

A conveyance capacity assessment was completed which ensured that the 100-year flow can be conveyed and contained within the roadway and concrete channel. For the conveyance capacity assessment, please see **Appendix F**. In addition to this, an erosion assessment was also completed. 100-year flow velocities from the concrete channel were calculated to be 0.62m/s which is less than 1.5m/s (permissible velocity for grass). As such, the proposed erosion protection of 300mm of 150mm clear stone, top dressed with 200mm of topsoil is sufficient. For the erosion assessment, please see **Appendix F**.

PROPOSED CONDITIONS

	ASPHALT ROADWAY (m^2)	ASPHALT DRIVEWAY (m^2)	ROOF (m^2)	GRASSED (m^2)	TOTAL (m^2)
AREA A1	974.95	209.52	618.65	1336.43	3139.55
AREA A2	0.00	0.00	0.00	1328.60	1328.60
AREA B	0.00	0.00	0.00	11691.85	11691.85
TOTAL (m^2)	974.95	209.52	618.65	14356.89	16160.01





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- EX. BUILDING
- EX. STORM SEWER
- PR. STORM SEWER
- PR. POND (MAX 3:1 SLOPE)
- PR. BUILDING ENVELOPE
- ASPHALT ROADWAY
- PR. SWALE
- LONGEST TRAVEL PATH
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0 BERNIDA ROAD MISSISSAUGA, ON

DRAINAGE PLAN
PROPOSED CONDITIONS

DESIGNED BY:	J.N.	SCALES:		PROJECT No.	19-631
CHECKED BY:	E.G.	HORIZONTAL:	1:500	DRAWING No.	FIG. 03
DRAWN BY:	J.N.	VERTICAL:		SHEET No.	
DATE:	MAR 16, 2020	SHEET SIZE:	11"x17"		

6.3 STORMWATER MANAGEMENT REQUIREMENTS

Stormwater Management (SWM) will be provided on-site in accordance with MOECP, CVC and City of Mississauga SWM design criteria. The following SWM criteria are provided below:

Quality Control	Enhanced level water quality protection, or 80% long term total suspended solids (TSS) removal is required
Erosion Control	5mm of on-site retention
Quantity Control	Flood Control is not applicable due to proximity to Lake Ontario, see Section 8.4.3
Water Balance / Infiltration	Match post development infiltration volumes and recharge quality to pre-development levels on an annual basis

The proposed stormwater strategy considers the conveyance and control of all runoff within the development area and includes the construction of a single stormwater management facility or bio-retention facility. This facility will provide the necessary control of water quality, erosion and water balance initiatives.

6.3.1 WATER QUALITY

The required suspended solids removal treatment is MOE Enhanced Protection Level (Level 1). This corresponds to a long-term average removal of 80% of total suspended solids (TSS).

Stormwater from the development will be characterized by runoff from roofs, yards, driveway and road surfaces. Given the relatively small site, water quality from the proposed development is likely to be relatively clean with the main contaminants of concern being:

- Suspended sediments
- Phosphorous
- Other (oil, grease, gas, temperature)

Areas A2 consists of grassed/landscaped areas. Grassed/landscaped drainage are considered clean and therefore no quality controls are proposed for Areas A2. Thus, water quality controls will only be provided for Area A1.

Water quality volumes (WQV) are function of the percent imperviousness of the drainage area, the size of the drainage area, and unit volumes reported in Table 3.2 of the Ministry of Environment Stormwater Management Planning and Design Manual. The

required WQV for the subject site was calculated and reported below in **Table 5**. WQV calculations are provided in **Appendix F.**

TABLE 5: WATER QUALITY VOLUME SUMMARY

	Area A1
Drainage Area	3140m^2
Imperviousness	57%
Unitary Volume (to achieve 80% TSS removal)	31.3m^3/ha
Required Water Quality Volume	9.8m^3

A treatment train approach is proposed for capturing and treating contaminated runoff.

- First, pre-treatment measures upstream of the bioretention facility will reduce runoff velocities and provide initial opportunities for sedimentation, featuring a 1.0m wide filter strip and swale lined with 300mm of 150mm clear stone, top dressed with 200mm of topsoil.

- Secondly, a bio-retention facility featuring a 3.8m wide top width and 2m wide bottom width will capture and retain stormwater for infiltration. The bio-retention facility will feature plantings that improve sediment and contaminant capture, prior to subsurface infiltration through a hardwood mulch layer, engineered filter media layer and a storage gravel layer. A detailed cross section of the facility is provided in the drawings located in **Appendix G**. The facility has been designed such that the WQV is retained and infiltrated towards a subsurface gravel storage layer, where surface runoff will infiltrate through the native soils. To ensure the WQV is retained and infiltrated, the facility is sized so the ponding storage can accommodate the WQV.

- Thirdly, all overflow from the bio-retention facility must discharge via a flow spreader through an existing vegetated area prior to entering Turtle Creek. This vegetated filter strip will provide a tertiary opportunity for sediment capture and deposition. Sheet flow velocities were calculated to be 0.23m/s which is less than 1.5m/s (permissible velocity for grass) and as such, erosion due to outflows form the facility is not expected. Flow velocity calculations are provided in **Appendix F**.

The boreholes from the geotechnical investigation indicate that the underlying soils consist of silty sand and silt. Soil Engineers reported an estimated percolation rate of 30 to 60min/cm. Therefore, to be conservative the percolation rate of 60min/cm will be used for design calculations, which is equivalent to 10mm/hr. The clear stone layer was

sized to infiltrate 9.8m^3 in 42 hours, which meets the maximum drawdown time of 48 hours as required by CVC. Drawdown time calculations are provided in **Appendix F**.

According to the geotechnical investigation, Borehole No. 2 and 3 will best reflect the subsurface conditions of the bioretention facility. The groundwater elevation reported by Borehole No. 2 and 3 is 78.6m. Therefore, in order to have a vertical clearance of 1.0m from the high groundwater elevation, the bottom of the subsurface layer is proposed to be at 79.6m.

A summary of the quality control requirements and provided design characteristics are provided in **Table 6**. As per the CVC LID manual, bioretention facilities provided 80% TSS removals. Detailed calculations supporting the required storage depths, drawdown time and required footprint areas were determined based on expected percolation rates.

TABLE 6: SWMF - QUALITY CONTROL DESIGN SUMMARY

Parameter	Required	Provided
Maximum Storage Depth	450mm	300mm
Minimum Footprint Area	82.02m^2	96.50m^2
Minimum subsurface Storage Volume	9.8m^3	11.6m^3
Maximum Drawdown Time	48 hours	42 hours

Specific details regarding the facility are provided in **Appendix G**. For detailed water quality calculations, please see **Appendix F**.

6.3.2 EXTENDED DETENTION/EROSION CONTROL

The CVC Erosion Control Criteria requires that 5mm of on-site retention be provided.

For Area A1, erosion control will be provided with the proposed bioretention facility via temporary retention and infiltration. The facility has been designed such that the erosion control volume is retained and infiltrated towards a subsurface gravel storage layer, where surface runoff will infiltrate through the native soils. Erosion control and facility sizing calculations are provided in **Appendix F**. Area A2 does not require any erosion controls as they only consist of landscaped/grassed surfaces, which provide 5mm of depression storage.

See **Table 7** below for a summary of erosion control volume requirements and the provided storage for the proposed development.

TABLE 7: SWMF - EROSION CONTROL SUMMARY

Area	Area (m^2)	Required Volume (m^3)	Provided Volume (m^3)
Area A1, A2	4468.15	22.3	24.9

The depression storage from the grassed areas will provide 13.3m^3 of erosion control storage. In addition, the proposed bio-retention facility will provide 11.6m^3 of subsurface storage. Therefore, in total, 24.9m^3 of storage is provided to meet erosion control requirements.

6.3.3 WATER QUANTITY

As per CVC, the flood control criteria for Turtle Creek is post to pre control for the 2 to 10-year storm events. However, the development is located approximately 360m from the shoreline of Lake Ontario where Turtle Creek outlets. Implementing quantity controls for on-site detention this close to Lake Ontario is not advantageous. In fact, retaining water on site typically improves the opportunity to coincide with peak flows generated from upstream resulting in a greater combined peak flow. As such, it is standard procedure to release the 2-year to 100-year uncontrolled when close to a watercourse outlet.

Due to the proximity to Lake Ontario, no quantity controls are proposed.

According to the CVC LID manual, bioretention facilities can provide 85% runoff reduction, however, for conservative purposes, this was not considered as part of this analysis.

6.3.4 BIORETENTION FACILITY DESIGN SUMMARY

The bioretention facility is to incorporate the following features, see the engineering drawings in **Appendix G** for more details:

- 3:1 side slopes;
- Salt tolerant plantings for aesthetics and treatment purposes;
- 75mm mulch layer to provide additional pre-treatment to infiltration;
- 250mm depth of filter media (engineered sand);
- 100mm pea gravel layer;
- 300mm depth gravel storage layer with storage capacity to capture the water quality volume;
- Greater than 1m separation from groundwater and bedrock;
- A full width of 3.8m and a bottom width of 2m
- Ponding depth of 300mm
- 500mm wide grassed berm surrounding the facility
- Ponding exceeding a depth of 300mm will spill over the berm and sheet flow towards Turtle Creek

6.3.5 BIO-RETENTION PLANTING PLAN

The proposed bioretention facility will contain a variety of plantings for aesthetic and filtration purposes.

The CVC LID manual provides planting recommendations to provide further filtration. Plant Species have been proposed as per the CVC LID Landscape Design Guide, 2010 – Table 3.2.7 – Bioretention Plant List – Salt Exposure. It is anticipated salting will occur during the winter seasons, and therefore, salt-tolerant species have been selected. Details regarding suitable plant species for the SWMF are provided in **Drawing C3**.

7.0 WATER BALANCE

Urbanization increases impervious cover which, if left unmitigated, typically results in a decrease of infiltration and evapotranspiration and increase of runoff. Most notably, infiltration-decrease reduces groundwater-recharge and soil-moisture replenishment. It also reduces stream baseflow needed for sustaining aquatic life. Therefore, it is important to maintain the natural hydrologic cycle as much as possible.

The site is located in an ecologically significant groundwater recharge area (EGRA) as classified by Figure B8 in Appendix B of the CVC SWM Criteria, as such, according to CVC SWM Water Balance criteria, post development infiltration volumes and recharge quality will be maintained to pre development levels.

A detailed and site-specific water balance analysis was prepared using MOE's Stormwater Management Planning and Design Manual, March 2003 as per CVC's technical guidelines. This approach uses the method developed by Thornthwaite and Mather.

The parameters used for the water balance analysis are provided in **Table 8**.

TABLE 8: MOE WATER BALANCE INFILTRATION PARAMETERS

	Existing		Proposed	
Parameter	**Area**	**Factor**	**Area**	**Factor**
Topography	Hilly Land	0.1	Hilly Land	0.1
Soils	Clay	0.1	Clay	0.1
Cover	Woodland	0.2	Cultivated	0.1
Total Infiltration Factor		**0.4**		**0.3**

Refer to MOE 2003 for Infiltration Factors, See **Appendix F** for detailed water balance calculations

A total deficit volume of 177.1m^3/year will not be infiltrated into the ground given the proposed development plan and resulting change in pervious cover. As such, this annual volume must be balanced and infiltrated back into the ground under proposed conditions.

The water balance target of 177.1m^3/year will be provided through the bioretention facility. The bioretention facility captures a drainage based on an annual surplus factor of 304.8mm/year.

The bioretention facility has the ability to capture a total rainfall volume of 6mm from the impervious areas, it is documented that 50% of rainfall events are below 5mm in total depth and therefore is an adequate volume to size for infiltration purposes.

Based on an annual surplus factor of 304.8mm/year, the annual infiltration volume towards the bioretention facilities was then determined. The total annual additional volume equates to 394.6m^3 per year, thus providing adequate subsurface infiltration. A summary of the infiltration volumes provided by the bioretention facility is reported in **Table 9**.

TABLE 9: BIORETENTION FACILITY WATER BALANCE PARAMETERS

	Area A1
Future Contributing Area	3139.6m^2
Annual Surplus	304.8mm/year
Total Annual Volume Infiltrated	394.6m^3

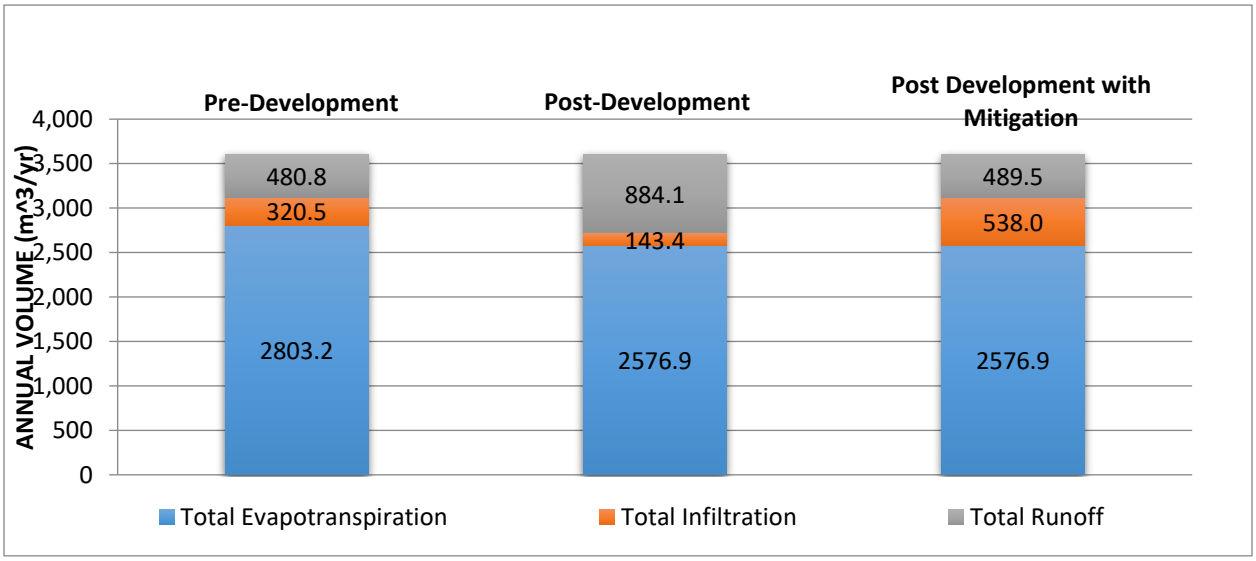


FIGURE 4: PRE-DEVELOPMENT, POST-DEVELOPMENT AND POST-DEVELOPMENT WITH MITIGATION WATER BALANCE

For Water Balance calculations please see **Appendix F**.

8.0 EROSION AND SEDIMENT CONTROL

Erosion and sediment controls (ESC) will be implemented for all construction activities, including topsoil striping, material stockpiling, pavement construction, and grading operations. Design details will include a phased approach to minimize disturbance including considerations for restoration.

ESC measures will be provided during detailed design, and may include, but not be limited to:

- Silt fence (light/heavy) – placed in order to divert runoff and contain sediments within the construction area. The fencing consists of a filter fabric secured by posts anchored to the ground. Heavy duty fencing includes wire mesh for reinforcement.
- Sediment Bags – to be used if dewatering is needed during construction. Any work area to be dewatered must discharge the sediment-laden flow through a dewatering filter bag placed in a well vegetated and stabilized area surrounded by Silt Soxx to capture silt from the water.
- Silt Soxx – a tubular mesh netting containing filter media used as a barrier filter for runoff containing excess sediment. To be used in conjunction with sediment bags for dewatering operations as well as a substitute for Silt Fence.
- Rock Check Dams – to be placed within a drainage swale to hold back water and reduce velocities to prevent erosion and promote sedimentation.
- Silt Sacks – to be installed in active catch basins to filter any stormwater leaving the construction area to prevent sediment from entering the drainage system. The Silt Sack is placed underneath the catch basin grate and holds the sediment until emptied.
- Temporary sediment ponds – allow for the detention of runoff containing excess sediment as a result of construction operations. The detention time allows sedimentation to occur before the run-off is discharged.
- Mud tracking control – mud mats, consisting of a geotextile overlain by clear stone will be placed at the access to the site during construction to prevent equipment and vehicles from tracking sediments off-site.
- Dust Suppression – a local water supply or a water truck is to be used to spray and dampen the construction area to reduce airborne dust. With an emphasis on hauling and other vehicular traffic routes.

9.0 CONCLUSIONS

As presented in this report, the proposed Bernida Road development will meet the following municipal and provincial standards and regulations specified for:

- General site grading;
- Water distribution;
- Sanitary sewer servicing;
- Utilities;
- Major and minor stormwater drainage systems;
- Stormwater management;

In summary, it has been determined that the proposed Bernida Road development can be adequately serviced with existing and proposed infrastructure is in accordance with policies and guidelines required by the City of Mississauga, CVC and other regulating agencies.

10.0 REFERENCES

City of Mississauga – Development Requirements Manual, January 2020

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

Ministry of the Environment – Design Guidelines for Sewage Works, 2008

Ministry of Transportation (MTO) – Drainage Management Manual, 1997

Ontario Ministry of Natural Resources and Forestry – Technical Guide – River and Stream Systems: Erosion Hazard Limit, 2002

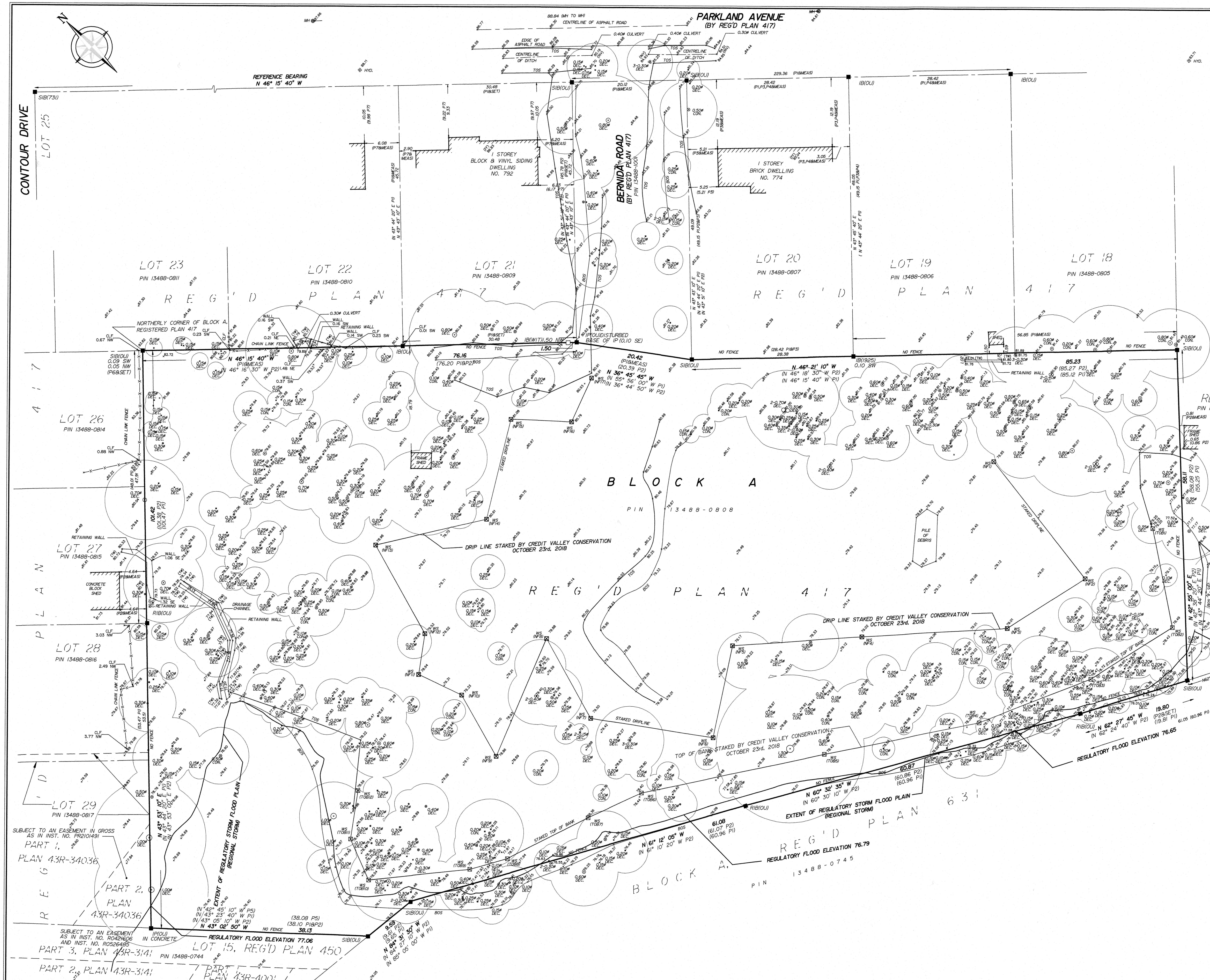
Region of Peel – Public Works Stormwater Design Criteria and Procedural Manual June 2019 (version 2.1)

Credit Valley Conservation Authority (CVC) – Stormwater Management Criteria, August 2012 (version 1.0)

Toronto and Region Conservation Authority (TRCA) & Credit Valley Conservation Authority (CVC) – Low Impact Development Stormwater Management Planning and Design Guide, 2010 (version 1.0)

APPENDIX A

Draft Plan and Survey



ASSOCIATION OF ONTARIO LAND SURVEYORS
PLAN SUBMISSION FORM
2061342
THIS PLAN IS NOT VALID UNLESS IT IS AN EMBOSSED ORIGINAL COPY ISSUED BY THE SURVEYOR In accordance with Regulation 1026, Section 29(3).

SURVEYOR'S REAL PROPERTY REPORT – PART 1

PLAN OF SURVEY AND TOPOGRAPHY OF
BLOCK A
REGISTERED PLAN 417
CITY OF MISSISSAUGA

REGIONAL MUNICIPALITY OF PEEL

5 0 5 10 15 20 25 METRES

SCALE 1 : 300

J. H. Gelbloom Surveying Limited
Ontario Land Surveyor 2019

SURVEYOR'S REAL PROPERTY REPORT – PART 2

REGISTERED EASEMENTS AND/OR RIGHT-OF-WAY
None

NOTABLES
Note the Location of the Fences along the Northeasterly limit and the Northwesterly limit of the Subject Property in the vicinity of the Northerly Corner of the Subject Property.

Note the Location of the Retaining Wall along the Northwesterly limit of the Subject Property in the vicinity of the Northerly Corner of the Subject Property.

LEGEND

■	Survey Monument Found
□	Survey Monument Set
SIB	Standard Iron Bar
IB	Iron Bar
RIB	Round Iron Bar
IP	Iron Pipe
(OU)	Origin Unknown
WIT	Witness
731	J.R. Dunning, O.L.S.
1925	Mandarin Surveyors Ltd., O.L.S.
P1	Registered Plan 417
P2	Topographic Survey by Robert T. Force, O.L.S., dated June 13, 2001
P3	Plan Cook & Dunning, O.L.S., dated April 14, 1995
P4	Plan of Survey by Mandarin Surveyors Ltd., O.L.S., dated June 15, 2017
P5	Plan 43R-3141
P6	Plan of Survey by Tarasick McMillan Kubicki Ltd., O.L.S., dated March 9, 2011
P7	Plan of Survey by Cook & Dunning, O.L.S., dated May 12, 1954
CLF	Chain Link Fence
DEC.	Deciduous Tree
CON.	Coniferous Tree
TOS	Top of Slope
BOS	Bottom of Slope
TW	Top of Wall Elevation
INV	Invert Elevation
FF	Finished Floor Elevation
N	North
S	South
E	East
W	West
MH	Maintenance Hole
HYD.	Fire Hydrant
WS	Wood Stake

NOTE
This REPORT can be updated by this office, however NO ADDITIONAL PRINTS of this ORIGINAL REPORT will be issued, subsequent to the DATE OF CERTIFICATION.
All building ties are perpendicular to property lines unless otherwise noted.

This REPORT was prepared for Technosonic Industries Ltd. and the undersigned accepts no responsibility for use by other parties.

NOTE
Distances shown on this plan are in metres and can be converted to feet by dividing by 0.3048.

BEARING NOTE
Bearings are Astronomic, and are Referred to the Southwesterly limit of Parkland Avenue as shown on Reg'd Plan 417, having a Bearing of N 46° 15' 40" W.

BENCHMARK
Elevations are Referred to the City of Mississauga Benchmark No. 710, having an Elevation of 93.663 m.

SURVEYOR'S CERTIFICATE
I certify that:
1: This survey and plan are correct and in accordance with the Surveys Act, the Surveyors Act, and the Regulations made under them.
2: The survey was completed on the 20th day of January, 2019.

Jan. 24, 2019
Date

A. Musil
Andrew Musil, O.L.S.

Party Chief:	Drawn By:	Checked By:	Project:
N.A.	G.S.	A.M.	18-228

J. H. Gelbloom Surveying Limited
Ontario Land Surveyor
476 Morden Road, Unit 102, Oakville, Ont., L6K 3W4
office@jhgsurveying.ca
Phone:(905) 338-8210 Fax:(905) 338-9446

PARKLAND AVENUE
(BY REG'D PLAN 417)

BERNIDA ROAD
(BY REG'D PLAN 417)

N 46° 29' 45" W
20.12

N 44° 36' 30" E

LOT 23

LOT 22

LOT 21

LOT 20

LOT 19

LOT 18

LOT 17

LOT 26

LOT 27

LOT 28

LOT 29

1.50

7.00

1.50

N 46° 23' 00" W

76.14

N 46° 34' 30" W

85.27

20.12

N 36° 27' 05" W

R13.00

6.00

6.00

Lot A

Lot B

POTENTIAL
2 STORY
DWELLING
6500 sf

POTENTIAL
2 STORY
DWELLING
6500 sf

30m SETBACK FROM TOP OF BANK

DRIP LINE STAKED BY CREDIT VALLEY CONSERVATION
OCTOBER 23rd, 2018

STAKED DRIPLINE

TOP OF BANK STAKED BY CREDIT VALLEY CONSERVATION
OCTOBER 23rd, 2018

STAKED TOP OF BANK

EXTENT OF REGULATORY STORM FLOOD PLAIN
(REGIONAL STORM)

REGULATORY FLOOD ELEVATION 76.49

REGULATORY FLOOD ELEVATION 76.65

REGULATORY FLOOD ELEVATION 76.79

REGULATORY FLOOD ELEVATION 77.06

N 42° 47' 30" E

N 62° 34' 10" W

19.80

N 65° 39' 40" W

60.81

N 61° 19' 10" W

61.08

N 43° 10' 00" W

36.13

N 84° 38' 40" W

9.59

N 43° 40' 00" E

10.42

38.11

BLOCK A, REG'D PLAN 631

LOT 15, REG'D PLAN 450

Site Data		
Total Lot Area	15,197.41 sm	(1.519 ha)
Zoning		R2-4
Lot A Area		8,430.36 sm
Lot B Area		6,767.05 sm

Preliminary Site Plan

0 Bernida Road, Mississauga, ON
Residential Land Proposal

Harper Dell & Associates Inc.
Planning, Traffic and Land Development Consulting
1370 Hurontario St.
Mississauga, ON, L5G 3G4

Date: Jan 28, 2019
Scale: 1:650

SP

APPENDIX B

Geotechnical Investigation by Soil Engineers

Soil Engineers Ltd.
CONSULTING ENGINEERS
GEOTECHNICAL • ENVIRONMENTAL • HYDROGEOLOGICAL • BUILDING SCIENCE
90 WEST BEAVER CREEK ROAD, SUITE 100, RICHMOND HILL, ONTARIO L4B 1E7 · TEL: (416) 754-8515 · FAX: (905) 881-8335

BARRIE	MISSISSAUGA	OSHAWA	NEWMARKET	GRAVENHURST	HAMILTON
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FAX: (705) 721-7864	FAX: (905) 542-2769	FAX: (905) 725-1315	FAX: (905) 881-8335	FAX: (705) 684-8522	FAX: (905) 542-2769

A REPORT TO
TECHNISONIC INDUSTRIES LTD.

A SOIL INVESTIGATION FOR PROPOSED TWO 2–STOREY RESIDENTIAL BUILDINGS

BERNIDA ROAD AND PARKLAND AVENUE

CITY OF MISSISSAUGA

REFERENCE NO. 1906-S087

AUGUST 2019

DISTRIBUTION

2 Copies - Harper Dell & Associates Inc.
1 Copy - Technisonic Industries Ltd.
1 Copy - Soil Engineers Ltd. (Mississauga)
1 Copy - Soil Engineers Ltd. (Richmond Hill)

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1.0 INTRODUCTION

In accordance with written authorization dated June 13, 2019, from Mr. George Paclik, President, of Technisonic Industries Ltd., a geotechnical investigation was carried out at a parcel of land located at Bernida Road and Parkland Avenue, in the City of Mississauga, for the proposed development of two 2-storey Residential Buildings.

The purpose of the investigation was to reveal the subsurface conditions and to determine the engineering properties of the disclosed soils for the design and construction of the proposed project.

The findings and resulting geotechnical recommendations are presented in this Report.

2.0 SITE AND PROJECT DESCRIPTION

The City of Mississauga is situated on Halton-Peel till plain where drift extends onto a shale bedrock of either Queenston or Georgian Bay Formation at shallow to moderate depths. In places, the drift has been eroded by the glacial lake (Peel Ponding) and filled with lacustrine sand, silt, clay and reworked till.

The subject site is an open field, situated at Bernida Road and Parkland Avenue, in the City of Mississauga. The site area is grass-covered, with dense trees at the perimeter. The ground surface is highest at Parkland Avenue and descends towards the west where Turtle Creek is located.

The proposed project consists of the construction of a new access road and two 2-storey residential buildings, each with a basement.

3.0 **FIELD WORK**

The field work, consisting of 3 boreholes to depths of 3.5 m and 6.5 m, was performed on June 28, 2019, at the locations shown on the Borehole Location Plan, Drawing
No. 1.

