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983 Yonge Street

FUNCTIONAL SERVICING & PRELIMINARY STORMWATER MANAGEMENT

Little Lake Communities Inc.

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Issue	Date	Description
0	June 25, 2024	Draft - Client Review
1	August 13, 2024	Final Report

Document Contents

Tables

Figures

Appendices

1 Introduction

Tatham Engineering Limited was retained by Little Lake Communities Inc. to prepare a Functional Servicing (FS) and Preliminary Stormwater Management (SWM) Report in support of obtaining an Official Plan amendment (OPA) and Zoning By-law amendment (ZBA) for a residential development located at 983 Yonge Street in the Town of Midland (Town). A Traffic Impact Study prepared by Tatham is submitted under separate cover.

1.1 EXISTING SITE CONDITIONS

The overall development site is approximately 4.274ha in size and is currently identified as "Natural Heritage" in the Official Plan and is zoned as Residential R1-H. The site is bound by existing residential properties to the north and east, wetland and Little Lake to the south and additional residential and undeveloped lands to the west. The site is currently vacant with heavy vegetation coverage throughout.

The site is relatively flat with gentle grading in the northern section adjacent to Yonge Street transitioning to steep grades toward the south. Drainage within the development lands is generally conveyed south to the existing wetland and Little Lake.

The site is located within a Significant Groundwater Recharge Area (SGRA) with approximately one third of the property at its southern limit identified as being within a Highly Vulnerable Aquifer (HVA). The site is located within the outermost band of a Wellhead Protection Area (WHPA) but is not located within an Intake Protection Zone (IPZ). Drainage from the site is conveyed to Little Lake, which is within the Midland Bay watershed and the service area of the Severn Sound Environmental Association (SSEA). The site location is illustrated on Figure 1.

1.2 FUTURE DEVELOPMENT CONCEPT

The conceptual design of the development will include extension of Russ Howard Drive to the west across the development parcel to its western limit. A new proposed road will bisect the site in a north to south direction connecting Russ Howard Drive to Yonge Street. At this preliminary stage, the extension of these roadways will allow for the development of the following:

- Two apartment blocks, each containing 43 units;
- 29 Townhouse units;
- 14 semi-detached residential dwellings; and
- 8 single family residential dwellings.

Municipal servicing is proposed through connections to existing infrastructure within Yonge Street and Russ Howard Drive while drainage and SWM will be provided through new infrastructure within the proposed roadways and a new surface outlet near the southern limit of the development parcel. Preliminary design drawings for the development are appended to this report.

1.3 BACKGROUND INFORMATION

Several guidelines, background reports and studies relating to municipal services in the area were utilized in preparation of this report as follows:

- Water Supply for Public Fire Protection (Fire Underwriters Survey, 2020);
- Design Guidelines for Drinking Water Systems (MECP, 2008);
- Design Guidelines for Sewage Works (MECP, 2008);
- Design Criteria for Sewage Works, Storm Sewers and Forcemains for Alterations Authorized under Environmental Compliance Approvals (MECP, 2022);
- Fire Hydrants: Installation, Field Testing and Maintenance, 5th edition, AWWA;
- Town of Midland Engineering Development Design Standards, (2024);
- Town of Midland Wastewater Master Plan, (2021) and
- Stormwater Management Planning and Design Manual, (Ministry of the Environment, 2003).

2 Existing Site Servicing

Municipal servicing for the proposed development will be provided through extension of existing services on Russ Howard Drive or connection to existing municipal services on Yonge Street. The following provides a brief description of existing services and approximations of capacities.

2.1 SANITARY SEWAGE INFRASTRUCTURE

2.1.1 Russ Howard Drive

Connection for the proposed development to the existing 250 mm diameter sanitary sewer on Russ Howard Drive is provided through a maintenance hole (MH) structure located at the common property line between the development and terminal end of the roadway. The sewers collect and convey sewage from the adjacent residential development to the sewage pumping station (SPS) located at 415 Russ Howard Drive. The existing sewers have a full flow capacity of approximately 42.0 L/s and were initially designed to service approximately 13.4 ha of future development lands to the west of the site which include the proposed development.

The SPS collects sewage flows from existing residential developments on Keller Drive, Russ Howard Drive, Jordeli Lane, Stollar Place, Cornell Drive, Shewfelt Crescent, Sarah Boulevard and Jane Boulevard. Sewage is pumped to the existing sanitary sewer on Yonge Street via a 150 mm diameter forcemain on Russ Howard Drive. Equipped with a total of three pumps, the SPS has a firm capacity of 23 L/s with Peak capacity of 34 L/s. In the Town's Wastewater Master Plan, it is estimated peak flows entering the pump station, coincident with a 100-year storm event reach 28 L/s with minimal changes to flows and service area in the future. No capacity concerns with the station are identified in this report. Sanitary sewer design sheets calculating estimated peak sewage flows within the development are provided in Appendix B.

2.1.2 Yonge Street

The trunk sewer on Yonge Street consists of a 450 mm diameter pipe at 1.6% along the frontage of the proposed development and 1.4% downstream of the discharge point for the SPS on Russ Howard Drive. The existing sewers have a full flow capacity of approximately 337 L/s in this location. Capacity constraints in the Yonge Street sanitary sewer are identified in the post 2041 growth condition near the intersections of Len Self Boulevard and Leitz Road however, alternatives for rehabilitation, upgrades and re-routing are anticipated to be completed prior to 2041 to alleviate these constraints. No capacity constraints are identified in the immediate vicinity of the development site. The sanitary sewer design sheets in Appendix B include estimates of peak sewage flows in the Yonge Street sewer conveyed from the existing SPS.

2.2 WATER SERVICING INFRASTRUCTURE

Water service on both Yonge Street and Russ Howard Drive is currently provided through existing 150 mm diameter, PVC watermains maintained by the Town. Recent hydrant testing completed in close proximity to the site alongside flow test data provided by the Town indicate fire flows between 150 L/s and 190 L/s are achievable at a residual pressure of 140 kPa. A summary of the test results is provided in Table 1 while a calculation summary is provided in Appendix C.

Table 1: Fire Hydrant Flow Data Summary

LOCATION	STATIC PRESSURE KPA (PSI)	RESIDUAL PRESSURE KPA (PSI)	FLOW RATE L/S (GPM)	
			MEASURED	ESTIMATED MAX.
958 Yonge Street & 384 Keller Drive	579 (84)	517 (75)	51 (813)	148 (2,345)
958 Yonge Street & 384 Keller Drive	579 (84)	441 (64)	91 (1,444)	171 (2,706)
424 Russ Howard Drive & Rear of 404 Keller Drive	462 (67)	434 (63)	51 (813)	194 (3,075)
424 Russ Howard Drive & Rear of 404 Keller Drive	462 (67)	372 (54)	91 (1,444)	182 (2,890)
VLA Development (Cook Drive)	586 (85)	448 (65)	85 (1,353)	161 (2,557)
VLA Development (Cook Drive)	586 (85)	448 (65)	89 (1,404)	167 (2,653)

Watermain pressures are understood to be relatively high in the area with a static pressure of approximately 580 kPa observed in flow testing on Yonge Street and 460 kPa on Russ Howard Drive. Existing pressure reducing valves (PRV's) are noted on both Keller Drive and Russ Howard Drive to maintain pressures in the downgradient watermain within typical maximum thresholds. It is anticipated a similar device will also be required within the proposed development parcel.

3 Proposed Sanitary Sewers

3.1 PIPE SIZES AND LAYOUT

Sewage conveyance within the proposed development will be provided with 200 mm diameter sanitary sewers on the new roadway. The sewers within the extension of Russ Howard Drive will be maintained at 250 mm diameter to ensure capacity is maintained for potential future developments to the west. Each of the individual single family, semi-detached and townhome units will be provided with individual 125 mm diameter service connections with cleanouts provided at the property line. For the apartment blocks, each will be provided with a minimum 150 mm diameter service stub.

Connections to existing municipal infrastructure will be completed in two locations. A new sewer servicing only the two proposed apartment blocks is proposed to be directly connected to the sanitary sewer on Yonge Street. The remainder of the development will be serviced through the extension of existing sewage infrastructure on Russ Howard Drive. This configuration is intended to minimize the impact the higher density components of the development could have on the existing pump station.

3.2 DESIGN FLOWS

Conceptual peak sewage flows for the development are calculated by applying the population and unit flow rate parameters as described in the Town's Engineering Design Standards and Wastewater Master Plan. The applicable standards are generally summarized below:

- Unit flow rate of 450 L/person/day (Town Standards);
- Alternate unit flow rate of 300 L/person/day (Wastewater Master Plan);
- Occupancy of 3.0, 2.5 and 2.0 people per unit for single family, townhome and apartment dwellings respectively;
- Peaking factor calculated using the Harmon Equation;
- Inflow and infiltration of 0.23 L/s; and
- Population of 50 people/hectare for future development lands.

For the purposes of this review, the unit flow rate in the Town Standards is applied in assessing potential capacity constraints within the local gravity sewers while the unit flow rate presented in the Wastewater Master Plan is applied in assessing the SPS and receiving infrastructure on Yonge Street.

3.3 IMPACTS TO EXISTING INFRASTRUCTURE AND PLANNED GROWTH

As previously indicated, the design of the SPS on Russ Howard Drive included 13.4 ha of future development lands. For comparison with the proposed development, this area is included in design calculations for existing sewage flows and reduced, through development of the site, in proposed calculations. These calculations are summarized on a total of four sanitary sewer design sheets included in Appendix B to allow comparison between existing and proposed conditions at both 300 L/person/day and 450 L/person/day. It is noted the total development area decreases from 31.0 ha in existing condition to 30.84 ha in proposed condition on the design sewer design sheets. This is due to a portion of the development site associated with the proposed SWM controls being excluded from the sanitary sewer drainage area.

For ease of reference, key sewage flow information from the design sheets is also provided in Table 2 for comparison.

Table 2: Sewage Flow Summary

SCENARIO	FUTURE EXTERNAL DEVELOPMENT (L/s)	DEVELOPMENT SITE (L/s)		SPS INLET (L/s)	SPS OUTLET (Yonge St.) (L/s)
		To Yonge	To SPS		
Existing 300 L/p/day	12.2	N/A	N/A	23.7	23.7
Existing 450 L/p/day	16.7	N/A	N/A	32.0	32.0
Proposed 300 L/p/day	8.9	2.8	2.3	22.6	25.4
Proposed 450 L/p/day	12.3	4.0	3.2	30.5	34.5

Based on the above, the proposed development configuration will reduce sewage flows to the SPS compared with the existing future development estimates. The reduction is approximately 4.6% for both flow conditions. This is achieved through providing a direct gravity service connection for the high-density blocks to Yonge Street, as demonstrated by the increase in sewage flows in the Yonge Street trunk sewer at the SPS outlet. Under the most conservative figures, this will result in a peak sewage flow increase of 2.5 L/s in the Yonge Street sewer system compared with the previous estimates associated with the adjacent development and SPS.

While the proposed development does represent an increase in peak flow in the trunk sewer infrastructure, it is anticipated this will have minimal impact on the timing or scope of the planned 2041 capacity upgrades.

4 Proposed Water Supply and Distribution

4.1 WATER DEMAND

Water demand for the development was calculated in conformance with the Town of Midland Design Criteria and MECP design guidelines based upon the following parameters and conditions:

- Minimum system pressure of 275 kPa (40 psi) during normal (Average day to Peak flow) conditions;
- Minimum system pressure of 140 kPa (20 psi) during maximum day demand plus fire flow;
- Maximum system static pressure of 700 kPa (101.5 psi);
- Residential water demand of 450 L/person/day;
- Occupancy rates consisting of:
  - 3.0 people per unit for single family and semi-detached dwellings;
  - 2.5 people per unit for Townhouse dwellings; and
  - 2.0 people per unit for apartment dwellings.
- Maximum day factor of at least 2.0;
- Peak hour factor of at least 4.5.

4.1.1 Domestic Service Demands

Apartment Blocks

Average daily domestic demand for each apartment building was calculated to be 0.5 L/s based on the criteria above. Applying the minimum peaking factors per the Town design standards establishes a maximum day demand of 1.0 L/s and peak hour demand of 2.25 L/s. Interpolating peaking factors per Table 3-3 of the MECP design guidelines results in a maximum day demand of 3.50 L/s and peak hour demand of 5.30 L/s.

Full Development

When considering the development as a whole, an average population density of 2.75 people per unit was calculated to coincide with the total population of 325 people. This population corresponds with an average daily demand of 1.69 L/s. Applying the minimum peaking factors per the Town design standards results in a maximum day demand of 3.39 L/s and peak hour demand of 7.62 L/s. Interpolating peaking factors from Table 3-3 of the MECP design guidelines results in a maximum day demand of 5.92 L/s and peak hour demand of 8.97 L/s.

Supporting calculations for the domestic demands are provided in Appendix C.

4.1.2 Fire Protection

Preliminary flows for fire fighting were estimated based on the Fire Underwriters Survey, 2020 (FUS). As detailed building plans are not available, conservative building construction methodologies and floor areas were used to calculate preliminary fire flow requirements as provided below. Supporting calculations are provided in Appendix C.

Apartment Block

Presuming a Type IVB – Mass Timber construction for the apartment block with no sprinkler protection, a fire fighting demand of 150 L/s is calculated when no measures to reduce the demand are considered.

Measures to reduce the fire demand to 83 L/s are recommended recognizing the size of existing infrastructure and requirement for a pressure reducing valve which will limit reverse flow in the watermain at its inlet connection. This reduction can be achieved through the implementation of a fully supervised water sprinkler system to the Type IVB construction, but alternatives may also include alternate construction materials (non-combustible, Type IVA Mass Timber, etc.) or protection of all vertical openings per the National Building Code (NBC).

Townhouse Blocks

The townhouse blocks are anticipated to comply with ordinary construction as described in the FUS. Utilizing townhouse block number 5 as the worst case, due to size and proximity to other dwellings, a fire demand of 183 L/s is calculated.

Recognizing the townhomes will require stepped foundations due to the prevailing grade, it is recommended every two units be separated with a vertical firewall with 2-hour rating. This allows every two units to be considered as separate buildings with adjacent units having no exposure charge provided there are no openings in the firewall. Providing this firewall reduces the fire demand to 100 L/s.

Semi-Detached Dwellings

The semi-detached dwellings are considered to consist of ordinary construction as described in the FUS. Considering the entire building as a single entity, a fire flow demand of 117 L/s is anticipated. Should the common wall between the two dwellings consist of a 2-hour fire separation, this demand is reduced to 100 L/s.

Single Family Dwellings

The single family dwellings were also considered to consist of ordinary construction as described in the FUS. Based on this conservative assumption, a fire fighting demand of 100 L/s is calculated.

4.2 PROPOSED WATER SYSTEM

4.2.1 Watermains

Water servicing within the development is proposed to consist of 150 mm diameter watermain. Extending from the existing terminus of the watermain on Russ Howard Drive, the new watermain will extend up the proposed Street A with connection to the existing watermain on Yonge Street through either a live tap or cutting a new valve into the existing municipal watermain. A short section of watermain extending along the proposed terminus of Russ Howard Drive will be terminated with a valve and hydrant to facilitate future extension into the adjacent development lands.

Based on anticipated maximum day demand and fire flow calculations, the 150 mm diameter watermain will be capable of conveying approximately 106 L/s with velocity of 3.0 m/s where the flow can be drawn from two directions simultaneously. Where flow in only one direction is possible (apartment blocks) the proposed watermain would be capable of conveying a combined maximum day demand and fire flow of 86 L/s with resultant velocity of 4.9 m/s.

In accordance with the recent update to Town standards, and recognizing proposed medium to high density occupancies proposed within the development, fire hydrants are proposed with minimum separation of 90 m.

4.2.2 Pressure Reducing Valve

Recognizing existing high pressures in the watermain on Yonge Street, prevailing grade of the site and existing pressure reducing valves on Keller Drive and Russ Howard Drive, a pressure reducing valve (PRV) will also be required for the proposed development. The preliminary location of the PRV is the common lot line between the apartment blocks and the townhouse blocks for ease of access and to minimize potential for conflict along property frontages.

Based on preliminary grading of the road, the elevation of the watermain will be approximately 220.00 m. Preliminary calculations indicate pressure in the watermain will reach 657 kPa (95 psi) at this location, approaching the maximum 690 kPa (100 psi) recommended under typical best practice. With the PRV reducing pressures to 344 kPa (50 psi) at this location, system pressure on Russ Howard Drive at the bottom of the site is calculated to be approximately 477 kPa (69 psi) which is consistent with the pressures observed in the fire flow test results.

While the updated Town standards require a maximum pressure of 550 kPa (80 psi), the proposed configuration is proposed as an exception to this requirement recognizing its conformance with existing conditions in vicinity of the site.

4.2.3 Service Connections

Each single-family dwelling and each unit in semi-detached dwellings and townhome parcels will be provided with individual water services. For these dwellings, the minimum 25 mm diameter service size noted in Town standards will be sufficient for providing domestic water to the units.

Referring to the preliminary water service demands for the apartment blocks, a single 50 mm diameter service will be sufficient for the domestic supply to each of the buildings. Demands and corresponding velocities are summarized in Table 3.

Table 3: Apartment Building – 50 mm Dia. Service Size

CONDITION	PEAKING FACTOR	FLOW (L/s)	VELOCITY (m/s)
Average Day Demand	1.0	0.50	0.25
Max. Day Demand (Town Standards)	2.0	1.00	0.50
Peak Hour Demand (Town Standards)	4.5	2.25	1.13
Max Day Demand (MECP Standards)	7.0	3.50	1.75
Peak Hour Demand (MECP Standards)	10.6	5.30	2.65

Based on the above results, the service is sufficiently sized to achieve the minimum flushing velocity of 0.8 m/s when the minimum peaking factors are applied but maintain velocities below 3.0 m/s under the most conservative of the peak demand calculations. While the maximum velocity of 1.5 m/s is marginally exceeded when the MECP peaking factors are applied, this is considered a conservative estimate of the maximum day demand.

For fire protection, a separate, dedicated service to the building is proposed. It is anticipated the future building design will reduce the fire flow demand to 83 L/s, in which case a dedicated 150 mm diameter watermain will be capable of meeting the demand with velocities reaching 4.9 m/s under the conservative maximum day plus fire flow demand using the MECP peaking factors.

5 Stormwater Management

5.1 EXISTING DRAINAGE CONDITIONS

Information relating to existing topography, ground cover and drainage patterns was obtained through a review of available plans, base mapping and topographic survey of the parcel. The existing development area consists of a parcel fronting Yonge Street approximately 50 m to the west of Keller Drive.

The existing topography of the property generally consists of a gently graded platform adjacent to the Yonge Street right-of-way, increasing to 3:1 slopes in some sections deeper into the site and approaching the wetland area surrounding Little Lake. Taken as an average, site grading is approximately 7.5% in a northwest to southeast direction. Drainage from the site is conveyed through an existing wetland and into Little Lake. There is no external drainage conveyed through the site.

There are currently no onsite stormwater management controls and the site is currently vacant with dense vegetation observed on the majority of the property. The existing drainage area of the site conveyed to Little Lake is approximately 3.70 ha as illustrated on the Pre-Development Drainage Plan (Drawing STM-1A) enclosed as Figure 2.

Peak flows for the 1:2-year through 1:100-year return frequency design storms have been generated using the Town of Midland intensity-duration-frequency (IDF) parameters and are summarized in Table 2. Supporting calculations for establishing runoff coefficients and peak flow calculations are provided in Appendix D.

Table 4: Existing Condition – Peak Flow Summary

STORM	PEAK FLOW RATE (L/s)
1:2-year	85.1
1:5-year	112.2
1:10-year	130.3
1:25-year	168.3
1:50-year	205.1
1:100-year	234.6

5.2 STORMWATER MANAGEMENT PLAN DESIGN CRITERIA

The proposed SWM has been developed to address potential adverse impacts the development may have on the local surface water features, surface water quality and groundwater conditions. The proposed preliminary SWM plan is outlined in the following sections:

- Attenuation of post-development peak flow rates to pre-development design is not recommended due to the proximity of the site to Little Lake and steep grading of the site which provides limited capacity for storage. Future post to pre-development quantity controls are proposed for the two apartment blocks through future Site Plan Applications to ensure sufficient capacity is maintained in the receiving sewers. Water quantity controls for the remainder of the site are therefore not proposed.
- Water quality controls are proposed to provide Enhanced, 80% total suspended solids (TSS) removal as the site is located immediately upstream of Little Lake and existing wetlands along its perimeter in addition to being located within a SGRA, HVA and WHPA. A treatment train approach consisting of a conventional oil grit separator and infiltration cell is proposed to meet the quality control objective. This approach will also have the benefit of providing pre-treatment of runoff prior to infiltration in consideration of the sensitivity of the local groundwater.
- In further recognition of the SGRA, efforts to minimize changes in water balance between the pre- and post-development condition are proposed.
- To minimize the impact of the site in terms of conveying phosphorous in surface runoff, budgeting of pre and post-development phosphorous concentrations along with mitigation measures will be considered.
- A siltation and erosion control plan will be required to prevent migration of sediment off-site during construction activities.

5.3 QUANTITY CONVEYANCE

Concept grading and SWM servicing are provided on the Overall Development Plan (ODP-1) in the conceptual design drawing set. A Post-Development Drainage Plan (Drawing STM-2) is enclosed as Figure 3. The design drawings included herein are preliminary in nature and are representative of potential development. During the SPA and Plan of Subdivision applications, a final Stormwater Management Report and detailed engineering drawings will be provided.