The holes were advanced at intervals to the sampling depths by a track-mounted, continuous-flight power-auger machine equipped for soil sampling. Standard Penetration Tests, using the procedures described on the enclosed "List of Abbreviations and Terms", were performed at the sampling depths. The test results are recorded as the Standard Penetration Resistance (or 'N' values) of the subsoil. The relative density of the granular strata and the consistency of the cohesive strata are inferred from the 'N' values. Split-spoon samples were recovered for soil classification and laboratory testing.

The field work was supervised and the findings recorded by a Geotechnical Technician.

The elevation at each of the borehole locations was interpolated from the spot elevations shown on the site plan provided by the client.

4.0 SUBSURFACE CONDITIONS

Detailed descriptions of the encountered subsurface conditions are presented on the Borehole Logs, comprising Figures 1 to 3, inclusive. The revealed stratigraphy is plotted on the Subsurface Profile, Drawing No. 2, and the engineering properties of the disclosed soils are discussed herein.

This investigation has disclosed that beneath a veneer of topsoil and a layer of earth fill, the site is underlain by strata of silt and sand.

4.1 Topsoil (All Boreholes)

The revealed topsoil is 13 m and 23 cm thick. It is dark brown in colour, indicating that it contains appreciable amounts of roots and humus. These materials are unstable and compressible under loads; therefore, the topsoil is considered to be void of engineering value. Due to its humus content, it may produce volatile gases and generate an offensive odour under anaerobic conditions. Therefore, the topsoil must not be buried below any structures or deeper than 1.2 m below the finished grade, so that it will not have an adverse impact on the environmental well-being of the developed areas.

Since the topsoil is considered void of engineering value, it can only be used for general landscaping and landscape contouring purposes. A fertility analysis can be carried out to determine the suitability of the topsoil as a planting material.

4.2 **Earth Fill** (All Boreholes)

The earth fill was found extending to depths from 1.4 to 4.0 m below the prevailing ground surface. The earth fill consists of silty clay and silty sand materials, with a trace of gravel and organics.

The obtained 'N' values of the fill range from 2 to 28, with a median of 9 blows per 30 cm of penetration, indicating that it was loosely placed with nominal compaction and has partially self-consolidated. Its density is considered to be non-uniform and is generally in a loose condition.

A grain size analysis was performed on 1 representative sample of the earth fill; the result is plotted on Figure 4.

The natural water content values range from 6% to 21%, with a median of 16%, indicating that the earth fill is in a moist to wet condition, which has been confirmed by the sample examinations.

Due to its unknown history, non-uniform, generally loose density and the presence of organics, the earth fill is considered unsuitable for supporting structures. For structural use, the fill must be subexcavated, sorted free of organics and any deleterious material and properly compacted.

The extent of the fill and its quality must be assessed by test pits prior to and/or during the construction of the project.

One must be aware that the samples retrieved from boreholes 10 cm in diameter may not be truly representative of the geotechnical and environmental quality of the fill,

and do not indicate whether the topsoil beneath the earth fill was completely stripped. This should be further assessed by laboratory testing and test pits.

4.3 **Silt** (Borehole 3)

The silt deposit was encountered below a layer of earth fill and overlying a layer of silty sand. It is embedded with seams and layers of silty clay and fine sand and contains a variable amount of clay. The laminated structure shows that the silt is a lacustrine deposit.

The natural water content values of the silt samples range from 12% to 17%, with a median of 15%, indicating it is in a very moist to wet condition and is water bearing. The wet samples became highly dilatant when shaken by hand, showing the shear strength of the silt will be subject to dynamic disturbance.

The obtained 'N' values range from 27 blows per 30 cm to 50 blows per 15 cm, with a median of 35 blows per 30 cm of penetration, indicating that the relative density of the silt is compact to very dense, being generally dense.

Grain size analyses were performed on 2 representative samples and the results are plotted on Figure 5.

Based on the above findings, the engineering properties relating to the project are given below:

- Highly frost susceptible, with high soil-adfreezing potential.
- Highly water erodible; it is susceptible to migration through small openings under seepage pressure.

- Relatively low to low permeability, depending on its clay content, with an estimated coefficient of permeability of 10^{-5} to 10^{-6} cm/sec, an estimated percolation rate of 30 to 60 min/cm, and runoff coefficients of:

Slope	
0% - 2%	0.11 to 0.15
2% - 6%	0.16 to 0.20
6% +	0.23 to 0.28

- The soil has a high capillarity and water retention capacity.
- A frictional soil, its shear strength is density dependent. Due to the dilatancy, the strength of the wet silt is susceptible to impact disturbance; i.e., the disturbance will induce a build-up of pore pressure within the soil mantle, resulting in soil dilation and a reduction in shear strength.
- In excavation, the moist silt will be stable in relatively steep cuts, while the wet silt will slough and run slowly with seepage bleeding from the cut face, and the bottom will boil under a piezometric head of 0.3 m.
- A poor pavement-supportive material, with an estimated California Bearing Ratio (CBR) value of 6%.
- Moderate corrosivity to buried metal, with an estimated electrical resistivity of 4500 ohm·cm.

4.4 **Sand** (All Boreholes)

The sand deposit was encountered below the earth fill or below the silt at the lower stratigraphy. It extends to the maximum investigated depth at all boreholes. Sample examinations show that it is non-cohesive, consists of fine to medium sand, with some silt to being silty. The laminated structure shows the deposit was derived from a lacustrine environment.

The obtained 'N' values range from 6 blows per 30 cm to 50 blows per 8 cm, with a median of 67 blows per 30 cm of penetration; therefore, the relative density of the sand is loose to very dense, being generally very dense.

The natural water content was determined and the results are plotted on the Borehole Logs. The values range from 14% to 28%, with a median of 18%, showing that the sand deposit is in a wet condition. The wet samples are water bearing and displayed appreciable dilatancy when shaken by hand.

Accordingly, the following engineering properties are deduced:

- Highly frost susceptible with high soil-adfreezing potential.
- Highly water erodible.
- Pervious, with an estimated coefficient of permeability of 10^{-3} cm/sec, an estimated percolation rate of 10 min/cm, and runoff coefficients of:

Slope	
0% - 2%	0.04
2% - 6%	0.09
6% +	0.13

- A frictional soil, its shear strength is derived from internal friction and is density dependent. Due to its dilatancy, the shear strength of the wet sand is susceptible to impact disturbance; i.e., the disturbance will induce a build-up of pore pressure within the soil mantle, resulting in soil dilation and a reduction of shear strength.
- In relatively steep cuts, the sand will be stable in a damp to moist condition, but will slough if it is wet and run with water seepage. The bottom will boil under a piezometric head of 0.3 m.

- A fair material to support pavement, with an estimated CBR value of at least 8%.
- Moderately low corrosivity to buried metal, with an estimated electrical resistivity of 5000 ohm·cm.

4.5 Compaction Characteristics of the Revealed Soils

The obtainable degree of compaction is primarily dependent on the soil moisture and, to a lesser extent, on the type of compactor used and the effort applied.

As a general guide, the typical water content values of the revealed soils for Standard Proctor compaction are presented in Table 1.

Table 1 - Estimated Water Content for Compaction

Soil Type	Determined Natural Water Content (%)	Water Content (%) for Standard Proctor Compaction	
		100% (optimum)	Range for 95% or +
Earth Fill	6 to 21 (median 16)	11 to 18	6 to 23
Silt	12 to 17 (median 15)	13	8 to 17
Sand	14 to 28 (median 18)	11	6 to 16

Based on the above findings, the earth fill and silt are generally suitable for a 95% or + Standard Proctor compaction. However, the sand is too wet and will require proper aeration in dry, warm weather conditions or mixing with drier soils prior to structural compaction. The earth fill must be sorted free of organics and any other deleterious materials, prior to its use as structural backfill.

The silty clay fill should be compacted using a heavy-weight, kneading-type roller. The silty sand fill, silt and sand can be compacted by a smooth roller with or without vibration, depending on the water content of the soil being compacted. The lifts for compaction should be limited to 20 cm, or to a suitable thickness as assessed by test strips performed by the equipment which will be used at the time of construction.

It is difficult to monitor the lifts of backfill placed in deep trenches; therefore, it is preferable that the compaction of backfill at depths over 1.0 m below the subgrade be carried out on the wet side of the optimum. This would allow a wider latitude of lift thickness.

One should be aware that with considerable effort, a 90%± Standard Proctor compaction of the wet silt and sand is achievable. Further densification is prevented by the pore pressure induced by the compactive effort; however, large random voids will have been expelled, and with time the pore pressure will dissipate and the percentage of compaction will increase. There are many cases on record where after a few months of rest, the density of the compacted mantle has increased to over 95% of its maximum Standard Proctor dry density.

If the compaction of the soils is carried out with the water content within the range for 95% Standard Proctor dry density but on the wet side of the optimum, the surface of the compacted soil mantle will roll under the dynamic compactive load. This is unsuitable for pavement construction since each component of the pavement structure is to be placed under dynamic conditions which will induce the rolling action of the subgrade surface and cause structural failure of the new pavement. The foundation or bedding of the sewer and slab-on-grade will be placed on a subgrade which will not be subjected to impact loads. Therefore, the structurally compacted

soil mantle with the water content on the wet side or dry side of the optimum will provide an adequate subgrade for the construction.

5.0 GROUNDWATER CONDITIONS

The boreholes were checked for the presence of groundwater and the occurrence of cave-in upon their completion. The data are plotted on the Borehole Logs and summarized in Table 2.

Table 2 - Groundwater Levels

Borehole No.	Borehole Depth (m)	Soil Colour Changes Brown to Grey	Measured Groundwater/ Cave-in* Level On Completion	
		Depth (m)	Depth (m)	Elevation (m)
1	3.5	3.5+	2.4/2.7*	79.8/79.5*
2	6.5	6.5+	1.2/5.9*	78.6/73.9*
3	6.5	2.1	1.0	78.6

* Cave-in level (In wet sand and silt layers, the level generally represents the groundwater regime at the borehole location.)

Groundwater and cave-in were detected at depths ranging from 1.0 to 5.9 m below the prevailing ground surface. The encountered groundwater level generally represents the groundwater regime of the site at the time of the investigation. The groundwater regime is subject to seasonal fluctuation.

The soil colour changes from brown to grey at a depth of 2.1 m below the prevailing ground surface at Borehole 3. The brown soils have been oxidized.

The groundwater yield from the silt and sand is expected to be moderate to appreciable and persistent.

6.0 DISCUSSION AND RECOMMENDATIONS

The investigation has disclosed that beneath a veneer of topsoil, 13 cm and 23 cm thick, and a layer of earth fill extending to depths of 1.4 to 4.0 m below the prevailing ground surface, the site is underlain by strata of compact to very dense, generally dense silt and loose to very dense, generally very dense sand. The sand and silt are water-bearing.

Groundwater and cave-in were detected at depths ranging from 1.0 to 5.9 m below the prevailing ground surface. The encountered groundwater level generally represents the groundwater regime of the site at the time of the investigation. The groundwater regime is subject to seasonal fluctuation.

The groundwater yield from the silt and sand is expected to be moderate to appreciable and persistent.

The geotechnical findings which warrant special consideration are presented below:

1. The revealed topsoil is unsuitable for engineering applications and must be removed. It should not be buried below any structures or below 1.2 m from finished grade. It should only be used for landscaping purposes.
2. The existing earth fill is not suitable for structural use in its current condition. It can be replaced with and/or upgraded to engineered fill status for normal footings, slab-on-grade and underground services construction, provided it is found to be environmentally acceptable.
3. Due to the shallow groundwater level encountered, subexcavating the existing earth fill to construct engineered fill will require the site to be predrained by an appropriate dewatering system. This will increase the

construction cost of the project. In this case, the bottom layer of the engineered fill can consist of 50-mm Crusher-Run Limestone for subgrade stabilization.

4. The natural soils are suitable for normal spread and strip footing construction. The footing subgrade must be inspected by a geotechnical engineer, or a geotechnical technician under the supervision of a geotechnical engineer, to ensure that its condition is compatible with the design of the foundation.
5. For basement construction, perimeter subdrains and dampproofing of the foundation walls will be required. All the subdrains must be encased in a fabric filter to protect them against blockage by silting and must be connected to a positive outlet. As noted, groundwater occurs at shallow depths; therefore, floor subdrains will be required for basement construction.
6. In order to avoid extensive dewatering and minimize the impact of hydrostatic uplift on the floor slab, it is strongly recommended that the basement floor slab be at least 0.5 m above the highest level of groundwater fluctuation.
7. If wet subgrade conditions are encountered during basement excavation, a vapour barrier must be placed in the granular base of the floor, above the crown of the subdrain.
8. For slab-on-grade construction, all of the topsoil, earth fill, soft or loose soils should be subexcavated and replaced with properly compacted inorganic earth fill prior to the placement of the slab. Any new material for raising the grade should consist of organic-free soil compacted to at least 98% of its maximum Standard Proctor dry density. The slab should be constructed on a granular base, 20 cm thick, consisting of 20-mm Crusher-Run Limestone, or equivalent, compacted to its maximum Standard Proctor dry density.

9. A Modulus of Subgrade Reaction of 25 MPa/m is recommended for the design of the slab.
10. A Class 'B' bedding, consisting of compacted 20-mm Crusher-Run Limestone, is recommended for the construction of the underground services. Where wet silt or sand occurs, the sewer joints should be leak-proof, or should be wrapped with an appropriate waterproof membrane to prevent subgrade migration. If subgrade stabilization is required, the stone immersion technique may be applied. In areas where more extensive dewatering is required for sewer construction, a Class 'A' bedding should be considered.
11. The occurring soils are considered to be high in soil-adfreezing potential; therefore, the foundation walls or the perimeter grade beams must be either backfilled with non-frost-susceptible pit-run granular, or shielded with a polyethylene slip-membrane.
12. Excavation into the water-bearing soils will require dewatering prior to excavation.

The recommendations appropriate for the project described in Section 2.0 are presented herein. One must be aware that the subsurface conditions may vary between boreholes. Should this become apparent during construction, a geotechnical engineer must be consulted to determine whether the following recommendations require revision.

6.1 **Foundations**

Based on the borehole findings, the recommended soil pressures for use in the design of the normal spread and strip footings, together with the corresponding suitable founding levels, are presented in Table 3.

Table 3 - Founding Levels

Borehole No.	Maximum Allowable Soil Pressure (SLS)/ Factored Ultimate Soil Bearing Pressure (ULS) and Corresponding Founding Level	
	150 kPa (SLS) 250 kPa (ULS)	
	Depth (m)	Elevation. (m)
2	4.2 or +	75.6 or -
3	1.6 or +	78.0 or -

Proper groundwater control must be carried out for the foundation construction.

The existing earth fill layer can be upgraded to or replaced with engineered fill. In this case, soil pressures of 100 kPa (SLS) and 160 kPa (ULS) can be used for the design of the footings founded on engineered fill; the footings and the upper section of the foundation walls must be properly reinforced and designed by a qualified structural engineer.

Alternatively, the proposed house foundations can also be supported by Helical Piles. The load carried by the Helical Piles is directly related to the installation torque of the pile anchor in the underlying competent soil strata. The founding elevations and number of the Helical Piles should be determined by the prospective Helical Piles Foundation Systems contractor.

The recommended soil pressures (SLS) for normal foundations incorporate a safety factor of 3. The total and differential settlements of the foundations are estimated to be 25 mm and 15 mm, respectively.

The foundations exposed to weathering must be provided with 1.2 m of earth cover for frost protection.

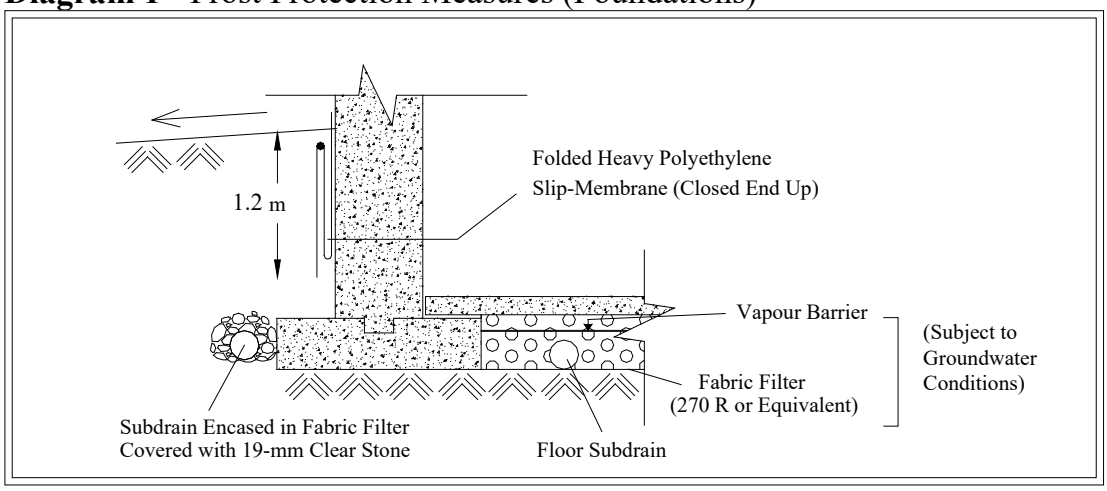
Due to the presence of topsoil and earth fill, the footing subgrade must be inspected by either a geotechnical engineer, or a geotechnical technician under the supervision of a geotechnical engineer, to ensure that its condition is compatible with the design of the foundation.

The groundwater at the site lies at shallow depths. In order to avoid extensive dewatering and minimize the impact of hydrostatic uplift on the floor slab, the basement level must be placed at least 0.5 m above the highest seasonal groundwater level. Perimeter subdrains, floor drains and dampproofing of the basement walls will be required. All the subdrains must be encased in a fabric filter to protect them against blockage by silting, and must be connected to a positive outlet, i.e., sump well or storm sewer.

For the basement placed below the groundwater regime, waterproofing will be required and the basement must be designed to resist the hydrostatic pressure and uplift, which will be costly and difficult to construct.

The occurring soils are high in frost heave and soil-adfreezing potential. If these are to be used for the foundation backfill, the foundation walls should be shielded by a polyethylene slip-membrane for protection against soil adfreezing. The recommended measures are schematically illustrated in Diagram 1.

Diagram 1 - Frost Protection Measures (Foundations)



The necessity to implement the above recommendations should be further assessed by a geotechnical engineer at the time of construction.

The foundations must meet the requirements specified by the latest Ontario Building Code, and the buildings must be designed to resist a minimum earthquake force using Site Classification ‘D’ (stiff soil).

6.2 **Engineered Fill**

The groundwater regime must be lowered to below the intended bottom of excavation prior to engineered fill construction.

The existing earth fill can be replaced with and/or upgraded to engineered fill, the engineering requirements for a certifiable fill for road construction, municipal services, slab-on-grade, and footings designed with a Maximum Allowable Soil Pressure (SLS) of 100 kPa and a Factored Ultimate Soil Bearing Pressure (ULS) of 160 kPa for normal footings are presented below:

1. All of the topsoil and loose earth fill must be removed. Any soft and loose soils must be inspected and proof-rolled prior to any fill placement, in order to assess any subexcavation requirements. The stripped surface must be surface compacted. The subgrade can be stabilized by placing a layer of compacted 50-mm Crusher-Run Limestone prior to filling.
2. Inorganic soils must be used, and they must be uniformly compacted in lifts 20 cm thick to 98% or + of their maximum Standard Proctor dry density up to the proposed finished grade. The soil moisture must be properly controlled on the wet side of the optimum. If the house foundations are to be built soon after the fill placement, the densification process for the engineered fill must be increased to 100% of the maximum Standard Proctor compaction.
3. In imported fill is to be used, it should be inorganic soils, free of any deleterious material with environmental issue (contamination). Any potential imported earth fill from off-site must be reviewed for geotechnical and environmental quality by the appropriate personnel as authorized by the developer or agency, before it is hauled to the site.
4. If the engineered fill is to be left over the winter months, adequate earth cover or equivalent must be provided for protection against frost action.
5. The engineered fill must extend over the entire graded area; the engineered fill envelope and finished elevations must be clearly and accurately defined in the field, and must be precisely documented by qualified surveyors. Foundations partially on engineered fill must be reinforced by two 15-mm steel reinforcing bars in the footings and upper section of the foundation walls, or be designed by a structural engineer to properly distribute the stress induced by the abrupt differential settlement (about 15 mm) between the natural soil and engineered fill.
6. The engineered fill must not be placed during the period from late November to early April when freezing ambient temperatures occur either persistently or

intermittently. This is to ensure that the fill is free of frozen soils, ice and snow.

7. Where the fill is to be placed on a bank steeper than 1 vertical:3 horizontal, the face of the bank must be flattened to 3 + so that it is suitable for safe operation of the compactor and the required compaction can be obtained.
8. Where the ground is wet due to subsurface water seepage, an appropriate subdrain scheme must be implemented prior to the fill placement, particularly if it is to be carried out on sloping ground.
9. The fill operation must be inspected on a full-time basis by a technician under the direction of a geotechnical engineer.
10. The footing and underground services subgrade must be inspected by the geotechnical consulting firm that supervised the engineered fill placement. This is to ensure that the foundations are placed within the engineered fill envelope, and the integrity of the fill has not been compromised by interim construction, environmental degradation and/or disturbance by the footing excavation.
11. Any excavation carried out in certified engineered fill must be reported to the geotechnical consultant who supervised the fill placement in order to document the locations of excavation and/or to supervise reinstatement of the excavated areas to engineered fill status. If construction on the engineered fill does not commence within a period of 2 years from the date of certification, the condition of the engineered fill must be assessed for re-certification.
12. Despite stringent control in the placement of the engineered fill, variations in soil type and density may occur in the engineered fill. Therefore, the strip footings and the upper section of the foundation walls constructed on the engineered fill will require continuous reinforcement with steel bars, depending on the uniformity of the soils in the engineered fill and the thickness of the engineered fill underlying the foundations. Should the footings and/or walls

require reinforcement, the required number and size of reinforcing bars must be assessed by considering the uniformity as well as the thickness of the engineered fill beneath the foundations. In sewer construction, the engineered fill is considered to have the same structural proficiency as a natural inorganic soil.

6.3 Slab-On-Grade

For slab-on-grade construction, the subgrade must consist of sound natural soil or inorganic earth fill compacted to at least 98% of its maximum Standard Proctor dry density. The slab should be constructed on a granular base, 20 cm thick, consisting of 20-mm Crusher-Run Limestone, or equivalent, compacted to its maximum Standard Proctor dry density.

A Modulus of Subgrade Reaction of 25 MPa/m is recommended for the design of the floor slab on sound native soil or on engineered fill.

The ground around the buildings must be graded to direct water away from the structure to minimize the frost heave phenomenon generally associated with the disclosed soils.

6.4 Underground Services

The subgrade for the underground services should consist of natural soil or compacted organic-free earth fill. Any loose earth fill must be subexcavated and replaced with properly compacted bedding material.

A Class 'B' bedding, consisting of compacted 20-mm Crusher-Run Limestone, is recommended for the construction of the underground services. Where wet silt or sand occurs, the sewer joints should be leak-proof, or should be wrapped with an appropriate waterproof membrane to prevent subgrade migration. If subgrade stabilization is required, the stone immersion technique may be applied. In areas where more extensive dewatering is required for sewer construction, a Class 'A' bedding should be considered.

In order to prevent pipe floatation when the sewer trench is deluged with water, a soil cover with a thickness equal to the diameter of the pipe should be in place at all times after completion of the pipe installation.

Openings to subdrains and catch basins should be shielded with a fabric filter to prevent blockage by silting.

6.5 **Trench Backfilling**

The on site inorganic soils are suitable for use as trench backfill. In the zone within 1.0 m below the pavement subgrade, the backfill should be compacted to at least 98% of its maximum Standard Proctor dry density with the moisture content 2% to 3% drier than the optimum. In the lower zone, a 95% or + Standard Proctor compaction is considered to be adequate; however, the material must be compacted on the wet side of the optimum. Below the floor slab, all the backfill must be compacted to 98% or + of its Maximum Standard Proctor dry density.

In normal underground services construction practice, the problem areas of ground settlement largely occur adjacent to manholes, catch basins, services crossings, foundation walls and columns. It is recommended that a sand backfill be used.

The narrow trenches should be cut at 1 vertical:2 or + horizontal so that the backfill can be effectively compacted. Otherwise, soil arching will prevent the achievement of proper compaction. The lift of each backfill layer should either be limited to a thickness of 20 cm, or the thickness should be determined by test strips.

6.6 Pavement Design for Access Road and Driveway

Based on the borehole findings, the recommended pavement design for the access road and driveway is presented in Tables 4 and 5.

Table 4 - Pavement Design for Access Road

Course	Thickness (mm)	OPS Specifications
Asphalt Surface	40	HL-3
Asphalt Binder	65	HL-8
Granular Base	200	Granular 'A' or equivalent
Granular Sub-base	250	Granular 'B' or equivalent

Table 5 - Pavement Design for Driveway

Course	Thickness (mm)	OPS Specifications
Asphalt Surface	25	HL-3F
Asphalt Binder	50	HL-8
Granular Base	150	Granular 'A' or equivalent

In preparation of the subgrade, the subgrade surface should be proof-rolled; any soft subgrade, organics and deleterious materials within 1.0 m below the underside of the granular sub-base should be subexcavated and replaced by properly compacted organic-free earth fill or granular material.

All the granular bases should be compacted to 100% Standard Proctor dry density.

Earth fill to raise the grade for pavement construction should consist of organic-free soil uniformly compacted to 98% or + of its maximum Standard Proctor dry density.

The subgrade in the zone within 1.0 m below the underside of the granular sub-base should be compacted to at least 98% of its maximum Standard Proctor dry density, with the moisture content 2% to 3% drier than its optimum.

Along the perimeter of the access road and driveway where surface runoff may drain onto the pavement, or water may seep into the granular base, a subdrain system should be installed. Subdrains, consisting of filter-wrapped weepers, should be connected to the catch basins and storm manholes and backfilled with free-draining granular material.

6.7 **Soil Parameters**

The recommended soil parameters for the project design are given in Table 6.

Table 6 - Soil Parameters

Unit Weight and Bulk Factor			
	Unit Weight (kN/m^3)	**Estimated Bulk Factor**	
	Bulk	**Loose**	**Compacted**
Earth Fill	21.0	1.20	1.00
Silt and Sand	20.5	1.20	0.98

Table 6 - Soil Parameters (cont'd)

Lateral Earth Pressure Coefficients			
	Active K_a	**At Rest K_o**	**Passive K_p**
Earth Fill	0.40	0.50	2.50
Silt and Sand	0.33	0.43	3.00

6.8 Excavation

Excavation should be carried out in accordance with Ontario Regulation 213/91.

For excavation purposes, the types of soils are classified in Table 7.

Table 7 - Classification of Soils for Excavation

Material	**Type**
Earth Fill, Silt and Sand above groundwater	3
Silt and Sand below groundwater	4

The groundwater yield from silt and sand is expected to be moderate to appreciable and persistent; groundwater may be controllable by pumping from closely spaced sumps for shallow excavation. However, deep excavations (more than 0.3 m into the groundwater regime) will be prone to side collapse and bottom heaving, and should be stabilized by the use of a well-point dewatering system. The appropriate method of dewatering should be determined by a hydrogeological study once the intended bottom of excavation is known.

Prospective contractors must be asked to assess the in situ subsurface conditions for soil cuts by digging test pits to at least 0.5 m below the intended bottom of excavation. These test pits should be allowed to remain open for a period of at least 4 hours to assess the trenching conditions.

7.0 LIMITATIONS OF REPORT

This report was prepared by Soil Engineers Ltd. for the account of Technisonic Industries Ltd., and for review by the designated agents, financial institutions, and government agencies. Use of the report is subject to the conditions and limitations of the contractual agreement. The material in the report reflects the judgment of Frank Lee, P.Eng. and Bernard Lee, P.Eng., in light of the information available to it at the time of preparation. Any use which a Third Party makes of this report, and/or any reliance on decisions to be made based on it are the responsibility of such Third Parties. Soil Engineers Ltd. accepts no responsibility for damages, if any, suffered by any Third Party as a result of decisions made or actions based on this report.

SOIL ENGINEERS LTD.

Frank Lee, P.Eng.

Bernard Lee, P.Eng.
FL/BL:dd

LIST OF ABBREVIATIONS AND DESCRIPTION OF TERMS

The abbreviations and terms commonly employed on the borehole logs and figures, and in the text of the report, are as follows:

SAMPLE TYPES

AS Auger sample
CS Chunk sample
DO Drive open (split spoon)
DS Denison type sample
FS Foil sample
RC Rock core (with size and percentage recovery)
ST Slotted tube
TO Thin-walled, open
TP Thin-walled, piston
WS Wash sample

PENETRATION RESISTANCE

Dynamic Cone Penetration Resistance:

A continuous profile showing the number of blows for each foot of penetration of a 2-inch diameter, 90° point cone driven by a 140-pound hammer falling 30 inches.

Plotted as '—●—'

Standard Penetration Resistance or 'N' Value:

The number of blows of a 140-pound hammer falling 30 inches required to advance a 2-inch O.D. drive open sampler one foot into undisturbed soil.

Plotted as '○'

WH Sampler advanced by static weight
PH Sampler advanced by hydraulic pressure
PM Sampler advanced by manual pressure
NP No penetration

SOIL DESCRIPTION

Cohesionless Soils:

'N' (blows/ft)	Relative Density
0 to 4	very loose
4 to 10	loose
10 to 30	compact
30 to 50	dense
over 50	very dense

Cohesive Soils:

Undrained Shear Strength (ksf)	'N' (blows/ft)	Consistency
less than 0.25	0 to 2	very soft
0.25 to 0.50	2 to 4	soft
0.50 to 1.0	4 to 8	firm
1.0 to 2.0	8 to 16	stiff
2.0 to 4.0	16 to 32	very stiff
over 4.0	over 32	hard

Method of Determination of Undrained Shear Strength of Cohesive Soils:

x 0.0 Field vane test in borehole; the number denotes the sensitivity to remoulding

△ Laboratory vane test

□ Compression test in laboratory

For a saturated cohesive soil, the undrained shear strength is taken as one half of the undrained compressive strength

METRIC CONVERSION FACTORS

1 ft = 0.3048 metres
1lb = 0.454 kg
1 inch = 25.4 mm
1ksf = 47.88 kPa

JOB NO.: 1906-S087

LOG OF BOREHOLE NO.: 1

FIGURE NO.: 1

PROJECT DESCRIPTION: Proposed Two 2-Storey Residential Buildings

METHOD OF BORING: Flight-Auger

PROJECT LOCATION: Bernida Road and Parkland Avenue
City of Mississauga

DRILLING DATE: June 28, 2019

El. (m) / Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value	Depth Scale (m)	Dynamic Cone (blows/30 cm) 10 30 50 70 90 / Shear Strength (kN/m²) 50 100 150 200 / Penetration Resistance (blows/30 cm) 10 30 50 70 90	Atterberg Limits PL LL / Moisture Content (%) 10 20 30 40	WATER LEVEL
82.2	Ground Surface							
0.0	**23 cm TOPSOIL**	1	DO	13	0		6	
	Brown/grey **EARTH FILL** silty sand a trace of gravel with organics	2	DO	10	1		11	
		3	DO	3	2		20	
80.1 2.1	Brown, loose to compact **MEDIUM SAND** some silt	4	DO	18	3		28	▽
78.7 3.5		5	DO	6	4		23	W.L. @ El. 79.8 m on completion Cave-In @ El. 79.5 m on completion
	END OF BOREHOLE				5			
					6			
					7			
					8			
					9			
					10			

Soil Engineers Ltd.

JOB NO.: 1906-S087

LOG OF BOREHOLE NO.: 2

FIGURE NO.: 2

PROJECT DESCRIPTION: Proposed Two 2-Storey Residential Buildings

METHOD OF BORING: Flight-Auger

PROJECT LOCATION: Bernida Road and Parkland Avenue
City of Mississauga

DRILLING DATE: June 28, 2019

El. (m) / Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value	Depth Scale (m)
79.8 / 0.0	Ground Surface				
	23 cm TOPSOIL	1	DO	7	0
	Brown/grey	2	DO	23	1
	EARTH FILL	3	DO	8	2
	silty sand and silty clay a trace of gravel with organics	4	DO	6	
		5	DO	2	3
75.8 / 4.0	Brown, dense to very dense	6A	DO		4
		6B	DO	33	
		7	DO	50/15	5
	SILTY SAND				6
73.3 / 6.5		8	DO	50/8	
	END OF BOREHOLE				7
					8
					9
					10

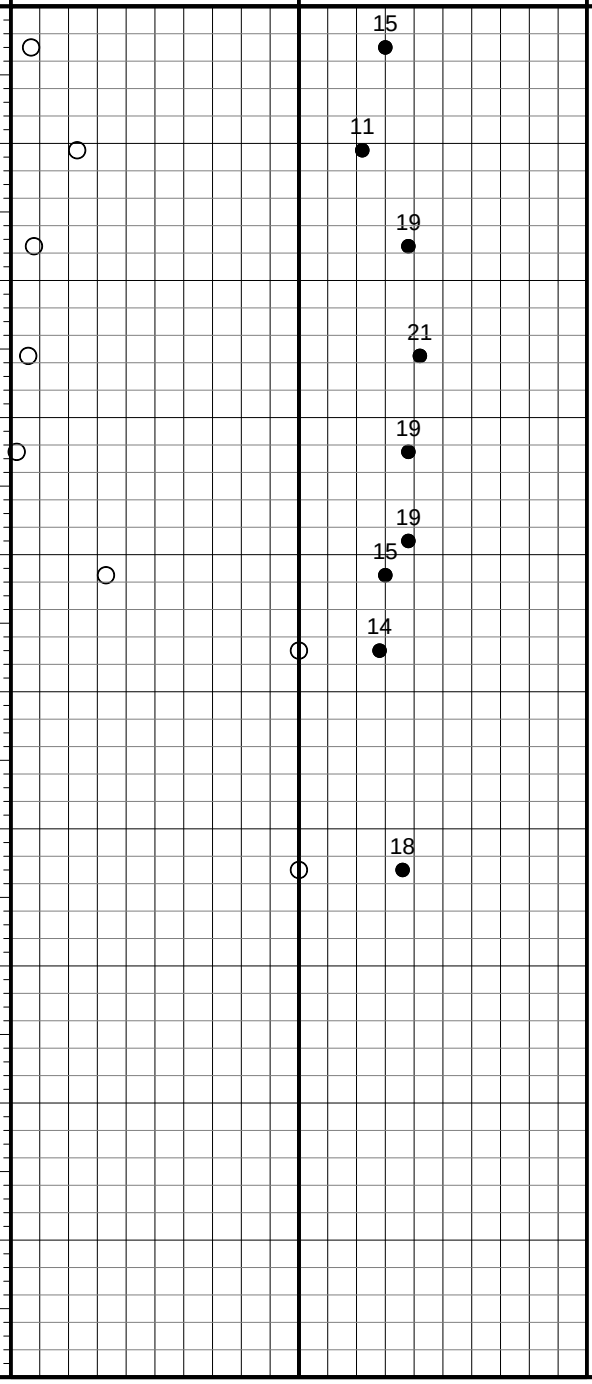
Dynamic Cone (blows/30 cm): 10 30 50 70 90

Shear Strength (kN/m²): 50 100 150 200

Penetration Resistance (blows/30 cm): 10 30 50 70 90

Atterberg Limits: PL — LL

Moisture Content (%): 10 20 30 40



WATER LEVEL

W.L. @ El. 78.6 m on completion

Cave-In @ El. 73.9 m on completion

Soil Engineers Ltd.

JOB NO.: 1906-S087

LOG OF BOREHOLE NO.: 3

FIGURE NO.: 3

PROJECT DESCRIPTION: Proposed Two 2-Storey Residential Buildings

METHOD OF BORING: Flight-Auger

PROJECT LOCATION: Bernida Road and Parkland Avenue
City of Mississauga

DRILLING DATE: June 28, 2019

El. (m) / Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value	Depth Scale (m)	Dynamic Cone (blows/30 cm) 10 30 50 70 90 / Shear Strength (kN/m²) 50 100 150 200 / Penetration Resistance (blows/30 cm) 10 30 50 70 90	Atterberg Limits PL LL / Moisture Content (%) 10 20 30 40	WATER LEVEL
79.6	Ground Surface							
0.0	**13 cm TOPSOIL**	1	DO	10	0		15	
	Brown/grey							
	EARTH FILL silty sand and silty clay a trace of gravel with organics	2	DO	28	1		16	▽
78.2								
1.4	Compact to very dense	3	DO	27	2		17	
	brown / grey							
		4	DO	31			16	
		5	DO	39	3		13	
	SILT				4			
		6	DO	50/15			12	
73.8					5			
5.8	Grey, very dense				6			
	SILTY SAND	7	DO	50/13			18	
73.1								
6.5	**END OF BOREHOLE**				7			
					8			
					9			
					10			

W.L. @ El. 78.6 m on completion

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GRAIN SIZE DISTRIBUTION

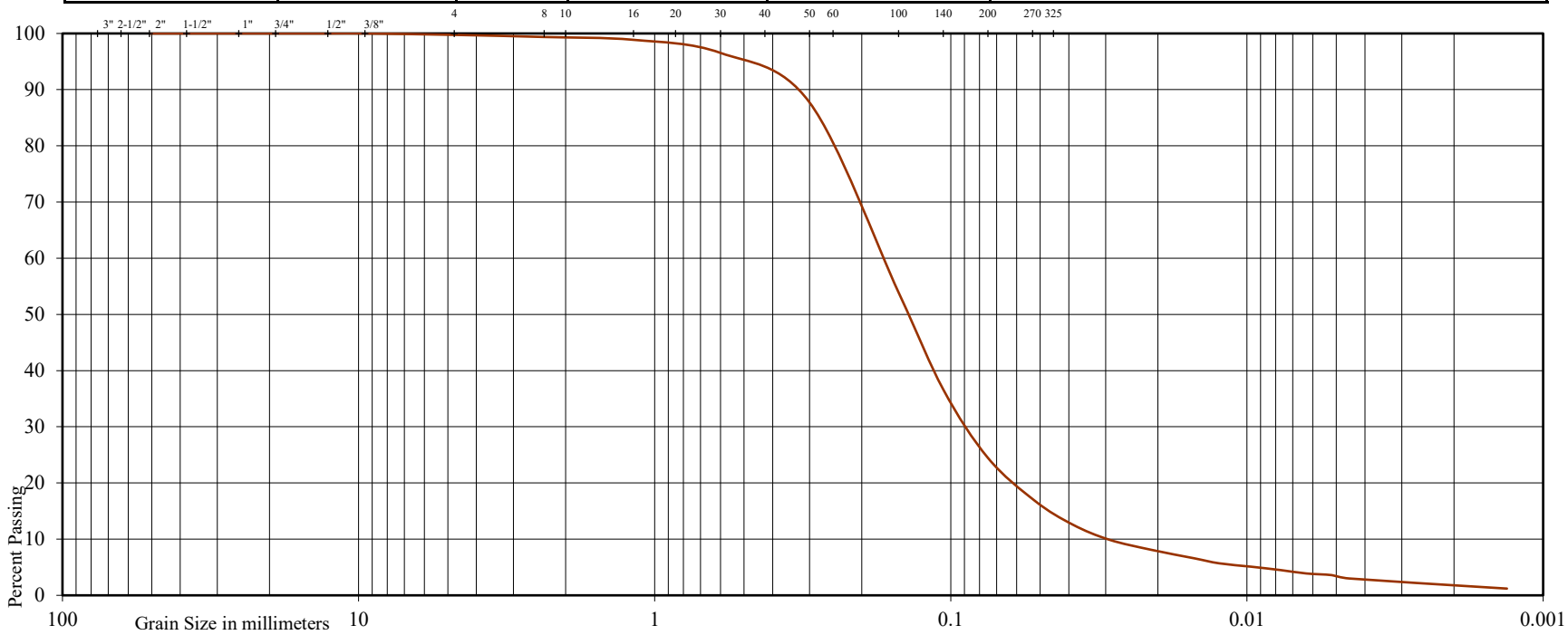
Reference No: 1906-S087

U.S. BUREAU OF SOILS CLASSIFICATION

GRAVEL		SAND				SILT	CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	V. FINE		

UNIFIED SOIL CLASSIFICATION

GRAVEL		SAND			SILT & CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	



Project: Proposed Two 2-Storey Residential Buildings

Location: Bernida Road and Parkland Avenue, City of Mississauga

Borehole No: 1

Sample No: 2

Depth (m): 1.1

Elevation (m): 81.1

Liquid Limit (%) = -

Plastic Limit (%) = -

Plasticity Index (%) = -

Moisture Content (%) = 11

Estimated Permeability (cm./sec.) = 10^{-3}

Classification of Sample [& Group Symbol]: SILTY FINE SAND (FILL), traces of clay and medium sand

Figure: 4

Soil Engineers Ltd.

GRAIN SIZE DISTRIBUTION

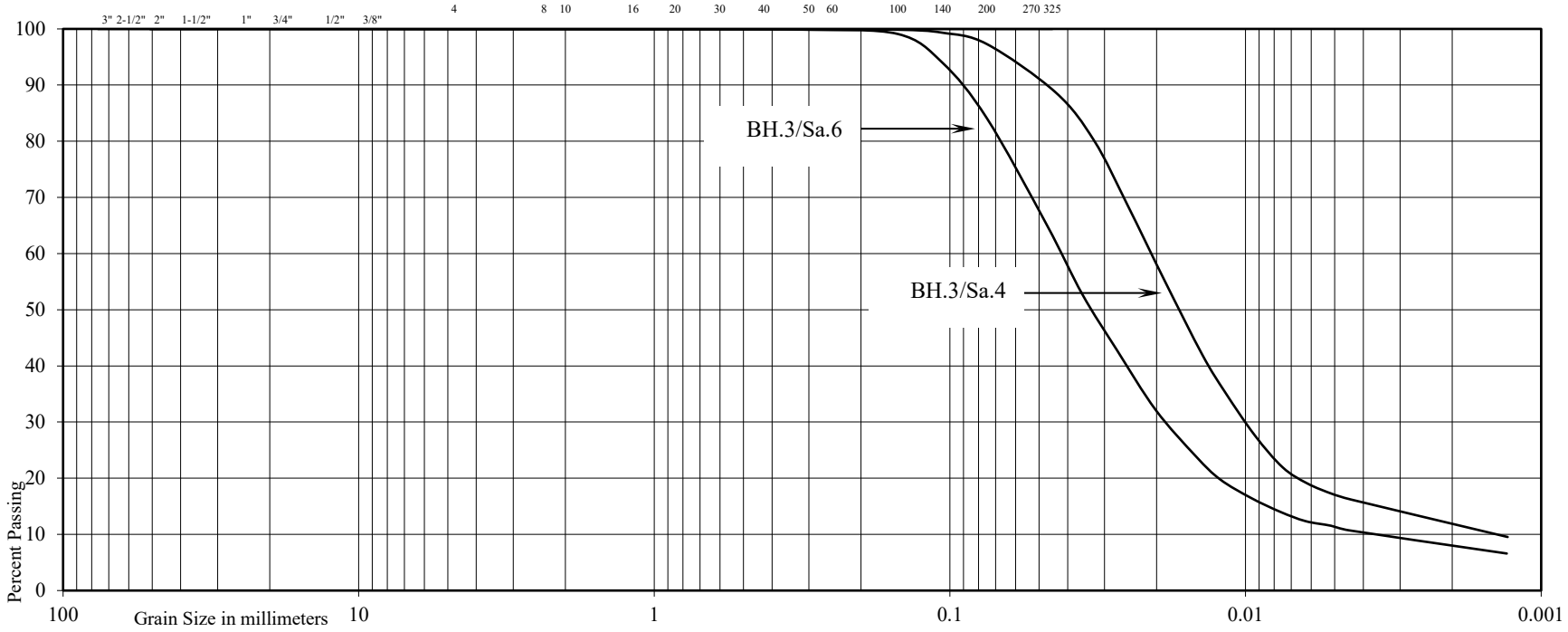
Reference No: 1906-S087

U.S. BUREAU OF SOILS CLASSIFICATION

GRAVEL		SAND				SILT	CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	V. FINE		

UNIFIED SOIL CLASSIFICATION

GRAVEL		SAND			SILT & CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	



Project: Proposed Two 2-Storey Residential Buildings

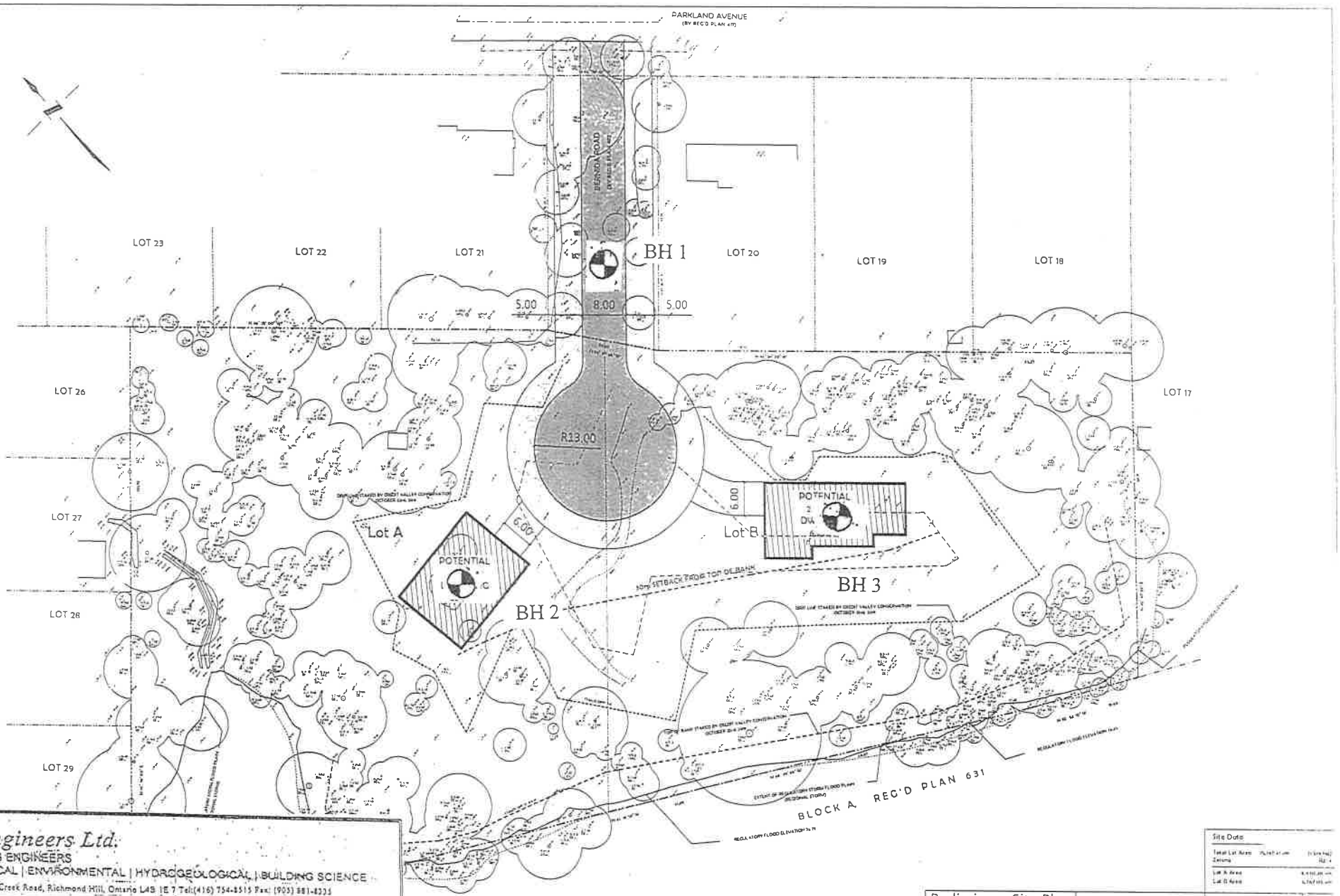
Location: Bernida Road and Parkland Avenue, City of Mississsuga

Borehole No:	3	3
Sample No:	4	6
Depth (m):	2.5	4.7
Elevation (m):	77.1	74.9

BH./Sa.	3/4	3/6
Liquid Limit (%) =	-	-
Plastic Limit (%) =	-	-
Plasticity Index (%) =	-	-
Moisture Content (%) =	16	12
Estimated Permeability (cm./sec.) =	10^{-6}	10^{-5}

Classification of Sample [& Group Symbol]: SILT, traces to some clay and fine sand

Figure: 5



Soil Engineers Ltd.
CONSULTING ENGINEERS
GEOTECHNICAL | ENVIRONMENTAL | HYDROGEOLOGICAL | BUILDING SCIENCE
90 West Beaver Creek Road, Richmond Hill, Ontario L4B 1E 7 Tel:(416) 754-8515 Fax: (905) 881-8335

BOREHOLE LOCATION PLAN

DESIGNED	CHECKED	DWG NO. 1	REV
SCALE 1:1000	REF. NO. 1906-S087	DATE August 2019	

Site Data

Preliminary Site Plan
0 Bernida Road, Mississauga, ON
Residential Land Proposal

Harper Dell & Associates Inc.
Planning, Traffic and Land Development Consulting
1370 Hurontario St
Mississauga, ON, L5G 3G4

Date: Mai 17, 2019
Scale: 1:500

SP

Soil Engineers Ltd.
CONSULTING ENGINEERS
GEOTECHNICAL | ENVIRONMENTAL | HYDROGEOLOGICAL | BUILDING SCIENCE

SUBSURFACE PROFILE
DRAWING NO. 2
SCALE: AS SHOWN

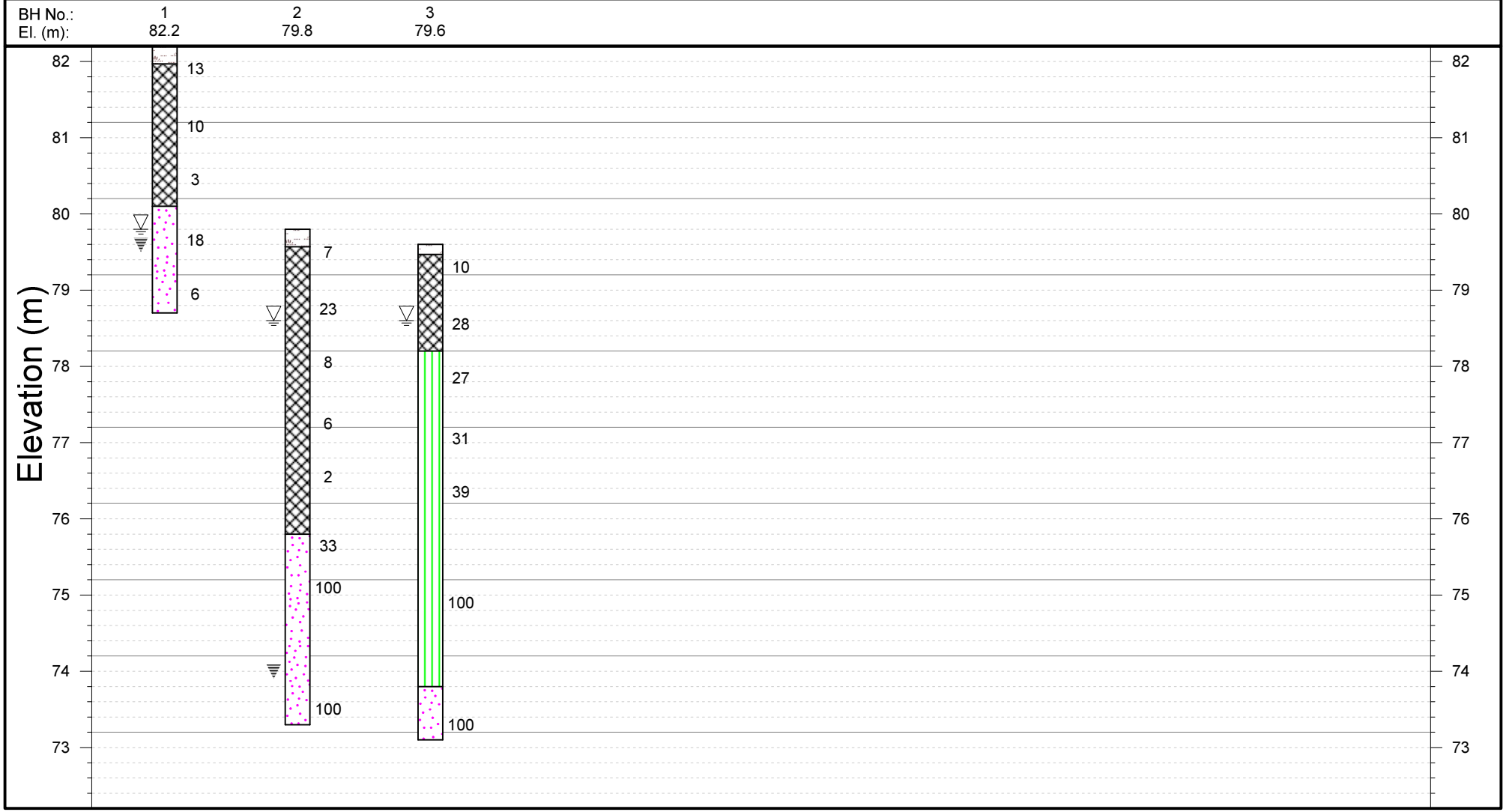
JOB NO.: 1906-S087
REPORT DATE: July 2019
PROJECT DESCRIPTION: Proposed Two 2-Storey Residential Buildings

PROJECT LOCATION: Bernida Road and Parkland Avenue
City of Mississauga

LEGEND

TOPSOIL | FILL | SAND | SILT

WATER LEVEL (END OF DRILLING) | CAVE-IN



APPENDIX C

EIS by EcoTec

EcoTec
ENVIRONMENTAL CONSULTANTS INC.

11537 Nassageweya-Esquesing Towline Road
Acton, Ontario
Canada L7J 2L7

Tel: (519) 853-4914
Fax: (519) 853-5013

May 13, 2019

Harper Dell & Associates Inc.
Planning, Traffic and Land Development Consultants
1370 Hurontario St.
Mississauga, Ontario
L5G 3H4

ATTENTION: **Nicholas Dell, BA. H**

FROM: **Gavin Maybury, B.Sc.**
Ecologist

RE: **Scoped Environmental Assessment of 0 Bernida Road, Mississauga, Ontario**

1.0 INTRODUCTION

EcoTec Environmental Consultants Inc. (EcoTec) was retained Harper Dell & Associates Inc in order to conduct natural environment investigations related to development within the subject property located at 0 Bernida Road in Mississauga, Ontario. This study was conducted in order to document the existing environmental features within the subject property, to determine potential impacts associated with site development, and recommend mitigation measures to prevent or lessen impacts.

The following report includes an outline of the field assessment methodology, an overview of the existing biophysical environment within the study area, as well as a summary of potential impacts associated with development of this site. General recommendations for environmental protection are also presented and reflect both proposed development and the documented existing conditions of the study area.

EcoTec
ENVIRONMENTAL CONSULTANTS INC.

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2.0 STUDY AREA

The study area for this evaluation is located at 0 Bernida Rd., directly south?? of Parkland Avenue in Mississuga, Ontario (Figure 1). The study area accounts for approximately 1.5 ha (hectares) of maintained green space, currently lacking any permanent structure or development. The land use immediately surrounding the property is predominantly, low density residential housing.

Figure 1. Map of study site at 0 Bernida Road, Missisauga Ontario.

The majority of the subject property is indicative of a cultural meadow community which abuts a riparian corridor belonging to Turtle Creek which flows toward Lake Ontario just beyond the southern property line. This corridor is part of the provincially evaluated Rattray Marsh wetland complex. Credit Valley Conservation (CVC) was onsite in October of 2018 in order to stake both the existing tree drip line and top of bank (TOB) associated with Turtle Creek to determine

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appropriate setbacks. These setbacks are shown in the preliminary site plan located in Appendix B.

2.1 Site Development Summary

The proposed project consists of a property severance which would result in two separate residential lots. Lot 'A' is located at the north end of, and comprises approximately 8,430 m^2 of the existing property. Lot 'B' is located toward at the south end of the existing property and is approximately 6,767 m^2. A single, two-story residential building is proposed for each lot, both proposed structures will occupy a total building footprint of 6,500 m^2 and will be oriented to face a future cul-de-sac (Bernida Road) originating from the current property access-way, off Parkland Ave.

3.0 METHODOLOGY

A preliminary field inventory and assessment of the existing environmental conditions of the subject property was conducted on April 4, 2019 by D. Clark and G. Maybury of EcoTec. In general, the field surveys were conducted in order to verify and document the existing biophysical environment of the study area. A backpack electrofisher was brought to the site in order to sample for fish communities. However, it was apparent that the Turtle Creek watercourse is located completely outside the property boundaries and would not be affected by the proposed development which would be located beyond the 30 meter top-of-bank setback staked by TRCA (October 2018). As such, no fish surveys were conducted. A photographic record of the study area can be found in Appendix A.

Additional features and environmental sensitivities assessed within the study area during the field surveys included existing vegetation communities as well as resident and migratory bird and wildlife species, including any Species at Risk (SAR).

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Wildlife species noted during the field investigation were identified by signs, visual observations, and vocalizations. As animal and bird migration/movement patterns may utilize areas both within and outside of the study area, birds and animals identified within and adjacent to the subject property were recorded and considered to be the residents or visitors of the area for the purpose of the study.

Historical background information and field data was gathered in order to determine the existing conditions of the natural resource features of the subject property. Background sources of information included the Ontario Ministry of Natural Resources and Forestry (MNRF), Ontario Nature, and the Natural Heritage Information Centre (NHIC).

4.0 EXSITING CONDITIONS

Field surveys were undertaken in order to acquire up-to-date information and a photographic record of the study area. The intent of the field surveys was to set baseline conditions of existing environmental sensitivities. The following sections provide a summary of the existing biophysical resources of the study area.

4.1 Vegetation Community: Cultural Meadow

This was the predominant vegetation community found within the subject property and consisted primarily of herbaceous vegetation species typical of culturally disturbed and/or manicured areas. The majority of the property's interior was historically cleared of mature, woody species and has since been dominated by herbaceous species which included orchard grass (*Dactylis glomerata*), ragweed (*Ambrosia* sp.), common burdock (*Arctium minus*), and perennial grasses (*Calamagrostis* sp.).

Scattered woody tree and shrub species were largely limited to the periphery of the property and were indicative of the Fresh-moist Willow Lowland Deciduous Forest (FOD7-3) which surrounds the property and separates it from the Cattail Organic Shallow Marsh (MAS3-1) community which

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bounds the riparian corridor of Turtle Creek to the east. Existing woody species, which comprise the majority of the surrounding canopy included green ash (*Fraxinus pennsylvanica*), eastern cottonwood (*Populus deltoids*), black walnut (*Juglans nigra*), and silver maple (*Acer saccharinum).* Small clumps and/or specimens of white birch (*Betula papyrifera*), tamarack (*Larix laricina*), white willow (*Salix alba*) and spruce (*Picea* sp.) are dotted across the property. The woody sub-canopy of the property consisted primarily of young willow (*Salix* sp.), red-osier dogwood (*Cornus sericea*), and staghorn sumac (*Rhus typhina*).

4.2 Avian and Wildlife Species

During the 2019 field assessment, the following avian species were visually observed or identified by vocalization, American robin (*Turdus migratorius*), northern cardinal (*Cardinalis cardinalis*), blue jay (*Cyanocitta cristata*), American goldfinch (*Spinus tristis*), common crow (*Corvus brachyrhynchos*), and red-winged blackbird (*Agelaius phoeniceus*).

Mammalian species observed during the 2019 field survey were limited to eastern gray squirrel (*Sciurus carolinensis*) and eastern chipmunk (*Tamias striatus*), however, there was secondary physical evidence of the area being used by white tailed deer (*Odocoileus virginianus*).

No reptiles or amphibian wildlife species were noted in 2019.