The site is modelled with a total of ten drainage catchments (Catchments 201 through 210) under the post-development concept. The catchments generally consist of a combination of rooftop and pavement (Runoff Coefficient of 0.95), grassed/landscaped areas (Runoff coefficient of

0.20) and composite runoff coefficients applied depending on development type (e.g. multiple residential, attached has a runoff coefficient of 0.75, etc.).

Catchment areas 201 through 208 are tributary to the proposed storm sewers and applied in both the storm sewer design and the maximum conveyance capacity of OGS applied in pre-treating runoff from the site. Catchment 209 is tributary to the proposed infiltration cell while Catchment 210 is conveyed from the site uncontrolled. Calculations to establish the composite runoff coefficients for each area are included in Appendix D.

The storm sewer is generally designed to convey peak flows from a 1:5-year return period storm event in conjunction with the relevant parameters from the Town's design criteria. To simulate the future quantity controls to be implemented in Catchments 201 and 202, a 1:100-year storm event is considered with a runoff coefficient of 0.20 applied. This ensures sufficient conveyance capacity is provided in the receiving sewer for controlled release of storm events from these parcels for all design storm events. Based on preliminary design flows, the proposed sewer will sufficiently convey the drainage from the entire post-development site to the proposed outlet.

Storm sewer grades have been designed such that depth of infrastructure in the steep road sections can be reduced to the extent practicable while also gradually reducing velocities ahead of the outlet to the infiltration feature. Sewer grade is reduced at each structure are incorporated in the design to ensure this is achieved while also respecting the minimum change in velocity of 0.6 m/s in the Town's standards.

As a further confirmation, the storm sewer design was checked with application of the 1:100-year design storm to verify potential capacity limitations. Through this exercise, it was determined the storm sewer could be made to have sufficient conveyance capacity for the 1:100-year storm event with very minor increases to pipe diameters in three sections of the sewer. Storm sewer design sheets for both the 5-year design storm and 100-year design storm are included in Appendix D.

Due to an overall increase in the imperviousness of the site, peak flows to Little Lake are anticipated to increase following development however, as the wetlands surrounding the lake are immediately downstream of the site, quantity controls are not proposed. To assess the increase in peak flows from the site and for reviewing major overland conveyance, the following composite runoff coefficients (CRC) were developed:

- Areas 201 through 208 combined:
    - To establish a design runoff coefficient for the 25 mm storm entering the OGS, and;
    - To assess overland flow conveyance of roads and parkette under an emergency overland flow condition from catchments 201 and 202.

- Areas 201 through 209 combined:
  - To assess design discharge from the infiltration cell with future controls in catchments 201 and 202, and;
  - To assess design discharge from the infiltration cell under an emergency overland flow event from catchments 201 and 202.

Calculations of the CRC's are included in Appendix D. Rational Method calculations for the site with the two varying conditions applied to catchments 201 and 202 are also included in Appendix D and summarized in Table 5.

Table 5: Post-Development – Peak Flow Summary

STORM	PEAK FLOW (L/s)		
	PRE-DEVELOPMENT	POST-DEVELOPMENT Future Controls	POST-DEVELOPMENT Emergency Overland Event
1:2-year	85.1	311.5	385.0
1:5-year	112.2	409.4	506.0
1:10-year	130.3	475.1	587.2
1:25-year	168.3	612.5	757.0
1:50-year	205.1	743.6	919.1
1:100-year	234.6	851.4	1,052.4

5.3.1 Major Event Flow Conveyance

For storms exceeding the 1:100-year storm event, where partial blockage of the sewers should occur or where capacity of the receiving sewer is exceeded, the proposed grading design of the road and parkette have been reviewed to verify conveyance capacity to the proposed infiltration cell and Little Lake under an uncontrolled, post-development 1:100-year storm event.

During an emergency overland flow event, the majority of drainage on the development site will be conveyed via Street A. For a conservative approach, it is presumed all site drainage upstream of the infiltration cell will be conveyed by this roadway and evenly split by the centerline. Presuming these conditions, the road is capable of conveying flows from the 100-year storm event a depth of 0.091 m, which is approximately 1 mm above the road centerline.

A similar exercise for area 207, which is conveyed to the extension of Russ Howard Drive, shows the 100-year storm flows can be conveyed at a depth of 0.093 m by the road which is graded at 0.5%. Similarly to Street A, this flow is conveyed approximately 3 mm above the centerline.

Drainage crossing the centerline of Russ Howard Drive will be conveyed via weir flow. Recognizing centerline grades increasing by 0.5% in either direction, drainage from a 100-Year storm event would cross the centerline at a depth of approximately 0.12 m above the centerline and extend to a total width of approximately 48.6 m. The resultant ponding over storm sewer inlets would be approximately 0.2 m.

An 8.5 m wide curb cut is proposed coincident with the frontage of the parkette to promote overland flow drainage from Russ Howard Drive through a channel in the parkette to the infiltration cell. Weir flow over curb cut would reach a maximum depth of approximately 0.17 m during a 1:100-year storm event. This coincides with a depth of approximately 0.21 m above the nearest storm sewer inlet.

Through the inclusion of a 4.5 m wide vegetated channel graded at 2.0%, the 1:100-year storm event flows can be conveyed through the parkette block at an approximate depth of 0.17 m, consistent with the depth of flow across the weir entering the block. This drainage will be conveyed to the proposed infiltration cell via continuation of the channel through the parkette block with a rip rap or similar erosion resistant material within the channel slope entering the infiltration cell.

Flows in excess of the storage capacity in the infiltration cell are conveyed to Little Lake and the surrounding wetlands via weir flow over the leeward bank of the infiltration cell. The berm formed by this leeward bank will be constructed at a consistent elevation with turf reinforcement which serves to minimize the flow depth, potential for channelization and potential for erosion downstream of the pond outlet. At approximately 25 m in length, depth of flow over the berm during a 1:100-year storm event reaches a depth of approximately 0.10 m under design flows and 0.11 m in an emergency overflow event. Under free flowing conditions downstream of the weir, the depth of flow is anticipated to be reduced to 0.02 m to 0.03 m as it flows down the proposed 3:1 slope.

Based on the foregoing, drainage from the 1:100-year storm event can be safely conveyed to the infiltration cell and Little Lake entirely by overland flow should the need arise. Copies of all channel flow calculations are included in Appendix E while weir flow calculations are included in Appendix F.

5.3.2 External Drainage

As previously indicated, drainage external to the site is generally contained within the adjacent parcels and does not impact drainage on the subject lands.

5.4 QUALITY CONTROL

Quality control to achieve 80% TSS removal is provided through a proposed treatment train.

Pre-treatment of drainage is first provided through an oil grit separator (OGS) in recognition of the site's location within a SGRA and HVA. While detailed design of the OGS will be considered during the detailed design phase of the development, a First Defense unit manufactured by Hydro International, is considered for preliminary design purposes. This OGS will remove the most common contaminants which can typically be generated in parking and roadway areas and is ETV certified to provide between 40.5% and 66.5% TSS removal, depending on surface loading rate. With a treatment capacity of approximately 204.7 L/s in the 2,400 mm diameter model, the OGS will be fully capable of treating runoff from the 25 mm storm event from the development. Further, the OGS also has a maximum conveyance capacity of 1,415 L/s, which is sufficient to convey the 1:100-year storm flows from the development. Typical detail drawings, ETV certification and manufacturer information on the OGS are included in Appendix G.

Preliminary design of the storm sewer network ensures the proposed OGS also provides pre-treatment of the future apartment blocks when accounting for their future, on-site quantity controls.

The proposed infiltration cell downstream of the OGS provides the primary quality control for the development through infiltration and filtration of water through the proposed sand layer. Referring to section 4.5.8 of the MECP design guidelines, "Enhanced" Level 1 water quality control corresponding to 80% TSS removal is achieved through providing sufficient volume to retain and infiltrate the runoff from a 15 mm storm event over 24 to 48 hours. For the purposes of this review, the runoff from a 25 mm storm is applied to ensure sufficient capacity for erosion control above the infiltration cell surface.

Conservatively presuming the trench will terminate in the sandy silt till material identified in borehole logs from the adjacent development, an infiltration trench footprint of 357 m^2, with approximate dimensions of 14.0 m by 25.5 m, will provide a 48-hour drawdown time. Surface storage within the cell to a depth of 200 mm is provided by the proposed berm and outlet weir on the leeward side of the infiltration cell. Underlain by a combination of sand, clear stone, permeable backfill and topsoil with presumed 40% void ratio and extending 2.45 m below the finished invert of the infiltration cell, the feature has sufficient capacity to store the runoff from a 25 mm storm event. Design calculations for the infiltration cell are included in Appendix G.

Combined with the proposed OGS in a treatment train configuration, the proposed controls will provide 93.0% TSS removal for the entire site. While the infiltration cell is sized to provide quality control for catchments 201 through 209, the OGS can only treat runoff from catchments 201 through 208. Therefore, further pre-treatment associated with future development will serve to further improve TSS. Treatment train calculations are provided in Appendix G.

5.5 WATER BUDGET

A preliminary water budget has been prepared for the site using the Thornthwaite and Mather approach to determine water surplus after evapotranspiration recognizing the site is within a SGRA and HVA. Based on the Shanty Bay Climate Normal Data for 2002 – 2021 (Environment Canada), the annual surplus available infiltration or runoff minus the annual deficit is 273.4 mm.

The infiltration from the annual surplus can be estimated based on infiltration factors from Table 3.1 of the MECP SWM Design Manual. Specific infiltration factors are provided for topography, soils and landcover.

Under existing conditions (undeveloped, hilly land with heavy tree cover with sandy soil) the site has an infiltration factor of 0.7. Under post-development conditions, the area of impervious land cover will increase, and a significant amount of tree cover will be removed, reducing the infiltration factor to 0.6. As such, the annual infiltration is estimated to decrease by 6,239 m^3 under the proposed conditions without mitigation.

The proposed infiltration cell acting as an LID to provide quality control, as detailed in Section 5.4 above, also promotes water balance through its infiltration function. With the proposed LID configuration, infiltration is anticipated to increase by 5,224 m^3 annually compared with existing conditions.

Preliminary water budget calculations are provided in Appendix H.

5.6 PHOSPHOROUS BUDGET

A preliminary phosphorous budget has been completed for the site using loading rates and removal efficiency values from the MECP Phosphorous Budget Tool and the 2022 LSRCA Technical Guidelines for Stormwater Management Submissions. Under existing conditions, the site has been modelled as a Forest land use with associated phosphorous loading rate of 0.10 kg/ha/year. Applied over the entire site, the existing phosphorous load would therefore be 0.37 kg/year.

Under post-development conditions, the site has been modelled as a combination of High Intensity Development – R and Low Intensity Development with associated phosphorous loading rates of 1.32 kg/ha/year and 0.13 kg/ha/year respectively. Prior to any mitigation, the post-development phosphorous load is 3.12 kg/year.

Best efforts have been provided to mitigate phosphorous loadings from the site in conjunction with the proposed measures to improve water balance. The proposed OGS unit provides a removal efficiency of 20% for approximately 3.36 ha of the site. The proposed infiltration trench provides an additional 60% removal efficiency while the proposed weir and overland conveyance route provide an additional 65% removal efficiency. Combined, these measures reduce the post-development phosphorous loadings from the site to 0.32 kg/year, representing a reduction of 0.05 kg/year compared with existing conditions. Supporting calculations are provided in Appendix I.

6 Utility Infrastructure

Utility services to the proposed development are located within the existing municipal right-of-way including overhead and underground services on Yonge Street with underground services available from Russ Howard Drive. Services will be extended within the proposed development in accordance with Town and individual utility service provider standards. Coordination with service providers has not been conducted at this time, however, it is not anticipated there will be limitations on servicing capacity.

Internal servicing to the site is anticipated to be through a common utility trench located within the boulevard opposite the water servicing infrastructure. Design of utility servicing will be coordinated with the utility companies during the final design stages.

6.1 ELECTRICAL SERVICES

Electrical service to the subject property will be provided by NT Power. Electrical servicing and streetlight design will be undertaken during the final design stage by an Electrical Consultant.

6.2 NATURAL GAS SERVICE

Natural gas service to the subject site will be provided by Enbridge Gas Inc. It is presumed each unit will include individual hot water heaters and HVAC systems for a conservative design of servicing infrastructure. Coordination with Enbridge for natural gas servicing design will be conducted during detailed design.

6.3 TELECOMMUNICATIONS

Telecommunications is provided to the area by both Rogers and Bell. Telecommunication service pedestals are observed along the east and west boulevards of Keller Drive with overhead wires and pedestals observed on the north side of Yonge Street. Design coordination with telecommunication service providers will be completed at detailed design.

6.4 POSTAL SERVICE

Canada Post provides mail delivery service to the Town of Midland, with community mailboxes the preferred method of delivery in this area. Location and sizing of community mailboxes will be coordinated with Canada Post during detailed design.

7 Erosion and Sediment Control

The proposed development is expected to occur in a single stage with the apartment buildings being subject to future Site Plan Approval processes. The internal roads and infrastructure will be constructed first followed by construction of individual dwellings and townhouse units. Erosion and sediment controls will be implemented for all construction activities including topsoil stripping, earthworks, road construction, foundation excavation and stockpiling material. The basic principles considered to minimize erosion and sedimentation and resistant negative environmental impacts include:

- Minimize wherever possible local disturbance activities (e.g. grading);
- Expose the smallest possible land area, where practical, to erosion for the shortest possible time;
- Implement control measures before the outset of construction activities;
- Institute control measures where needed and as required immediately; and
- Carry out regular inspections for all control measures and repair or maintain as necessary.

The proposed grading, servicing and building construction should be carried out in such a manner that a minimum amount of erosion occurs and such that sedimentation facilities control any erosion occurring.

Erosion and silt/sediment control measures will include but not be limited to the following:

- Erection of silt fences around the construction site;
- Dual layers of silt fencing to be provided adjacent to sensitive land areas;
- Provide sediment traps (e.g. berms, geotextiles, stone barriers and swales);
- Provide general “mud mats” at construction vehicle access point(s) to minimize off site tracking of sediment;
- Confine refueling/servicing of construction equipment to areas well away from inlets to minor or major stormwater system elements;
- Stockpile topsoil in designated location with silt fencing to prevent migration of material;

Removal of all erosion and sediment controls within the development should only occur after construction is complete and the site has been stabilized with vegetation. The proposed erosion controls are shown on drawing SC-1 in the design drawing set.

8 Conclusions

Development of the site can be completed in accordance with the preliminary draft plans can be accommodated.

Water demands for the domestic and fire flows can be supplied by existing municipal distribution infrastructure through connections on Yonge Street and Russ Howard Drive.

Sanitary sewer flows from the development represent a minor increase to the Yonge Street trunk sewer with a minor decrease in flow to the existing SPS on Russ Howard Drive. Sufficient capacity in receiving infrastructure is understood to be available with future capacity improvements planned for the 2041 growth horizon.

The proposed grading for the site is consistent with the predominant topography and will not direct runoff to neighbouring properties.

Post-development peak flow rates will be safely conveyed to the proposed quality control and Little Lake through a combination of storm sewers and overland flows contained to the proposed roadways.

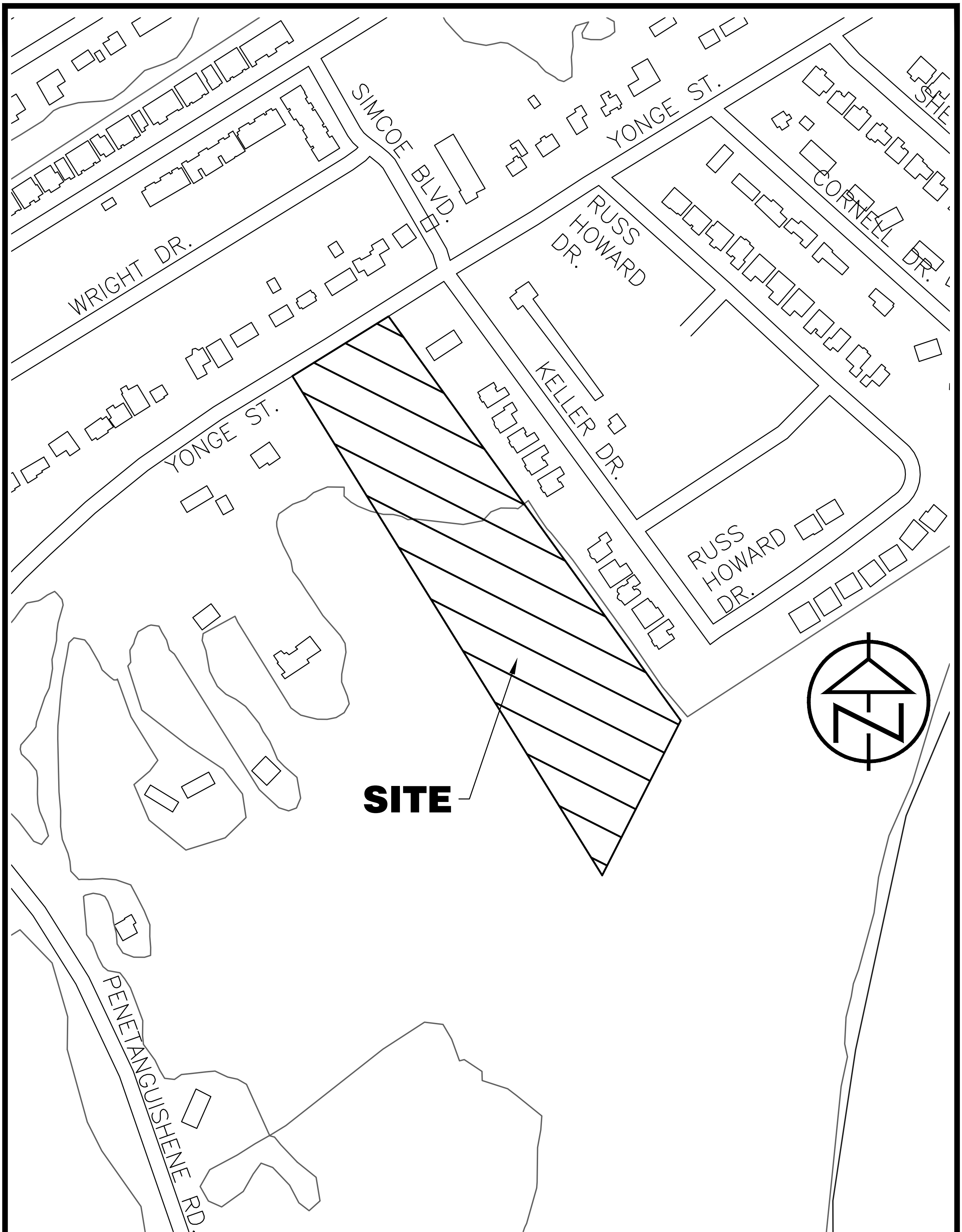
"Enhanced" Level 1 quality controls corresponding to 80% TSS removal are provided by the on-site controls and the receiving end of pipe SWM facility.

Water balance is achievable through the introduction of an infiltration cell at the outlet of the proposed storm sewer.

Proposed quality controls and water balance measures will provide phosphorous reduction sufficient to match existing conditions.

Utility servicing of the development can be accommodated through extension of existing infrastructure on adjacent roadways.

A series of siltation and erosion controls including heavy duty silt fence, mud mat, rip rap check dams and catchbasin filters will be implemented for all construction activities.