4.3 Fisheries and Aquatic Habitat

During the 2019 field assessment, no open channels or pools of standing water were located within the study area, therefore no fisheries sampling or surveys were completed. While all, or part, of study site may be considered contributing habitat by proximity to Turtle Creek, the proposed development plan observes all appropriate setbacks and the highly disturbed nature of the property makes it unlikely to appreciably contribute to adjacent aquatic habitat.

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4.4 Species at Risk

No Species at Risk (SAR) were observed within the study area during the field survey. However, background data from the MNRF and NHIC indicated that a number of SAR may exist within the study area, these species are summarized in Table 1. Given the existing site conditions, surrounding development and previous land use within the study area it is unlikely that any of these species are present.

Table 1: Potential Species at Risk identified within the 0 Bernida Road study area.

Species at Risk	Status	Potential Location	Preferred Habitat	Habitat Presence/Absence
Avian				
Eastern Meadowlark (*Sturnella magna*)	THR	General Area (<25 km)	Pastureland, hayfields, scrubland	Suitable habitat is limited with current site conditions
Bobolink (*Dolichonyx oryzivorus*)	THR	General area (< 25 km)	Pastureland, hayfields, tall grass meadow	Suitable habitat is limited with current site conditions
Barn Swallow (*Hirundo rustica*)	THR	General area (< 25 km)	Open structures adjacent to suitable foraging	Suitable habitat is not currently present, potential foraging grounds
Bank Swallow (*Riparia riparia*)	THR	General area (< 25 km)	Areas adjacent to water w/ proximity to exposed embankments	Suitable habitat is not currently present, potential foraging grounds
Eastern Wood-Pewee (*Contopus virens*)	SC	General area (< 25 km)	Intermediate-age forest stands w/ limited understory	Suitable habitat is limited with current site conditions
Common Nighthawk (*Chordeiles minor*)	SC	General area (< 25 km)	Pastureland, hayfields, tall grass meadow	Suitable habitat is limited with current site conditions
Wood Thrush (*Hylocichla mustelina)*	SC	General area (< 25 km)	Mature conifer-deciduous forests w/ well developed undergrowth	Suitable habitat is limited with current site conditions
Chimney Swift (*Chaetura pelagica*)	THR	General area (< 25 km)	Open structures adjacent to suitable foraging	Suitable habitat is not currently present, potential foraging grounds
Peregrine Falcon (*Falco peregrinus*)	THR	General area (< 25 km)	Open structures, or rock ledges adjacent to water	Suitable habitat is not currently present
Herpetofauna				
Snapping Turtle (*Chelydra serpentina*)	SC	General area (< 10 km)	Slow moving water w/ abundant vegetation	Suitable habitat is limited with current site conditions

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Northern Map Turtle (*Graptemys geographica*)	SC	General area (<10 km)	Deep, slow moving water w/ open shorelines	Suitable habitat is not currently present
Blandings Turtle (*Graptemys geographica*)	THR	General area (<10 km)	Shallow water wetlands w/ extensive vegetation	Suitable habitat is limited with current site conditions
Eastern Ribbonsnake (*Thamnophis sauritus*)	SC	General area (<10 km)	Shallow water wetlands	Suitable habitat is limited with current site conditions

THR = Federally Threatened; END = Federally Endangered; SC= Special Concern; Note: there are no known occurrences of Species at Risk within the study area

5.0 POTENTIAL IMPACTS AND MITIGATION

This section of the report describes the potential impacts on the biophysical environment associated with proposed property development. This section also outlines proposed mitigation measures to prevent and minimize adverse effects of the development on the surrounding natural resource features.

5.1 Vegetation

The predominant vegetation community on the subject property consists of a cultural meadow exhibited by the abundance of grass species and herbaceous vegetation typical of disturbed areas. Due to the previous land use practices and current state of the central, manicured cultural meadow area, disturbances to this vegetation community as a result of the proposed development are not predicted to be ecologically significant and will not foreseeably impact any rare species, faunal communities, nor degrade the properties ecological value.

The majority of mature trees onsite are located around the periphery of development will not be directly affected. However, several small trees including birch (*Betula*) and spruce (*Picea*) will need to be removed in order to accommodate the future residential structure on lot ‘A’. Four additional conifers are designated to be removed to accommodate the future cul-de-sac and Bernida Road access (Appendix B). The four birches and single spruce on lot ‘A’ offer little in terms of preferred habitat due to their small size, physical isolation, and open exposure.

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Additionally, their size and location does not currently contribute to habitat connectivity in a meaningful way; the proposed removal of these 9 trees should result in negligible ecological impact.

It is evident from the preliminary site plan (Appendix B), that the proposed development will encroach on the recommended 10 meter setback from the canopy drip line. Due to the current orientation of the site, and the prevalence of the Fresh-moist Willow Lowland Deciduous Forest (FOD7-3) surrounding the proposed development, a 10 meter setback from the peripheral dripline is not feasible with the proposed building envelope. Several trees including a green ash located directly adjacent to the proposed structure on Lot 'B' and a single eastern cottonwood located behind the proposed development on Lot 'A' are located within 3 meters of the structure but are not identified for removal, these should be removed prior to construction. In areas where the proposed structures encroach on the 10 meter dripline setback, EcoTec proposes that tree protection barrier be installed around any singular-specimen or stands of trees being encroached upon in order to prevent inadvertent damage and mitigate the ecological impact caused by development.

5.2 Avian and Wildlife Species Habitat

The study area and surroundings contained a diversity of habitat components potentially supportive of the life processes of birds and wildlife species utilizing the area. However, no negative impacts to avian and wildlife habitat are anticipated as a result of the proposed property development. Any and all clearing of existing trees should occur outside the migratory bird nesting window (April 15 – August 15) in order to prevent the destruction of nests and/or the harassment of wildlife. Should clearing be required within the nesting window, EcoTec recommends a qualified avian biologist be consulted to ensure no clearing activities will negatively impact avian wildlife.

No herpetofauna were identified on the site during the 2019 field survey. Habitat located within or immediately adjacent to the proposed building envelope were of minimal ecological value to most reptile and amphibian species. In addition, considering the prevalence of large tracts of more

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preferred habitat surrounding the subject property, including the natural riparian corridor to the west, no substantial impacts to herpetofauna communities are anticipated.

5.3 Fisheries and Aquatic Habitat

No negative impacts to fisheries habitat are anticipated as there is no active watercourse within the bounds of the subject property. Additionally, the proposed development is located outside recommended watercourse setbacks in relation to Turtle Creek located just beyond the western property line which should ensure minimal effects on the watercourse and contributing floodplain.

5.4 Species at Risk

Table 1 (Section 4.4) outlines a list of Species at Risk which may be present within the study area. However, although these species have historically been observed within a given proximity (Table 1) to the study area, it should be noted that suitable habitat for the majority of these species is currently limited or completely absent from the study area. In regards to eastern meadowlark (*Sturnellla magna*) and bobolink (*Dolichonyx oryzivorus*), the existing cultural meadow does represent suitable habitat, however both species require pastoral habitat greater than 5 ha^2 to establish a breeding territory (Hekert 1994, OMNR 2013); currently the site's size and vegetative composition does not fulfill the requirements for suitable bobolink or meadowlark breeding/nesting habitat.

6.0 CONCLUSIONS AND RECOMMENDATIONS

The following is a summary of recommendations for future development of the subject property at 0 Bernida Road in Mississauga. These recommendations have been developed in order to reduce environmental impacts as a result of potential development:

- It is recommended that any trees located less than 3 meters from either proposed structure be removed. Trees whose dripline setback is encroached upon by the building envelope

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should be properly protected and demarcated with tree protection barriers as per the City of Mississauga's Private Tree-Protection Bylaw.

- It is recommended that all clearing of existing trees should occur outside the migratory bird nesting window (April 15 – August 15) in order to prevent the destruction of nests and/or the harassment of wildlife.

- It is recommended that the MNRF be contacted immediately if any active nesting within the study area is observed during the course of site development and that a qualified avian biologist be consulted.

- It is recommended that the MNRF be contacted immediately if any Species at Risk are observed during the course of site development.

- It is recommended that exclusion fencing be installed aroundthe periphery of the property boundary to prevent herpetofauna from entering the site; specifically, along the western property line which abuts the Turtle Creek riparian corridor. Fencing should be installed in accordance with the MNRF Reptile and Amphibian Exclusion Fencing technical bulletin (2013).

- Erosion and sediment control measures should be installed prior to site grading and maintained throughout the duration of site development.

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7.0 REFERENCES

Herkert, J.R. 1994.The effects of habitat fragmentation on midwestern grassland bird communities. Ecological Applications 4:461–71.

OMNR. General Habitat Description for the Bobolink (Dolichonyx oryzivorus). 2013.

APPENDIX A:
STUDY AREA PHOTOGRAPHS

Photo 1. Study area located at 0 Bernida Road, Mississauga. Facing northeast from Lot ‘B’. April 4, 2019.

Photo 2. Study area located at 0 Bernida Road, Mississauga. Facing north from Lot ‘B’. April 4, 2019.

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Photo 3. Study area located at 0 Bernida Road, Mississauga. Facing south from Lot ‘A’. April 4, 2019.

Photo 4. Study area located at 0 Bernida Road, Mississauga. Facing south from the central access point off Parkland Avenue. April 4, 2019.

Photo 5. Green ash stand to receive tree-hoarding measures located on the east side of Lot ‘B’, 0 Bernida Road, Mississauga Ontario. Facing southeast April 4, 2019.

Photo 6. Birch and spruce trees proposed for removal, located on Lot ‘A’, 0 Bernida Road, Mississauga Ontario. Facing southeast April 4, 2019.

Photo 7. Trees to receive tree-hoarding measures located on the west side of Lot ‘a’, 0 Bernida Road, Mississauga Ontario. Facing south, April 4, 2019..

APPENDIX B:
PRELIMINARY SITE DEVELOPMENT PLAN

PARKLAND AVENUE
(BY REG'D PLAN 417)

BERNIDA ROAD
(BY REG'D PLAN 417)

N 46° 23' 45" W
20.12

N 46° 23' 00" W
76.14

N 46° 34' 30" W
28.42

N 36° 27' 05" W
20.42

N 43° 46' 00" E
101.42

N 43° 10' 00" W
36.13

N 44° 38' 40" W
9.39

N 60° 39' 40" W
61.08

N 61° 19' 10" W

N 62° 34' 10" W
19.80

N 42° 47' 30" E
38.11

N 46° 38' 30" E
85.27

5.00
8.00
5.00

R13.00

6.00
6.00

LOT 17
LOT 18
LOT 19
LOT 20
LOT 21
LOT 22
LOT 23
LOT 26
LOT 27
LOT 28
LOT 29

Lot A
Lot B

POTENTIAL
2 STORY
DWELLING
6500 sf

POTENTIAL
2 STORY
DWELLING
6500 sf

30m SETBACK FROM TOP OF BANK

DRIP LINE STAKED BY CREDIT VALLEY CONSERVATION
OCTOBER 23rd, 2018

DRIP LINE STAKED BY CREDIT VALLEY CONSERVATION
OCTOBER 23rd, 2018

TOP OF BANK STAKED BY CREDIT VALLEY CONSERVATION
OCTOBER 23rd, 2018

STAKED DRIPLINE

STAKED TOP OF BANK

EXTENT OF REGULATORY STORM FLOOD PLAIN
(REGIONAL STORM)

EXTENT OF REGULATORY STORM FLOOD PLAIN
(REGIONAL STORM)

REGULATORY FLOOD ELEVATION 77.06

REGULATORY FLOOD ELEVATION 76.79

REGULATORY FLOOD ELEVATION 76.65

REGULATORY FLOOD ELEVATION 76.49

BLOCK A, REG'D PLAN 631

LOT 15, REG'D PLAN 450

Site Data		
Total Lot Area	15,197.41 sm	(1.519 ha)
Zoning		R2-4
Lot A Area		8,430.36 sm
Lot B Area		6,767.05 sm

Preliminary Site Plan

0 Bernida Road, Mississauga, ON
Residential Land Proposal

Harper Dell & Associates Inc.
Planning, Traffic and Land Development Consulting
1370 Hurontario St.
Mississauga, ON, L5G 3G4

Date: Mar 17, 2019
Scale: 1:650

SP

APPENDIX D

Watermain Demand Calculations

WATER DEMAND CALCULATIONS

PROJECT: Bernida Road
LOCATION: Mississauga, ON
DATE: March 19 2020

DESIGNED BY: Elliot Pai, EIT.
REVIEWED BY: Eric Greck, P.Eng.

Design Parameters

Residential		
Persons Per Unit(cap/unit):	4.15	(as per Region of Peel correspondance)
Number of Proposed Dwellings (units):	2	
Average Day Residential flow (L/cap/day):	409	(Region of Peel, Watermain Design Criteria Section 2.3 Table 2)
Maximum Day Factor:	2	(Region of Peel, Watermain Design Criteria Section 2.3 Table 2)
Peak Hour Factor:	3	(Region of Peel, Watermain Design Criteria Section 2.3 Table 2)
Fire Flow for Single detached dwelling: (L/min)	6,000	Calculated (Fire underwriters survey, 1999)
Fire Flow for Single detached dwelling: (L/s)	100.00	

Manual Input
Automatic Output
Total Demand

Demands

	Residential			Totals							
Sector	Population	Average Daily Demand (L/day)	ADD (L/min)	Average Daily Demand (L/Day)	ADD (L/min)	Max. Daily Demand (L/day)	MDD (L/min)	Peak Hour Daily Demand	PHD (L/min)	MDD+FrFL (L/min)	Demand (L/s)
Total	9	3,394.70	2.36	3,394.70	2.36	6,789.40	4.71	10,184.10	7.07	6,004.71	100.08

0.078581019

FIRE FLOW CALCULATIONS

PROJECT: Bernida Rd
LOCATION: Mississauga, ON
DATE: March 19 2020

DESIGNED BY: Elliot Pai, EIT.
REVIEWED BY: Eric Greck, P.Eng.

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

NOTE Table based on procedures and figures from the Water Supply for Public Fire Protection - Fire Underwriters Survey of Canada, 1999.

Exposure distance factor max adjustment is 75%

Persons Per Unit(cap/unit): 4.15

Number of Proposed Dwellings (units): 2

A = The total floor area in square metres including all storeys, excluding basements at least 50% below grade.

Manual Input

PROPOSED RESIDENTIAL UNIT

Step	Description	Term	Options		Multiplier Associated with Option	Value used	Unit	Total Fire Flow (L/min)
1	Frame Use for Construction of Unit	**Building Material**						
		Coefficient related to type of construction (C)	Wood Frame		1.5	1.0		N/A
			Ordinary Construction		1.0			
			Non-combustible construction		0.8			
			Fire resistive materials (< 2 hrs)		0.7			
			Fire resistive materials (> 2 hrs)		0.6			
2	Number of Storeys					2	N/A	N/A
3	Floor Area (A)					637.4	(m²)	N/A
		Average Floor Measurements	Square Feet (ft²)		0.093	318.7		
			Square Metres (m²)		1			
			Hectares (ha)		10,000			
4	Fire Flow	Required fire flow without reductions or increases:					L/min	5,554
5	Combustibility of Building Contents	**Reductions / Increases From Factors Affecting Burning**						
		Occupancy content hazard reduction or surcharge Factor	Non-Combustible		-0.25	0.00	N/A	0
			Limited Combustible		-0.15			
			Combustible		0.00			
			Free Burning		0.15			
			Rapid Burning		0.25			
6	Building Equipped with Sprinklers	Sprinkler Reduction Factor	Complete Automatic Sprinklers		-0.50	0.00	N/A	0.00
			Adequate Automatic Sprinklers		-0.30			
			None		0.00			
7	Separation Distance Between Buildings	Exposure Distance Factor *	North Separation	45m +	0.00	0.00	N/A	0
			South Separation	45m +	0.00			
			East Separation	45m +	0.00			
			West Separation	45m+	0.00			
8	Required Fire Flow	**Total Required Fire Flow Rounded to the Nearest 1000 L/min:**						**6,000**
		Total Required Fire Flow in L/s:					100.0	
		Duration of Fire Flow (hrs):					2	
		Required Volume of Fire Flow (m³):					720	

APPENDIX E

Sanitary Demand Calculations

Consulting Engineer : Greck and Associates Limited
Project / Subdivision : Bernida Rd, Mississauga
Sheet: 1 of 1
Project No.: 19-631

Approved by: Eric Greck, P.Eng

Design Parameters

Residential Density (Semis+Single) =	4.15	Residential Density (Apartments**)	=	2.54	
Residential Density (Row Dwellings) =	3.5				
Manning 'n' =	0.013	Residential Density (Apartments*)	=	1.68	
# of new MH =	1				
Extran. Flow=	0.2	L/s/ha	New development Flow =	409	L/cap/day

Design Equations

Q(p) = (P x q x M) / 86400
Q(e) = i x A
Q(i) = 0.28 l/s/mh

P = population
M = peaking factor (Harmon)

M (Min) = 2
$M = 1 + 14 / (4 + (P/1000)^{1/2})$

Q(d) = Q(p) + Q(i) + Q(e) = peak design flow (L/s)

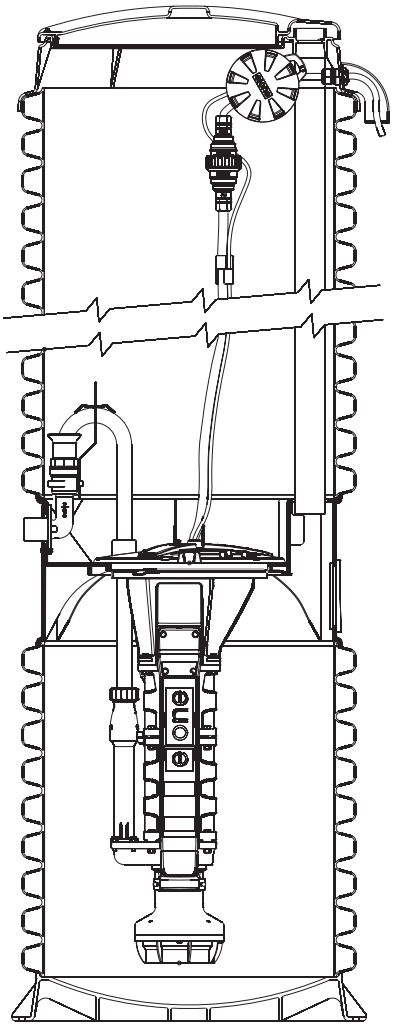
Notes/Comments: Minimum Allowable Actual Velocity 0.75 m/s, Max 3.5 m/s.
*Sanitary flows from each lot is to be serviced by a Eone DH071 grinder pump which will pump flows to MH2A. MH2A to MH1A to be gravity-fed. MH1A to tie into existing 250mm sanitary sewer on Parkland Ave.

References: Region of Peel Public Works - Design, Specifications, & Procedures - Linear Infrastructure Sanitary Sewer Design Criteria, March 2019

Location															Sewer Data							
Locations	From		To			Residential Area (Semis+Single**)	Residential Population	Residential P.F.	Residential Area	Residential Population	Population Peak Flow (L/s)	Peak Infiltration Flow (l/s)	Peak Extraneous Flow (L/s)	Total Design Flow (L/s)	Length	Pipe Size	Type of Pipe	Grade	Full Flow Capacity	Full Flow Velocity	Actual Velocity	%Full
	MH #	Inv (m)	MH #	Inv (m)	drop (m)	(units)	cap.	M(r)	(ha)	P	Q(r)	Q(i)	Q(e)	Q(d)	(m)	(mm)		(%)	(L/s)	(m/s)	(m/s)	%
Bernida Rd	*MH 0A	-	*MH 2A		-	2	9	4.42	0.45	9	0.19	0.28	0.09	0.56	-	125	PVC	-	-	-	-	-
Bernida Rd	*MH 2A	82.65	MH 1A	82.39	0.26			4.42	0.45	9	0.19	0.28	0.09	0.56	12.6	250	PVC	2.06	74.0	1.76	0.51	0.8

E/ONE EXTREME SERIES

DH071/DR071



Patent Numbers: 5,752,315
5,562,254 5,439,180

* Discharge data includes loss through check valve, which is minimal.

NA0050P01

General Features

The model DH071 or DR071 grinder pump station is a complete unit that includes: the grinder pump, check valve, HDPE (high density polyethylene) tank and controls. The DH071 or DR071 is packaged into a single complete unit, ready for installation.

The DH071 is the "hardwired," or "wired," model where a cable connects the motor controls to the level controls through watertight penetrations.

The DR071 is the "radio frequency identification" (RFID), or "wireless," model that uses wireless technology to communicate between the level controls and the motor controls.

All solids are ground into fine particles, allowing them to pass easily through the pump, check valve and small diameter pipelines. Even objects not normally found in sewage, such as plastic, rubber, fiber, wood, etc., are ground into fine particles.

The 1.25-inch discharge connection is adaptable to any piping materials, thereby allowing us to meet your local code requirements.

The tank is made of tough corrosion-resistant HDPE. The optimum tank capacity of 70 gallons is based on computer studies of water usage patterns. A single DH071 or DR071 is ideal for one, average single-family home and can also be used for up to two average single-family homes where codes allow and with consent of the factory. This model can accommodate flows of 700 GPD.

The internal check valve assembly, located in the grinder pump, is custom-designed for non-clog, trouble-free operation.

The grinder pump is automatically activated and runs infrequently for very short periods. The annual energy consumption is typically that of a 40-watt light bulb.

Units are available for indoor and outdoor installations. Outdoor units are designed to accommodate a wide range of burial depths.

Operational Information

Motor

1 hp, 1,725 rpm, high torque, capacitor start, thermally protected, 120/240V, 60 Hz, 1 phase

Inlet Connections

4-inch inlet grommet standard for DWV pipe. Other inlet configurations available from the factory.

Discharge Connections

Pump discharge terminates in 1.25-inch NPT female thread. Can easily be adapted to 1.25-inch PVC pipe or any other material required by local codes.

*Discharge**

15 gpm at 0 psig

11 gpm at 40 psig

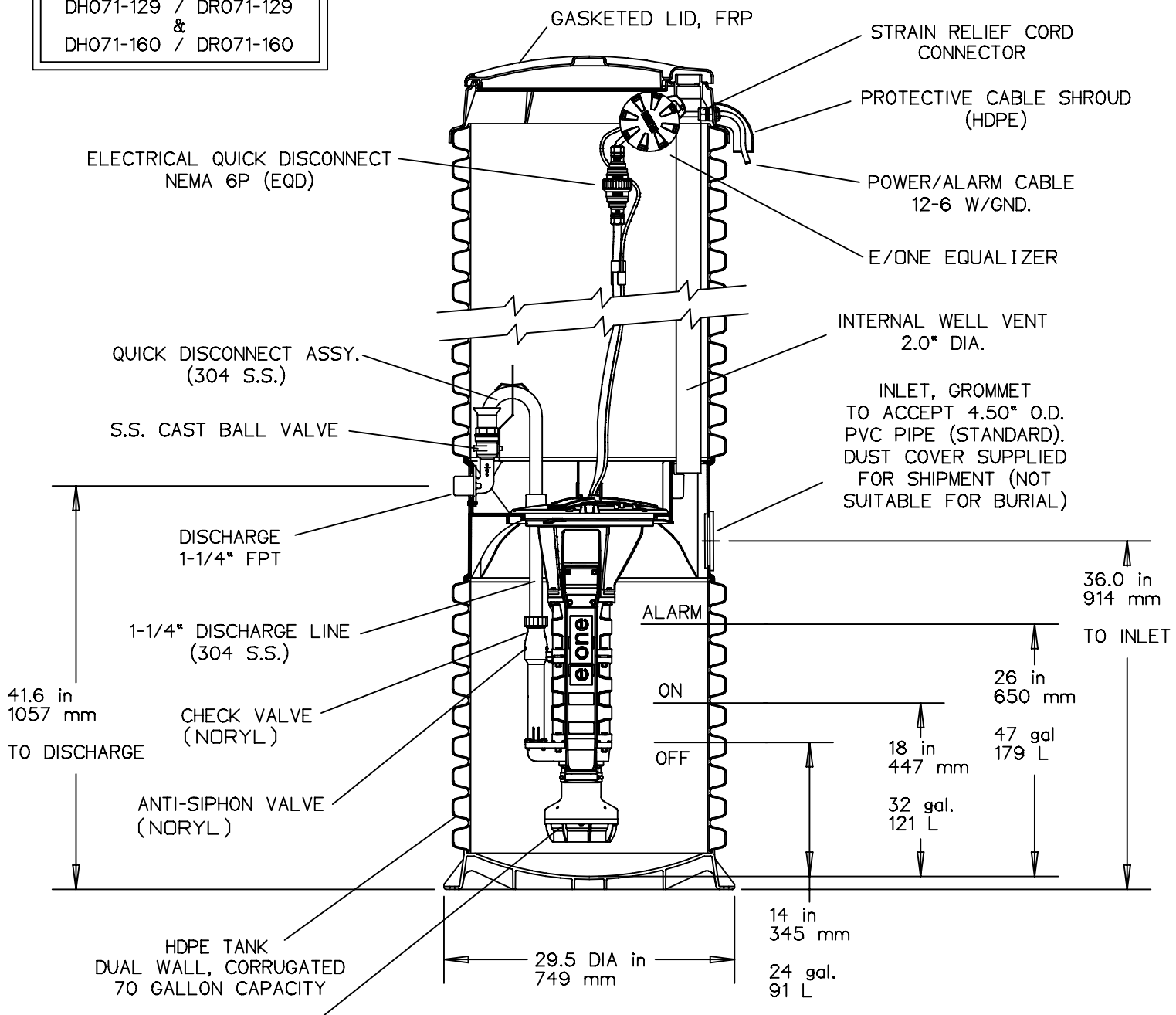
7.8 gpm at 80 psig

Overload Capacity

The maximum pressure that the pump can generate is limited by the motor characteristics. The motor generates a pressure well below the rating of the piping and appurtenances. The automatic reset feature does not require manual operation following overload.