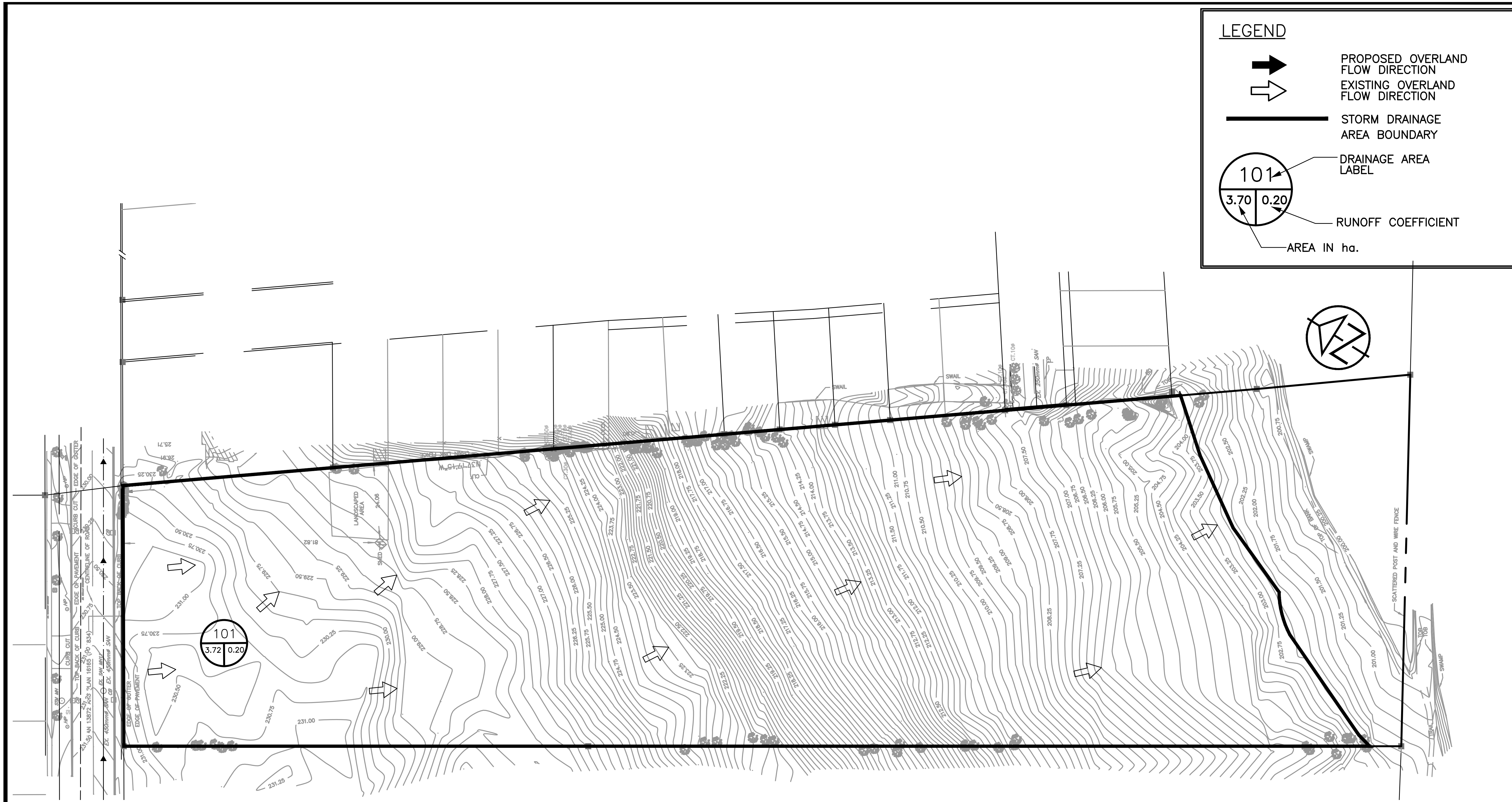
TATHAM ENGINEERING

983 YONGE STREET
TOWN OF MIDLAND

DWG. No. **FIG. 1**

SCALE: NTS | DATE: JUNE 2024 | JOB NO. 324829

Drawing Name: 324829–FIG–1.dwg, Plotted: Jun 20, 2024

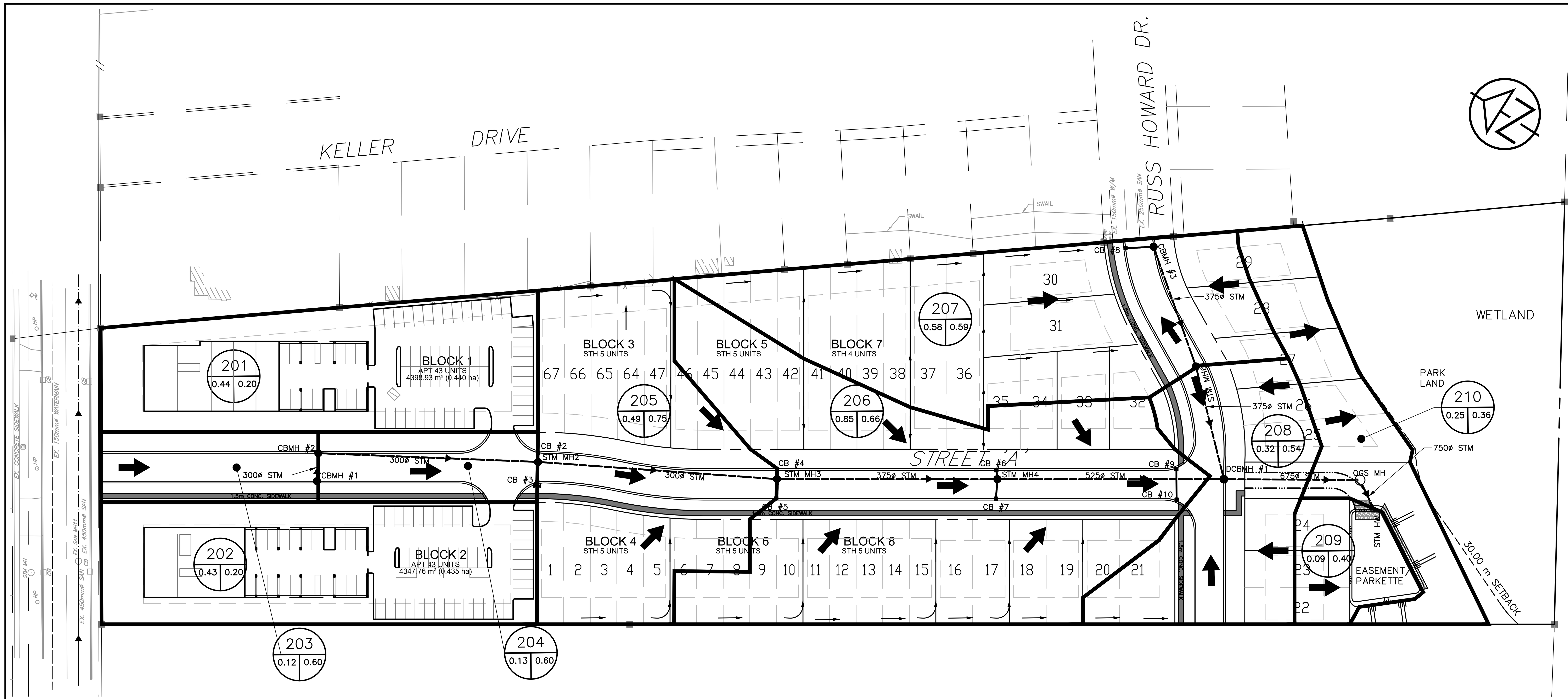


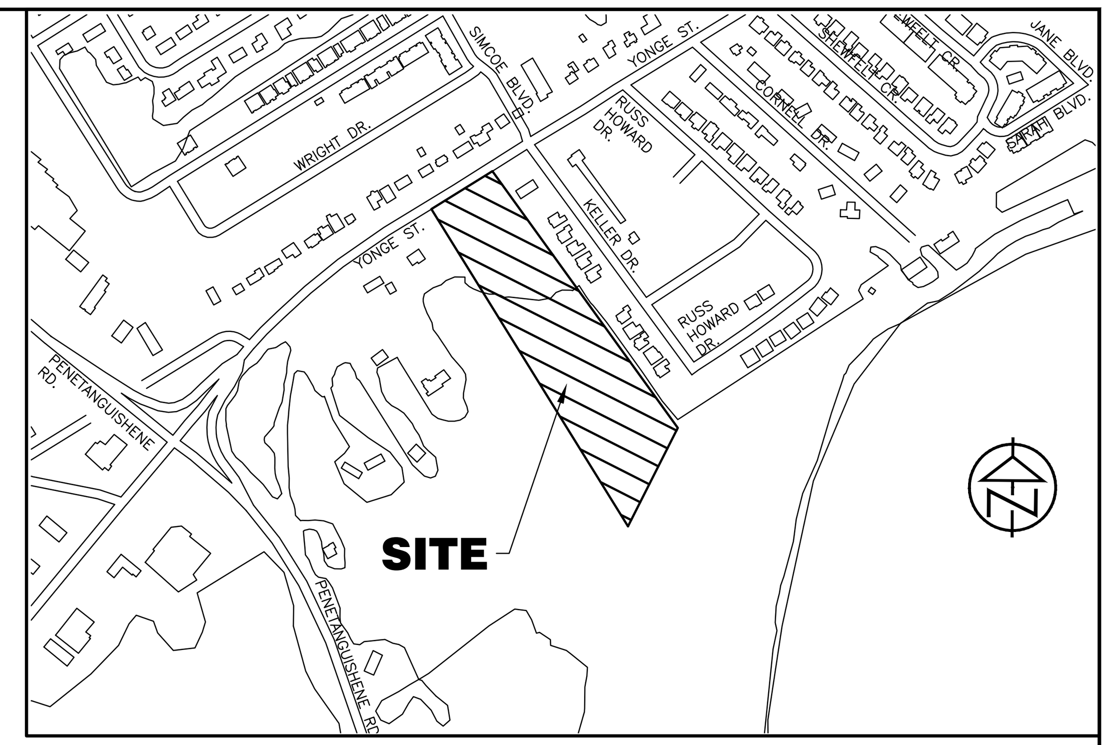
TATHAM ENGINEERING

983 YONGE STREET
TOWN OF MIDLAND
PRE-DEVELOPMENT DRAINAGE PLAN

DWG. No. **STM-1A**

SCALE: 1:1250	DRAWN: MPO	DATE: APRIL 2024	JOB NO. 324829





KEY PLAN
N.T.S.

LEGEND

- PROPOSED OVERLAND FLOW DIRECTION
- STORM DRAINAGE AREA BOUNDARY
- DRAINAGE AREA LABEL
- RUNOFF COEFFICIENT
- AREA IN ha.

NOTE: AREAS 201 AND 202 TO PROVIDE ON-SITE POST TO PRE DEVELOPMENT PEAK FLOW CONTROL THROUGH FUTURE SITE PLAN APPLICATION.

Storm Sewer Design Sheet

Project Information

983 Yonge Street	324829

Drawing Reference

Post Deelopment Storm Drainage Area - STM-2	May 24/24

Prepared By

JN	May 15/24

Reviewed By

Municipality

Town of Midland

Runoff Coefficient Adjustment

Equation	3	
Year	A	B
10	1.00	0.00
25	1.10	0.00
50	1.20	0.00
100	1.25	0.00

Time of Concentration

10 mins	for C≥0.60
15 mins	for C<0.60

IDF Curve Coefficients

Year	A	B	C
2	807.44	6.75	0.83
5	1135.40	7.50	0.84
10	1387.00	7.97	0.85
25	1676.20	8.30	0.86
50	1973.10	9.00	0.87
100	2193.10	9.04	0.87

Manning's Coefficient

Material	Value
CSP	0.024
Concrete	0.013
PVC	0.013

Notes

1)

Version Date: May 15, 2025
Version Number: 1

Engineer Stamp

Street Name	Area ID / Label	Upstream Maintenance Hole	Downstream Maintenance Hole	Area (ha)	5 Year Runoff Coefficient (C)	Design Storm (Year)	Adjusted Runoff Coefficient (C)	Area × Runoff Coefficient	Cumulative Area (ha)	Cumulative Area × Adjusted Runoff Coefficient	Time of Concentration (min)	Rainfall Intensity (mm/hr)	Peak Flow (m³/s)	Manning's Roughness Coefficient	Sewer Length (m)	Sewer Slope (%)	Actual Sewer Diameter (mm)	Full Flow Velocity (m/s)	Full Flow Capacity (L/s)	Actual Velocity (m/s)	Travel Time (min)	Calculated Sewer Diameter (mm)	Percentage of Full Flow Capacity (%)	Total Time of Travel (min)
Street A	201	Block 1	CBMH 2	0.44	0.20	100	0.25	0.11	0.44	0.11	15.00	137.49	0.042	0.013	6.0	4.2%	300	2.80	0.198	2.10	0.05	168	21.2%	15.05
	202	Block 2	CBMH 1	0.43	0.20	100	0.25	0.11	0.43	0.11	15.00	137.49	0.041	0.013	6.0	2.6%	300	2.21	0.156	1.74	0.06	182	26.3%	15.06
	203	CBMH 1	CBMH 2	0.12	0.60	5	0.60	0.07	0.55	0.18	15.06	82.61	0.057	0.013	8.0	4.2%	300	2.80	0.198	2.28	0.06	189	29.0%	15.12
		CBMH 2	STM MH 2	0.00	0.00	5	0.00	0.00	0.99	0.29	15.12	82.43	0.099	0.013	62.9	6.0%	300	3.35	0.237	3.01	0.35	216	41.9%	15.46
	204	STM MH 2	STM MH 3	0.13	0.60	5	0.60	0.08	1.12	0.37	15.46	81.38	0.116	0.013	68.5	6.0%	300	3.35	0.237	3.14	0.36	229	48.8%	15.83
	205	STM MH 3	STM MH 4	0.49	0.75	5	0.75	0.37	1.61	0.74	15.83	80.31	0.196	0.013	63.0	5.0%	**375**	3.55	0.392	3.35	0.31	289	50.0%	16.14
	206	STM MH 4	DCBMH 1	0.85	0.66	5	0.66	0.56	2.46	1.30	16.14	79.42	0.318	0.013	64.7	2.2%	**525**	2.95	0.638	2.77	0.39	404	49.8%	16.53
	207	CBMH 3	STM MH 5	0.58	0.59	5	0.59	0.34	0.58	0.34	15.00	82.79	0.079	0.013	36.3	1.4%	**375**	1.88	0.207	1.63	0.37	261	37.9%	15.37
		STM MH 5	DCBMH 1	0.00	0.00	5	0.00	0.00	0.58	0.34	15.37	81.66	0.078	0.013	33.2	1.4%	**375**	1.88	0.207	1.63	0.34	259	37.4%	15.71
	208	DCBMH 1	OGS MH	0.32	0.54	5	0.54	0.17	3.36	1.81	16.53	78.33	0.425	0.013	38.9	1.0%	**675**	2.35	0.841	2.21	0.29	523	50.6%	16.82
		OGS MH	Pond	0.00	0.00	5	0.00	0.00	3.36	1.81	16.82	77.54	0.421	0.013	9.0	0.5%	**750**	1.78	0.787	1.70	0.09	593	53.5%	16.91

BENCHMARKS

ONTARIO MINISTRY OF NATURAL RESOURCES AND FORESTRY AND FORESTRY BENCHMARK NO. 00820038051 (CGVD28: 78), ROUND IRON BAR WITH CAP 30cm BELOW GROUND. HAVING AN ELEVATION OF 214.518 METERS. LOCATED ON WEST SIDE OF HWY 93, ON SOUTH SIDE OF ENTRANCE TO NATIVE WOOD NURSERIES No. 8484, APPROXIMATELY 1.4 KM SOUTH OF JUNCTION OF HWY 93 & HWY 12.

NOTES

No.	REVISION DESCRIPTION	DATE
1.	1ST SUBMISSION	JUNE 24

ENGINEER STAMP

PRELIMINARY

983 YONGE STREET
TOWN OF MIDLAND

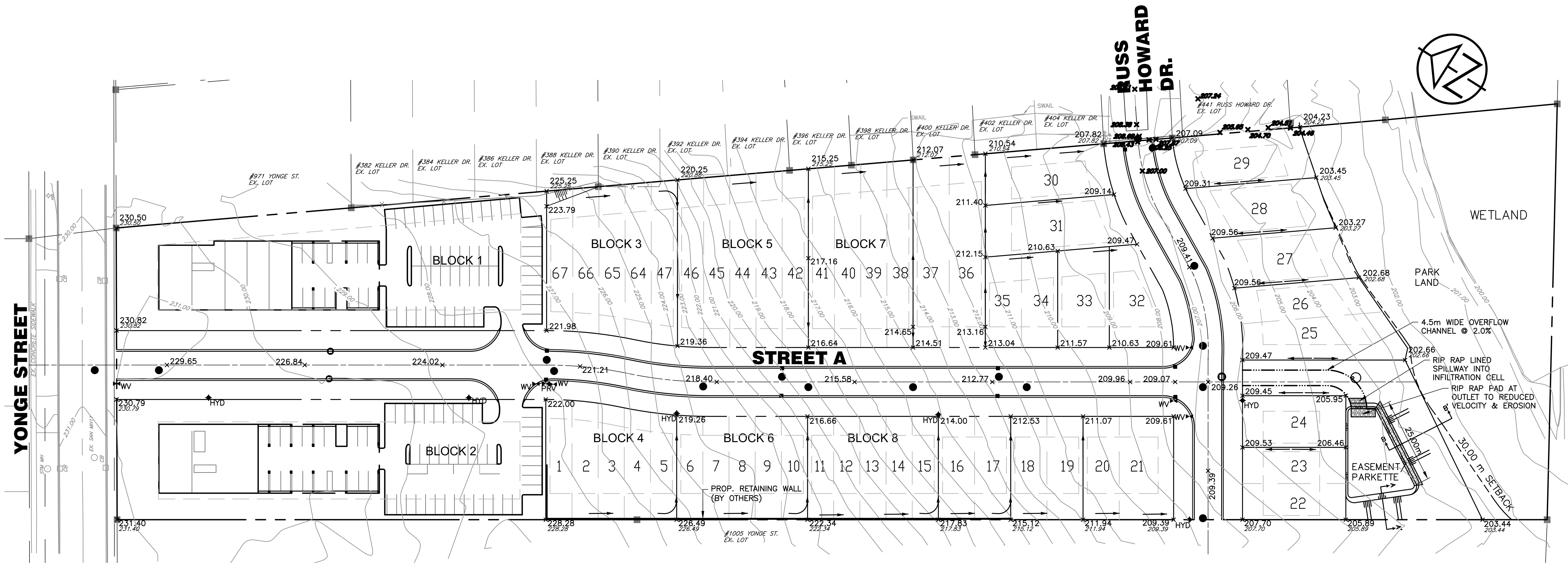
POST DEVELOPMENT STORM DRAINAGE AREAS

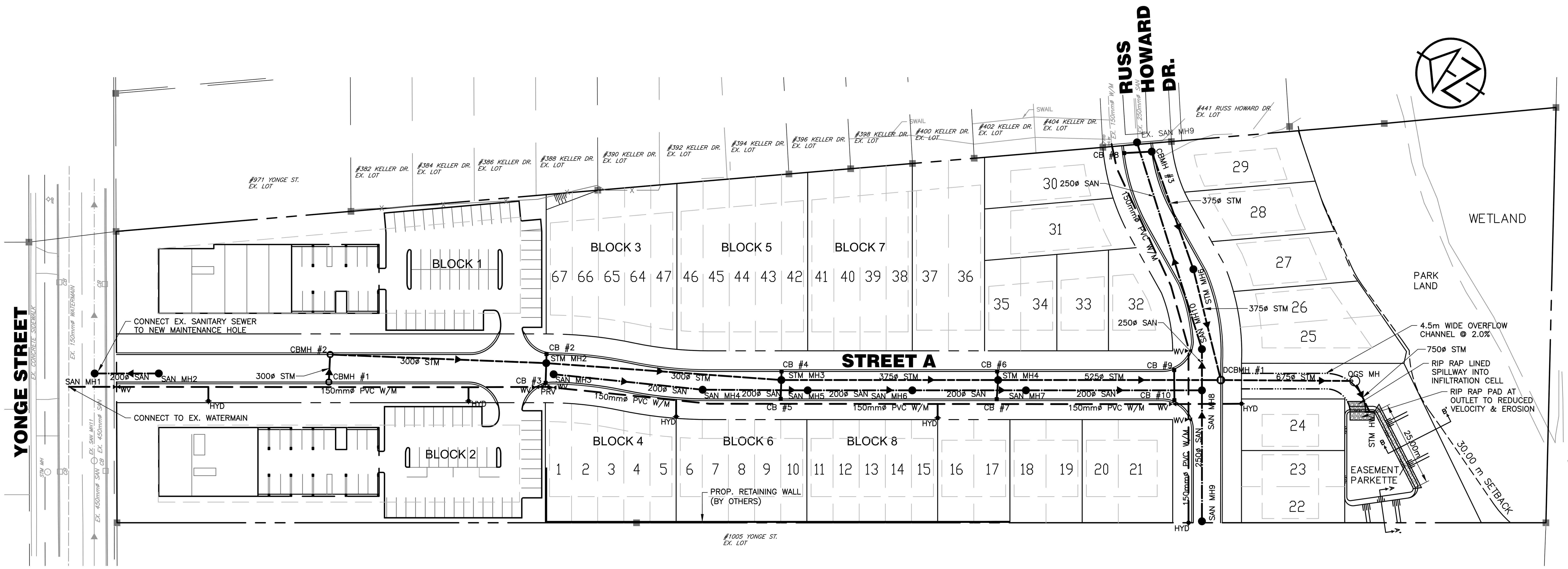
TATHAM ENGINEERING

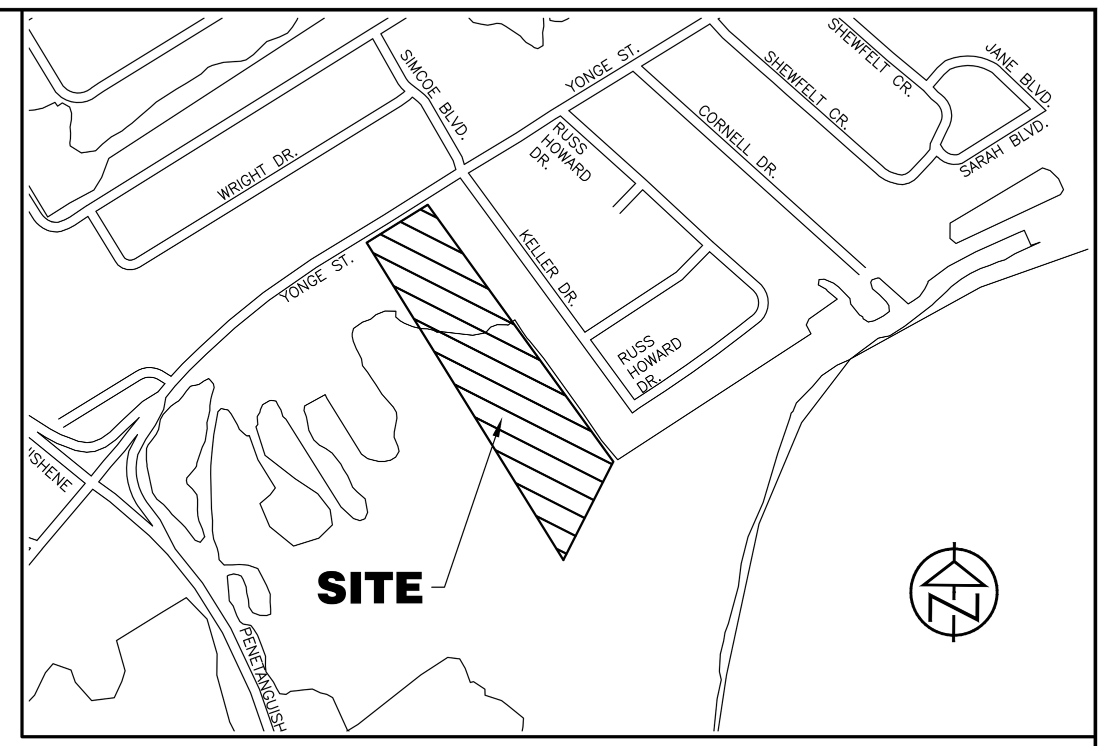
DESIGN: JN	FILE: 324829	DWG:
DRAWN: MPO	DATE: APRIL 2024	STM-2
CHECK: TWW	SCALE: 1:750	

Drawing Name: 324829-STM-1.dwg, Plotted: Jun 24, 2024

Appendix A:
Preliminary Drawings



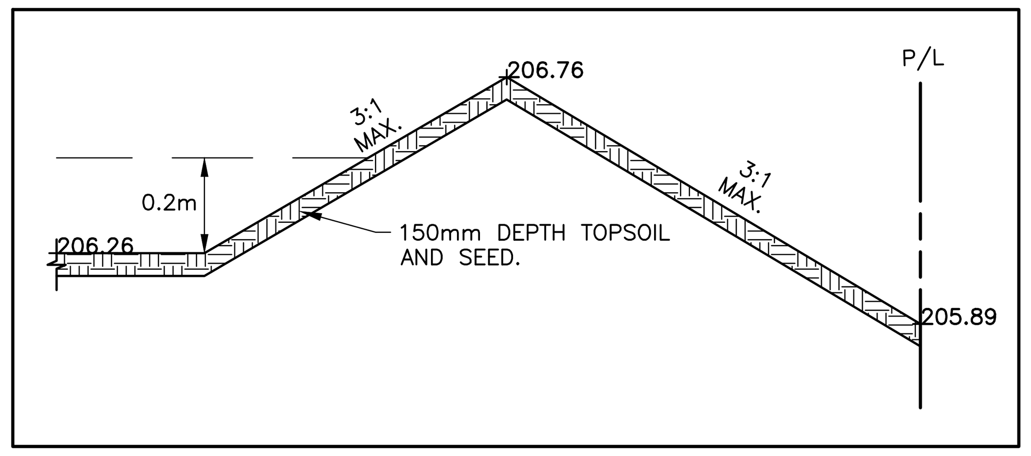




KEY PLAN
N.T.S.

LEGEND

ITEM	EXISTING	PROPOSED
PROPERTY LINE		
LOT LINE		
CENTERLINE		
DITCH/DIRECTION OF FLOW		
DRAINAGE SWALE/DIRECTION OF FLOW		
WATERMAIN/SIZE	150ø W/M	150ø W/M
FIRE HYDRANT	HYD	HYD
EXISTING WATER VALVE	WV	WV
SANITARY SEWER/SIZE/DIRECTION OF FLOW	200ø SAN	200ø SAN
SANITARY MAINTENANCE HOLE	SAN MH	SAN MH4
SANITARY FORCEMAIN		
STORM SEWER/SIZE/DIRECTION OF FLOW	375ø STM	375ø STM
STORM MAINTENANCE HOLE	STM MH	STM MH4
CATCH BASIN	CB	CB4
DOUBLE CATCH BASIN	DCB	DCB4
CATCH BASIN MAINTENANCE HOLE	CBMH	CBMH4
DOUBLE CATCH BASIN MAINTENANCE HOLE	DCBMH	DCBMH4



SECTION A–A DETAIL
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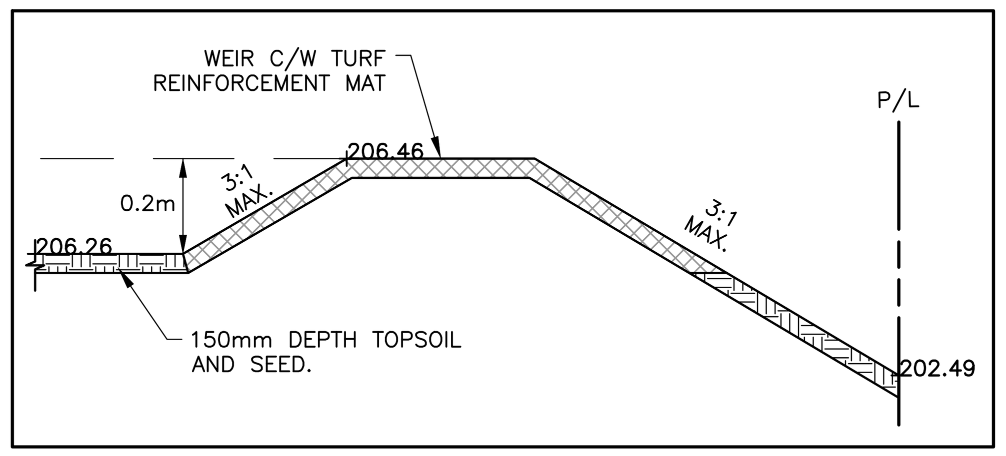


SECTION B–B DETAIL
SCALE: NTS

DISCLAIMER AND COPYRIGHT

CONTRACTOR MUST VERIFY ALL DIMENSIONS AND BE RESPONSIBLE FOR SAME. ANY DISCREPANCIES MUST BE REPORTED TO THE ENGINEER BEFORE COMMENCING WORK. DRAWINGS ARE NOT TO BE SCALED.

BENCHMARKS

ONTARIO MINISTRY OF NATURAL RESOURCES AND FORESTRY AND FORESTRY BENCHMARK NO. 00820038051 (CGVD28: 78), ROUND IRON BAR WITH CAP 30cm BELOW GROUND. HAVING AN ELEVATION OF 214.518 METERS. LOCATED ON WEST SIDE OF HWY 93, ON SOUTH SIDE OF ENTRANCE TO NATIVE WOOD NURSERIES No. 8484, APPROXIMATELY 1.4 KM SOUTH OF JUNCTION OF HWY 93 & HWY 12.

NOTES

No.	REVISION DESCRIPTION	DATE
1.	1ST SUBMISSION	AUG. 24

ENGINEER STAMP

LICENSED PROFESSIONAL ENGINEER
J. A. NEMISZ
100181826
Aug. 13, 2024
PROVINCE OF ONTARIO

983 YONGE STREET
TOWN OF MIDLAND

OVERALL DEVELOPMENT PLAN

TATHAM ENGINEERING

DESIGN: JN	FILE: 324829	DWG:
DRAWN: MPO	DATE: APRIL 2024	ODP-1
CHECK: TWW	SCALE: 1:750	

Drawing Name: 324829–ODP–1.dwg, Plotted: Aug 13, 2024

SILTATION AND EROSION CONTROL NOTES

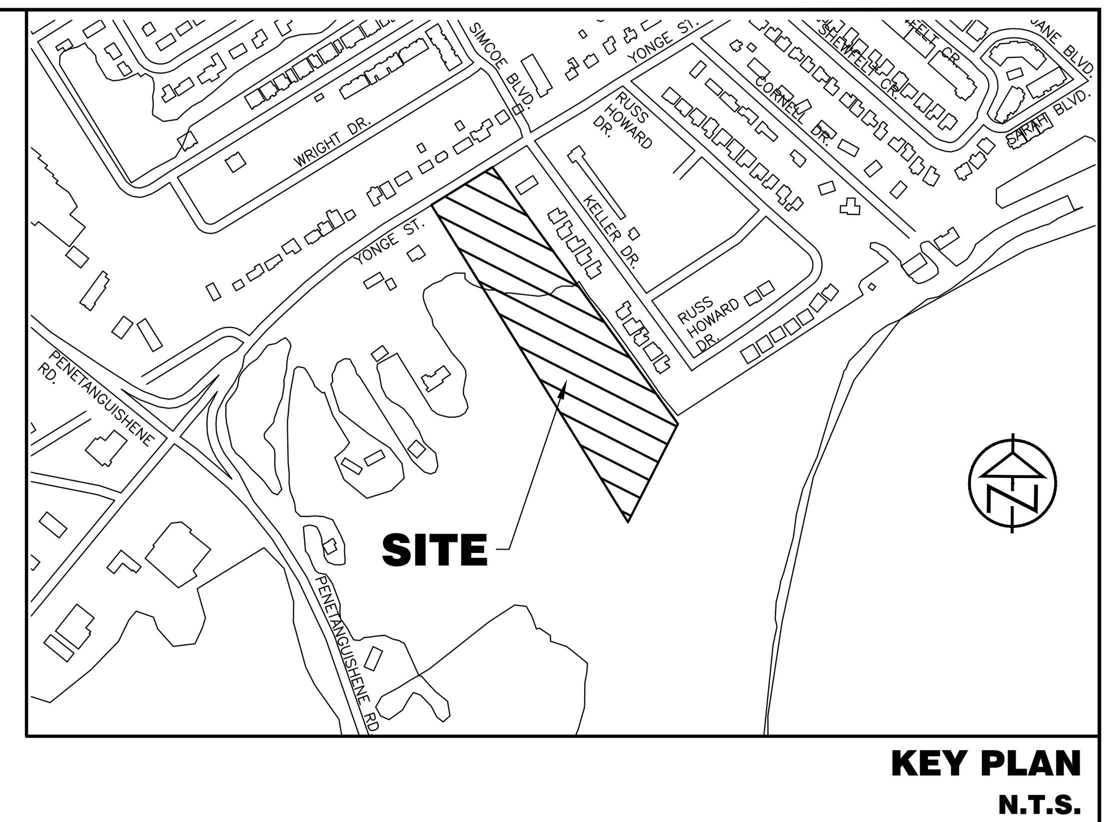
1. ALL SILTATION AND EROSION CONTROL MEASURES TO BE IN PLACE PRIOR TO CONSTRUCTION.
2. CONTRACTOR TO INSTALL AND MAINTAIN SILTATION CONTROL DEVICES AT LOCATIONS SHOWN, OR AS DIRECTED BY THE ENGINEER IF ADDITIONAL CONTROLS ARE DEEMED NECESSARY.
3. CONTRACTOR TO ARRANGE PRE-CONSTRUCTION MEETING WITH ENGINEER IMMEDIATELY AFTER PLACING ALL SILTATION CONTROL DEVICES.
4. SILTATION CONTROL DEVICES TO BE INSPECTED BY CONTRACTOR WEEKLY AND AFTER EACH RAINFALL. REPAIRS TO SILTATION CONTROL DEVICES TO BE COMPLETED PROMPTLY WHEN REQUIRED.
5. THE ENGINEER WILL INSPECT THE SEDIMENT AND EROSION CONTROL MEASURES PERIODICALLY, AND AFTER EACH MAJOR STORM EVENT. THE ENGINEER WILL NOTIFY THE CONTRACTOR OF CORRECTIVE ACTIONS REQUIRED AS SOON AS DEFICIENCIES ARE NOTED. THE CONTRACTOR MAINTAINS ULTIMATE RESPONSIBILITY TO ENSURE PROPER SEDIMENT AND EROSION CONTROL MEASURES ARE IMPLEMENTED AND MAINTAINED. ALL DEFICIENCIES AND CORRECTIVE MEASURES WILL BE DOCUMENTED BY THE CONTRACTOR IN A WEEKLY INSPECTION REPORT. A COPY OF THE WEEKLY INSPECTION REPORT WILL BE PROVIDED TO THE ENGINEER.
6. INSTALL SILT SACK IN ALL NEW CATCHBASINS/CATCHBASIN MAINTENANCE HOLES AND EXISTING CATCHBASINS/CATCHBASIN MAINTENANCE HOLES WITHIN THE CONSTRUCTION LIMITS AND/OR AREAS EXPOSED TO SILTATION. SILT SACK – REGULAR FLOW BY TERRAFIX OR APPROVED EQUAL.
7. CONTRACTOR TO REMOVE SILTATION CONTROL DEVICES ONLY AFTER ALL PAVING IS COMPLETED AND VEGETATION HAS STABILIZED.
8. ALL SILT FENCE PER OPSD 219.130

CONSTRUCTION ENTRANCE NOTES

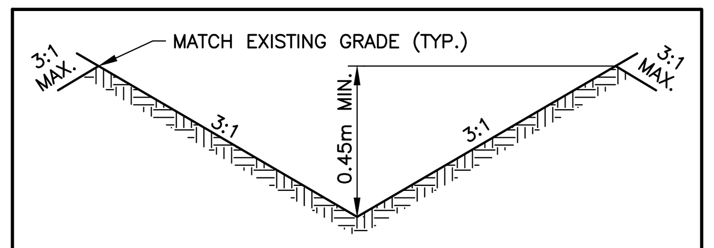
1. CONSTRUCT AND MAINTAIN CONSTRUCTION ENTRANCE AS SHOWN AND IN ACCORDANCE WITH O.P.S.D. 301.020.
2. ALL CONSTRUCTION VEHICLES TO ACCESS THE SITE USING THE DESIGNATED CONSTRUCTION ENTRANCE.
3. CONTRACTOR TO INSTALL AND MAINTAIN STONE MUD MAT AS DETAILED.
4. REMOVE TOPSOIL (WHERE APPLICABLE) BEFORE INSTALLING CONSTRUCTION ENTRANCE.
5. PROMPTLY REMOVE ANY MUD OR DUST WHICH IS TRANSPORTED BEYOND THE STONE MUD MAT TO MAINTAIN EXISTING ROAD DRIVING CONDITION.
6. ENTRANCE RADII TO BE MINIMUM 8.0m.

LEGEND

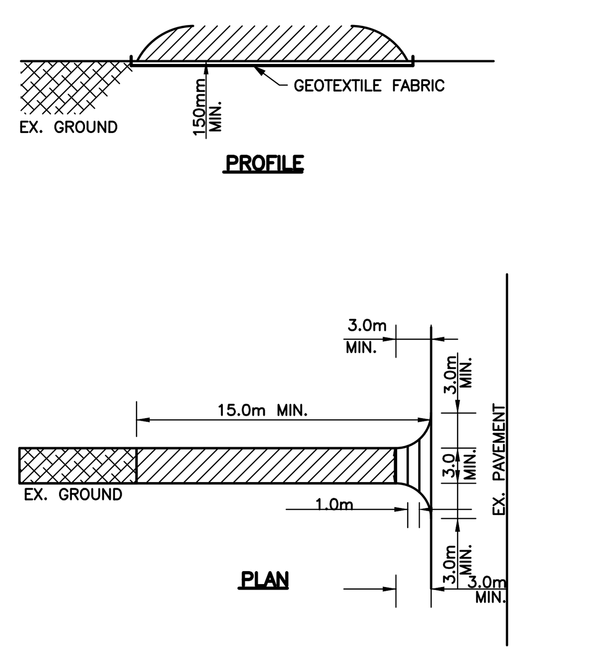
- SILT/TREE PROTECTION FENCE OPSD 219.130
- SBCD — STRAW BALE FLOW CHECK DAM OPSD 219.180
- RCD — PERMANENT ROCK CHECK DAM OPSD 219.211
- STONE MUD MAT
- CATCH BASIN FILTER
- TEMPORARY INTERCEPTOR SWALE



KEY PLAN
N.T.S.



TEMPORARY INTERCEPTOR SWALE DETAIL
NTS



STONE SIZE

THE STONE PAD SHALL BE A MIN. 150mm THICK. USE 50ømm STONE OR RECLAIMED CONCRETE EQUIVALENT FOR FIRST 10m FROM ADJACENT ROAD & 150mmø STONE FOR REMAINDER OF STONE PAD.

LENGTH

AS REQUIRED BUT NOT LESS THAN 15m (EXCEPT ON A SINGLE RESIDENCE LOT WHERE A 10m MIN. LENGTH WOULD APPLY).

WIDTH

3m MIN. BUT NOT LESS THAN THE WIDTH AT POINTS WHERE INGRESS AND EGRESS OCCURS.

GEOTEXTILE FABRIC

(TERRAFIX 270R OR EQUAL) WILL BE PLACED OVER THE ENTIRE AREA PRIOR TO PLACING STONE.

SURFACE WATER

ALL SURFACE WATER FLOWING OR DIRECTED TOWARD CONSTRUCTION ENTRANCES SHALL BE PIPED ACROSS THE ENTRANCE. IF PIPING IS IMPRACTICAL A MOUNTABLE BERM WITH 5:1 SLOPES WILL BE PERMITTED.

MAINTENANCE

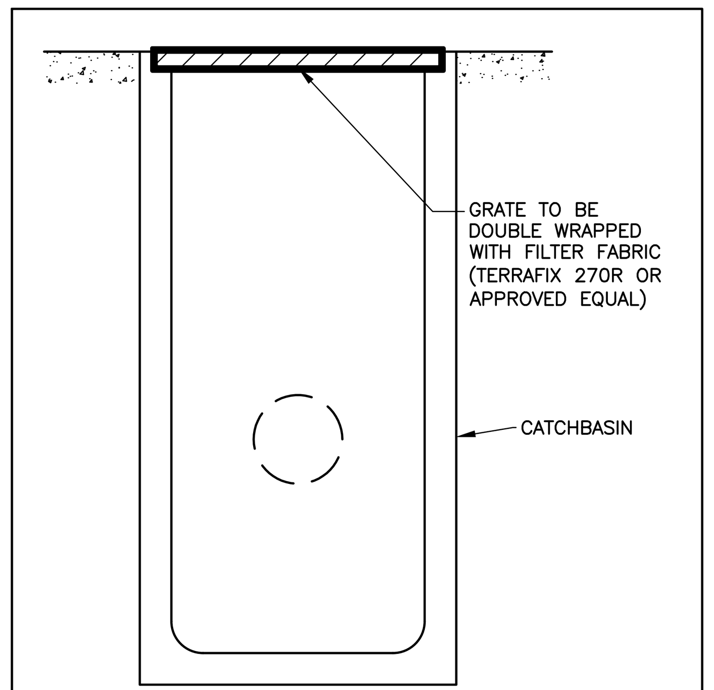
THE CONTRACTOR SHALL MAINTAIN THE ENTRANCE IN A CONDITION WHICH WILL PREVENT TRACKING OR FLOWING OF SEDIMENT ONTO PUBLIC RIGHT-OF-WAY. THIS MAY REQUIRE PERIODIC DRESSING WITH ADDITIONAL STONE AS CONDITIONS DEMAND AND REPAIR AND/OR CLEANOUT OF ANY MEASURES USED TO TRAP SEDIMENT. ALL SEDIMENT SPILLED, DROPPED, WASHED OR TRACKED ONTO PUBLIC RIGHT-OF-WAY MUST BE REMOVED IMMEDIATELY BY THE CONTRACTOR. UPON OBSERVATION OF CONTINUOUS MUD TRACKING ONTO ADJACENT STREETS, THE STONE MAT IS TO BE FULLY REPLACED.

WASHING

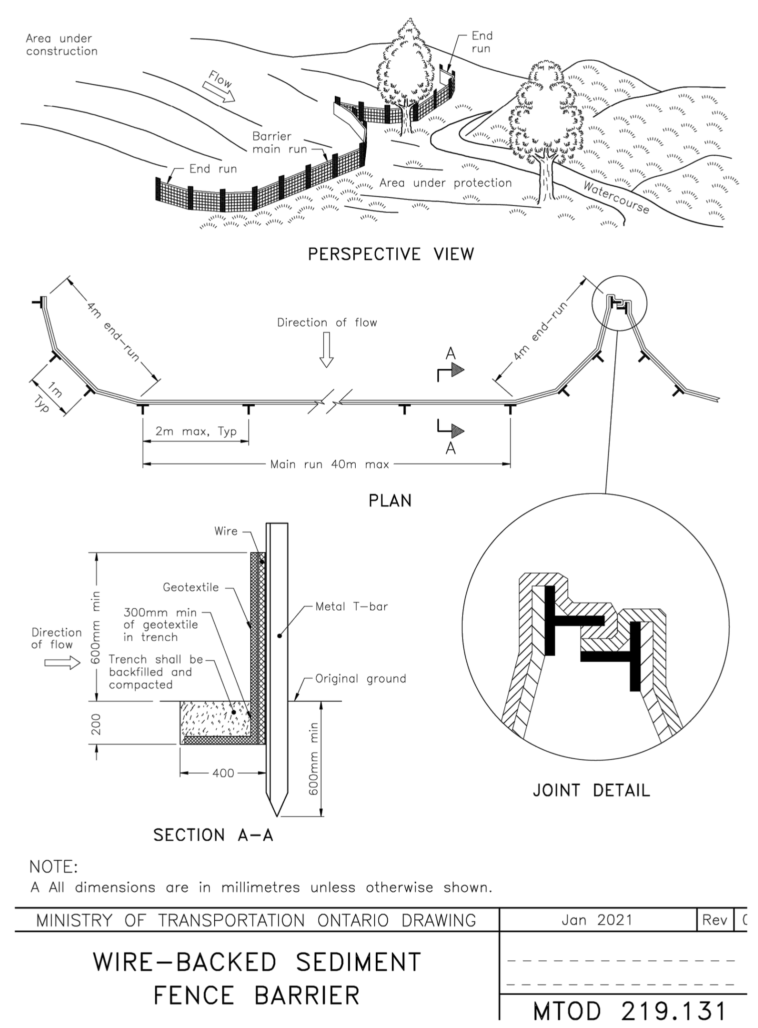
WHEELS SHALL BE CLEANED TO REMOVE SEDIMENT PRIOR TO ENTRANCE ONTO PUBLIC RIGHT-OF-WAY. WHEN WASHING IS REQUIRED, IT SHALL BE DONE ON AN AREA STABILIZED WITH STONE AND WHICH DRAINS INTO AN APPROVED SEDIMENT TRAPPING DEVICE.