OPTIONS : ☐ DH071 (HARD WIRED LEVEL CONTROLS)
☐ DR071 (WIRELESS LEVEL CONTROLS)

FIELD JOINT REQUIRED
FOR MODELS
DH071-129 / DR071-129
&
DH071-160 / DR071-160



CONCRETE BALLAST MAY BE REQUIRED
SEE INSTALLATION INSTRUCTIONS
FOR DETAILS

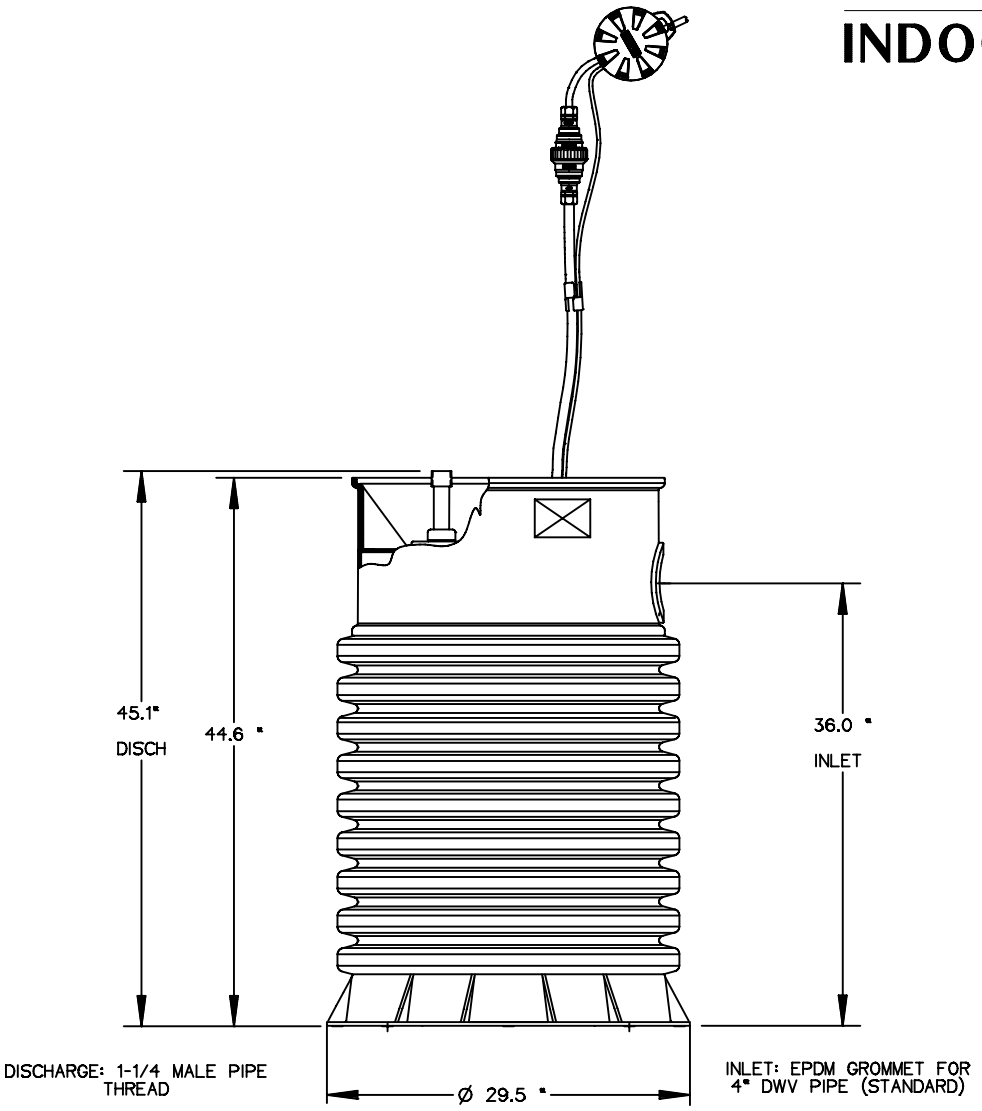
AD	CH	07/12/07	A	
DR BY	CHK'D	DATE	ISSUE	SCALE

SEWER SYSTEMS

MODEL DH071 / DR071
DETAIL SHEET

NA0050P02

DH071-44
INDOOR UNIT



LNT	GAE	04/24/07	-	
DR BY	CHK'D	DATE	ISSUE	SCALE

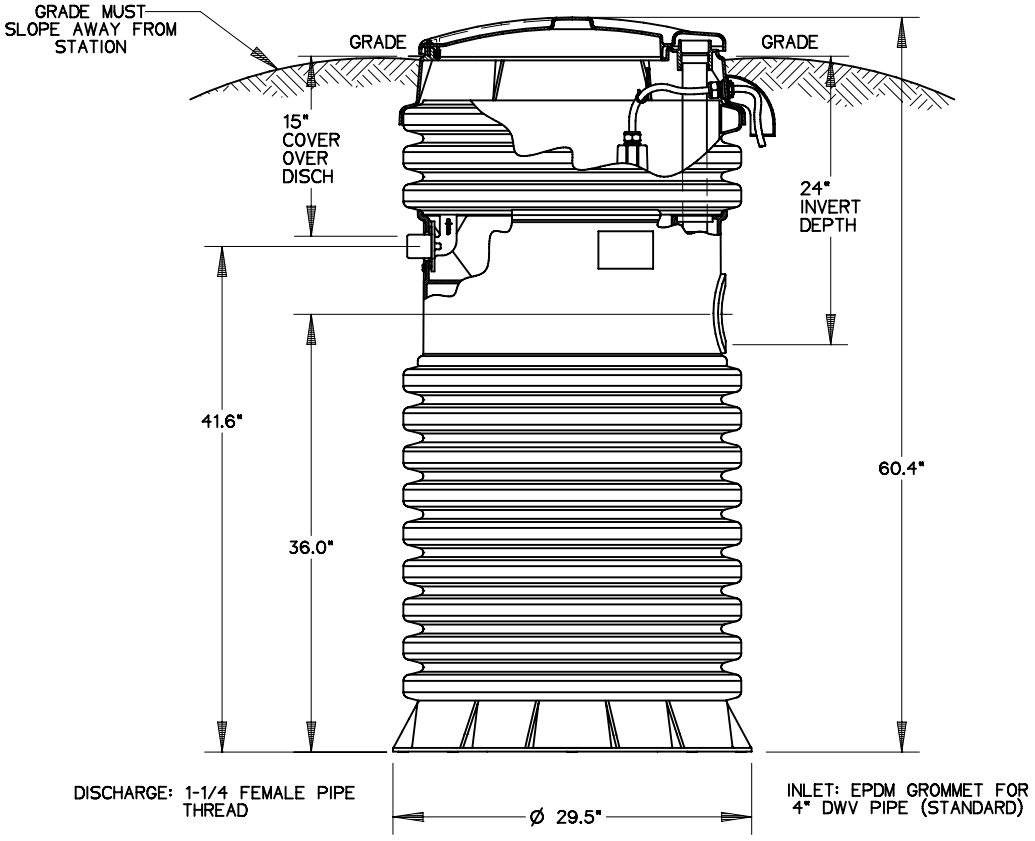
SEWER SYSTEMS

MODEL DH071-44

NA0050P03

OPTIONS : ☐ DH071-61 (HARD WIRED LEVEL CONTROLS)

☐ DR071-61 (WIRELESS LEVEL CONTROLS)



CONCRETE BALLAST MAY BE REQUIRED
SEE INSTALLATION INSTRUCTIONS
FOR DETAILS

AD	CAH	07/12/07	A	1/16
DR BY	CHK'D	DATE	ISSUE	SCALE

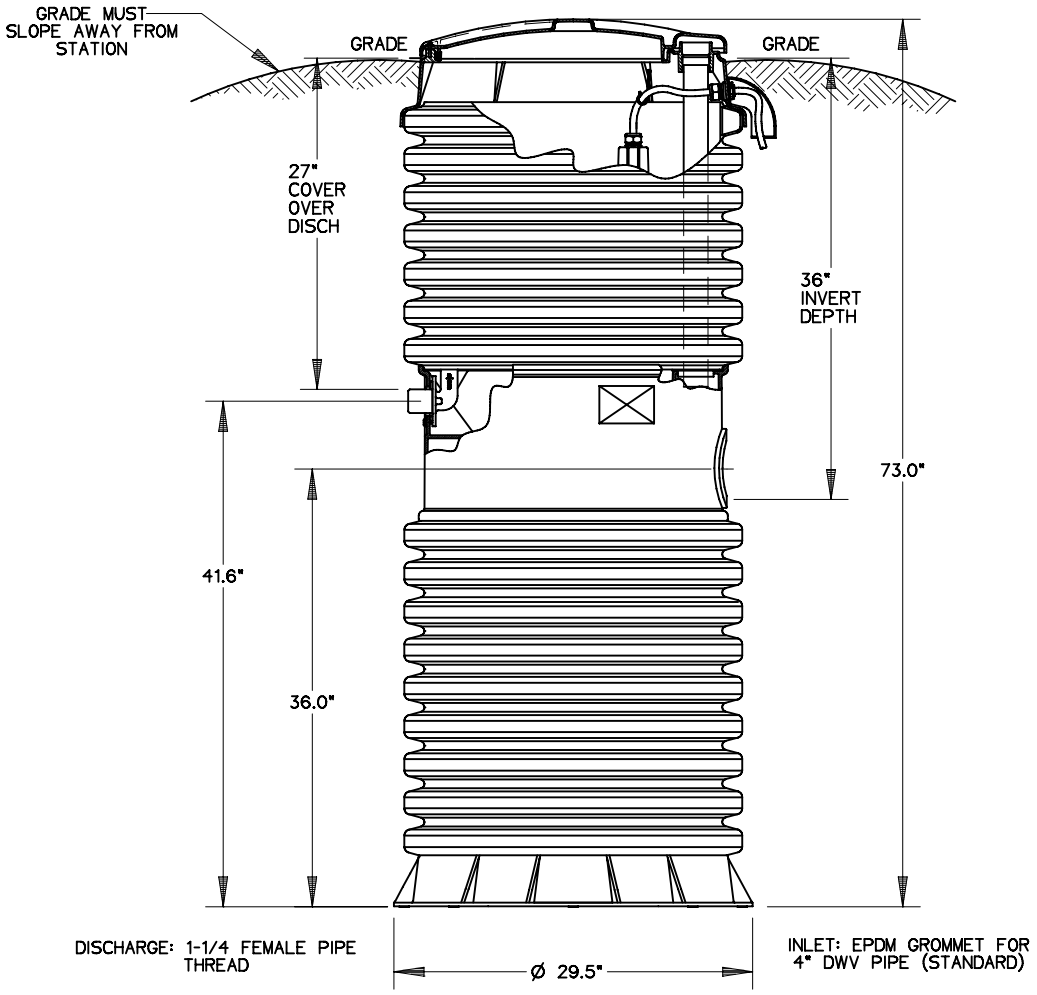
SEWER SYSTEMS

MODEL DH071-61 / DR071-61

NA0050P04

OPTIONS : ☐ DH071-74 (HARD WIRED LEVEL CONTROLS)

☐ DR071-74 (WIRELESS LEVEL CONTROLS)



CONCRETE BALLAST MAY BE REQUIRED
SEE INSTALLATION INSTRUCTION
FOR DETAILS

AD	CAH	07/12/07	A	1/16
DR BY	CHK'D	DATE	ISSUE	SCALE

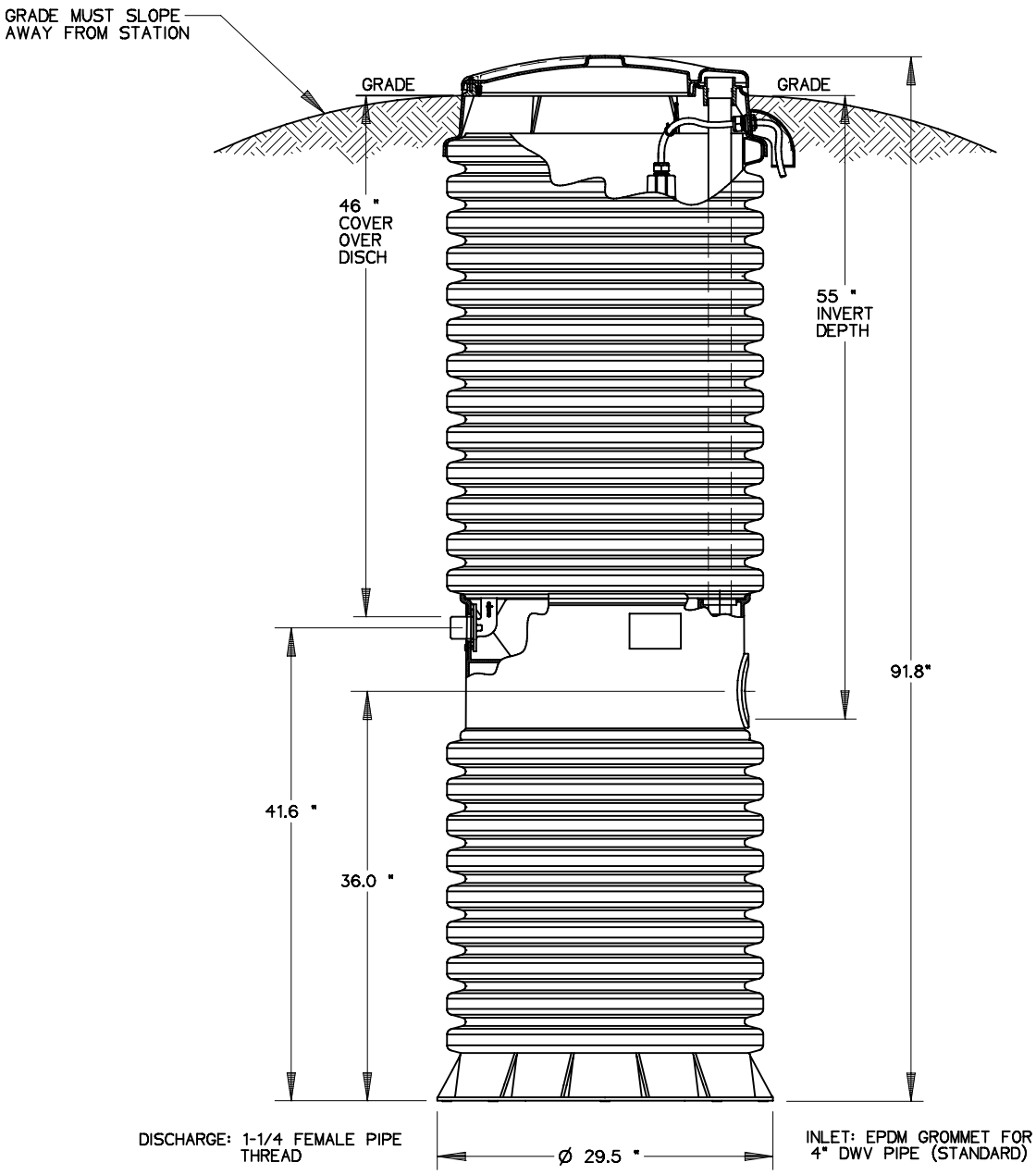
SEWER SYSTEMS

MODEL DH071-74 / DR071-74

NA0050P05

OPTIONS : ☐ DH071-93 (HARD WIRED LEVEL CONTROLS)

☐ DR071-93 (WIRELESS LEVEL CONTROLS)



CONCRETE BALLAST MAY BE REQUIRED
SEE INSTALLATION INSTRUCTIONS
FOR DETAILS

AD	CAH	07/12/07	A	1/16
DR BY	CHK'D	DATE	ISSUE	SCALE

SEWER SYSTEMS

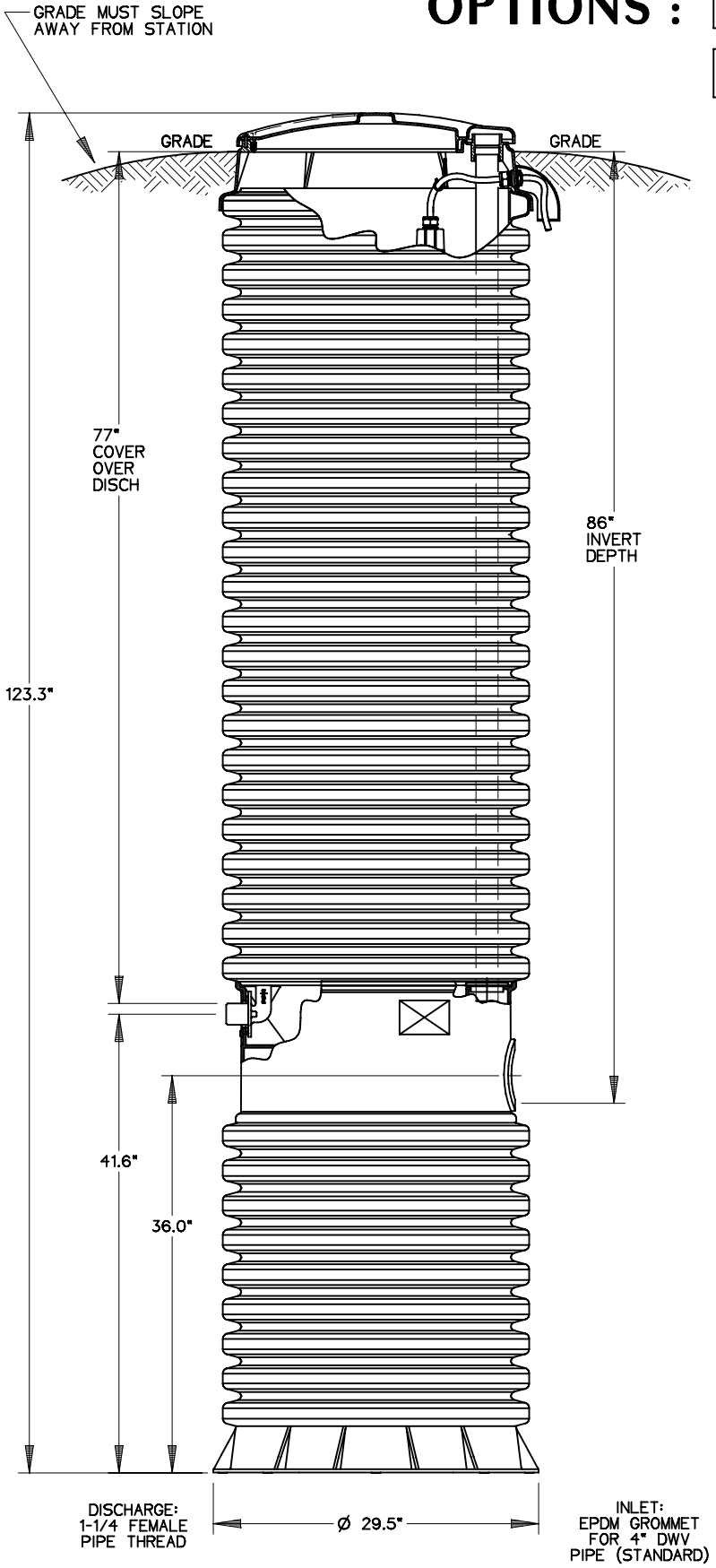
MODEL DH071-93 / DR071-93

NA0050P06

OPTIONS :

☐ DH071-124 (HARD WIRED LEVEL CONTROLS)

☐ DR071-124 (WIRELESS LEVEL CONTROLS)



CONCRETE BALLAST MAY BE REQUIRED
SEE INSTALLATION INSTRUCTIONS
FOR DETAILS

AD	CAH	07/13/07	A	1/16
DR BY	CHK'D	DATE	ISSUE	SCALE

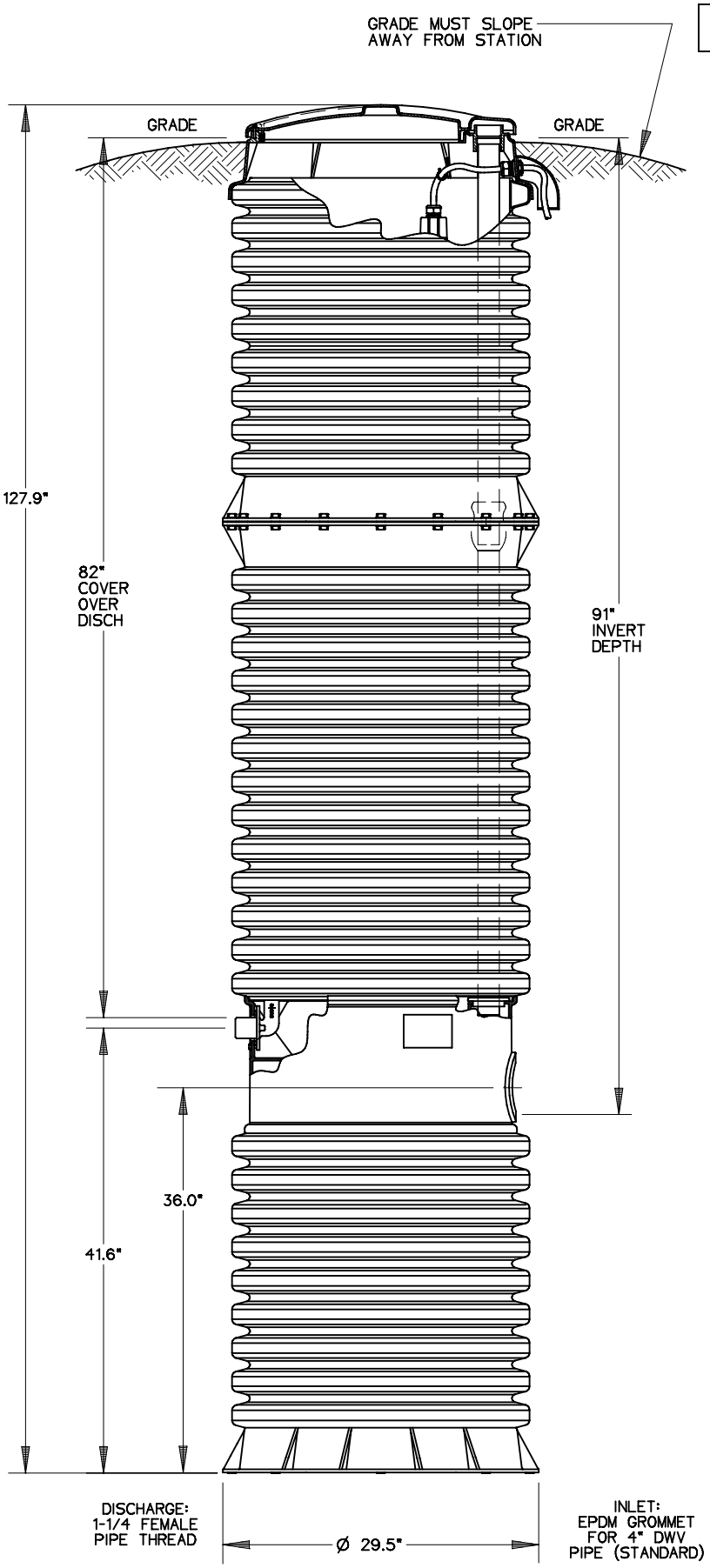
SEWER SYSTEMS

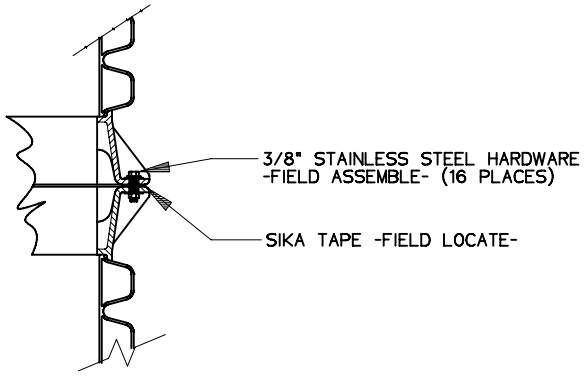
MODEL DH071-124 / DR071-124

NA0050P07

OPTIONS : ☐ DH071-129 (HARD WIRED LEVEL CONTROLS)

☐ DR071-129 (WIRELESS LEVEL CONTROLS)





DETAIL, FIELD JOINT

SEE INSTALLATION INSTRUCTIONS FOR FURTHER DETAILS

CONCRETE BALLAST MAY BE REQUIRED SEE INSTALLATION INSTRUCTIONS FOR DETAILS

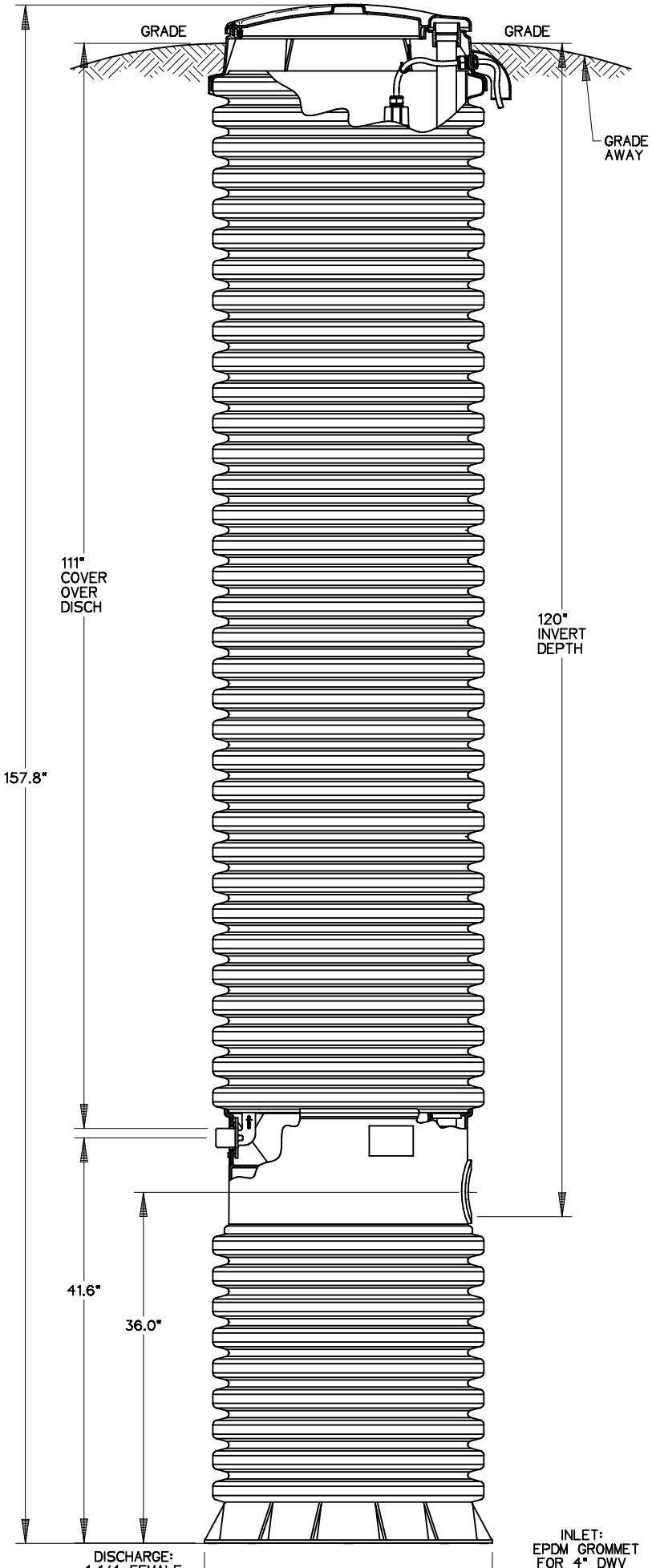
AD	CAH	07/13/07	A	1/16
DR BY	CHK'D	DATE	ISSUE	SCALE

SEWER SYSTEMS

MODEL DH071-129 / DR071-129

NA0050P08

OPTIONS : ☐ DH071-158 (HARD WIRED LEVEL CONTROLS)
☐ DR071-158 (WIRELESS LEVEL CONTROLS)



CONCRETE BALLAST MAY BE REQUIRED
SEE INSTALLATION INSTRUCTIONS
FOR DETAILS

AD	CAH	07/13/07	A	1/16
DR BY	CHK'D	DATE	ISSUE	SCALE

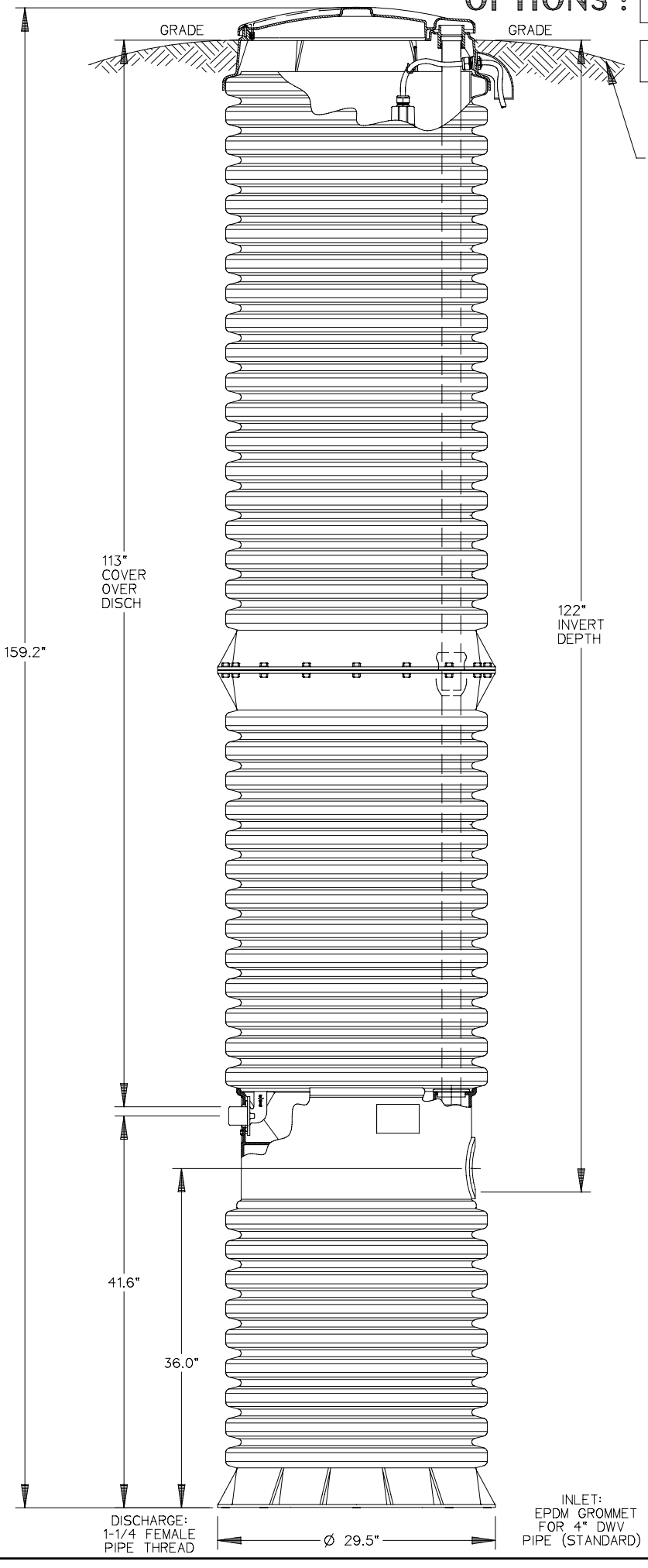
SEWER SYSTEMS

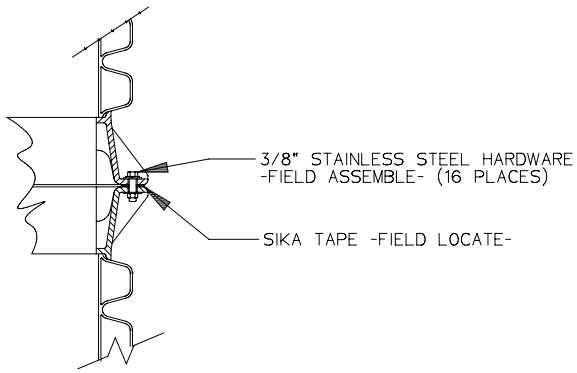
MODEL DH071-158 / DR071-158

NA0050P09

OPTIONS : ☐ DH071-160 (HARD WIRED LEVEL CONTROLS)

☐ DR071-160 (WIRELESS LEVEL CONTROLS)





DETAIL, FIELD JOINT

SEE INSTALLATION INSTRUCTIONS FOR FURTHER DETAILS

CONCRETE BALLAST MAY BE REQUIRED SEE INSTALLATION INSTRUCTIONS FOR DETAILS

AD	CAH	07/13/07	A	1/16
DR BY	CHK'D	DATE	ISSUE	SCALE

SEWER SYSTEMS

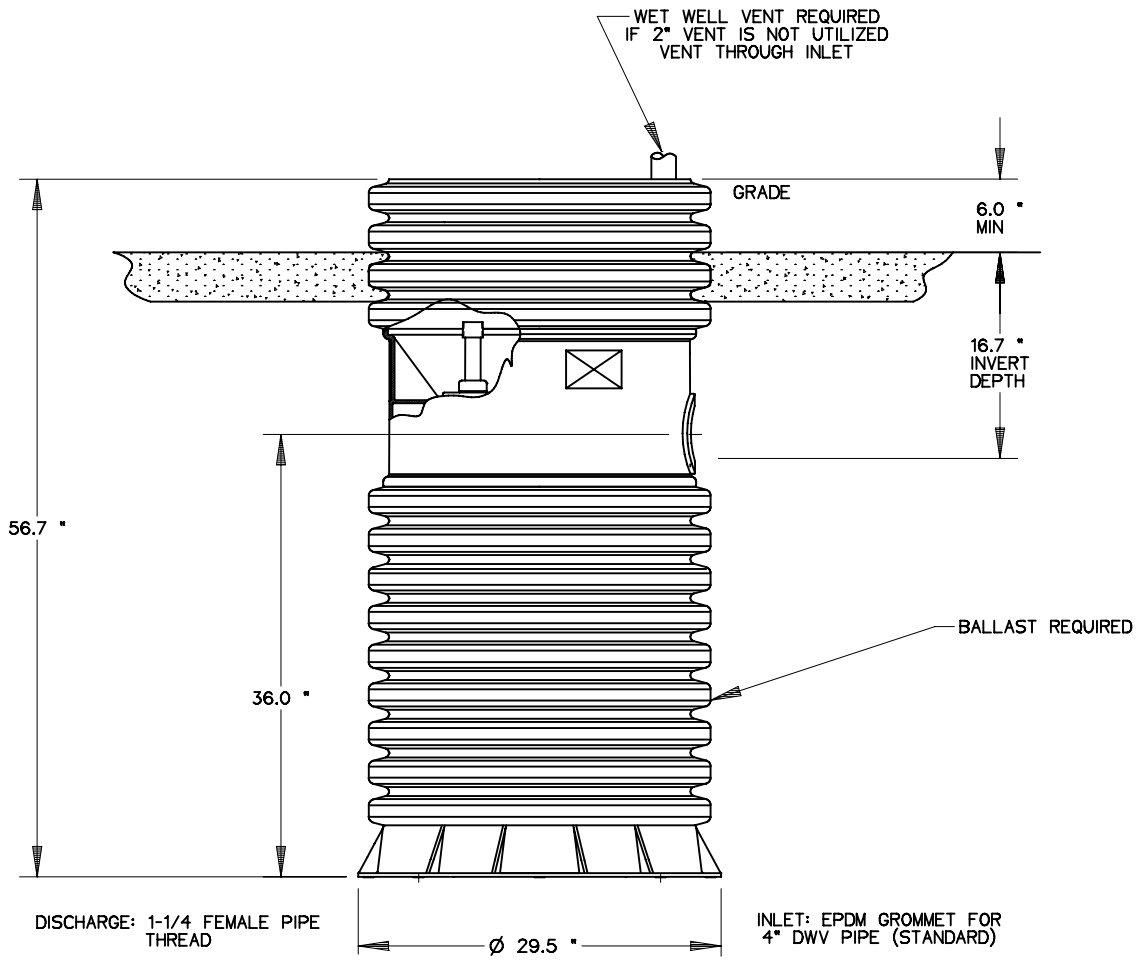
MODEL DH071-160 / DR071-160

NA0050P10

DH071-57

BUILDERS MODEL

STRAIGHT DISCHARGE



AD	CAH	04/26/07	-	1/16
DR BY	CHK'D	DATE	ISSUE	SCALE

SEWER SYSTEMS

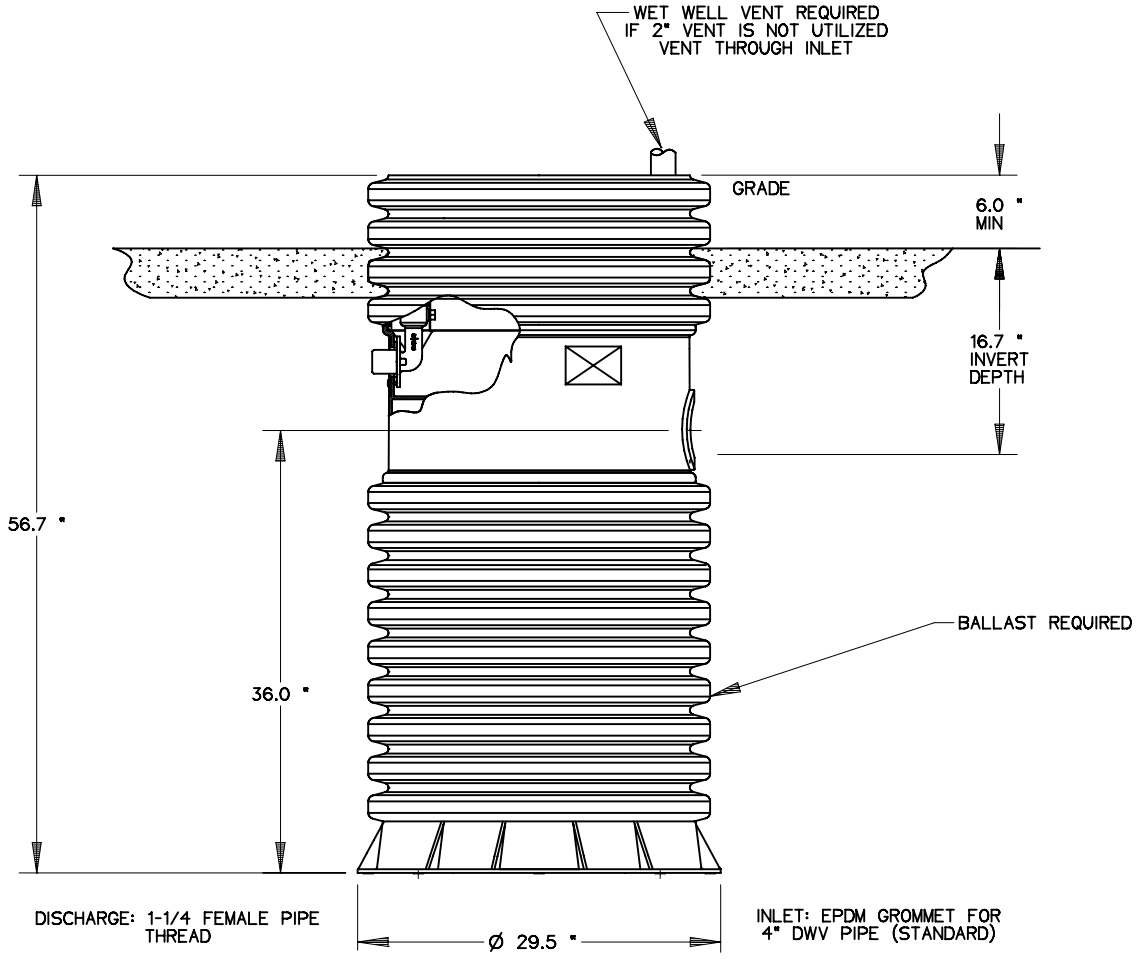
MODEL DH071-57
BUILDERS

NA0050P11

DH071-57

BUILDERS MODEL

DISCHARGE VALVE

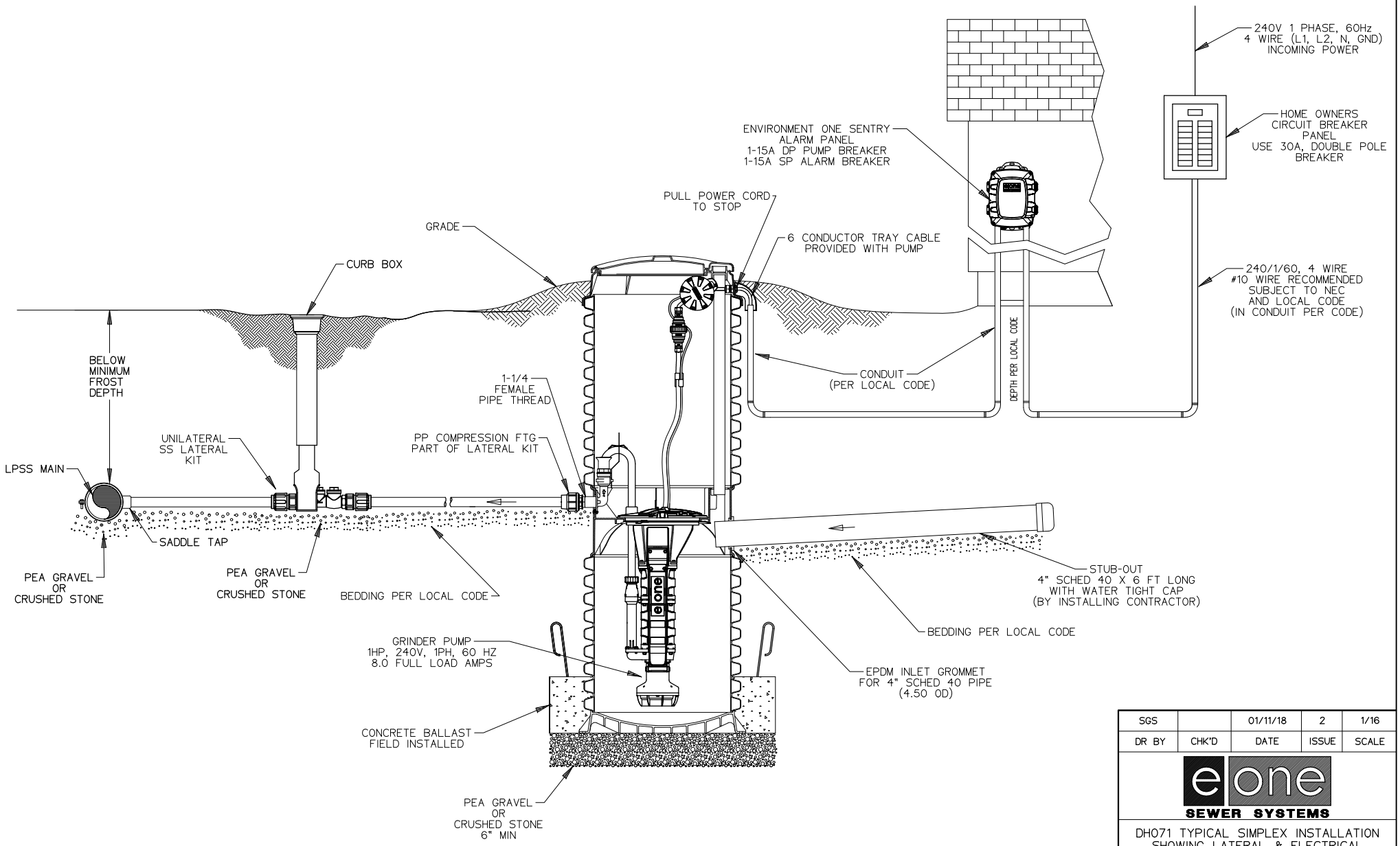


AD	CAH	04/26/07	-	1/16
DR BY	CHK'D	DATE	ISSUE	SCALE

SEWER SYSTEMS

MODEL DH071-57
BUILDERS

NA0050P12



SGS		01/11/18	2	1/16
DR BY	CHK'D	DATE	ISSUE	SCALE

SEWER SYSTEMS

DH071 TYPICAL SIMPLEX INSTALLATION
SHOWING LATERAL & ELECTRICAL

ESD 16-0072

APPENDIX F

Stormwater Management (SWM) Calculations

Site Characteristics
Site: 0 Bernida Road, Mississauaga
March 23, 2020

Existing Land-Use	Runoff Coefficient	Area A (m^2)	Area B (m^2)
Roof	0.90	0	0
Driveway	0.90	0	0
Road	0.90	0	0
Grassed area	0.25	4468	11692
Total		4468	11692
Composite Runoff Coefficient =		0.25	0.25

Proposed Land-Use	Runoff Coefficient	Area A1 (m^2)	Area A2 (m^2)	Area B (m^2)
Roof	0.90	619	0	0
Driveway	0.90	210	0	0
Road	0.90	975	0	0
Grassed area	0.25	1336	1329	11692
Total		3140	1329	11692
Composite Runoff Coefficient =		0.62	0.25	0.25

Proposed Areas A1 and A2 are to be developed, Area B to remain undeveloped and uncontrolled

Development Area (Area A1, A2) =	4468.15	m^2
Development Area Composite Runoff Coefficient =	0.51	

Quality Control
Site: 0 Bernida Road, Mississauaga
March 23, 2020

Under proposed conditions, WQ Controls will only be provided for Area A1
Areas A2 and B are grassed areas and runoff generated from these areas are considered clean
Provide Enhanced Treatment (80% TSS)

Water Quality Volume

Area	Total Area (m^2)	Runoff Coefficient	% Impervious	Water Quality Volume* (m^3/ha)	Water Quality Volume* (m^3)
Area A1	3140	0.62	57%	31.3	9.8
Total	3140	0.62	57%	31.3	9.8

*as per Table 3.2 of MOE SWM Planning and Design Manual for Infiltraiton

Bioretention Sizing

Bioretention Facility will service Area A1

Maximum Allowable Depth

$D_{c\,max} = i\,(t_s - d_p / i) / V_r$ where:

I = infiltration rate = 10 mm/hr

Estimated percolation rate for silt as reported in the geotechnical investigation by Soil Engineers (August, 2019) see Appendix B

ts = time to drain = 48 hours

Vr = void ratio = 0.4

dp = surface ponding = 300 mm

$D_{c\,max}$ =	450	mm
Proposed Depth =	300	mm
D_c =	0.30	m
Proposed Drawdown =	42.00	hours (minimum)

Required Footprint

A_f = WQV / (d_c V_r)

=	82.02	m^2
Proposed Footprint =	96.50	m^2
Subsurface Storage Volume =	11.58	m^3
Total Impervious Area	1803.12	m^2
Imp. Area to Footprint ratio	18.69	:1

Peak Runoff Assessment

Site: 0 Bernida Road, Mississauaga

March 23, 2020

For the purposes of peak runoff calculations, only areas within the development limits (Areas A1, A2) will be considered. Area B is proposed to remain as undeveloped land

No quantity controls are proposed for the subject site

Time of Concentration Calculations

Time of Concentration

Airport

If Runoff Coefficient < 0.4

$$T_c = \frac{.26\,(1.1 - C)\,L^{C}}{S_w^{0.33}}$$

where, L = Flow length (m)
Sw = slope (%)
C = Runoff Coefficient

Bransby

If Runoff Coefficient > 0.4

$$T_c = \frac{0.057\,L}{S_w^{0.2}\,A^{0.1}}$$

where, L = Flow length (m)
Sw = slope (%)
A = Area (ha)

	Area	Runoff Coefficient	Method	Length (m)	Area (ha)	S (%)	T (min)
Existing	**Area A**	0.25	Airport	113.5	0.447	5.53	16.79
Proposed	**Area A1, A2**	0.51	Bransby	97.4	0.447	6.04	4.20

Peak Runoff Assessment

2 year Rainfall Intensity, I = $610 (T+4.6)^{-0.78}$

10 year Rainfall Intensity, I = $1010 (T+4.6)^{-0.78}$

100 year Rainfall Intensity, I = $1450 (T+4.9)^{-0.78}$

T = Time of Concentration

Peak Runoff, Q = 0.0028 C I A

C = Runoff Coefficient

A = Area (ha)

I = Rainfall Intensity (mm/hr)

An adjustment factor of 1.25 has been applied for the 100 year

Existing

Drainage Area	Area (ha)	Intensity (mm/hr)			Runoff Coefficient	Peak Runoff (L/s)		
		2 Year	10 Year	100 Year		2 Year	10 Year	100 Year*
Area A	0.447	56	93	132	0.25	17.4	28.7	51.0

Proposed

Drainage Area	Area (ha)	Intensity (mm/hr)			Runoff Coefficient	Peak Runoff (L/s)		
		2 Year	10 Year	100 Year		2 Year	10 Year	100 Year*
Area A1, A2	0.447	112	185	259	0.51	71.1	117.8	205.9

*Applied a runoff coefficient correection factor of 1.25 to account for the increased saturation during large storm events

Erosion Assessment of the 3:1 slope for sheet flow from bioretention facility to Turtle Creek

	Area A1	
Area =	3140	m^2
Runoff Coefficient =	0.62	

Area	Runoff Coefficient	Method	Length (m)	Area (ha)	S (%)	T (min)
Area A1	0.62	Bransby	97.4	0.314	6.04	4.35

Time of Concentration	4.35	min		
100 Year Intensity	255.72	mm/hr		
100-year Peak Flow (uncontrolled)	173.89	L/s	0.174	m^3/s
Spillway Length =	47	m		
Weir Coefficient =	1.84			
Weir Equation:	$Q = C L H^{3/2}$			
H =	0.016	m		
Flow Area =	0.75	m^2		
Flow Velocity =	0.23	m/s		

Flow velocities do not exceed 1.5 m/s, therefore rip rap protection is not required. However as a precaution, 150mm diameter riprap with 300mm depth is proposed

Conveyance Capacity of Curb Cut Concrete Channel

Area A1

Area = 3140 m^2

Runoff Coefficient = 0.62

Area	Runoff Coefficient	Method	Length (m)	Area (ha)	S (%)	T (min)
Area A1	0.62	Bransby	97.4	0.314	6.04	4.35

Time of Concentration 4.35 min

100 Year Intensity 255.72 mm/hr

100-year Peak Flow (uncontrolled) 173.89 L/s 0.174 m^3/s

$Q = 1/n\ A\ R^{2/3}\ S^{1/2}$

Curb Cut width = 2.5 m

Area = 0.375 m^2

Mannings roughness = 0.013

Wetted Perimeter = 2.80 m

Hydraulic Radius = 0.13 m

Slope = 5.0%

Velocity = 4.51 m/s

Flow = 1.69 m^3/s

The curb cut concrete channel can convey 1.69m^3/s of flow which exceeds the 100 year flow of 0.174m^3/s from Area A1

Erosion Assessment of Curb Cut Concrete Channel Outlet

Determine velocity of flows for rip rap protection at curb cut outlet

Spillway Length =	2.5	m
Weir Coefficient =	1.84	
Weir Equation:	$Q = C\ L\ H^{3/2}$	
H =	0.113	m
Flow Area =	0.28	m^2
Flow Velocity =	0.62	m/s

Flow velocities do not exceed 1.5 m/s, therefore rip rap protection is not required. However as a precaution, 150mm diameter riprap with 300mm depth is proposed

Water Balance
Site: 0 Bernida Road, Mississauaga
March 23, 2020

Erosion Control / Waterbalance Volume Calculations

As per CVC LID Manual, the 5mm volume is required to be infiltrated throughout the development.

Drainage Area	Cover	Drainage Area (m^2)	Initial Abstraction (mm)	Initial Abstraction (m^3)	Additional Req. Runoff Volume to be Infiltrated (mm)	Additional Req. Runoff Volume to be Infiltrated (m^3)	Provided Bioretention Volume (m^3)	Total Volume Infiltrated (m^3)	Total Required Volume Infiltrated (mm)	% of Required 5mm Volume
Area A1, A2	Roof	618.65	0.0	0.0	5.0	3.1	11.6		1.9	
	Asphalt Driveway	209.52	0.0	0.0	5.0	1.0			0.6	
	Road	974.95	0.0	0.0	5.0	4.9			2.9	
	Grassed	2665.03	5.0	13.3	0.0	0.0			8.0	
	Total	4468.15	3.0	13.3	2.0	9.0	11.6	24.9	22.3	111%

ROAD HYDRAULIC FLOW CAPACITY

Road Checked: Bernida Road

ROW Width: 20m

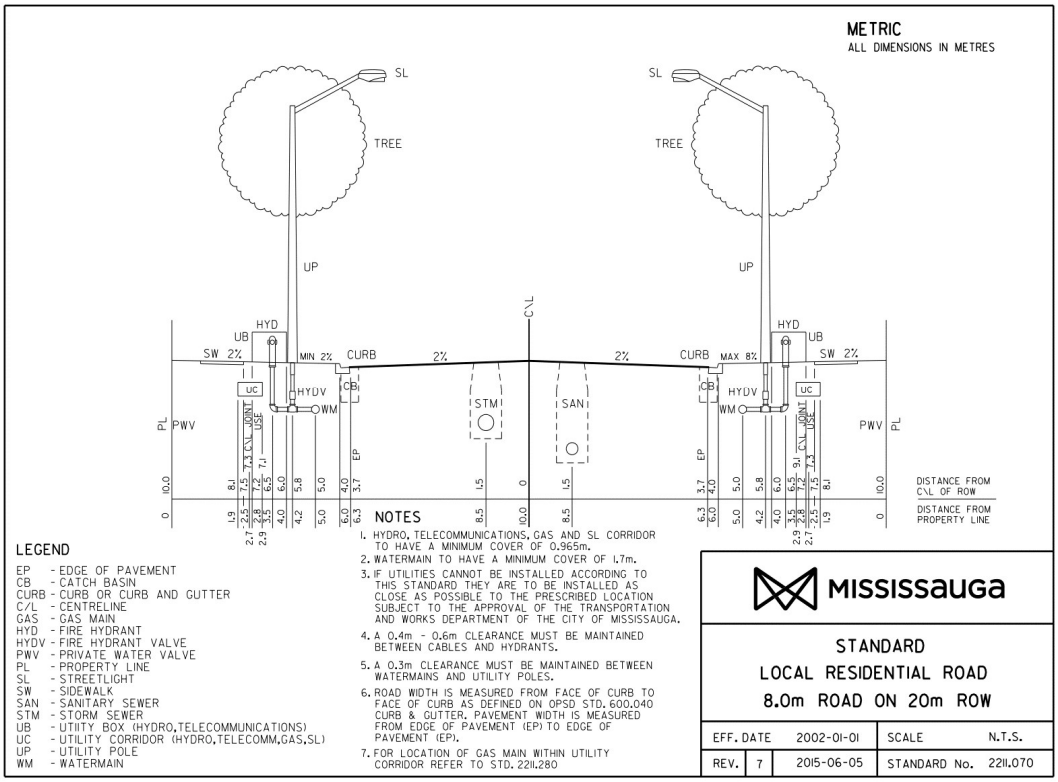
Notes: Capacity based on minimum Bernida Road Slope of 6% to experience most major drainage.
Future 100yr Peak Uncontrolled Flow 0.174m^3/s.

Top of Curb

Depth of Flow From Gutter (mm): 150

		Paved Area
Area -A	m^2	0.88
Wetted Perimeter	m	8.302
Hydraulic Radius -R	m	0.106
Mannings Roughness -n		0.013
R^2/3		0.224
k=(R^2/3)/n		17.229
V-=k*(S^0.5)		
Q=V*A		

Road Grade (%) Grade Step	S^0.5	0.1	V(m/s)	Q(m^3/s)
6.00	0.245		4.22	3.71
6.10	0.247		4.26	3.74
6.20	0.249		4.29	3.78
6.30	0.251		4.32	3.81
6.40	0.253		4.36	3.84
6.50	0.255		4.39	3.87
6.60	0.257		4.43	3.90
6.70	0.259		4.46	3.92
6.80	0.261		4.49	3.95
6.90	0.263		4.53	3.98
7.00	0.265		4.56	4.01



Climate Data								Pervious Area			Impervious Area		
Month	**Days in the month**	**Hours of Sunlight**	**Mean Temperature**	**Heat Index**	**Potential Evapo-transpiration ***	**Daylight Correction Value**	**Total Precipitation**	**Adjusted Potential Evapo-transpiration ##**	**Surplus**	**Deficit**	**Adjusted Potential Evapo-transpiration ****	**Surplus**	**Deficit**
			(T) #	**I**	**mm/month**		**mm**	**mm**	**mm**	**mm**	**mm**	**mm**	**mm**
January	31	9.9	-4.7	0.00	0.0	0.85	59.8	0.00	59.8	0.0	0.0	59.8	0.0
February	28	11	-3.9	0.00	0.0	0.86	46.7	0.00	46.7	0.0	0.0	46.7	0.0
March	31	12.5	0.1	0.00	0.3	1.08	54.4	0.32	54.1	0.0	0.3	54.1	0.0
April	30	14	6.4	1.45	28.4	1.17	65.2	33.14	32.1	0.0	26.5	38.7	0.0
May	31	15.3	12.3	3.91	58.2	1.32	73.9	76.69	0.0	2.8	61.4	12.5	0.0
June	30	16	17.7	6.78	86.8	1.33	71.0	115.76	0.0	44.8	92.6	0.0	21.6
July	31	15.6	20.9	8.72	104.2	1.34	75.8	139.98	0.0	64.2	112.0	0.0	36.2
August	31	14.4	20.1	8.22	99.8	1.24	78.3	123.79	0.0	45.5	99.0	0.0	20.7
September	30	12.9	15.6	5.60	75.6	1.08	73.5	81.24	0.0	7.7	65.0	8.5	0.0
October	31	11.4	9.3	2.56	42.8	0.98	70.0	42.04	28.0	0.0	33.6	36.4	0.0
November	30	10.2	4	0.71	17.0	0.85	79.3	14.41	64.9	0.0	11.5	67.8	0.0
December	31	9.5	-1.3	0.00	0.0	0.82	58.8	0.00	58.8	0.0	0.0	58.8	0.0
TOTAL	365			38.0	513.1		**807**	**627**	**344.3**	**165**	**501.9**	**383.3**	**79**

Notes

* PET = 16 [10 T / I]$^{\alpha}$

where, $\alpha = (675 * 10^{-9} * I^3) - (771 * 10^{-7} * I^2) + (1792 * 10^{-5} * I) + 0.49239 = 1.077$

Canadian Climate Normals 1981-2010 Station Data - Oakville Southeast WPCP -
https://climate.weather.gc.ca/climate_normals/results_1981_2010_e.html?searchType=stnProx&txtRadius=25&selCity=&selPark=&optProxType=custom&txtCentralLatDeg=43&txtCentralLatMin=31&txtCentralLatSec=25.23&txtCentralLongDeg=79&txtCentralLongMin=36&txtCentralLongSec=18.30&txtLatDecDeg=&txtLongDecDeg=&stnID=4846&dispBack=0

Pervious Surplus: 179.3 **mm**

Impervious Surplus: 304.8 **mm**

** Based on Adjusted PET x

Impervious Factor = 0.80

Water Balance Design Sheet		**Pre-Development**	
Site : Bernida Rd			
March 23, 2020		Area A1	
Catchment Parameter	**Units**	**Existing**	**Total**
Area	m^2	4468.2	4468.2
Pervious Area	m^2	4468.2	4468.2
Impervious Area	m^2	0.0	0.0
Infiltration Factors			
Topography		0.1	
Soil		0.1	
Land Cover		0.2	
MOE Infiltration Factor		0.40	
Actual Infiltration Factor		0.40	
Runoff Coefficient		0.25	
Runoff from Impervious Surfaces*		0%	
Inputs (per Unit Area)			
Precipitation	mm/yr	807	807
Run- on	mm/yr	0	0
Other	mm/yr	0	0
Total Inputs	mm/yr	807	807
Outputs (per Unit Area)			
Precipitation Surplus	mm/yr	179	179
Net Surplus	mm/yr	179	179
Total Evapotranspiration	**mm/yr**	**627**	**627**
Infiltration	mm/yr	72	72
Total Infiltration	**mm/yr**	**72**	**72**
Runoff Pervious Areas	mm/yr	108	108
Runoff Impervious Areas	mm/yr	0	0
Total Runoff	**mm/yr**	**108**	**108**
Total Outputs	**mm/yr**	**807**	**807**
Difference (input - output)	mm/yr	0	0
Inputs (Volumes)			
Precipitation	m^3/yr	3604	3604
Run-on	m^3/yr	0	0
Other Inputs	m^3/yr	0	0
Total Inputs	m^3/yr	3604	3604
Outputs (Volumes)			
Precipitation Surplus	m^3/yr	801	801
Net Surplus	m^3/yr	801	801
Total Evapotranspiration	**m^3/yr**	**2803**	**2803**
Infiltration	m^3/yr	321	321
Total Infiltration	**m^3/yr**	**321**	**321**
Runoff Pervious Areas	m^3/yr	481	481
Runoff Impervious Areas	m^3/yr	0	0
Total Runoff	**m^3/yr**	**481**	**481**
Total Outputs	**m^3/yr**	**3604**	**3604**
Difference (input - output)	m^3/yr	0	0

Water Balance Design Sheet		**Post Development**		
Site : Bernida Rd				
March 23, 2020		Area A1, A2	Area A1, A2	
Catchment Parameter	**Units**	**Pervious**	**Impervious**	**Total**
Area	m^2	2665.0	1803.1	4468.2
Pervious Area	m^2	2665.0	0.0	2665.0
Impervious Area	m^2	0.0	1803.1	1803.1
Infiltration Factors				
Topography		0.1	0.1	
Soil		0.1	0.1	
Land Cover		0.1	0.1	
MOE Infiltration Factor		0.30	0.30	
% Impervious		0%	100%	
Actual Infiltration Factor (% imp x MOE Factor)		0.30	0.00	
Inputs (per Unit Area)				
Precipitation	mm/yr	807	807	807
Run- on	mm/yr	0	0	0
Other	mm/yr	0	0	0
Total Inputs	mm/yr	807	807	807
Outputs (per Unit Area)				
Precipitation Surplus	mm/yr	179	305	230
Net Surplus	mm/yr	179	305	230
Total Evapotranspiration	**mm/yr**	**627**	**502**	**577**
Infiltration	mm/yr	54	0	32
Total Infiltration	**mm/yr**	**54**	**0**	**32**
Runoff Pervious Areas	mm/yr	126	0	75
Runoff Impervious Areas	mm/yr	0	305	123
Total Runoff	**mm/yr**	**126**	**305**	**198**
Total Outputs	**mm/yr**	**807**	**807**	**807**
Difference (input - output)	mm/yr	0	0	0
Inputs (Volumes)				
Precipitation	m^3/yr	2150	1455	3604
Run-on	m^3/yr	0	0	0
Other Inputs	m^3/yr	0	0	0
Total Inputs	m^3/yr	2150	1455	3604
Outputs (Volumes)				0
Precipitation Surplus	m^3/yr	478	550	1028
Net Surplus	m^3/yr	478	550	1028
Total Evapotranspiration	**m^3/yr**	**1672**	**905**	**2577**
Infiltration	m^3/yr	143	0	143
Total Infiltration	**m^3/yr**	**143**	**0**	**143**
Runoff Pervious Areas	m^3/yr	335	0	335
Runoff Impervious Areas	m^3/yr	0	550	550
Total Runoff	**m^3/yr**	**335**	**550**	**884**
Total Outputs	**m^3/yr**	**2150**	**1455**	**3604**
Difference (input - output)	m^3/yr	0	0	0