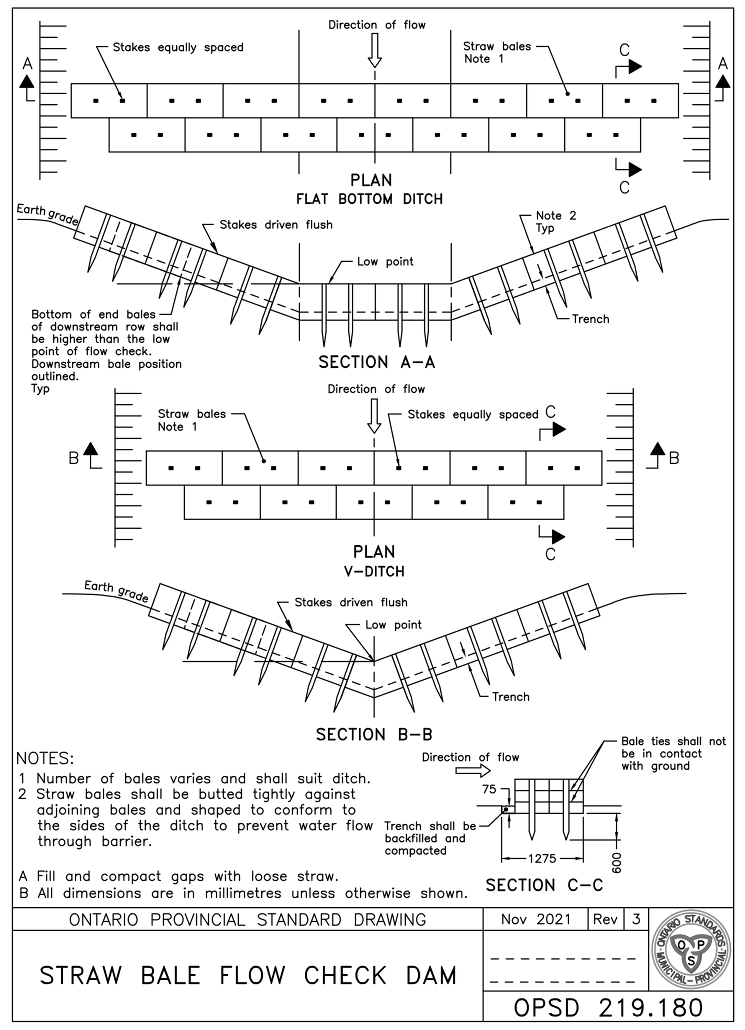
INSPECTION AND REQUIRED MAINTENANCE AFTER EACH RAIN SHALL BE PROVIDED BY THE CONTRACTOR.

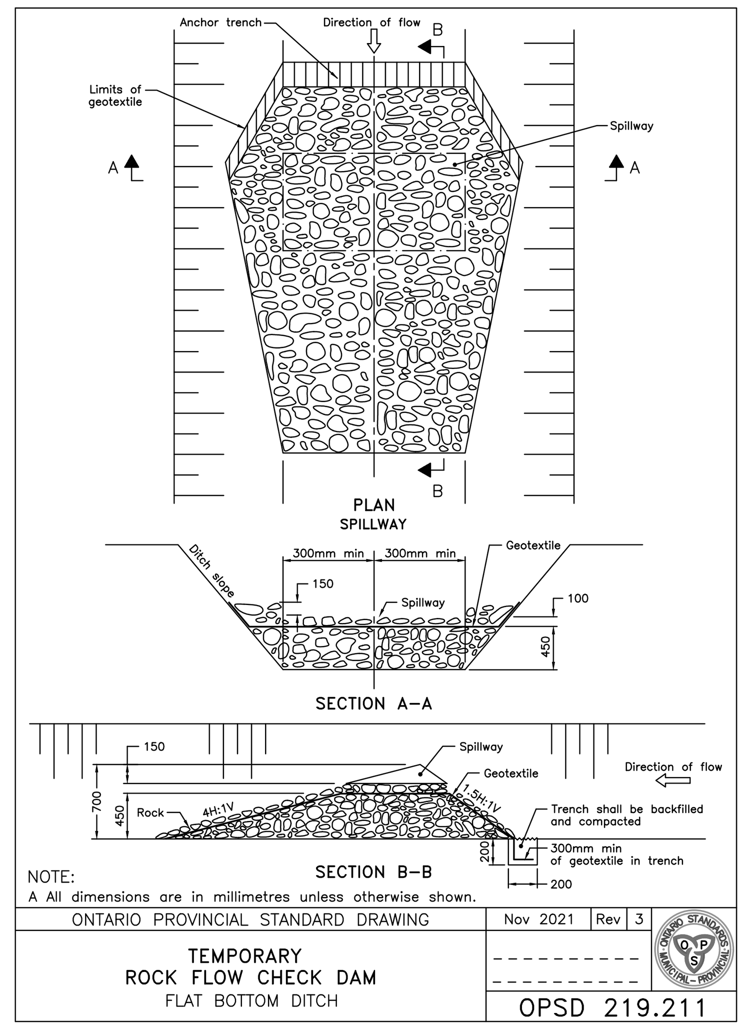
STONE MUD MAT DETAIL
SCALE: NTS

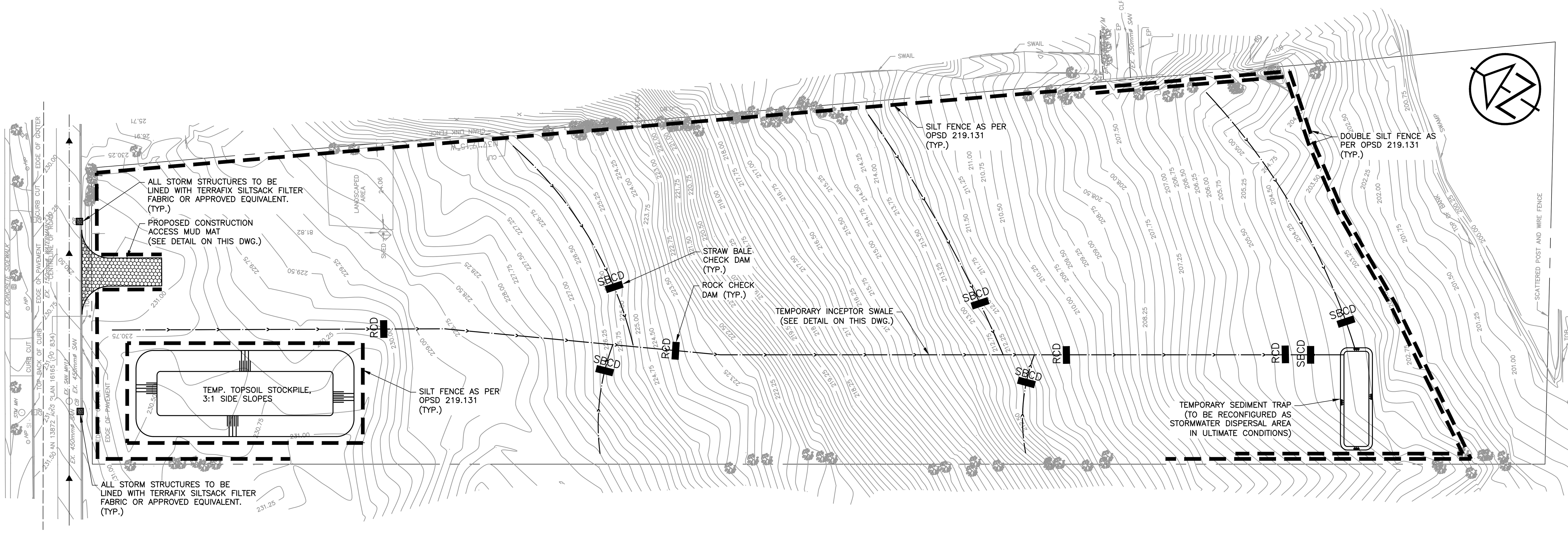


CATCHBASIN FILTRATION DETAIL
SCALE: N.T.S.









DISCLAIMER AND COPYRIGHT

BENCHMARKS

ONTARIO MINISTRY OF NATURAL RESOURCES AND FORESTRY AND FORESTRY BENCHMARK NO. 00820038051 (CGVD28: 78), ROUND IRON BAR WITH CAP 30cm BELOW GROUND. HAVING AN ELEVATION OF 214.518 METERS. LOCATED ON WEST SIDE OF HWY 93, ON SOUTH SIDE OF ENTRANCE TO NATIVE WOOD NURSERIES No. 8484, APPROXIMATELY 1.4 KM SOUTH OF JUNCTION OF HWY 93 & HWY 12.

NOTES

No.	REVISION DESCRIPTION	DATE
1.	1ST SUBMISSION	AUG. 24

ENGINEER STAMP

LICENSED PROFESSIONAL ENGINEER
J. A. NEMISZ
100181826
Aug. 13, 2024
PROVINCE OF ONTARIO

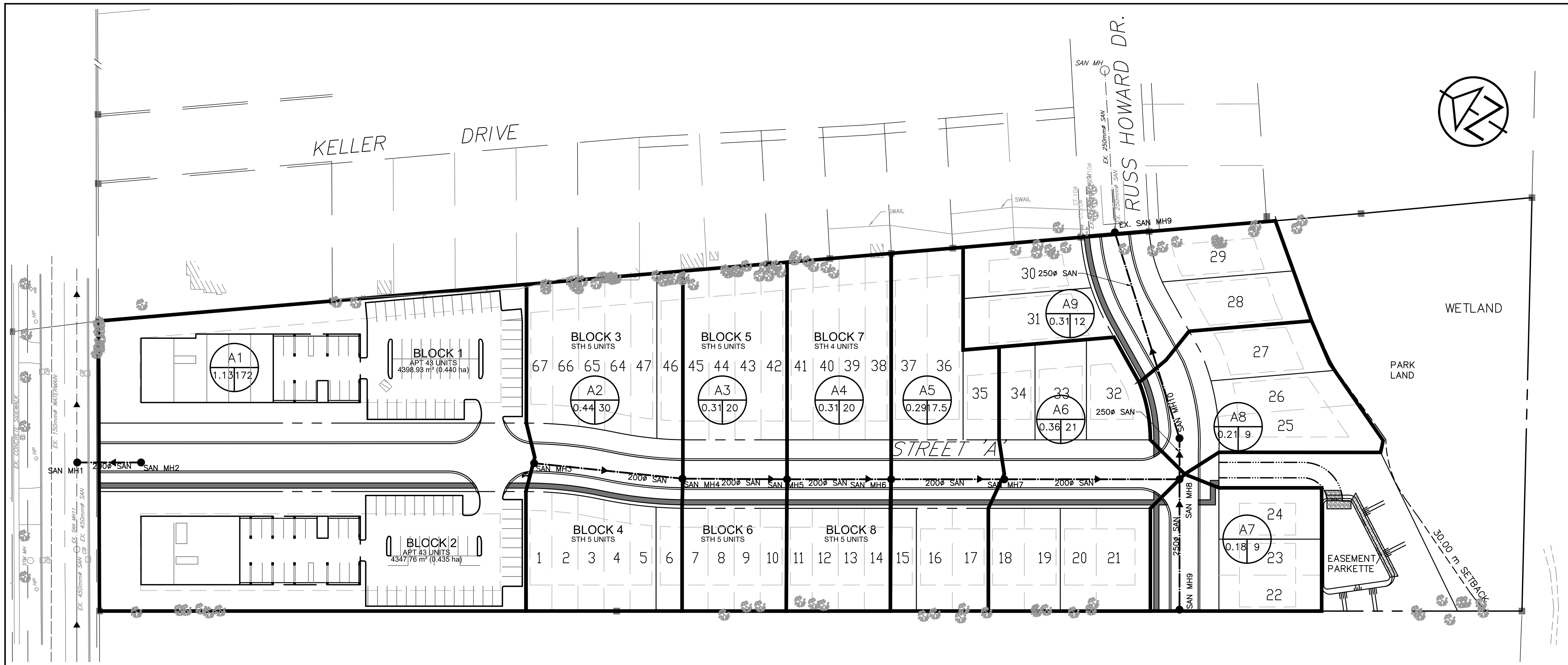
983 YONGE STREET
TOWN OF MIDLAND

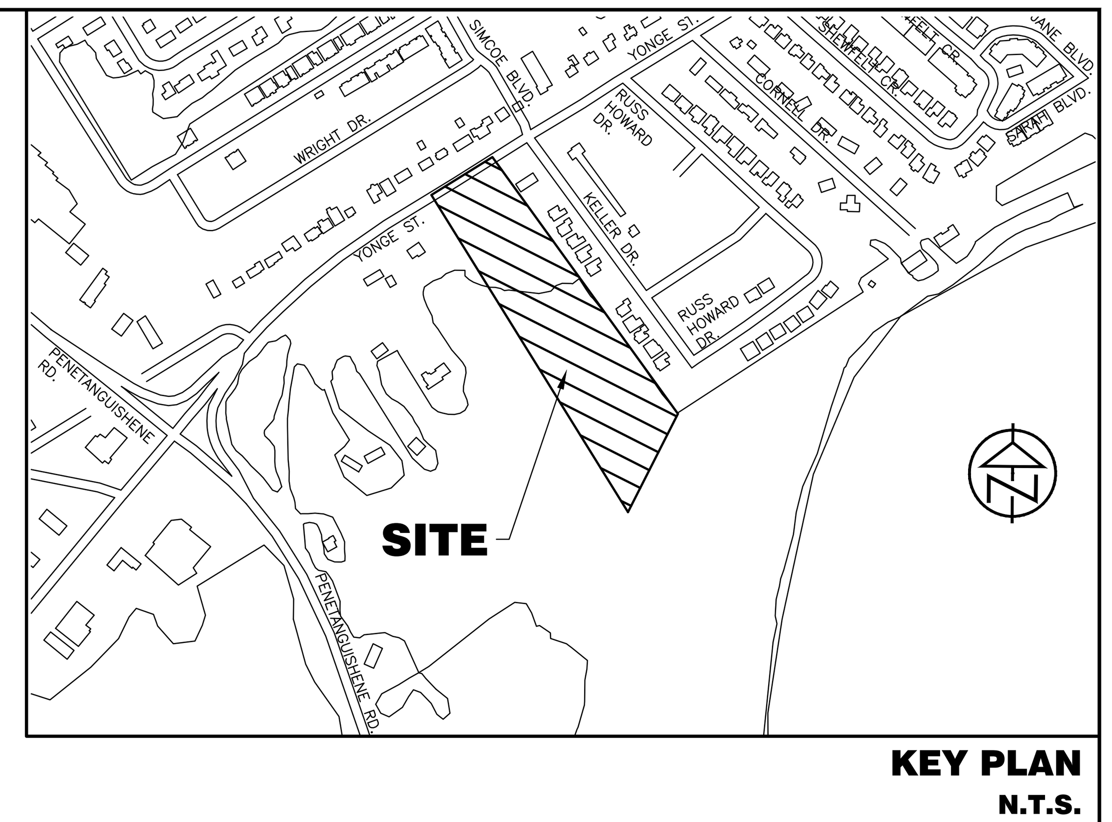
EROSION AND SEDIMENT CONTROL PLAN

TATHAM ENGINEERING

DESIGN: JN	FILE: 324829	DWG: SC-1
DRAWN: MPO	DATE: APRIL 2024	
CHECK: TWW	SCALE: 1:750	

Drawing Name: 324829–SC–1.dwg, Plotted: Aug 13, 2024





KEY PLAN
N.T.S.

LEGEND

- SANITARY DRAINAGE AREA BOUNDARY
- SANITARY SEWER/DIRECTION OF FLOW
- CATCHMENT AREA LABEL (A1)
- POPULATION * (10)
- DRAINAGE AREA (ha.) (0.24)

- * 2.0 PEOPLE PER UNIT FOR APARTMENTS
- * 2.5 PEOPLE PER UNIT FOR TOWN HOUSES
- * 3.0 PEOPLE PER UNIT FOR OTHER RESIDENTIAL

Sanitary Sewer Design Sheet

Version Date: May 27, 2024
Version Number: 1

Project Information

983 Yonge Street, Midland - Proposed Design - 450 L/cap/day	324829

Drawing Reference

324829 - SAN-1	May 27/24

Prepared By

JN	May 27/24

Reviewed By

Municipality

Town of Midland

Population Density

Capita per Unit	Low	Medium	High
	3.00	2.50	2.00

Infiltration

Infiltration (L/s/ha)	0.23

Manning's Coefficient

Pipe Material	Value
Concrete	0.013
PVC	0.013
Applied	0.013

Flow

Development Type	Average (L/cap/day)	Peaking Factor
Residential	450	Harmon
Development Type	**Average (L/ha/day)**	**Peaking Factor**
Institution	-	-
Commercial	25,000	-
Industrial (High)	-	-
Industrial (Low)	35,000	-

Notes

1) Unit rate of 450 L/cap/day applied in accordance with Town Standards to assess peak flow capacity of local gravity sewers.
2) Area of 0.16 ha not serviced by sanitary sewer removed from development lands.

Engineers Seal

Street Name	Area Label/ID	Upstream Maintenance Hole	Downstream Maintenance Hole	Development Type	Population Density	Number of Units	Population (cap)	Accumulated Population (cap)	Peaking Factor	Area (ha)	Cumulative Area (ha)	Average Flow (L/s) Development	Average Flow (L/s) Infiltration	Average Flow (L/s) Total	Peak Flow (L/s) Development	Peak Flow (L/s) Infiltration	Peak Flow (L/s) Total	Proposed Sanitary Sewer: Sewer Length (m)	Sewer Slope (%)	Actual Sewer Diameter (mm)	Full Flow Velocity (m/s)	Full Flow Capacity (L/s)	Actual Velocity (m/s)	Calculated Sewer Diameter (mm)	Percentage of Full Flow Capacity (%)
Stollar Development Design	EXT 1	EXT 1	SANMH 8	Residential	Med.	194	485.0	485.0	3.98	9.70	9.70	2.53	2.23	4.76	10.06	2.23	12.29			#VALUE!			#VALUE!		
Street A	A1	SANMH 2	SANMH 1	Residential	High	86	172.0	172.0	4.17	1.13	1.13	0.90	0.26	1.16	3.74	0.26	4.00	19.0	1.0%	200	1.04	32.80	0.68	91	12.2%
	A2	SANMH 3	SANMH 4	Residential	Med.	12	30.0	30.0	4.35	0.44	0.44	0.16	0.10	0.26	0.68	0.10	0.78	43.0	6.0%	200	2.56	80.34	0.84	35	1.0%
	A3	SANMH 4	SANMH 5	Residential	Med.	8	20.0	50.0	4.31	0.31	0.75	0.26	0.17	0.43	1.12	0.17	1.30	30.5	6.0%	200	2.56	80.34	0.97	43	1.6%
	A4	SANMH 5	SANMH 6	Residential	Med.	8	20.0	70.0	4.28	0.31	1.06	0.36	0.24	0.61	1.56	0.24	1.81	30.5	6.0%	200	2.56	80.34	1.06	48	2.2%
	A5		SANMH 6	Residential	Med.	1	2.5	2.5	4.46		0.00	0.01		0.01	0.06		0.06			#VALUE!			#VALUE!		
		SANMH 6	SANMH 7	Residential	Low	5	15.0	87.5	4.26	0.29	1.35	0.46	0.31	0.77	1.94	0.31	2.25	33.0	3.6%	200	1.98	62.23	0.93	58	3.6%
	A6	SANMH 7	SANMH 8	Residential	Low	7	21.0	108.5	4.23	0.36	1.71	0.57	0.39	0.96	2.39	0.39	2.79	53.0	1.9%	200	1.44	45.21	0.78	70	6.2%
	A7	SANMH 8	SANMH 9	Residential	Low	3	9.0	602.5	3.93	0.18	11.59	3.14	2.67	5.80	12.34	2.67	15.00	39.5	0.5%	250	0.86	42.05	0.75	170	35.7%
	A8	SANMH 9	SANMH 10	Residential	Low	3	9.0	611.5	3.93	0.21	11.80	3.18	2.71	5.90	12.51	2.71	15.22	34.0	0.5%	250	0.86	42.05	0.75	171	36.2%
	A9	SANMH 10	EX SANMH 9	Residential	Low	4	12.0	623.5	3.92	0.31	12.11	3.25	2.79	6.03	12.74	2.79	15.52	40.0	0.5%	250	0.86	42.05	0.75	172	36.9%

BENCHMARKS

ONTARIO MINISTRY OF NATURAL RESOURCES AND FORESTRY AND FORESTRY BENCHMARK NO. 00820038051 (CGVD28: 78), ROUND IRON BAR WITH CAP 30cm BELOW GROUND. HAVING AN ELEVATION OF 214.518 METERS. LOCATED ON WEST SIDE OF HWY 93, ON SOUTH SIDE OF ENTRANCE TO NATIVE WOOD NURSERIES No. 8484, APPROXIMATELY 1.4 KM SOUTH OF JUNCTION OF HWY 93 & HWY 12.

NOTES

No.	REVISION DESCRIPTION	DATE
1.	1ST SUBMISSION	AUG. 24

ENGINEER STAMP

LICENSED PROFESSIONAL ENGINEER
J. A. NEMISZ
100181826
Aug. 13, 2024
PROVINCE OF ONTARIO

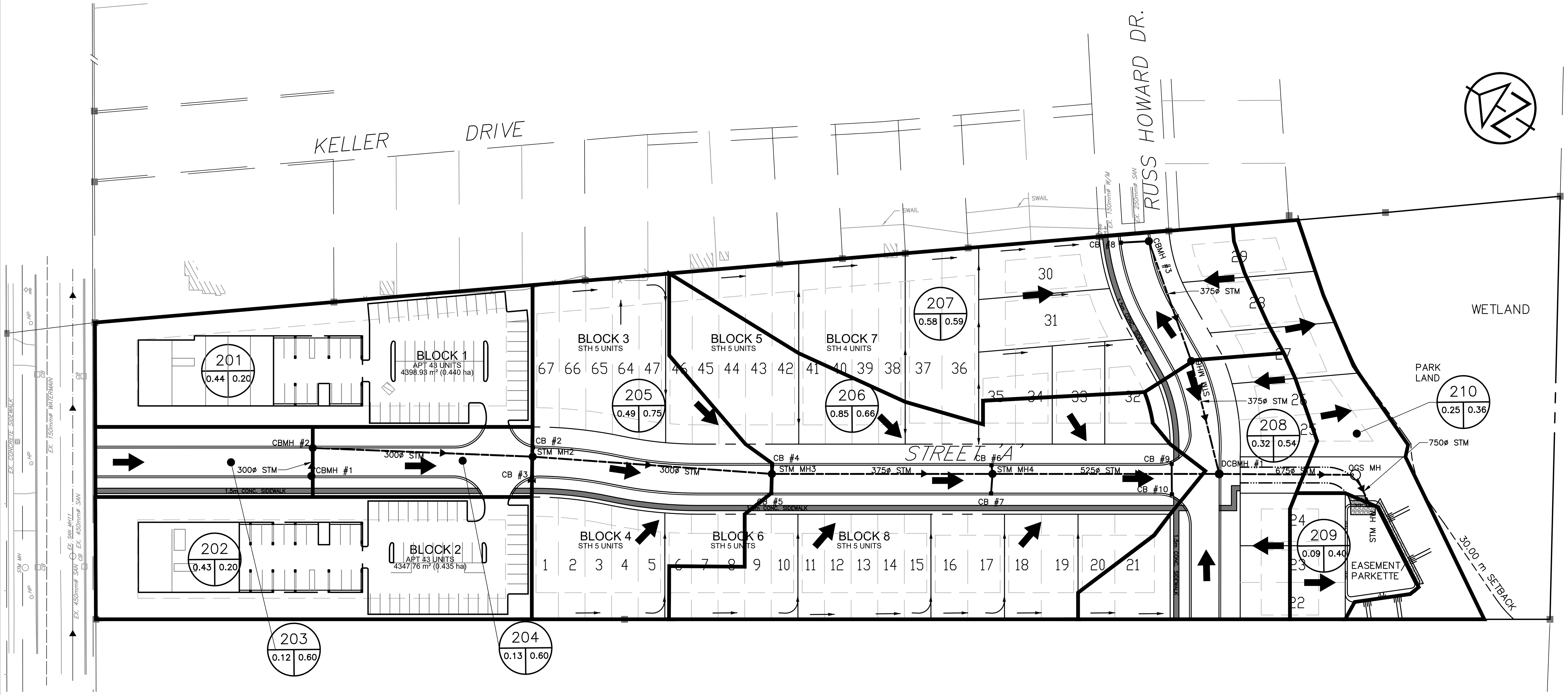
983 YONGE STREET
TOWN OF MIDLAND

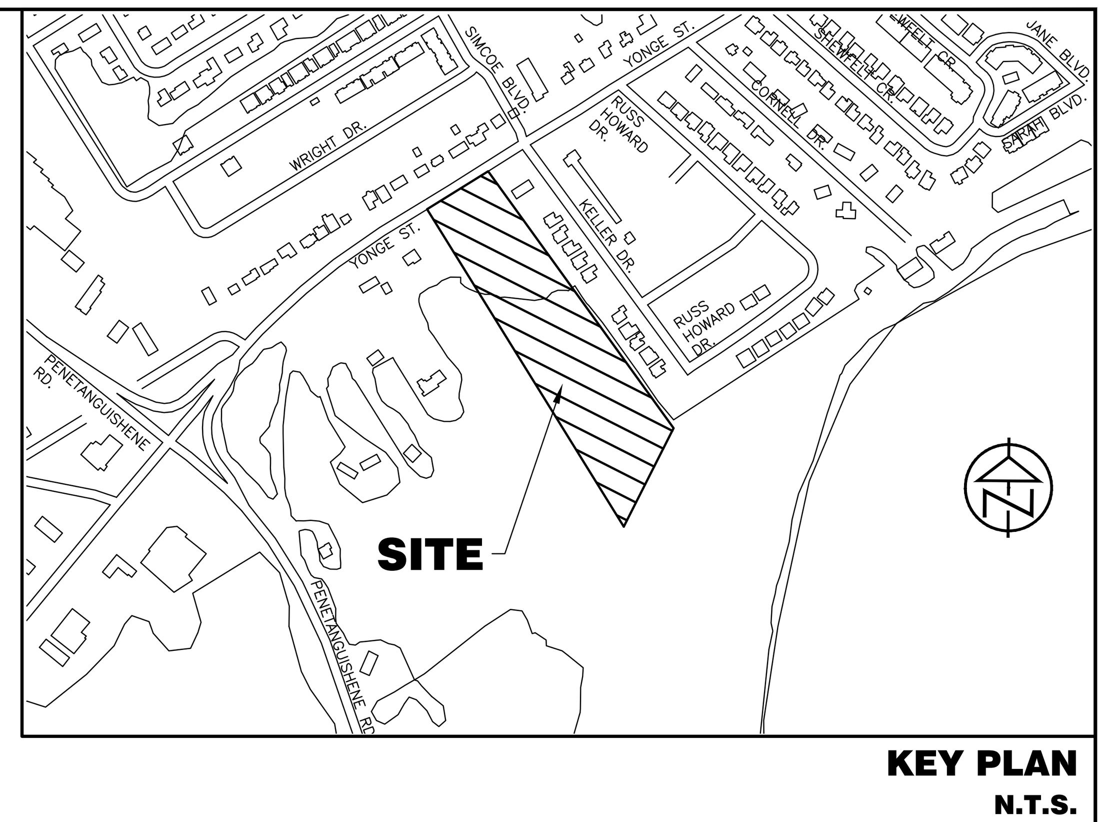
SANITARY DRAINAGE AREAS

TATHAM ENGINEERING

DESIGN: JN	FILE: 324829	DWG: SAN-1
DRAWN: MPO	DATE: APRIL 2024	
CHECK: TWW	SCALE: 1:750	

Drawing Name: 324829-SAN-1.dwg, Plotted: Aug 13, 2024





KEY PLAN
N.T.S.

LEGEND

- PROPOSED OVERLAND FLOW DIRECTION
- STORM DRAINAGE AREA BOUNDARY
- DRAINAGE AREA LABEL
- RUNOFF COEFFICIENT
- AREA IN ha.

NOTE: AREAS 201 AND 202 TO PROVIDE ON-SITE POST TO PRE DEVELOPMENT PEAK FLOW CONTROL THROUGH FUTURE SITE PLAN APPLICATION.

Storm Sewer Design Sheet

Version Date: May 15, 2025
Version Number: 1

Project Information

983 Yonge Street	324829

Drawing Reference

Post Deelopment Storm Drainage Area - STM-2	May 24/24

Prepared By

JN	May 15/24

Reviewed By

Municipality

Town of Midland

Runoff Coefficient Adjustment

Equation	3	
Year	**A**	**B**
10	1.00	0.00
25	1.10	0.00
50	1.20	0.00
100	1.25	0.00

Time of Concentration

10 mins	for C≥0.60
15 mins	for C<0.60

IDF Curve Coefficients

Year	A	B	C
2	807.44	6.75	0.83
5	1135.40	7.50	0.84
10	1387.00	7.97	0.85
25	1676.20	8.30	0.86
50	1973.10	9.00	0.87
100	2193.10	9.04	0.87

Manning's Coefficient

Material	Value
CSP	0.024
Concrete	0.013
PVC	0.013

Notes

1)

Engineer Stamp

Street Name	Area ID / Label	Upstream Maintenance Hole	Downstream Maintenance Hole	Area (ha)	5 Year Runoff Coefficient (C)	Design Storm (Year)	Adjusted Runoff Coefficient (C)	Area × Runoff Coefficient	Cumulative Area (ha)	Cumulative Area × Adjusted Runoff Coefficient	Time of Concentration (min)	Rainfall Intensity (mm/hr)	Peak Flow (m³/s)	Manning's Roughness Coefficient	Sewer Length (m)	Sewer Slope (%)	Actual Sewer Diameter (mm)	Full Flow Velocity (m/s)	Full Flow Capacity (L/s)	Actual Velocity (m/s)	Travel Time (min)	Calculated Sewer Diameter (mm)	Percentage of Full Flow Capacity (%)	Total Time of Travel (min)
Street A	201	Block 1	CBMH 2	0.44	0.20	100	0.25	0.11	0.44	0.11	15.00	137.49	0.042	0.013	6.0	4.2%	300	2.80	0.198	2.10	0.05	168	21.2%	15.05
	202	Block 2	CBMH 1	0.43	0.20	100	0.25	0.11	0.43	0.11	15.00	137.49	0.041	0.013	6.0	2.6%	300	2.21	0.156	1.74	0.06	182	26.3%	15.06
	203	CBMH 1	CBMH 2	0.12	0.60	5	0.60	0.07	0.55	0.18	15.06	82.61	0.057	0.013	8.0	4.2%	300	2.80	0.198	2.28	0.06	189	29.0%	15.12
		CBMH 2	STM MH 2	0.00	0.00	5	0.00	0.00	0.99	0.29	15.12	82.43	0.099	0.013	62.9	6.0%	300	3.35	0.237	3.01	0.35	216	41.9%	15.46
	204	STM MH 2	STM MH 3	0.13	0.60	5	0.60	0.08	1.12	0.37	15.46	81.38	0.116	0.013	68.5	6.0%	300	3.35	0.237	3.14	0.36	229	48.8%	15.83
	205	STM MH 3	STM MH 4	0.49	0.75	5	0.75	0.37	1.61	0.74	15.83	80.31	0.196	0.013	63.0	5.0%	**375**	3.55	0.392	3.35	0.31	289	50.0%	16.14
	206	STM MH 4	DCBMH 1	0.85	0.66	5	0.66	0.56	2.46	1.30	16.14	79.42	0.318	0.013	64.7	2.2%	**525**	2.95	0.638	2.77	0.39	404	49.8%	16.53
	207	CBMH 3	STM MH 5	0.58	0.59	5	0.59	0.34	0.58	0.34	15.00	82.79	0.079	0.013	36.3	1.4%	**375**	1.88	0.207	1.63	0.37	261	37.9%	15.37
		STM MH 5	DCBMH 1	0.00	0.00	5	0.00	0.00	0.58	0.34	15.37	81.66	0.078	0.013	33.2	1.4%	**375**	1.88	0.207	1.63	0.34	259	37.4%	15.71
	208	DCBMH 1	OGS MH	0.32	0.54	5	0.54	0.17	3.36	1.81	16.53	78.33	0.425	0.013	38.9	1.0%	**675**	2.35	0.841	2.21	0.29	523	50.6%	16.82
		OGS MH	Pond	0.00	0.00	5	0.00	0.00	3.36	1.81	16.82	77.54	0.421	0.013	9.0	0.5%	**750**	1.78	0.787	1.70	0.09	593	53.5%	16.91

BENCHMARKS

ONTARIO MINISTRY OF NATURAL RESOURCES AND FORESTRY AND FORESTRY BENCHMARK NO. 00820038051 (CGVD28: 78), ROUND IRON BAR WITH CAP 30cm BELOW GROUND. HAVING AN ELEVATION OF 214.518 METERS. LOCATED ON WEST SIDE OF HWY 93, ON SOUTH SIDE OF ENTRANCE TO NATIVE WOOD NURSERIES No. 8484, APPROXIMATELY 1.4 KM SOUTH OF JUNCTION OF HWY 93 & HWY 12.

NOTES

No.	REVISION DESCRIPTION	DATE
1.	1ST SUBMISSION	AUG. 24

ENGINEER STAMP

LICENSED PROFESSIONAL ENGINEER
J. A. NEMISZ
100181826
Aug. 13, 2024
PROVINCE OF ONTARIO

983 YONGE STREET
TOWN OF MIDLAND

POST DEVELOPMENT STORM DRAINAGE AREAS

TATHAM ENGINEERING

DESIGN: JN	FILE: 324829	DWG:
DRAWN: MPO	DATE: APRIL 2024	**STM-2**
CHECK: TWW	SCALE: 1:750	

Drawing Name: 324829-STM-1.dwg, Plotted: Aug 13, 2024

Appendix B:
Sanitary Sewer Calculations

TATHAM ENGINEERING

Sanitary Sewer Design Sheet

Version Date: May 27, 2024

Version Number: 1

Project Information

983 Yonge Street, Midland - Original Design - 300 L/cap/day	324829

Drawing Reference

324829 - SAN-1	May 27/24

Prepared By

JN	May 27/24

Reviewed By

Municipality

Town of Midland

Population Density

Capita per Unit	Low	Medium	High
	3.00	2.50	2.00

Infiltration

Infiltration (L/s/ha)	0.23

Manning's Coefficient

Pipe Material	Value
Concrete	0.013
PVC	0.013
Applied	0.013

Flow

Development Type	Average (L/cap/day)	Peaking Factor
Residential	300	Harmon
Development Type	**Average (L/ha/day)**	**Peaking Factor**
Institution	-	-
Commercial	25,000	-
Industrial (High)	-	-
Industrial (Low)	35,000	-

Notes

1) Unit rate of 300 L/cap/day considered per recommendations of Wastewater Master Plan to assess capacity impacts on receiving infrastructure.

Engineers Seal

Street Name	Area Label/ID	Upstream Maintenance Hole	Downstream Maintenance Hole	Development Type	Population Density	Number of Units	Population (cap)	Accumulated Population (cap)	Peaking Factor	Area (ha)	Cumulative Area (ha)	Average Flow (L/s) Development	Average Flow (L/s) Infiltration	Average Flow (L/s) Total	Peak Flow (L/s) Development	Peak Flow (L/s) Infiltration	Peak Flow (L/s) Total	Proposed Sanitary Sewer: Sewer Length (m)	Sewer Slope (%)	Actual Sewer Diameter (mm)	Full Flow Velocity (m/s)	Full Flow Capacity (L/s)	Actual Velocity (m/s)	Calculated Sewer Diameter (mm)	Percentage of Full Flow Capacity (%)
Stollar Development Design	EXT 1	EXT 1	SANMH 9	Residential	Med.	268	670.0	670.0	3.91	13.40	13.40	2.33	3.08	5.41	9.09	3.08	12.17			#VALUE!			#VALUE!		
Russ Howard Drive	8	SANMH 9	SANMH 8	Residential	Low	2	6.0	676.0	3.90	0.21	13.61	2.35	3.13	5.48	9.16	3.13	12.29	47.0	1.0%	250	1.21	59.47	0.91	138	20.7%
Keller Drive	8 - 14	SANMH 11	SANMH 8	Residential	Low	29	87.0	87.0	4.26	2.84	2.84	0.30	0.65	0.96	1.29	0.65	1.94	30.4	5.0%	200	2.33	73.34	1.01	51	2.6%
Russ Howard Drive	7	SANMH 8	SANMH 7	Residential	Low	11	33.0	796.0	3.86	0.91	17.36	2.76	3.99	6.76	10.67	3.99	14.67	110.0	0.5%	250	0.86	42.05	0.74	168	34.9%
	6	SANMH 7	SANMH 6	Residential	Low	7	21.0	817.0	3.85	0.58	17.94	2.84	4.13	6.96	10.94	4.13	15.06	60.5	0.5%	250	0.86	42.05	0.75	170	35.8%
Commercial Block - Floor Area	1		SANMH 5	Commercial			-	0.0	-	0.47	0.47	0.14	0.11	0.24		0.11	0.11			#VALUE!			#VALUE!		
Commercial Block - Infiltration	1		SANMH 5	Institution			-	0.0	-	0.54	0.54		0.12	0.12		0.12	0.12			#VALUE!			#VALUE!		
Russ Howard Drive	2 - 5	SANMH 5	SANMH 6	Residential	Low	23	69.0	69.0	4.28	2.29	3.30	0.38	0.76	1.13	1.03	0.76	1.79	14.2	8.0%	200	2.95	92.77	1.17	45	1.9%
SPS Easement		SANMH 6	SANMH 15	Institution			-	886.0	-		21.24	3.21	4.89	8.10	11.96	4.89	16.85	44.7	4.4%	250	2.54	124.88	1.70	118	13.5%
		SANMH 15	SPS	Institution			-	886.0	-		21.24	3.21	4.89	8.10	11.96	4.89	16.85	31.3	5.8%	250	2.90	142.60	1.88	112	11.8%
External Developments																									
Cornell Drive		EXT 2	SPS	Residential	Low	21	63.0	63.0	4.29	2.71	2.71	0.22	0.62	0.84	0.94	0.62	1.56			#VALUE!			#VALUE!		
Shewfelt Crescent		EXT 3	SPS	Residential	Low	31	93.0	93.0	4.25	3.63	3.63	0.32	0.83	1.16	1.37	0.83	2.21			#VALUE!			#VALUE!		
Sarah & Jane Boulevard		EXT 4A	SPS	Residential	Med.	60	150.0	150.0	4.19	3.42	3.42	0.52	0.79	1.31	2.18	0.79	2.97			#VALUE!			#VALUE!		
		EXT 4B	SPS	Residential	Low	2	6.0	6.0	4.43		0.00	0.02		0.02	0.09		0.09			#VALUE!			#VALUE!		
Russ Howard Drive		SPS	Y SANMH 10	Institution			-	1198.0	-		31.00	4.30	7.13	11.43	16.55	7.13	23.68			#VALUE!			#VALUE!		

TATHAM ENGINEERING

Sanitary Sewer Design Sheet

Version Date: May 27, 2024
Version Number: 1

Project Information

983 Yonge Street, Midland - Original Design - 300 L/cap/day	324829

Drawing Reference

324829 - SAN-1	May 27/24

Prepared By

JN	May 27/24

Reviewed By

Municipality

Town of Midland

Population Density

Capita per Unit	Low	Medium	High
	3.00	2.50	2.00

Infiltration

Infiltration (L/s/ha)	0.23

Manning's Coefficient

Pipe Material	Value
Concrete	0.013
PVC	0.013
Applied	0.013

Flow

Development Type	Average (L/cap/day)	Peaking Factor
Residential	300	Harmon
Development Type	**Average (L/ha/day)**	**Peaking Factor**
Institution	-	-
Commercial	25,000	-
Industrial (High)	-	-
Industrial (Low)	35,000	-

Notes

1) Unit rate of 300 L/cap/day considered per recommendations of Wastewater Master Plan to assess capacity impacts on receiving infrastructure.

Engineers Seal

Street Name	Area Label/ID	Upstream Maintenance Hole	Downstream Maintenance Hole	Development Type	Population Density	Number of Units	Population (cap)	Accumulated Population (cap)	Peaking Factor	Area (ha)	Cumulative Area (ha)	Average Flow (L/s) Development	Average Flow (L/s) Infiltration	Average Flow (L/s) Total	Peak Flow (L/s) Development	Peak Flow (L/s) Infiltration	Peak Flow (L/s) Total	Proposed Sanitary Sewer Sewer Length (m)	Sewer Slope (%)	Actual Sewer Diameter (mm)	Full Flow Velocity (m/s)	Full Flow Capacity (L/s)	Actual Velocity (m/s)	Calculated Sewer Diameter (mm)	Percentage of Full Flow Capacity (%)
Yonge Street		Y SANMH 11	Y SANMH 10	Institution		0	-	0.0	-	0.00	0.00							107.0	1.6%	450	2.27	360.63	#VALUE!	#VALUE!	#VALUE!
		Y SANMH 10	Y SANMH 9	Institution		0	-	1198.0	-	0.00	31.00	4.30	7.13	11.43	16.55	7.13	23.68	110.0	1.4%	450	2.12	337.34	1.19	166	7.0%

Sanitary Sewer Design Sheet

TATHAM ENGINEERING

Version Date: May 27, 2024

Version Number: 1

Project Information

983 Yonge Street, Midland - Original Design - 450 L/cap/day	324829

Drawing Reference

324829 - SAN-1	May 27/24

Prepared By

JN	May 27/24

Reviewed By

Municipality

Town of Midland

Population Density

Capita per Unit	Low	Medium	High
	3.00	2.50	2.00

Infiltration

Infiltration (L/s/ha)	0.23

Manning's Coefficient

Pipe Material	Value
Concrete	0.013
PVC	0.013
Applied	0.013

Flow

Development Type	Average (L/cap/day)	Peaking Factor
Residential	450	Harmon
Development Type	**Average (L/ha/day)**	**Peaking Factor**
Institution	-	-
Commercial	25,000	-
Industrial (High)	-	-
Industrial (Low)	35,000	-

Notes

1) Unit rate of 450 L/cap/day applied in accordance with Town Standards to assess peak flow capacity of local gravity sewers.