Water Balance Design Sheet		**Post Development with Mitigation**			
Site : Bernida Rd					
March 23, 2020		Area A1: to bioretention		Uncontrolled	
Catchment Parameter	**Units**	**Pervious**	**Impervious**	**Area A2**	**Total**
Area	m^2	1336.4	1803.1	1328.6	4468.2
Pervious Area	m^2	1336.4	0.0	1328.6	2665.0
Impervious Area	m^2	0.0	1803.1	0.0	1803.1
Infiltration Factors					
Topography		0.1	0.1	0.1	
Soil		0.1	0.1	0.1	
Land Cover		0.1	0.1	0.1	
MOE Infiltration Factor		0.30	0.30	0.30	
% Impervious		0%	100%	0%	
Actual Infiltration Factor (% imp x MOE Factor)		0.30	0.00	0.30	
Inputs (per Unit Area)					
Precipitation	mm/yr	807	807	807	807
Run- on	mm/yr	0	0	0	0
Other	mm/yr	0	0	0	0
Total Inputs	mm/yr	807	807	807	807
Outputs (per Unit Area)					
Precipitation Surplus	mm/yr	179	305	179	230
Net Surplus	mm/yr	179	305	179	230
Total Evapotranspiration	**mm/yr**	**627**	**502**	**627**	577
Infiltration	mm/yr	54	0	54	32
LID Infiltration	mm/yr	90	152	0	88
Total Infiltration	**mm/yr**	**143**	**152**	**54**	120
Runoff Pervious Areas	mm/yr	36	0	126	48
Runoff Impervious Areas	mm/yr	0	152	0	62
Total Runoff	**mm/yr**	**36**	**152**	**126**	110
Total Outputs	**mm/yr**	**807**	**807**	**807**	807
Difference (input - output)	mm/yr	0	0	0	0
Inputs (Volumes)					
Precipitation	m^3/yr	1078	1455	1072	3604
Run-on	m^3/yr	0	0	0	0
Other Inputs	m^3/yr	0	0	0	0
Total Inputs	m^3/yr	1078	1455	1072	3604
Outputs (Volumes)					
Precipitation Surplus	m^3/yr	240	550	238	1028
Net Surplus	m^3/yr	240	550	238	1028
Total Evapotranspiration	**m^3/yr**	**838**	**905**	**834**	**2577**
Infiltration	m^3/yr	72	0	71	143
LID Infiltration	m^3/yr	120	275	0	395
Total Infiltration	**m^3/yr**	**192**	**275**	**71**	**538**
Runoff Pervious Areas	m^3/yr	48	0	167	215
Runoff Impervious Areas	m^3/yr	0	275	0	275
Total Runoff	**m^3/yr**	**48**	**275**	**167**	**490**
Total Outputs	**m^3/yr**	**1078**	**1455**	**1072**	**3604**
Difference (input - output)	m^3/yr	0	0	0	**0**

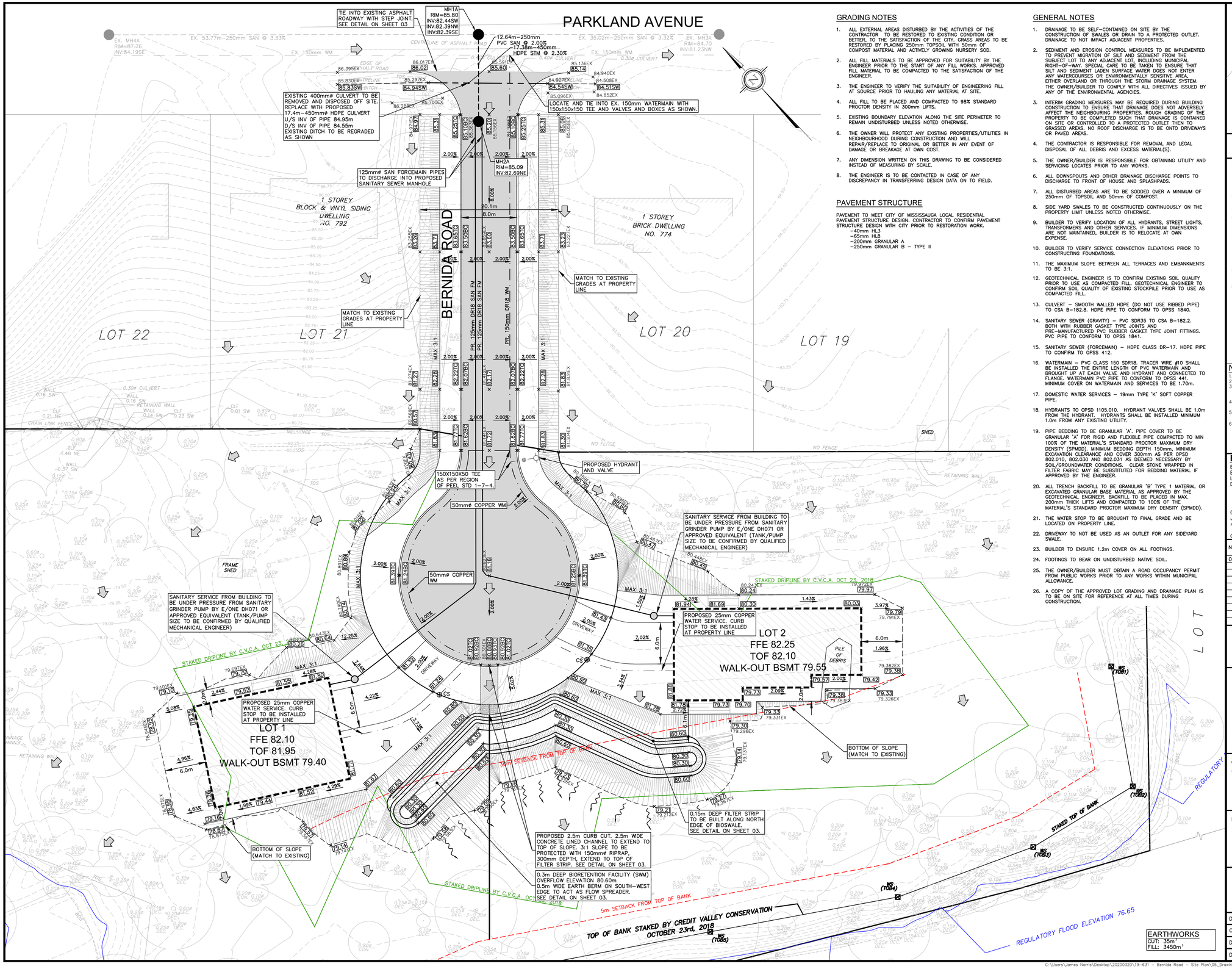
Water Balance Summary Sheet
Site : Bernida Rd

March 23, 2020

	Units	Pre-	Post-	Change	Post Development	Change (Pre- to Post-Mitigation)
Inputs (Volumes)						
Precipitation	m^3/yr	3604.5	3604.5	0%	3604.5	0%
Run-on	m^3/yr	0.0	0.0	0%	0.0	0%
Other Inputs	m^3/yr	0.0	0.0	0.0	0.0	0%
Total Inputs		**3604**	**3604**	0%	**3604**	0%
Outputs (Volumes)						
Precipitation Surplus	m^3/yr	801.3	1027.5	28%	1027.5	28%
Net Surplus	m^3/yr	801.3	1027.5	28%	1027.5	28%
Total Evapotranspiration	**m^3/yr**	2803.2	2576.9	-8%	2576.9	-8%
Infiltration	m^3/yr	320.5	143.4	-55%	143.4	-55%
LID Infiltration	m^3/yr	0.0	0.0	0%	394.6	0%
Total Infiltration	**m^3/yr**	**320.5**	**143.4**	-55%	**538.0**	68%
Runoff Pervious Areas	m^3/yr	480.8	334.5	-30%	214.7	-55%
Runoff Impervious Areas	m^3/yr	0.0	549.6	0%	6.0	0%
Total Runoff	**m^3/yr**	**480.8**	**884.1**	84%	**489.5**	2%
Total Outputs	**m^3/yr**	3604.5	3604.5	0%	3604.5	0%

APPENDIX G

Drawings



GRADING NOTES

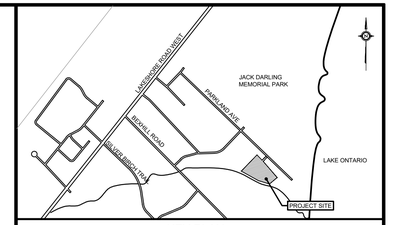
1. ALL EXTERNAL AREAS DISTURBED BY THE ACTIVITIES OF THE CONTRACTOR TO BE RESTORED TO EXISTING CONDITION OR BETTER, TO THE SATISFACTION OF THE CITY. GRASS AREAS TO BE RESTORED BY PLACING 250mm TOPSOIL WITH 50mm OF COMPOST MATERIAL AND ACTIVELY GROWING NURSERY SOD.
2. ALL FILL MATERIALS TO BE APPROVED FOR SUITABILITY BY THE ENGINEER PRIOR TO THE START OF ANY FILL WORKS. APPROVED FILL MATERIAL TO BE COMPACTED TO THE SATISFACTION OF THE ENGINEER.
3. THE ENGINEER TO VERIFY THE SUITABILITY OF ENGINEERING FILL AT SOURCE PRIOR TO HAULING ANY MATERIAL AT SITE.
4. ALL FILL TO BE PLACED AND COMPACTED TO 98% STANDARD PROCTOR DENSITY IN 300mm LIFTS.
5. EXISTING BOUNDARY ELEVATION ALONG THE SITE PERIMETER TO REMAIN UNDISTURBED UNLESS NOTED OTHERWISE.
6. THE OWNER WILL PROTECT ANY EXISTING PROPERTIES/UTILITIES IN NEIGHBOURHOOD DURING CONSTRUCTION AND WILL REPAIR/REPLACE TO ORIGINAL OR BETTER IN ANY EVENT OF DAMAGE OR BREAKAGE AT OWN COST.
7. ANY DIMENSION WRITTEN ON THIS DRAWING TO BE CONSIDERED INSTEAD OF MEASURING BY SCALE.
8. THE ENGINEER IS TO BE CONTACTED IN CASE OF ANY DISCREPANCY IN TRANSFERRING DESIGN DATA ON TO FIELD.

PAVEMENT STRUCTURE

PAVEMENT TO MEET CITY OF MISSISSAUGA LOCAL RESIDENTIAL PAVEMENT STRUCTURE DESIGN. CONTRACTOR TO CONFIRM PAVEMENT STRUCTURE DESIGN WITH CITY PRIOR TO RESTORATION WORK.
- –40mm HL3
- –65mm HL8
- –200mm GRANULAR A
- –250mm GRANULAR B – TYPE II

GENERAL NOTES

1. DRAINAGE TO BE SELF-CONTAINED ON SITE BY THE CONSTRUCTION OF SWALES OR DRAIN TO A PROTECTED OUTLET. DRAINAGE TO NOT IMPACT ADJACENT PROPERTIES.
2. SEDIMENT AND EROSION CONTROL MEASURES TO BE IMPLEMENTED TO PREVENT MIGRATION OF SILT AND SEDIMENT FROM THE SUBJECT LOT TO ANY ADJACENT LOT, INCLUDING MUNICIPAL RIGHT-OF-WAY. SPECIAL CARE TO BE TAKEN TO ENSURE THAT SILT AND SEDIMENT LADEN SURFACE WATER DOES NOT ENTER ANY WATERCOURSES OR ENVIRONMENTALLY SENSITIVE AREA, EITHER OVERLAND OR THROUGH THE STORM DRAINAGE SYSTEM. THE OWNER/BUILDER TO COMPLY WITH ALL DIRECTIVES ISSUED BY ANY OF THE ENVIRONMENTAL AGENCIES.
3. INTERIM GRADING MEASURES MAY BE REQUIRED DURING BUILDING CONSTRUCTION TO ENSURE THAT DRAINAGE DOES NOT ADVERSELY AFFECT THE NEIGHBOURING PROPERTIES. ROUGH GRADING OF THE PROPERTY TO BE COMPLETED SUCH THAT DRAINAGE IS CONTAINED ON SITE OR CONTROLLED TO A PROTECTED OUTLET THEN TO GRASSED AREAS. NO ROOF DISCHARGE IS TO BE ONTO DRIVEWAYS OR PAVED AREAS.
4. THE CONTRACTOR IS RESPONSIBLE FOR REMOVAL AND LEGAL DISPOSAL OF ALL DEBRIS AND EXCESS MATERIAL(S).
5. THE OWNER/BUILDER IS RESPONSIBLE FOR OBTAINING UTILITY AND SERVICING LOCATES PRIOR TO ANY WORKS.
6. ALL DOWNSPOUTS AND OTHER DRAINAGE DISCHARGE POINTS TO DISCHARGE TO FRONT OF HOUSE AND SPLASHPADS.
7. ALL DISTURBED AREAS ARE TO BE SODDED OVER A MINIMUM OF 250mm OF TOPSOIL AND 50mm OF COMPOST.
8. SIDE YARD SWALES TO BE CONSTRUCTED CONTINUOUSLY ON THE PROPERTY LIMIT UNLESS NOTED OTHERWISE.
9. BUILDER TO VERIFY LOCATION OF ALL HYDRANTS, STREET LIGHTS, TRANSFORMERS AND OTHER SERVICES. IF MINIMUM DIMENSIONS ARE NOT MAINTAINED, BUILDER IS TO RELOCATE AT OWN EXPENSE.
10. BUILDER TO VERIFY SERVICE CONNECTION ELEVATIONS PRIOR TO CONSTRUCTING FOUNDATIONS.
11. THE MAXIMUM SLOPE BETWEEN ALL TERRACES AND EMBANKMENTS TO BE 3:1.
12. GEOTECHNICAL ENGINEER IS TO CONFIRM EXISTING SOIL QUALITY PRIOR TO USE AS COMPACTED FILL. GEOTECHNICAL ENGINEER TO CONFIRM SOIL QUALITY OF EXISTING STOCKPILE PRIOR TO USE AS COMPACTED FILL.
13. CULVERT – SMOOTH WALLED HDPE (DO NOT USE RIBBED PIPE) TO CSA B-182.8. HDPE PIPE TO CONFORM TO OPSS 1840.
14. SANITARY SEWER (GRAVITY) – PVC SDR35 TO CSA B-182.2. BOTH WITH RUBBER GASKET TYPE JOINTS AND PRE-MANUFACTURED PVC RUBBER GASKET TYPE JOINT FITTINGS. PVC PIPE TO CONFORM TO OPSS 1841.
15. SANITARY SEWER (FORCEMAIN) – HDPE CLASS DR-17. HDPE PIPE TO CONFIRM TO OPSS 412.
16. WATERMAIN – PVC CLASS 150 SDR18. TRACER WIRE #10 SHALL BE INSTALLED THE ENTIRE LENGTH OF PVC WATERMAIN AND BROUGHT UP AT EACH VALVE AND HYDRANT AND CONNECTED TO FLANGE. WATERMAIN PVC PIPE TO CONFORM TO OPSS 441. MINIMUM COVER ON WATERMAIN AND SERVICES TO BE 1.70m.
17. DOMESTIC WATER SERVICES – 19mm TYPE 'K' SOFT COPPER PIPE.
18. HYDRANTS TO OPSD 1105.010. HYDRANT VALVES SHALL BE 1.0m FROM THE HYDRANT. HYDRANTS SHALL BE INSTALLED MINIMUM 1.0m FROM ANY EXISTING UTILITY.
19. PIPE BEDDING TO BE GRANULAR 'A'. PIPE COVER TO BE GRANULAR 'A' FOR RIGID AND FLEXIBLE PIPE COMPACTED TO MIN 100% OF THE MATERIAL'S STANDARD PROCTOR MAXIMUM DRY DENSITY (SPMDD). MINIMUM BEDDING DEPTH 150mm, MINIMUM EXCAVATION CLEARANCE AND COVER 300mm AS PER OPSD 802.010, 802.030 AND 802.031 AS DEEMED NECESSARY BY SOIL/GROUNDWATER CONDITIONS. CLEAR STONE WRAPPED IN FILTER FABRIC MAY BE SUBSTITUTED FOR BEDDING MATERIAL IF APPROVED BY THE ENGINEER.
20. ALL TRENCH BACKFILL TO BE GRANULAR 'B' TYPE 1 MATERIAL OR EXCAVATED GRANULAR BASE MATERIAL AS APPROVED BY THE GEOTECHNICAL ENGINEER. BACKFILL TO BE PLACED IN MAX. 200mm THICK LIFTS AND COMPACTED TO 100% OF THE MATERIAL'S STANDARD PROCTOR MAXIMUM DRY DENSITY (SPMDD).
21. THE WATER STOP TO BE BROUGHT TO FINAL GRADE AND BE LOCATED ON PROPERTY LINE.
22. DRIVEWAY TO NOT BE USED AS AN OUTLET FOR ANY SIDEYARD SWALE.
23. BUILDER TO ENSURE 1.2m COVER ON ALL FOOTINGS.
24. FOOTINGS TO BEAR ON UNDISTURBED NATIVE SOIL.
25. THE OWNER/BUILDER MUST OBTAIN A ROAD OCCUPANCY PERMIT FROM PUBLIC WORKS PRIOR TO ANY WORKS WITHIN MUNICIPAL ALLOWANCE.
26. A COPY OF THE APPROVED LOT GRADING AND DRAINAGE PLAN IS TO BE ON SITE FOR REFERENCE AT ALL TIMES DURING CONSTRUCTION.



KEY PLAN
N.T.S.

LEGEND

EXISTING		PROPOSED	
MH1A	SANITARY MANHOLE	MH1A	SANITARY MANHOLE
HYD&V	FIRE HYDRANT	HYD&V	FIRE HYDRANT
VB	VALVE & BOX	VB	VALVE & BOX
	SANITARY SEWER		STORM SEWER
	WATERMAIN		SANITARY SEWER (GRAVITY)
	EASEMENT		SANITARY SEWER (FORCEMAIN)
	RIGHT OF WAY		WATERMAIN
	LOT LINE	CS	WATER SERVICE WITH CURB STOP
	FENCE LINE		LIMIT OF SUBJECT PROPERTY
	EDGE OF PAVEMENT		RIGHT OF WAY
x265.22EX	ELEVATION		EDGE OF PAVEMENT
	BUILDING	x265.22	ELEVATION
	RETAINING WALL	2.00%	GRADED SLOPE
	MAJOR CONTOUR LABEL		PONDING FACILITY (MAX 3:1 SLOPE)
	MINOR CONTOUR LABEL		OVERLAND FLOW
	TREE		

NOTES

1. ALL DIMENSIONS ARE IN METRES UNLESS OTHERWISE NOTED.
2. CONTOUR INTERVAL IS 0.25m.
3. ALL DIMENSIONS SHALL BE CHECKED AND VERIFIED IN THE FIELD BY THE CONTRACTOR PRIOR TO ANY CONSTRUCTION, AND ANY DISCREPANCIES SHALL BE REPORTED IMMEDIATELY TO THE ENGINEER.
4. ALL WORK SHALL BE IN ACCORDANCE WITH CURRENT CITY OF MISSISSAUGA STANDARD SPECIFICATIONS AND DRAWINGS UNLESS OTHERWISE NOTED HEREIN.
5. ORDER OF PRECEDENCE OF STANDARDS DRAWINGS IS FIRSTLY CITY OF MISSISSAUGA, AND SECONDLY ONTARIO PROVINCIAL STANDARD DRAWINGS (OPSD).
6. THE CONTRACTOR TO BE RESPONSIBLE FOR LOCATION OF ALL EXISTING U/G AND OVERHEAD UTILITIES. CONTRACTOR IS REQUIRED TO OBTAIN ALL LOCATIONS & NOTIFY THE VARIOUS UTILITY COMPANIES 72 HOURS PRIOR TO THE COMMENCEMENT OF ANY WORK. THE CITY OF MISSISSAUGA AND CONSULTANT ASSUMES NO RESPONSIBILITY FOR THE ACCURACY OF THE LOCATIONS OF EXISTING UTILITIES AS INDICATED ON THIS DRAWING.

BENCHMARK

BENCHMARK No. 710
ELEVATION = 93.663m
LOCATION: CITY OF MISSISSAUGA
DESCRIPTION:

COMPLETED BY:
J. H. GELBLOOM SURVEYING LIMITED – ONTARIO LAND SURVEYORS
476 MORDEN ROAD, UNIT 102, OAKVILLE, ON L6K 3W4 (905) 336-8210

COMPLETED ON: JANUARY 20, 2019

NO.	REVISION	DATE	BY	APPROVED
01	ISSUED FOR APPROVAL	2020/03/25	E.G.	

Greck
5770 Highway 7, Woodbridge, Ontario, L4L 1T8 www.greck.ca

LICENSED PROFESSIONAL ENGINEER
March 25, 2020
E. J. GRECK
100068911
PROVINCE OF ONTARIO

CLIENT NAME:
GEORGE PACLIK

PROJECT NAME:

BERNIDA ROAD SUBDIVISION

0 BERNIDA ROAD MISSUSSAUGA, ON

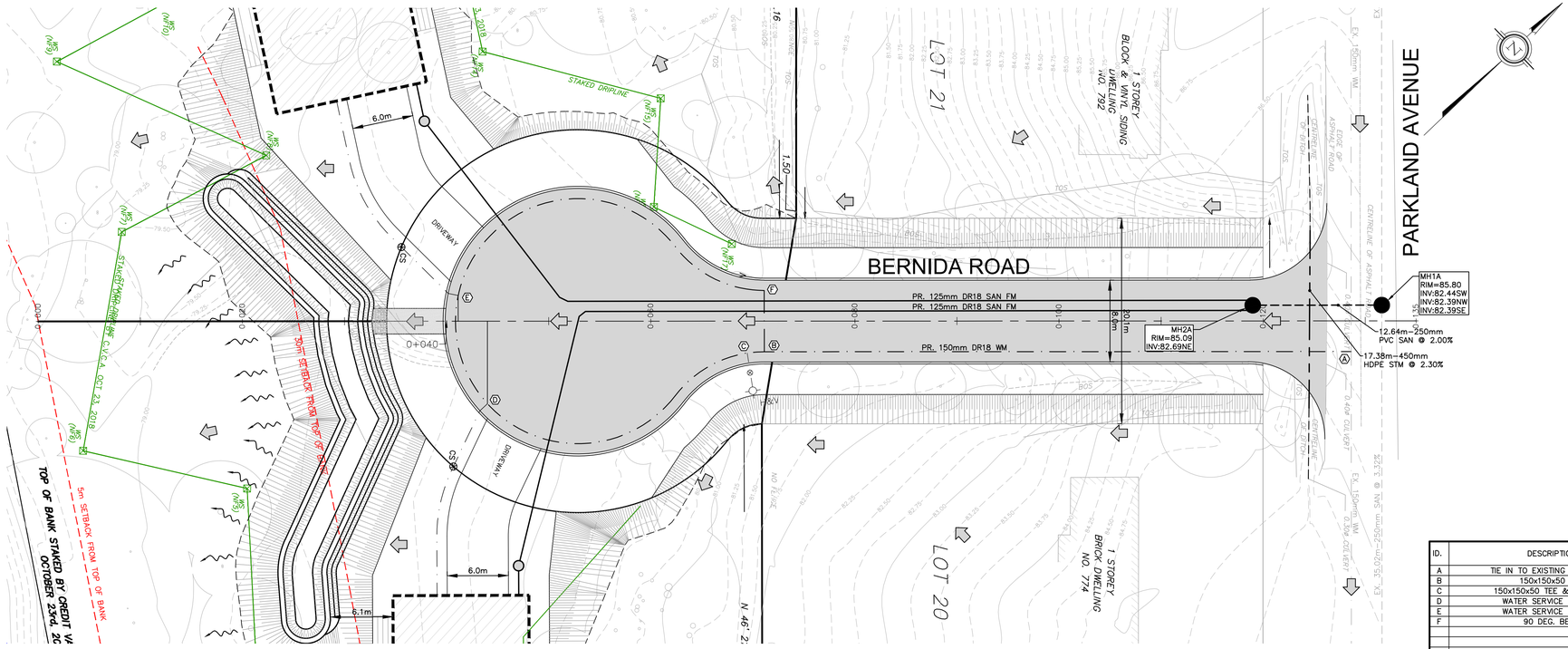
SITE SERVICING AND GRADING PLAN

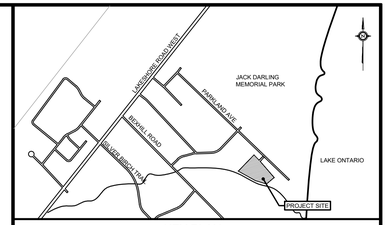
DESIGNED BY:	J.N.	SCALES:	
CHECKED BY:	E.G.	HORIZONTAL:	1:250
DRAWN BY:	J.N.	VERTICAL:	
DATE:	MAR 20, 2020	SHEET SIZE:	24"x36"

PROJECT No. 19-631
DRAWING No. C1
SHEET No. 01

C:\Users\James Norris\Desktop\20200320\19-631 – Bernida Road – Site Plan\05_Drawings\CAD\19-631_BASE.dwg

Date Plotted: Mar 21, 2020 – 1:41 PM





KEY PLAN
N.T.S.

LEGEND

EXISTING		PROPOSED	
MH1A	SANITARY MANHOLE	MH1A	SANITARY MANHOLE
HYD&V	FIRE HYDRANT	HYD&V	FIRE HYDRANT
VB	VALVE & BOX	VB	VALVE & BOX
	SANITARY SEWER		STORM SEWER
	WATERMAIN		SANITARY SEWER (GRAVITY)
	EASEMENT		SANITARY SEWER (FORCEMAIN)
	RIGHT OF WAY		WATERMAIN
	LOT LINE	CS	WATER SERVICE WITH CURB STOP
	FENCE LINE		LIMIT OF SUBJECT PROPERTY
	EDGE OF PAVEMENT		RIGHT OF WAY
x 265.22EX	ELEVATION		EDGE OF PAVEMENT
	BUILDING	x265.22	ELEVATION
	RETAINING WALL	2.00%	GRADED SLOPE
	MAJOR CONTOUR LABEL		PONDING FACILITY (MAX 3:1 SLOPE)
	MINOR CONTOUR LABEL		OVERLAND FLOW
	TREE		

ID.	DESCRIPTION	STATION	ELEV. TOP
A	TIE IN TO EXISTING WATERMAIN	0+128.6	83.93
B	150x150x50 TEE	0+071.1	79.96
C	150x150x50 TEE & HYDRANT	0+069.5	79.94
D	WATER SERVICE LATERAL	0+044.0	79.39
E	WATER SERVICE LATERAL	0+041.1	79.27
F	90 DEG. BEND	0+071.1	79.96

NOTES

1. ALL DIMENSIONS ARE IN METRES UNLESS OTHERWISE NOTED.
2. CONTOUR INTERVAL IS 0.25m.
3. ALL DIMENSIONS SHALL BE CHECKED AND VERIFIED IN THE FIELD BY THE CONTRACTOR PRIOR TO ANY CONSTRUCTION, AND ANY DISCREPANCIES SHALL BE REPORTED IMMEDIATELY TO THE ENGINEER.
4. ALL WORK SHALL BE IN ACCORDANCE WITH CURRENT CITY OF MISSISSAUGA STANDARD SPECIFICATIONS AND DRAWINGS UNLESS OTHERWISE NOTED HEREIN.
5. ORDER OF PRECEDENCE OF STANDARDS DRAWINGS IS FIRSTLY CITY OF MISSISSAUGA, AND SECONDLY ONTARIO PROVINCIAL STANDARD DRAWINGS (OPSD).
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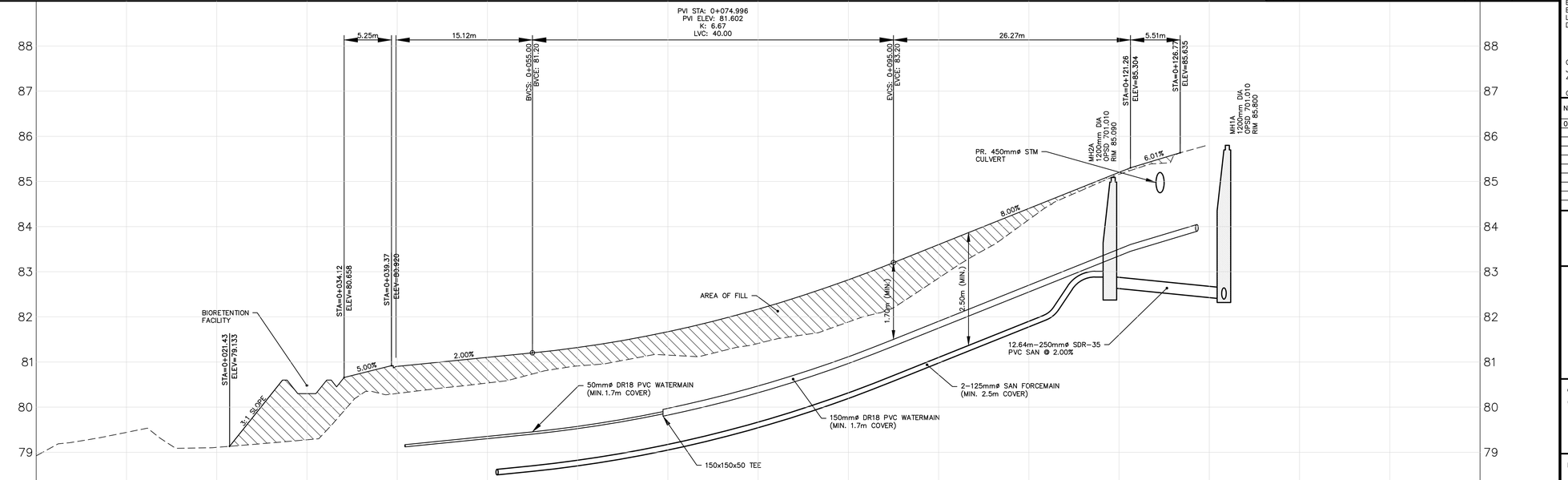
BENCHMARK

BENCHMARK No. 710
ELEVATION = 93.663m
LOCATION: CITY OF MISSISSAUGA
DESCRIPTION:

COMPLETED BY:
J. H. GELBLOOM SURVEYING LIMITED – ONTARIO LAND SURVEYORS
476 MORDEN ROAD, UNIT 102, OAKVILLE, ON L6K 3W4 (905) 336-8210

COMPLETED ON: JANUARY 20, 2019

NO.	REVISION	DATE	BY	APPROVED
01	ISSUED FOR APPROVAL	2020/03/25	E.G.	