Engineers Seal

Street Name	Area Label/ID	Upstream Maintenance Hole	Downstream Maintenance Hole	Development Type	Population Density	Number of Units	Population (cap)	Accumulated Population (cap)	Peaking Factor	Area (ha)	Cumulative Area (ha)	Average Flow (L/s) Development	Average Flow (L/s) Infiltration	Average Flow (L/s) Total	Peak Flow (L/s) Development	Peak Flow (L/s) Infiltration	Peak Flow (L/s) Total	Proposed Sanitary Sewer: Sewer Length (m)	Sewer Slope (%)	Actual Sewer Diameter (mm)	Full Flow Velocity (m/s)	Full Flow Capacity (L/s)	Actual Velocity (m/s)	Calculated Sewer Diameter (mm)	Percentage of Full Flow Capacity (%)
Stollar Development Design	EXT 1	EXT 1	SANMH 9	Residential	Med.	268	670.0	670.0	3.91	13.40	13.40	3.49	3.08	6.57	13.63	3.08	16.71			#VALUE!			#VALUE!		
Russ Howard Drive	8	SANMH 9	SANMH 8	Residential	Low	2	6.0	676.0	3.90	0.21	13.61	3.52	3.13	6.65	13.74	3.13	16.87	47.0	1.0%	250	1.21	59.47	0.99	156	28.4%
Keller Drive	8 - 14	SANMH 11	SANMH 8	Residential	Low	29	87.0	87.0	4.26	2.84	2.84	0.45	0.65	1.11	1.93	0.65	2.58	30.4	5.0%	200	2.33	73.34	1.09	57	3.5%
Russ Howard Drive	7	SANMH 8	SANMH 7	Residential	Low	11	33.0	796.0	3.86	0.91	17.36	4.15	3.99	8.14	16.01	3.99	20.00	110.0	0.5%	250	0.86	42.05	0.81	189	47.6%
	6	SANMH 7	SANMH 6	Residential	Low	7	21.0	817.0	3.85	0.58	17.94	4.26	4.13	8.38	16.40	4.13	20.53	60.5	0.5%	250	0.86	42.05	0.81	191	48.8%
Commercial Block - Floor Area	1		SANMH 5	Commercial			-	0.0	-	0.47	0.47	0.14	0.11	0.24		0.11	0.11			#VALUE!			#VALUE!		
Commercial Block - Infiltration	1		SANMH 5	Institution			-	0.0	-	0.54	0.54		0.12	0.12		0.12	0.12			#VALUE!			#VALUE!		
Russ Howard Drive	2 - 5	SANMH 5	SANMH 6	Residential	Low	23	69.0	69.0	4.28	2.29	3.30	0.50	0.76	1.25	1.54	0.76	2.30	14.2	8.0%	200	2.95	92.77	1.25	50	2.5%
SPS Easement		SANMH 6	SANMH 15	Institution			-	886.0	-		21.24	4.75	4.89	9.64	17.94	4.89	22.83	44.7	4.4%	250	2.54	124.88	1.85	132	18.3%
		SANMH 15	SPS	Institution			-	886.0	-		21.24	4.75	4.89	9.64	17.94	4.89	22.83	31.3	5.8%	250	2.90	142.60	2.04	126	16.0%
External Developments																									
Cornell Drive		EXT 2	SPS	Residential	Low	21	63.0	63.0	4.29	2.71	2.71	0.33	0.62	0.95	1.41	0.62	2.03			#VALUE!			#VALUE!		
Shewfelt Crescent		EXT 3	SPS	Residential	Low	31	93.0	93.0	4.25	3.63	3.63	0.48	0.83	1.32	2.06	0.83	2.89			#VALUE!			#VALUE!		
Sarah & Jane Boulevard		EXT 4A	SPS	Residential	Med.	60	150.0	150.0	4.19	3.42	3.42	0.78	0.79	1.57	3.27	0.79	4.06			#VALUE!			#VALUE!		
		EXT 4B	SPS	Residential	Low	2	6.0	6.0	4.43		0.00	0.03		0.03	0.14		0.14			#VALUE!			#VALUE!		
Russ Howard Drive		SPS	Y SANMH 10	Institution			-	1198.0	-		31.00	6.38	7.13	13.51	24.82	7.13	31.95			#VALUE!			#VALUE!		

Sanitary Sewer Design Sheet

Version Date:	May 27, 2024
Version Number:	1

Project Information

983 Yonge Street, Midland - Original Design - 450 L/cap/day	324829

Drawing Reference

324829 - SAN-1	May 27/24

Prepared By

JN	May 27/24

Reviewed By

Municipality

Town of Midland

Population Density

Capita per Unit	Low	Medium	High
	3.00	2.50	2.00

Infiltration

Infiltration (L/s/ha)	0.23

Manning's Coefficient

Pipe Material	Value
Concrete	0.013
PVC	0.013
Applied	0.013

Flow

Development Type	Average (L/cap/day)	Peaking Factor
Residential	450	Harmon
Development Type	**Average (L/ha/day)**	**Peaking Factor**
Institution	-	-
Commercial	25,000	-
Industrial (High)	-	-
Industrial (Low)	35,000	-

Notes

1) Unit rate of 450 L/cap/day applied in accordance with Town Standards to assess peak flow capacity of local gravity sewers.

Engineers Seal

Street Name	Area Label/ID	Upstream Maintenance Hole	Downstream Maintenance Hole	Development Type	Population Density	Number of Units	Population (cap)	Accumulated Population (cap)	Peaking Factor	Area (ha)	Cumulative Area (ha)	Average Flow (L/s) Development	Average Flow (L/s) Infiltration	Average Flow (L/s) Total	Peak Flow (L/s) Development	Peak Flow (L/s) Infiltration	Peak Flow (L/s) Total	Proposed Sanitary Sewer: Sewer Length (m)	Sewer Slope (%)	Actual Sewer Diameter (mm)	Full Flow Velocity (m/s)	Full Flow Capacity (L/s)	Actual Velocity (m/s)	Calculated Sewer Diameter (mm)	Percentage of Full Flow Capacity (%)
Yonge Street		Y SANMH 11	Y SANMH 10	Institution		0	-	0.0	-	0.00	0.00							107.0	1.6%	450	2.27	360.63	#VALUE!	#VALUE!	#VALUE!
		Y SANMH 10	Y SANMH 9	Institution		0	-	1198.0	-	0.00	31.00	6.38	7.13	13.51	24.82	7.13	31.95	110.0	1.4%	450	2.12	337.34	1.29	186	9.5%

Sanitary Sewer Design Sheet

Version Date:	May 27, 2024
Version Number:	1

Project Information

983 Yonge Street, Midland - Proposed Design - 300 L/cap/day	324829

Drawing Reference

324829 - SAN-1	May 27/24

Prepared By

JN	May 27/24

Reviewed By

Municipality

Town of Midland

Population Density

Capita per Unit	Low	Medium	High
	3.00	2.50	2.00

Infiltration

Infiltration (L/s/ha)	0.23

Manning's Coefficient

Pipe Material	Value
Concrete	0.013
PVC	0.013
Applied	0.013

Flow

Development Type	Average (L/cap/day)	Peaking Factor
Residential	300	Harmon
Development Type	**Average (L/ha/day)**	**Peaking Factor**
Institution	-	-
Commercial	25,000	-
Industrial (High)	-	-
Industrial (Low)	35,000	-

Notes

1) Unit rate of 300 L/cap/day considered per recommendations of Wastewater Master Plan to assess capacity impacts on receiving infrastructure.
2) Area of 0.16 ha not serviced by sanitary sewer removed from development lands.

Engineers Seal

Street Name	Area Label/ID	Upstream Maintenance Hole	Downstream Maintenance Hole	Development Type	Population Density	Number of Units	Population (cap)	Accumulated Population (cap)	Peaking Factor	Area (ha)	Cumulative Area (ha)	Average Flow (L/s) Development	Average Flow (L/s) Infiltration	Average Flow (L/s) Total	Peak Flow (L/s) Development	Peak Flow (L/s) Infiltration	Peak Flow (L/s) Total	Proposed Sanitary Sewer Sewer Length (m)	Sewer Slope (%)	Actual Sewer Diameter (mm)	Full Flow Velocity (m/s)	Full Flow Capacity (L/s)	Actual Velocity (m/s)	Calculated Sewer Diameter (mm)	Percentage of Full Flow Capacity (%)
Stollar Development Design	EXT 1	EXT 1	SANMH 8	Residential	Med.	194	485.0	485.0	3.98	9.70	9.70	1.68	2.23	3.92	6.70	2.23	8.94			#VALUE!			#VALUE!		
Street A	A1	SANMH 2	SANMH 1	Residential	High	86	172.0	172.0	4.17	1.13	1.13	0.60	0.26	0.86	2.49	0.26	2.75	19.0	1.0%	200	1.04	32.80	0.61	79	8.4%
	A2	SANMH 3	SANMH 4	Residential	Med.	12	30.0	30.0	4.35	0.44	0.44	0.10	0.10	0.21	0.45	0.10	0.55	43.0	6.0%	200	2.56	80.34	0.77	31	0.7%
	A3	SANMH 4	SANMH 5	Residential	Med.	8	20.0	50.0	4.31	0.31	0.75	0.17	0.17	0.35	0.75	0.17	0.92	30.5	6.0%	200	2.56	80.34	0.88	37	1.1%
	A4	SANMH 5	SANMH 6	Residential	Med.	8	20.0	70.0	4.28	0.31	1.06	0.24	0.24	0.49	1.04	0.24	1.28	30.5	6.0%	200	2.56	80.34	0.96	42	1.6%
	A5		SANMH 6	Residential	Med.	1	2.5	2.5	4.46		0.00	0.01		0.01	0.04		0.04			#VALUE!			#VALUE!		
		SANMH 6	SANMH 7	Residential	Low	5	15.0	87.5	4.26	0.29	1.35	0.30	0.31	0.61	1.29	0.31	1.60	33.0	3.6%	200	1.98	62.23	0.85	51	2.6%
	A6	SANMH 7	SANMH 8	Residential	Low	7	21.0	108.5	4.23	0.36	1.71	0.38	0.39	0.77	1.59	0.39	1.99	53.0	1.9%	200	1.44	45.21	0.71	62	4.4%
	A7	SANMH 8	SANMH 9	Residential	Low	3	9.0	602.5	3.93	0.18	11.59	2.09	2.67	4.76	8.22	2.67	10.89	39.5	0.5%	250	0.86	42.05	0.68	151	25.9%
	A8	SANMH 9	SANMH 10	Residential	Low	3	9.0	611.5	3.93	0.21	11.80	2.12	2.71	4.84	8.34	2.71	11.05	34.0	0.5%	250	0.86	42.05	0.69	151	26.3%
	A9	SANMH 10	EX SANMH 9	Residential	Low	4	12.0	623.5	3.92	0.31	12.11	2.16	2.79	4.95	8.49	2.79	11.28	40.0	0.5%	250	0.86	42.05	0.69	153	26.8%

TATHAM ENGINEERING

Sanitary Sewer Design Sheet

Version Date: May 27, 2024

Version Number: 1

Project Information

983 Yonge Street, Midland - Proposed Design - 300 L/cap/day	324829

Drawing Reference

324829 - SAN-1	May 27/24

Prepared By

JN	May 27/24

Reviewed By

Municipality

Town of Midland

Population Density

	Low	Medium	High
Capita per Unit	3.00	2.50	2.00

Infiltration

Infiltration (L/s/ha)	0.23

Manning's Coefficient

Pipe Material	Value
Concrete	0.013
PVC	0.013
Applied	0.013

Flow

Development Type	Average (L/cap/day)	Peaking Factor
Residential	300	Harmon
Development Type	**Average (L/ha/day)**	**Peaking Factor**
Institution	-	-
Commercial	25,000	-
Industrial (High)	-	-
Industrial (Low)	35,000	-

Notes

1) Unit rate of 300 L/cap/day considered per recommendations of Wastewater Master Plan to assess capacity impacts on receiving infrastructure.
2) Area of 0.16 ha not serviced by sanitary sewer removed from development lands.

Engineers Seal

Street Name	Area Label/ID	Upstream Maintenance Hole	Downstream Maintenance Hole	Development Type	Population Density	Number of Units	Population (cap)	Accumulated Population (cap)	Peaking Factor	Area (ha)	Cumulative Area (ha)	Average Flow (L/s): Development	Average Flow (L/s): Infiltration	Average Flow (L/s): Total	Peak Flow (L/s): Development	Peak Flow (L/s): Infiltration	Peak Flow (L/s): Total	Proposed Sanitary Sewer: Sewer Length (m)	Sewer Slope (%)	Actual Sewer Diameter (mm)	Full Flow Velocity (m/s)	Full Flow Capacity (L/s)	Actual Velocity (m/s)	Calculated Sewer Diameter (mm)	Percentage of Full Flow Capacity (%)
Russ Howard Drive	8	EX SANMH 9	EX SANMH 8	Residential	Low	2	6.0	629.5	3.92	0.21	12.32	2.19	2.83	5.02	8.57	2.83	11.40	47.0	1.0%	250	1.21	59.47	0.89	135	19.2%
Keller Drive	8 - 14	EX SANMH 11	EX SANMH 8	Residential	Low	27	81.0	81.0	4.27	2.84	2.84	0.28	0.65	0.93	1.20	0.65	1.85	30.4	5.0%	200	2.33	73.34	0.99	50	2.5%
Russ Howard Drive	7	EX SANMH 8	EX SANMH 7	Residential	Low	11	33.0	743.5	3.88	0.91	16.07	2.58	3.70	6.28	10.01	3.70	13.71	110.0	0.5%	250	0.86	42.05	0.73	164	32.6%
	6	EX SANMH 7	EX SANMH 6	Residential	Low	7	21.0	764.5	3.87	0.58	16.65	2.65	3.83	6.48	10.28	3.83	14.11	60.5	0.5%	250	0.86	42.05	0.73	166	33.6%
Commercial Block - Floor Area	1		EX SANMH 5	Commercial			-	0.0	-	0.47	0.47	0.14	0.11	0.24		0.11	0.11			#VALUE!			#VALUE!		
Commercial Block - Infiltration	1		EX SANMH 5	Institution			-	0.0	-	0.54	0.54		0.12	0.12		0.12	0.12			#VALUE!			#VALUE!		
Russ Howard Drive	2 - 5	EX SANMH 5	EX SANMH 6	Residential	Low	23	69.0	69.0	4.28	2.29	3.30	0.38	0.76	1.13	1.03	0.76	1.79	14.2	8.0%	200	2.95	92.77	1.17	45	1.9%
SPS Easement		EX SANMH 6	EX SANMH 15	Institution			-	833.5	-		19.95	3.03	4.59	7.62	11.31	4.59	15.89	44.7	4.4%	250	2.54	124.88	1.68	115	12.7%
		EX SANMH 15	EX SPS	Institution			-	833.5	-		19.95	3.03	4.59	7.62	11.31	4.59	15.89	31.3	5.8%	250	2.90	142.60	1.85	110	11.1%
External Developments																									
Cornell Drive		EXT 2	EX SPS	Residential	Low	18	54.0	54.0	4.31	2.71	2.71	0.19	0.62	0.81	0.81	0.62	1.43			#VALUE!			#VALUE!		
Shewfelt Crescent		EXT 3	EX SPS	Residential	Low	31	93.0	93.0	4.25	3.63	3.63	0.32	0.83	1.16	1.37	0.83	2.21			#VALUE!			#VALUE!		
Sarah & Jane Boulevard		EXT 4A	EX SPS	Residential	Med.	60	150.0	150.0	4.19	3.42	3.42	0.52	0.79	1.31	2.18	0.79	2.97			#VALUE!			#VALUE!		
		EXT 4B	EX SPS	Residential	Low	2	6.0	6.0	4.43		0.00	0.02		0.02	0.09		0.09			#VALUE!			#VALUE!		
Russ Howard Drive		EX SPS	Y SANMH 10	Institution			-	1136.5	-		29.71	4.08	6.83	10.92	15.76	6.83	22.59			#VALUE!			#VALUE!		

Sanitary Sewer Design Sheet

TATHAM ENGINEERING

Version Date:	May 27, 2024
Version Number:	1

Project Information

983 Yonge Street, Midland - Proposed Design - 300 L/cap/day	324829

Drawing Reference

324829 - SAN-1	May 27/24

Prepared By

JN	May 27/24

Reviewed By

Municipality

Town of Midland

Population Density

Capita per Unit	Low	Medium	High
	3.00	2.50	2.00

Infiltration

Infiltration (L/s/ha)	0.23

Manning's Coefficient

Pipe Material	Value
Concrete	0.013
PVC	0.013
Applied	0.013

Flow

Development Type	Average (L/cap/day)	Peaking Factor
Residential	300	Harmon
Development Type	**Average (L/ha/day)**	**Peaking Factor**
Institution	-	-
Commercial	25,000	-
Industrial (High)	-	-
Industrial (Low)	35,000	-

Notes

1) Unit rate of 300 L/cap/day considered per recommendations of Wastewater Master Plan to assess capacity impacts on receiving infrastructure.
2) Area of 0.16 ha not serviced by sanitary sewer removed from development lands.

Engineers Seal

Street Name	Area Label/ID	Upstream Maintenance Hole	Downstream Maintenance Hole	Development Type	Population Density	Number of Units	Population (cap)	Accumulated Population (cap)	Peaking Factor	Area (ha)	Cumulative Area (ha)	Average Flow (L/s) Development	Average Flow (L/s) Infiltration	Average Flow (L/s) Total	Peak Flow (L/s) Development	Peak Flow (L/s) Infiltration	Peak Flow (L/s) Total	Proposed Sanitary Sewer Sewer Length (m)	Sewer Slope (%)	Actual Sewer Diameter (mm)	Full Flow Velocity (m/s)	Full Flow Capacity (L/s)	Actual Velocity (m/s)	Calculated Sewer Diameter (mm)	Percentage of Full Flow Capacity (%)
Yonge Street		SANMH 1	Y SANMH 10	Institution		0	-	172.0	-	0.00	1.13	0.60	0.26	0.86	2.49	0.26	2.75	107.0	1.6%	450	2.27	360.63	0.70	72	0.8%
		Y SANMH 10	Y SANMH 9	Institution		0	-	1308.5	-	0.00	30.84	4.68	7.09	11.77	18.25	7.09	25.35	110.0	1.4%	450	2.12	337.34	1.21	170	7.5%

TATHAM ENGINEERING

Sanitary Sewer Design Sheet

Version Date:	May 27, 2024
Version Number:	1

Project Information

983 Yonge Street, Midland - Proposed Design - 450 L/cap/day	324829

Drawing Reference

324829 - SAN-1	May 27/24

Prepared By

JN	May 27/24

Reviewed By

Municipality

Town of Midland

Population Density

	Low	Medium	High
Capita per Unit	3.00	2.50	2.00

Infiltration

Infiltration (L/s/ha)	0.23

Manning's Coefficient

Pipe Material	Value
Concrete	0.013
PVC	0.013
Applied	0.013

Flow

Development Type	Average (L/cap/day)	Peaking Factor
Residential	450	Harmon
Development Type	**Average (L/ha/day)**	**Peaking Factor**
Institution	-	-
Commercial	25,000	-
Industrial (High)	-	-
Industrial (Low)	35,000	-

Notes

1) Unit rate of 450 L/cap/day applied in accordance with Town Standards to assess peak flow capacity of local gravity sewers.
2) Area of 0.16 ha not serviced by sanitary sewer removed from development lands.

Engineers Seal

Street Name	Area Label/ID	Upstream Maintenance Hole	Downstream Maintenance Hole	Development Type	Population Density	Number of Units	Population (cap)	Accumulated Population (cap)	Peaking Factor	Area (ha)	Cumulative Area (ha)	Average Flow (L/s) Development	Average Flow (L/s) Infiltration	Average Flow (L/s) Total	Peak Flow (L/s) Development	Peak Flow (L/s) Infiltration	Peak Flow (L/s) Total	Proposed Sanitary Sewer: Sewer Length (m)	Sewer Slope (%)	Actual Sewer Diameter (mm)	Full Flow Velocity (m/s)	Full Flow Capacity (L/s)	Actual Velocity (m/s)	Calculated Sewer Diameter (mm)	Percentage of Full Flow Capacity (%)
Stollar Development Design	EXT 1	EXT 1	SANMH 8	Residential	Med.	194	485.0	485.0	3.98	9.70	9.70	2.53	2.23	4.76	10.06	2.23	12.29			#VALUE!			#VALUE!		
Street A	A1	SANMH 2	SANMH 1	Residential	High	86	172.0	172.0	4.17	1.13	1.13	0.90	0.26	1.16	3.74	0.26	4.00	19.0	1.0%	200	1.04	32.80	0.68	91	12.2%
	A2	SANMH 3	SANMH 4	Residential	Med.	12	30.0	30.0	4.35	0.44	0.44	0.16	0.10	0.26	0.68	0.10	0.78	43.0	6.0%	200	2.56	80.34	0.84	35	1.0%
	A3	SANMH 4	SANMH 5	Residential	Med.	8	20.0	50.0	4.31	0.31	0.75	0.26	0.17	0.43	1.12	0.17	1.30	30.5	6.0%	200	2.56	80.34	0.97	43	1.6%
	A4	SANMH 5	SANMH 6	Residential	Med.	8	20.0	70.0	4.28	0.31	1.06	0.36	0.24	0.61	1.56	0.24	1.81	30.5	6.0%	200	2.56	80.34	1.06	48	2.2%
	A5		SANMH 6	Residential	Med.	1	2.5	2.5	4.46		0.00	0.01		0.01	0.06		0.06			#VALUE!			#VALUE!		
		SANMH 6	SANMH 7	Residential	Low	5	15.0	87.5	4.26	0.29	1.35	0.46	0.31	0.77	1.94	0.31	2.25	33.0	3.6%	200	1.98	62.23	0.93	58	3.6%
	A6	SANMH 7	SANMH 8	Residential	Low	7	21.0	108.5	4.23	0.36	1.71	0.57	0.39	0.96	2.39	0.39	2.79	53.0	1.9%	200	1.44	45.21	0.78	70	6.2%
	A7	SANMH 8	SANMH 9	Residential	Low	3	9.0	602.5	3.93	0.18	11.59	3.14	2.67	5.80	12.34	2.67	15.00	39.5	0.5%	250	0.86	42.05	0.75	170	35.7%
	A8	SANMH 9	SANMH 10	Residential	Low	3	9.0	611.5	3.93	0.21	11.80	3.18	2.71	5.90	12.51	2.71	15.22	34.0	0.5%	250	0.86	42.05	0.75	171	36.2%
	A9	SANMH 10	EX SANMH 9	Residential	Low	4	12.0	623.5	3.92	0.31	12.11	3.25	2.79	6.03	12.74	2.79	15.52	40.0	0.5%	250	0.86	42.05	0.75	172	36.9%

TATHAM ENGINEERING

Sanitary Sewer Design Sheet

Version Date: May 27, 2024

Version Number: 1

Project Information

983 Yonge Street, Midland - Proposed Design - 450 L/cap/day	324829

Drawing Reference

324829 - SAN-1	May 27/24

Prepared By

JN	May 27/24

Reviewed By

Municipality

Town of Midland

Population Density

Capita per Unit	Low	Medium	High
	3.00	2.50	2.00

Infiltration

Infiltration (L/s/ha)	0.23

Manning's Coefficient

Pipe Material	Value
Concrete	0.013
PVC	0.013
Applied	0.013

Flow

Development Type	Average (L/cap/day)	Peaking Factor
Residential	450	Harmon
Development Type	**Average (L/ha/day)**	**Peaking Factor**
Institution	-	-
Commercial	25,000	-
Industrial (High)	-	-
Industrial (Low)	35,000	-

Notes

1) Unit rate of 450 L/cap/day applied in accordance with Town Standards to assess peak flow capacity of local gravity sewers.
2) Area of 0.16 ha not serviced by sanitary sewer removed from development lands.