STORM INVERT							STORM INVERT
SANITARY INVERT							SANITARY INVERT
PROPOSED GRADE	PR. 79.133 CB (m)	PR.80.90 CB (0.60m)	PR.81.32 CB (0.41m)	PR.82.17 CB (0.76m)	PR.83.60 CB (0.74m)	PR.85.20 CB (0.04m)	PROPOSED GRADE
℄ CHAINAGE	0+020	0+040	0+060	0+080	0+100	0+120	℄ CHAINAGE

Greck
5770 Highway 7, Woodbridge, Ontario, L4L 1T8

LICENSED PROFESSIONAL ENGINEER
March 25, 2020
E. J. GRECK
100048911
PROVINCE OF ONTARIO

CLIENT NAME:
GEORGE PACLIK

PROJECT NAME:

BERNIDA ROAD SUBDIVISION

0 BERNIDA ROAD MISSUSSAUGA, ON

ROADWORKS PLAN AND PROFILE

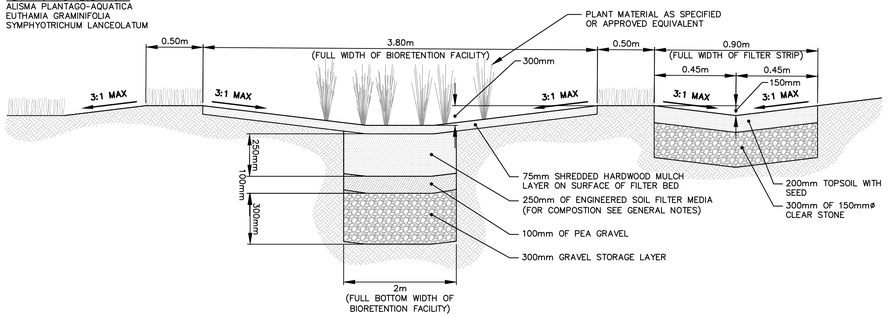
DESIGNED BY:	J.N.	SCALES:	
CHECKED BY:	E.G.	HORIZONTAL:	1:250
DRAWN BY:	J.N.	VERTICAL:	1:50
DATE:	MAR 20, 2020	SHEET SIZE:	24"x36"

PROJECT No. 19-631
DRAWING No. C2
SHEET No. 02

C:\Users\James Norris\Desktop\20200320\19-631 – Bernida Road – Site Plan\05_Drawings\CAD\19-631_BASE.dwg

Date Plotted: Mar 21, 2020 – 1:41 PM

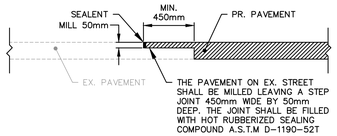
PLANTING AND VEGETATION:
ALISMA PLANTAGO-AQUATICA
EUTHAMIA GRAMINIFOLIA
SYMPHYOTRICHUM LANCEOLATUM



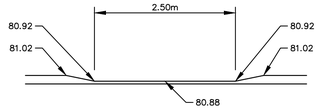
BIORETENTION PONDING FACILITY DETAIL
N.T.S.

BIORETENTION PONDING FACILITY

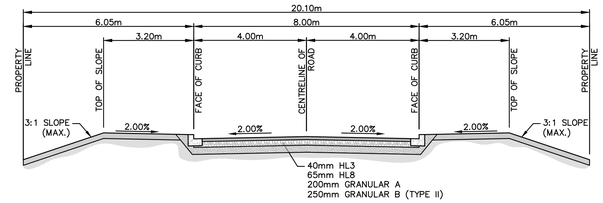
1. INSTALLATION ONLY TO BEGIN AFTER CONTRIBUTING DRAINAGE AREA HAS BEEN STABILIZED OR FLOWS HAVE BEEN SAFELY ROUTED AROUND THE AREA.
2. *GRAVEL STORAGE LAYER:* 300mm THICK STORAGE LAYER TO BE WASHED 50mm DIAMETER CLEAR STONE
3. *PEA GRAVEL CHOKING LAYER:* 100mm THICK CHOKING LAYER TO BE WASHED 3mm TO 10mm DIAMETER CLEAR STONE
4. *ENGINEERED SOIL COMPOSITION.*
   250mm THICK FILTER MIXTURES TO CONTAIN:
   - 85 TO 88% SAND
   - 8 TO 12% SOIL FINES
   - 3 TO 5% ORGANIC MATTER IN FORM OF LEAF COMPOST
   - FOR FURTHER INFORMATION OF FILTER MEDIA SEE: LOW IMPACT DEVELOPMENT STORMWATER MANAGEMENT PLANNING AND DESIGN GUIDE, Version 1, 2010.
5. *MULCH:* 75mm MULCH LAYER IS TO COMPRISE OF SHREDDED HARDWOOD BARK
6. NO HEAVY TRAFFIC OR CONSTRUCTION EQUIPMENT TO BE ALLOWED WITHIN THE BIOSWALE LIMITS TO PREVENT COMPACTION OF NEWLY INSTALLED MATERIALS.
7. THE BOTTOM OF THE FACILITY IS TO BE EXCAVATED TO GRADE FOR ANY SEDIMENT THAT MAY HAVE BUILT UP DURING CONSTRUCTION.
8. PLANT SPECIES SELECTED AS PER TABLE 3.2.7 OF THE T.R.C.A. LID LANDSCAPE DESIGN GUIDE



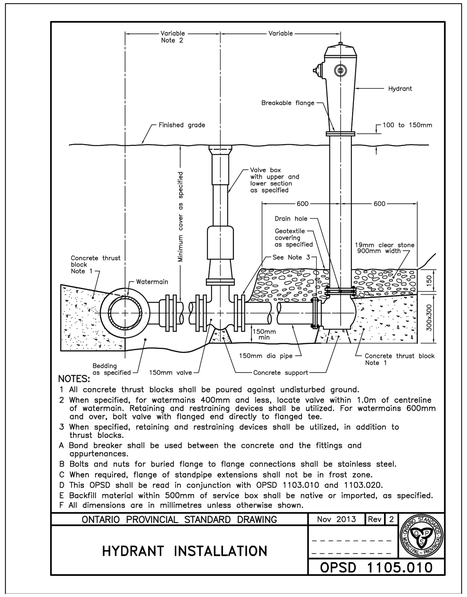
TYPICAL STEP JOINT DETAIL
N.T.S.



CURB CUT
N.T.S.

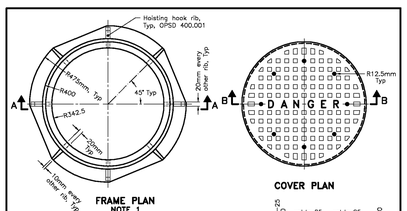


TYPICAL ROAD SECTION
N.T.S.



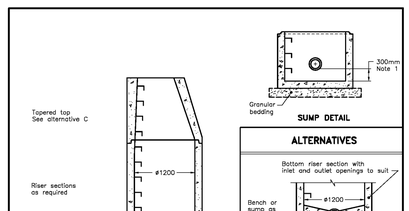
NOTES:
1 All concrete thrust blocks shall be poured against undisturbed ground.
2 When specified, for watermains 400mm and less, locate valve within 1.0m of centreline of watermain. Retaining and restraining devices shall be utilized. For watermains 600mm and over, bolt valve with flanged end directly to flanged tee.
3 When specified, retaining and restraining devices shall be utilized, in addition to thrust blocks.
A Bond breaker shall be used between the concrete and the fittings and appurtenances.
B Bolts and nuts for buried flange to flange connections shall be stainless steel.
C When required, flange of standpipe extensions shall not be in frost zone.
D This OPSD shall be read in conjunction with OPSD 1103.010 and 1103.020.
E Backfill material within 500mm of service box shall be native or imported, as specified.
F All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2013	Rev 2
HYDRANT INSTALLATION		OPSD 1105.010



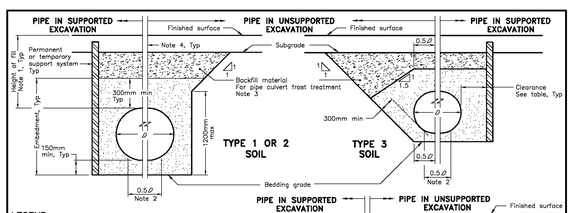
NOTE:
1 As an option, frame may be completely round.
A All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2013	Rev 3
CAST IRON, CIRCULAR FRAME WITH CIRCULAR 745mm COVER FOR MAINTENANCE HOLES		OPSD 401.020



NOTES:
1 The sump is measured from the lowest invert.
A Granular backfill shall be placed to a minimum thickness of 300mm all around the maintenance hole.
B Precast concrete components shall be according to OPSD 701.030, 701.031, or 701.032.
C Structure exceeding 5.0m in depth shall include safety platform according to OPSD 404.020.
D Pipe support according to OPSD 708.020.
E For benching and pipe opening details, see OPSD 701.021.
F For adjustment unit and frame installation, see OPSD 704.010.
G All dimensions are nominal.
H All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2014	Rev 5
PRECAST CONCRETE MAINTENANCE HOLE 1200mm DIAMETER		OPSD 701.010

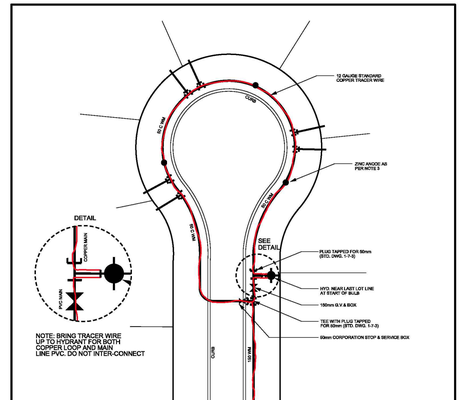


LEGEND:
Ø – Inside diameter

NOTES:
1 Height of fill is measured from the finished surface to top of pipe.
2 The pipe bed shall be compacted and shaped to receive the bottom of the pipe.
3 Pipe culvert frost treatment shall be according to OPSD 803.030 and 803.031.
4 Condition of excavation is symmetrical about centreline of pipe.
A Granular material placed in the haunch area shall be compacted prior to placing and compacting the remainder of the embedment material.
B Soil types as defined in the Occupational Health and Safety Act and Regulations
C All dimensions are in metres unless otherwise shown.

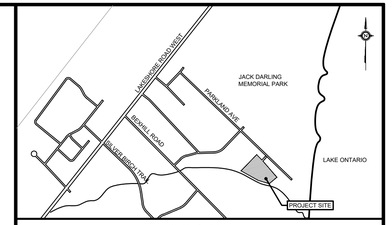
CLEARANCE TABLE	
Pipe Inside Diameter mm	Clearance mm
900 or less	300
Over 900	500

ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2014	Rev 3
FLEXIBLE PIPE EMBEDMENT AND BACKFILL EARTH EXCAVATION		OPSD 802.010



NOTE
1. PROVIDE 25mm DIA. SERVICE FOR LOTS.
2. FOR OFFSET OF WATERMAIN FROM STREET LINE, REFER TO THE LOCAL MUNICIPALITIES RELEVANT STANDARD CROSS-SECTION.
3. ZINC ANODE (2.10.24) TO BE INSTALLED AS PER OPSS.442 - CONSTRUCTION SPECIFICATION FOR CORROSION PROTECTION OF NEW AND EXISTING WATERMAINS, AT 16m INTERVAL SPACING.

Region of Peel working with you	PUBLIC WORKS STANDARD DRAWING	REV. DATE: APRIL 2018
TYPICAL 50mm WATERMAIN ON CUL-DE-SAC	APPROVED BY E.G. / DRAWN BY AINLEY GROUP, TJ	
	STD. DWG. NUMBER 1-7-4 / SCALE N.T.S.	



KEY PLAN
N.T.S.

NOTES
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BENCHMARK No. 710
ELEVATION = 93.663m
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DESCRIPTION:

COMPLETED BY:
J. H. GELBLOOM SURVEYING LIMITED – ONTARIO LAND SURVEYORS
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COMPLETED ON: JANUARY 20, 2019

NO.	REVISION	DATE	BY	APPROVED
01	ISSUED FOR APPROVAL	2020/03/25	E.G.	

Greck
5770 Highway 7, Woodbridge, Ontario, L4L 1T8 www.greck.ca

LICENSED PROFESSIONAL ENGINEER
March 25, 2020
E. J. GRECK
100048911
PROVINCE OF ONTARIO

CLIENT NAME:
GEORGE PACLIK

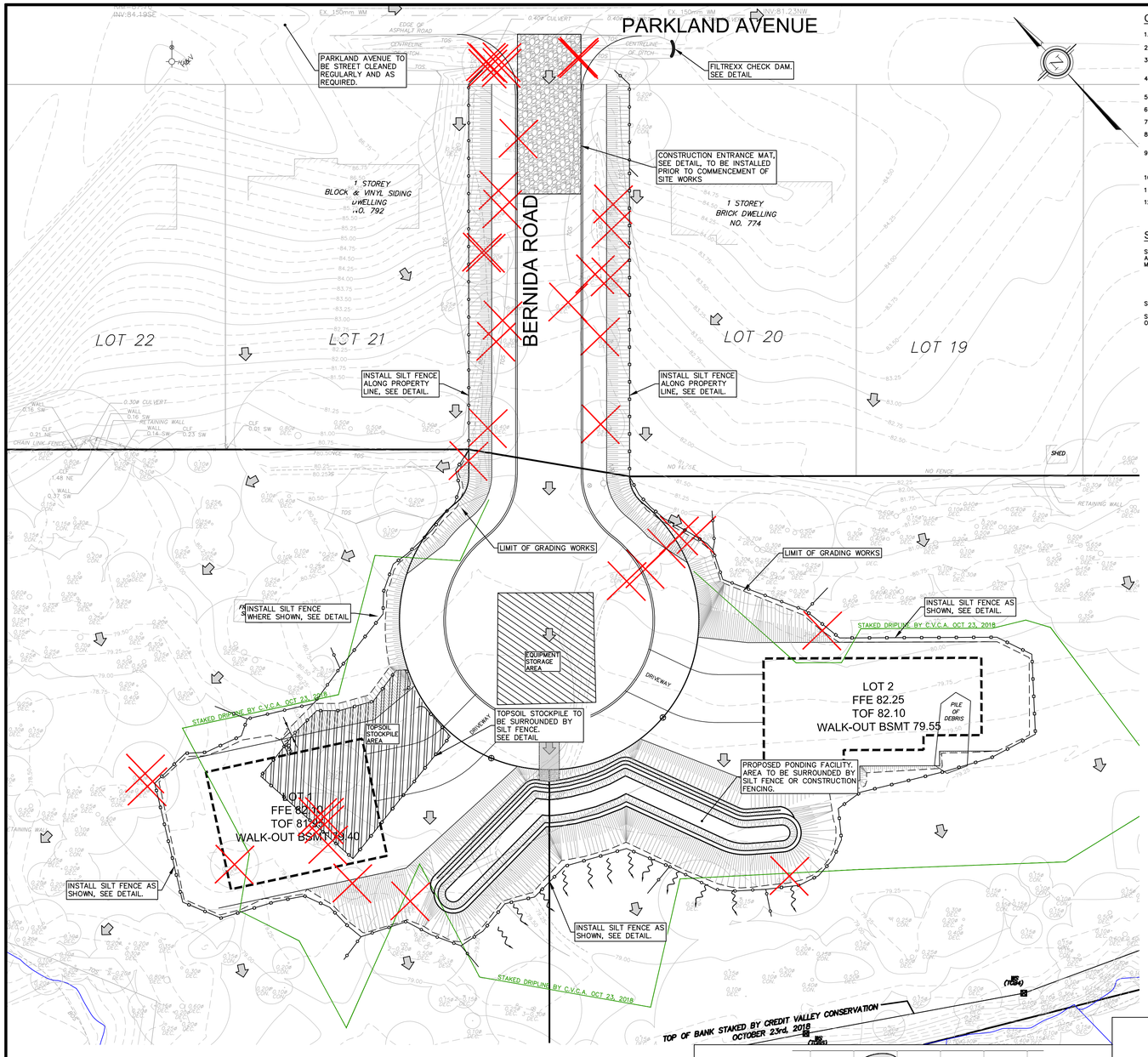
PROJECT NAME:

BERNIDA ROAD SUBDIVISION

0 BERNIDA ROAD MISSUSSAUGA, ON

DETAILS

DESIGNED BY: J.N.	SCALES:	PROJECT No.	19-631
CHECKED BY: E.G.	HORIZONTAL:	DRAWING No.	C3
DRAWN BY: J.N.	VERTICAL:	SHEET No.	03
DATE: MAR 20, 2020	SHEET SIZE: 24"x36"		



CONSTRUCTION STAGING NOTES

1. INSTALLATION OF CONSTRUCTION MUD MAT.
2. SILT/SEDIMENT FENCING TO BE INSTALLED WHERE SHOWN.
3. CLEARING, GRUBBING, AND REMOVALS. TOPSOIL TO BE STORED ON SITE WHERE SHOWN AND SURROUNDED BY SILT FENCING.
4. INSTALLATION OF WATERMAIN PIPE AND APPURTENANCES AND SANITARY SEWER FORCEMAINS.
5. PROPOSED ROADWAY GRADING WORKS TO BE COMPLETED.
6. CONSTRUCT PROPOSED BIORETENTION PONDING FACILITY.
7. INSTALLATION OF ASPHALT ROADWAY BASECOAT.
8. ALL EXPOSED EARTH TO BE RESTORED BY PLACING 250mm TOPSOIL WITH 50mm OF COMPOST MATERIAL AND ACTIVELY GROWING NURSERY SOD.
9. REMOVE CONSTRUCTION MUD MAT AND CONSTRUCT PROPOSED GRAVITY SANITARY SEWER WORK, INSTALLATION OF HDPE STORM CULVERT TO BE COMPLETED AT THIS TIME IN CONJUNCTION WITH SANITARY SEWER WORKS.
10. INSTALLATION OF ASPHALT ROADWAY TOP COAT.
11. DISTURBED AREAS TO BE RETURNED TO EXISTING CONDITIONS OR BETTER.
12. REMOVAL OF ALL TEMPORARY EROSION AND SEDIMENT CONTROL MEASURES.

SEED MIXTURE

SEED MIXTURE TO BE AS SPECIFIED INT HE CONTRACT DOCUMENTS AND TO BE APPROVED BY THE ENGINEER PRIOR TO ANY HAND-SEEDING OR BLOWN MULCHING.

- 50% KENTUCKY BLUEGRASS
- 40% FINE FESCUES
- 10% PERENNIAL RYEGRASS

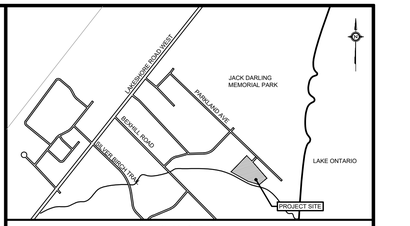
SEED AT A RATE OF 25Kg/ha

SMALL AREAS OF FAILURE MUST BE RE-SEEDED PROMPTLY. IF LARGE AREAS OF FAILURE OCCUR, THE METHOD OF SEEDING SHOULD BE RE-EVALUATED.

EROSION AND SEDIMENT CONTROL NOTES

THE FOLLOWING EROSION AND SEDIMENT CONTROL (ESC) MEASURES ARE TO BE READ IN CONJUNCTION WITH GRECK GRADING PLAN AND IN ACCORDANCE WITH THE EROSION AND SEDIMENT CONTROL GUIDELINES FOR URBAN CONSTRUCTION, CITY OF MISSISSAUGA, PEEL REGION, AND C.V.C.A.

1. THE CONTRACTOR IS TO PROVIDE CITY OF MISSISSAUGA, REGION OF PEEL, AND C.V.C.A. WITH 48 HOURS ADVANCE NOTICE PRIOR TO INITIATION OF CONSTRUCTION.
2. ALL SEDIMENT CONTROL MEASURES SUCH AS SEDIMENT CONTROL FENCE, CONSTRUCTION MUDMATS, SEDIMENT TRAPS, SWALES AND CHECK DAMS MUST BE INSTALLED PRIOR TO THE COMMENCEMENT OF SITE WORKS.
3. COFFER DAM AND PUMPS TO BE IMPLEMENTED WHERE NECESSARY.
4. SEDIMENT CONTROLS SHOULD BE INSPECTED ON A REGULAR BASIS AND AFTER EVERY SIGNIFICANT RAINFALL EVENT. ALL DAMAGED ESC MEASURES WILL BE REPAIRED AND/OR REPLACED AS REQUIRED WITHIN 48 HOURS OF INSPECTION TO THE SATISFACTION OF THE REGION OF PEEL, THE CITY OF MISSISSAUGA, AND THE C.V.C.A.
5. ADDITIONAL MATERIALS SUCH AS CLEAR STONE, FILTER FABRIC, HOSES AND SILTSOXX TO BE KEPT ONSITE AT ALL TIMES FOR CONDUCTING REPAIRS TO SEDIMENT CONTROL MEASURES.
6. ALL DISTURBED AREAS LEFT INACTIVE FOR MORE THAN THIRTY DAYS ARE TO BE STABILIZED WITH GRASS SEED OR SOD.
7. THE STABILIZATION SEED MIXTURE IS TO BE APPLIED AT A MINIMUM RATE OF 25KG/HA USING TERRASEED. SEE SEED MIX TABLE ON THIS SHEET, OR APPROVED EQUIVALENT.
8. ENGINEERED MODIFICATIONS TO THE ESC PLAN MAY BE NEEDED AS SITE CONDITIONS CHANGE THROUGHOUT THE CONSTRUCTION PROCESS. THESE UPDATES MUST REFLECT BEST MANAGEMENT PRACTICES TO CONTROL SEDIMENT AND EROSION ONSITE AND SHOULD BE COMPLETED BASED ON DIRECTION FROM THE SITE ENGINEER. ADDITIONAL MEASURES MAY BE REQUIRED AS DIRECTED BY THE ENGINEER THROUGHOUT THE CONSTRUCTION PROCESS.
9. TEMPORARY SEDIMENT TRAP(S) ARE TO BE CONSTRUCTED AT THE BEGINNING OF SITE GRADING AND IF THE SITE DRAINAGE CHANGES DURING CONSTRUCTION. IT MAY BE NECESSARY FOR TEMPORARY SWALES TO BE CONSTRUCTED TO DIRECT SITE FLOWS TO THE TEMPORARY SEDIMENT TRAP(S) DURING ROUGH GRADING AND AS CONSTRUCTION PROGRESSES.
10. IF STOCKPILES ARE USED ON-SITE FOR THE STORAGE OF EXCESS MATERIAL, THEY ARE TO BE SURROUNDED BY SILT FENCE, SEE DETAIL THIS SHEET. ALL EXCAVATED MATERIAL IS TO BE DRIED AS REQUIRED AND TRANSPORTED FROM THE SITE. SOIL DRYING LOCATIONS TO BE SURROUNDED WITH SILT FENCE, SEE DETAIL THIS SHEET.
11. ANY DEWATERING OCCURRING ON SITE MUST BE IN ACCORDANCE WITH AN APPROVED DEWATERING PLAN. ADDITIONAL DEWATERING REQUIREMENTS MAY BE DEEMED NECESSARY AND SHALL BE IMPLEMENTED AS DIRECTED BY THE ENGINEER, CONTRACT ADMINISTRATOR OR LOCAL MUNICIPALITY.
12. PARKLAND AVENUE TO BE STREET CLEANED REGULARLY AND AS REQUIRED.
13. DUST CONTROL MEASURES ARE TO BE UNDERTAKEN AS NECESSARY, WATER TRUCK MUST BE AVAILABLE AT ALL TIMES.
14. AN APPROVED SPILLS MANAGEMENT PLAN IS TO BE KEPT ONSITE.
15. SPILL CLEANUP EQUIPMENT SUCH AS ABSORPTIVE MEDIA IS TO BE MAINTAINED ONSITE FOR IMMEDIATE USE IN THE EVENT OF A SPILL
16. SPILLS ARE TO BE REPORTED IMMEDIATELY TO THE M.O.E. SPILLS ACTION CENTRE AT 1-800-268-6060.
17. THE CONTRACTOR WILL BE RESPONSIBLE FOR CLEAN-UP AND RESTORATION, INCLUDING ALL COSTS, DUE TO THE RELEASE OF SEDIMENT FROM THE SITE.
18. ADDITIONAL SEDIMENT CONTROL DEVICES MAY BE DEEMED NECESSARY AND AS SITE CONDITIONS CHANGE AND SHALL BE INSTALLED AS DIRECTED BY THE SITE ENGINEER, CONTRACT ENGINEER, CITY OF MISSISSAUGA, REGION OF PEEL, C.V.C.A., OR M.O.E.
19. ALL TEMPORARY ESC TO BE REMOVED FROM SITE AFTER THE COMPLETION OF ALL EARTHWORKS AND STABILIZATION (VEGETATION) OF EXPOSED SOILS



KEY PLAN

N.T.S.

LEGEND

EXISTING		PROPOSED	
MH1A	SANITARY MANHOLE	MH1A	SANITARY MANHOLE
HYD&V	FIRE HYDRANT	HYD&V	FIRE HYDRANT
VB	VALVE & BOX	VB	VALVE & BOX
	CURB STOP		CURB STOP
	EASEMENT		LIMIT OF SUBJECT PROPERTY
	RIGHT OF WAY		RIGHT OF WAY
	LOT LINE		LOT LINE
	FENCE LINE		FENCE LINE
	CURB/SIDEWALK		CURB/SIDEWALK
	BUILDING		BUILDING
	RETAINING WALL		SILT FENCE/SILTSOXX
	MAJOR CONTOUR LABEL		OVERLAND FLOW
	MINOR CONTOUR LABEL		CONSTRUCTION MUD-MAT
			TREE REMOVAL
			FILTREXX CHECK DAM

NOTES

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BENCHMARK No. 710
ELEVATION = 93.663m
LOCATION: CITY OF MISSISSAUGA
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COMPLETED BY:
J. H. GELBLOOM SURVEYING LIMITED – ONTARIO LAND SURVEYORS
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COMPLETED ON: JANUARY 20, 2019

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01	ISSUED FOR APPROVAL	2020/03/25	E.G.	

Greck
5770 Highway 7, Woodbridge, Ontario, L4L 1T8 www.greck.ca

LICENSED PROFESSIONAL ENGINEER
March 25, 2020
E.J. GRECK
100089317
PROVINCE OF ONTARIO

CLIENT NAME:
GEORGE PACLIK

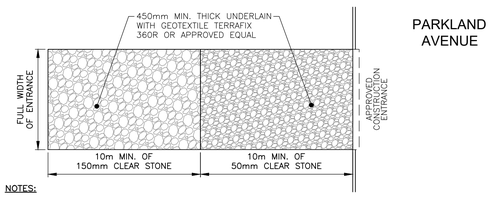
PROJECT NAME:

BERNIDA ROAD SUBDIVISION

0 BERNIDA ROAD MISSUSSAUGA, ON

EROSION SEDIMENT CONTROL PLAN AND DETAILS

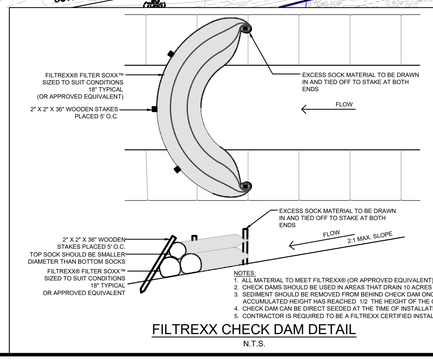
DESIGNED BY:	J.N.	SCALES:		PROJECT No.	19-631
CHECKED BY:	E.G.	HORIZONTAL:	1:300	DRAWING No.	C4
DRAWN BY:	J.N.	VERTICAL:	N/A	SHEET No.	04
DATE:	MAR 20, 2020	SHEET SIZE:	24"x36"		



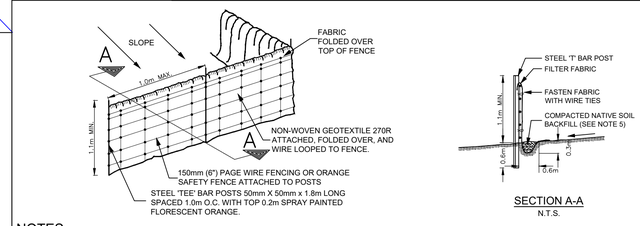
NOTES:

1. GRANULAR MATERIAL IS TO BE CLEAN APPROVED MATERIAL AND PLACED AT NOTED DIMENSIONS PRIOR TO LAND DISTURBANCE.
2. GEOTEXTILE IS TO BE UNDERLAIN OVER THE ENTIRE AREA PRIOR TO STONE PLACEMENT.
3. MAINTENANCE – THE ENTRANCE SHALL BE MAINTAINED IN A CONDITION WHICH WILL REDUCE TRACKING OR FLOWING OF SEDIMENT ONTO R.O.W. AND GRANULAR MATERIAL IS TO BE REPLACED AS WARRANTED OR DIRECTED BY THE SITE ENGINEER.

CONSTRUCTION MUDMAT DETAIL
N.T.S.



FILTREXX CHECK DAM DETAIL
N.T.S.



SECTION A-A
N.T.S.

NOTES

1. SILT CONTROL FENCE SHOULD BE ALIGNED WITH CONTOURS FOR SHEET OVERLAND FLOW.
2. SILT/SEDIMENT CONTROL FENCE IS TO LOCATED IN AREAS OF LOW SEDIMENT YIELD ON SLOPES THAT CONFORM TO MTO DRAINAGE MANUAL VOLUME 2 'CHART F4–3C TOPOGRAPHIC FACTOR LS BASED ON SLOPE LENGTH AND GRADIENT.'
3. SILT/SEDIMENT CONTROL FENCE SHALL BE INSTALLED WITH FILTER MEDIA FABRIC TOED INTO THE SOIL A MIN. OF 300mm BY EITHER STATIC SLICING OR TRENCH METHODS WITH COMPACTION OF TRENCH MATERIAL MEETING 95% STANDARD PROCTOR DENSITY.
4. STEEL 'T' BAR POSTS ARE TO BE SPACED MAX. 1.0m ON CENTER.
5. ALL DIMENSIONS ARE IN METRES UNLESS OTHERWISE SHOWN.
6. GEOTEXTILE FABRIC TO BE COMPRISED OF NON–WOVEN U.V. STABILIZED MATERIAL. FABRIC TO BE FOLDED OVER TOP OF FENCE MIN. 300mm AND WIRE FASTENED.

SEDIMENT CONTROL FENCE DETAIL
N.T.S.