Engineers Seal

Street Name	Area Label/ID	Upstream Maintenance Hole	Downstream Maintenance Hole	Development Type	Population Density	Number of Units	Population (cap)	Accumulated Population (cap)	Peaking Factor	Area (ha)	Cumulative Area (ha)	Average Flow (L/s) Development	Average Flow (L/s) Infiltration	Average Flow (L/s) Total	Peak Flow (L/s) Development	Peak Flow (L/s) Infiltration	Peak Flow (L/s) Total	Proposed Sanitary Sewer: Sewer Length (m)	Sewer Slope (%)	Actual Sewer Diameter (mm)	Full Flow Velocity (m/s)	Full Flow Capacity (L/s)	Actual Velocity (m/s)	Calculated Sewer Diameter (mm)	Percentage of Full Flow Capacity (%)
Russ Howard Drive	8	EX SANMH 9	EX SANMH 8	Residential	Low	2	6.0	629.5	3.92	0.21	12.32	3.28	2.83	6.11	12.85	2.83	15.69	47.0	1.0%	250	1.21	59.47	0.97	152	26.4%
Keller Drive	8 - 14	EX SANMH 11	EX SANMH 8	Residential	Low	27	81.0	81.0	4.27	2.84	2.84	0.42	0.65	1.08	1.80	0.65	2.45	30.4	5.0%	200	2.33	73.34	1.07	56	3.3%
Russ Howard Drive	7	EX SANMH 8	EX SANMH 7	Residential	Low	11	33.0	743.5	3.88	0.91	16.07	3.87	3.70	7.57	15.02	3.70	18.72	110.0	0.5%	250	0.86	42.05	0.79	184	44.5%
	6	EX SANMH 7	EX SANMH 6	Residential	Low	7	21.0	764.5	3.87	0.58	16.65	3.98	3.83	7.81	15.42	3.83	19.25	60.5	0.5%	250	0.86	42.05	0.80	186	45.8%
Commercial Block - Floor Area	1		EX SANMH 5	Commercial			-	0.0	-	0.47	0.47	0.14	0.11	0.24		0.11	0.11			#VALUE!			#VALUE!		
Commercial Block - Infiltration	1		EX SANMH 5	Institution			-	0.0	-	0.54	0.54		0.12	0.12		0.12	0.12			#VALUE!			#VALUE!		
Russ Howard Drive	2 - 5	EX SANMH 5	EX SANMH 6	Residential	Low	23	69.0	69.0	4.28	2.29	3.30	0.50	0.76	1.25	1.54	0.76	2.30	14.2	8.0%	200	2.95	92.77	1.25	50	2.5%
SPS Easement		EX SANMH 6	EX SANMH 15	Institution			-	833.5	-		19.95	4.48	4.59	9.07	16.96	4.59	21.55	44.7	4.4%	250	2.54	124.88	1.82	129	17.3%
		EX SANMH 15	EX SPS	Institution			-	833.5	-		19.95	4.48	4.59	9.07	16.96	4.59	21.55	31.3	5.8%	250	2.90	142.60	2.01	123	15.1%
External Developments																									
Cornell Drive		EXT 2	EX SPS	Residential	Low	18	54.0	54.0	4.31	2.71	2.71	0.28	0.62	0.90	1.21	0.62	1.83			#VALUE!			#VALUE!		
Shewfelt Crescent		EXT 3	EX SPS	Residential	Low	31	93.0	93.0	4.25	3.63	3.63	0.48	0.83	1.32	2.06	0.83	2.89			#VALUE!			#VALUE!		
Sarah & Jane Boulevard		EXT 4A	EX SPS	Residential	Med.	60	150.0	150.0	4.19	3.42	3.42	0.78	0.79	1.57	3.27	0.79	4.06			#VALUE!			#VALUE!		
		EXT 4B	EX SPS	Residential	Low	2	6.0	6.0	4.43		0.00	0.03		0.03	0.14		0.14			#VALUE!			#VALUE!		
Russ Howard Drive		EX SPS	Y SANMH 10	Institution			-	1136.5	-		29.71	6.06	6.83	12.89	23.64	6.83	30.48			#VALUE!			#VALUE!		

Sanitary Sewer Design Sheet

TATHAM ENGINEERING

Version Date:	May 27, 2024
Version Number:	1

Project Information

983 Yonge Street, Midland - Proposed Design - 450 L/cap/day	324829

Drawing Reference

324829 - SAN-1	May 27/24

Prepared By

JN	May 27/24

Reviewed By

Municipality

Town of Midland

Population Density

Capita per Unit	Low	Medium	High
	3.00	2.50	2.00

Infiltration

Infiltration (L/s/ha)	0.23

Manning's Coefficient

Pipe Material	Value
Concrete	0.013
PVC	0.013
Applied	0.013

Flow

Development Type	Average (L/cap/day)	Peaking Factor
Residential	450	Harmon
Development Type	**Average (L/ha/day)**	**Peaking Factor**
Institution	-	-
Commercial	25,000	-
Industrial (High)	-	-
Industrial (Low)	35,000	-

Notes

1) Unit rate of 450 L/cap/day applied in accordance with Town Standards to assess peak flow capacity of local gravity sewers.
2) Area of 0.16 ha not serviced by sanitary sewer removed from development lands.

Engineers Seal

Street Name	Area Label/ID	Upstream Maintenance Hole	Downstream Maintenance Hole	Development Type	Population Density	Number of Units	Population (cap)	Accumulated Population (cap)	Peaking Factor	Area (ha)	Cumulative Area (ha)	Average Flow (L/s)			Peak Flow (L/s)			Proposed Sanitary Sewer							
												Development	Infiltration	Total	Development	Infiltration	Total	Sewer Length (m)	Sewer Slope (%)	Actual Sewer Diameter (mm)	Full Flow Velocity (m/s)	Full Flow Capacity (L/s)	Actual Velocity (m/s)	Calculated Sewer Diameter (mm)	Percentage of Full Flow Capacity (%)
Yonge Street		SANMH 1	Y SANMH 10	Institution		0	-	172.0	-	0.00	1.13	0.90	0.26	1.16	3.74	0.26	4.00	107.0	1.6%	450	2.27	360.63	0.77	83	1.1%
		Y SANMH 10	Y SANMH 9	Institution		0	-	1308.5	-	0.00	30.84	6.95	7.09	14.04	27.38	7.09	34.47	110.0	1.4%	450	2.12	337.34	1.32	191	10.2%

Appendix C:
Water Servicing Calculations

TATHAM ENGINEERING

PROJECT	983 Yonge Street, Midland	FILE	324829		
		DATE	June 13, 2024		
SUBJECT	Available Fire Flow from Hydrant Test	NAME	JN	CHKD	-
		PAGE	1	OF	1

DESIGN EQUATION

The following equation provided by the *AWWA M17 Fire Hydrants: Installation, Field Testing, and Maintenance* calculates the available fire flow at a desired residual pressure, given observed hydrant test results of static pressure, hydrant flow and residual pressure.

$$Q_r = Q_f \left(\frac{h_r}{h_f}\right)^{0.54}$$

Where: Q_r is the flow at a desired residual pressure (U.S. GPM)

Q_f is the observed flow (U.S. GPM)

h_r is the difference between the static pressure and the desired residual pressure (psi)

h_f is the observed drop in pressure from static pressure to residual pressure (psi)

CALCULATION *Enter values in the cells highlighted in blue*

Hydrant Test Description	Observed			Calculated		Target		
	Static Pressure (psi)	Residual Pressure (psi)	Hydrant Flow (U.S. GPM) Q_f	h_r	h_f	Residual Pressure (psi)	Hydrant Flow Q_r (GPM)	(L/s)
958 Yonge	84	75	813	64	9	20	2,345	148
	84	64	1,444	64	20	20	2,706	171
404 Keller	67	63	813	47	4	20	3,075	194
	67	54	1,444	47	13	20	2,890	182
VLA Dev.	85	65	1,353	65	20	20	2,557	161
	85	65	1,404	65	20	20	2,653	167
							Average AFF at 20 psi	**171**

TATHAM ENGINEERING

Project:	983 Yonge Street	Date:	May 24, 2024
File No.:	324829	Designed:	JN
Subject:	Fire Flow Calculations Apartment Block - Type IVB - Mass Timber Construction	Checked	
Revisions:			

Fire Underwriters Survey Fire Flow Calculations

Calculation Based on 2020 Publication "Water Supply for Public Fire Protection" by Fire Underwriters Survey (FUS).

Step	Description	Term	Options	Multiplier Associated with Option	Choose	Value used	Unit	Total Fire Flow (L/min)	
		Framing Material							
1	Frame Use for Construction of Unit	Coefficient related to type of construction (C)	Type V - Wood Frame Construction	1.5	Type IVB - Mass Timber Construction	**0.9**	%	N/A	
			Type IVA - Mass Timber Construction	0.8					
			Type IVB - Mass Timber Construction	0.9					
			Type IVC - Mass Timber Construction	1.0					
			Type IVD - Mass Timber Construction	1.5					
			Ordinary Construction	1.0					
			Non-combustible Construction	0.8					
			Fire Resistive Construction	0.6					
2	Total Effective Area	Largest Floor Area				**752**	m^2	N/A	
		Percentage of the Total Area of the Other Floors for Coefficient 1.0 to 1.5			**100%**				
		Percentage of the Total Area of the Other Floors for Coefficient below 1.0:							
		a) If any vertical opening in the building are unprotected, consider the two largest adjoining floor areas plus 50% of all floors immediately above them up to a maximum of eight, **or**			**50%**	**1128**			
		b) If all vertical openings and exterior vertical communications are properly protected in accordance with the National Building Code, consider only the single largest Floor Area plus 25% of each of the two immediately adjoining floors.			**25%**				
		Total Effective Area				**1880**			
3	Required Fire Flow without Reductions or Increases	Required Fire Flows without Reductions or Increases per FUS): (RFF= 220 x C x $A^{0.5}$)						9,000	
4	Factors Affecting Burning	**Reductions / Increases Due to Factors Affecting Burning**							
4.1	Combustibility of Building Contents	Occupancy content hazard reduction or surcharge	Non-combustible	-0.25	Limited combustible	-0.15	%	(1,350)	7,650
			Limited combustible	-0.15					
			Combustible	0.00					
			Free burning	0.15					
			Rapid burning	0.25					
4.2	Reduction Due to Presence of Sprinklers	Sprinkler reduction	For a fully supervised system the conditions a), b) and c) below must be met.			0	%	-	7,650
			a) Automatic sprinkler protection designed and installed in accordance with NFPA 13	-0.3	No				
			b) Water supply is standard for both the system and the Fire Department hose lines	-0.1	No				
			c) Fully supervised system	-0.1	No				
			None	0.0	No				
4.3	Separation Distance Between Units (Use 10% for 2 hour Fire Separation between adjacent units)	Exposure distance between units	North Side	Greater than 30.0 m	0.00	0.15	%	1,148	8,798
			East Side	10.1 to 20.0 m	0.15				
			South Side	Greater than 30.0 m	0.00				
			West Side	Greater than 30.0 m	0.00				
4.4	Combustibility of Wood Shingle or Shake Roof Material	Surcharge for potential to spread fire	Non-combustible roofing material	0	Non-combustible roofing material	0	L/min	0	8,798
			Low risk of fire spread	2000					
			Moderate risk of fire spread	3000					
			High risk of fire spread	4000					
	Total Required Fire Flow, rounded to nearest 1000 L/min, with max/min limits applied:							9,000	
5	Required Fire Flow, Duration and Volume	Total Required Fire Flow (above) in L/s:						150	
		Required Duration of Fire Flow of 9,000 L/min (hrs):						2	
		Required volume for Fire Flow of 9,000 L/min (m^3):						1,080	

TATHAM ENGINEERING	Project: 983 Yonge Street	Date: May 24, 2024
	File No.: 324829	Designed: JN
	Subject: Fire Flow Calculations Apartment Block - Type IVB - Mass Timber Construction - Sprinklered	Checked
	Revisions:	

Fire Underwriters Survey Fire Flow Calculations

Calculation Based on 2020 Publication "Water Supply for Public Fire Protection" by Fire Underwriters Survey (FUS).

Step	Description	Term	Options	Multiplier Associated with Option	Choose	Value used	Unit	Total Fire Flow (L/min)	
		Framing Material							
1	Frame Use for Construction of Unit	Coefficient related to type of construction (C)	Type V - Wood Frame Construction	1.5	Type IVB - Mass Timber Construction	**0.9**	%	N/A	
			Type IVA - Mass Timber Construction	0.8					
			Type IVB - Mass Timber Construction	0.9					
			Type IVC - Mass Timber Construction	1.0					
			Type IVD - Mass Timber Construction	1.5					
			Ordinary Construction	1.0					
			Non-combustible Construction	0.8					
			Fire Resistive Construction	0.6					
2	Total Effective Area	Largest Floor Area				**752**	m^2	N/A	
		Percentage of the Total Area of the Other Floors for Coefficient 1.0 to 1.5			**100%**				
		Percentage of the Total Area of the Other Floors for Coefficient below 1.0:							
		a) If any vertical opening in the building are unprotected, consider the two largest adjoining floor areas plus 50% of all floors immediately above them up to a maximum of eight, **or**			**50%**	**1128**			
		b) If all vertical openings and exterior vertical communications are properly protected in accordance with the National Building Code, consider only the single largest Floor Area plus 25% of each of the two immediately adjoining floors.			**25%**				
					Total Effective Area	**1880**			
3	Required Fire Flow without Reductions or Increases	Required Fire Flows without Reductions or Increases per FUS): (RFF= 220 x C x $A^{0.5}$)						9,000	
4	Factors Affecting Burning	**Reductions / Increases Due to Factors Affecting Burning**							
4.1	Combustibility of Building Contents	Occupancy content hazard reduction or surcharge	Non-combustible	-0.25	Limited combustible	-0.15	%	(1,350)	7,650
			Limited combustible	-0.15					
			Combustible	0.00					
			Free burning	0.15					
			Rapid burning	0.25					
4.2	Reduction Due to Presence of Sprinklers	Sprinkler reduction	For a fully supervised system the conditions a), b) and c) below must be met.			-0.5	%	(3,825)	3,825
			a) Automatic sprinkler protection designed and installed in accordance with NFPA 13	-0.3	Yes				
			b) Water supply is standard for both the system and the Fire Department hose lines	-0.1	Yes				
			c) Fully supervised system	-0.1	Yes				
			None	0.0	No				
4.3	Separation Distance Between Units (Use 10% for 2 hour Fire Separation between adjacent units)	Exposure distance between units	North Side	Greater than 30.0 m	0.00	0.15	%	1,148	4,973
			East Side	10.1 to 20.0 m	0.15				
			South Side	Greater than 30.0 m	0.00				
			West Side	Greater than 30.0 m	0.00				
4.4	Combustibility of Wood Shingle or Shake Roof Material	Surcharge for potential to spread fire	Non-combustible roofing material	0	Non-combustible roofing material	0	L/min	0	4,973
			Low risk of fire spread	2000					
			Moderate risk of fire spread	3000					
			High risk of fire spread	4000					
	Total Required Fire Flow, rounded to nearest 1000 L/min, with max/min limits applied:							5,000	
5	Required Fire Flow, Duration and Volume	Total Required Fire Flow (above) in L/s:						83	
		Required Duration of Fire Flow of 5,000 L/min (hrs):						1.75	
		Required volume for Fire Flow of 5,000 L/min (m^3):						525	

TATHAM ENGINEERING

Project:	983 Yonge Street	Date:	May 24, 2024
File No.:	324829	Designed:	JN
Subject:	Fire Flow Calculations Townhouse Block 5 - Ordinary Construction	Checked	
Revisions:			

Fire Underwriters Survey Fire Flow Calculations

Calculation Based on 2020 Publication "Water Supply for Public Fire Protection" by Fire Underwriters Survey (FUS).

Step	Description	Term	Options	Multiplier Associated with Option	Choose	Value used	Unit	Total Fire Flow (L/min)	
		Framing Material							
1	Frame Use for Construction of Unit	Coefficient related to type of construction (C)	Type V - Wood Frame Construction	1.5	Ordinary Construction	**1.0**	%	N/A	
			Type IVA - Mass Timber Construction	0.8					
			Type IVB - Mass Timber Construction	0.9					
			Type IVC - Mass Timber Construction	1.0					
			Type IVD - Mass Timber Construction	1.5					
			Ordinary Construction	1.0					
			Non-combustible Construction	0.8					
			Fire Resistive Construction	0.6					
2	Total Effective Area	Largest Floor Area				**650**	m^2	N/A	
		Percentage of the Total Area of the Other Floors for Coefficient 1.0 to 1.5			**100%**	**650**			
		Percentage of the Total Area of the Other Floors for Coefficient below 1.0:							
		a) If any vertical opening in the building are unprotected, consider the two largest adjoining floor areas plus 50% of all floors immediately above them up to a maximum of eight, **or**			**50%**				
		b) If all vertical openings and exterior vertical communications are properly protected in accordance with the National Building Code, consider only the single largest Floor Area plus 25% of each of the two immediately adjoining floors.			**25%**				
					Total Effective Area	**1300**			
3	Required Fire Flow without Reductions or Increases	Required Fire Flows without Reductions or Increases per FUS): (RFF= 220 x C x A$^{0.5}$)						8,000	
4	Factors Affecting Burning	**Reductions / Increases Due to Factors Affecting Burning**							
4.1	Combustibility of Building Contents	Occupancy content hazard reduction or surcharge	Non-combustible	-0.25	Limited combustible	-0.15	%	(1,200)	6,800
			Limited combustible	-0.15					
			Combustible	0.00					
			Free burning	0.15					
			Rapid burning	0.25					
4.2	Reduction Due to Presence of Sprinklers	Sprinkler reduction	For a fully supervised system the conditions a), b) and c) below must be met.			0	%	-	6,800
			a) Automatic sprinkler protection designed and installed in accordance with NFPA 13	-0.3	No				
			b) Water supply is standard for both the system and the Fire Department hose lines	-0.1	No				
			c) Fully supervised system	-0.1	No				
			None	0.0	No				
4.3	Separation Distance Between Units (Use 10% for 2 hour Fire Separation between adjacent units)	Exposure distance between units	North Side	0 to 3.0 m	0.25	0.65	%	4,420	11,220
			East Side	10.1 to 20.0 m	0.15				
			South Side	0 to 3.0 m	0.25				
			West Side	Greater than 30.0 m	0.00				
4.4	Combustibility of Wood Shingle or Shake Roof Material	Surcharge for potential to spread fire	Non-combustible roofing material	0	Non-combustible roofing material	0	L/min	0	11,220
			Low risk of fire spread	2000					
			Moderate risk of fire spread	3000					
			High risk of fire spread	4000					
	Total Required Fire Flow, rounded to nearest 1000 L/min, with max/min limits applied:							11,000	
5	Required Fire Flow, Duration and Volume	Total Required Fire Flow (above) in L/s:						183	
		Required Duration of Fire Flow of 11,000 L/min (hrs):						2	
		Required volume for Fire Flow of 11,000 L/min (m^3):						1,320	

Project:	983 Yonge Street	Date:	May 24, 2024
File No.:	324829	Designed:	JN
Subject:	Fire Flow Calculations Townhouse Block 5 - 2-hour Firewall Between Every Two Units	Checked	
Revisions:			

Fire Underwriters Survey Fire Flow Calculations

Calculation Based on 2020 Publication "Water Supply for Public Fire Protection" by Fire Underwriters Survey (FUS).

Step	Description	Term	Options	Multiplier Associated with Option	Choose	Value used	Unit	Total Fire Flow (L/min)	
		Framing Material							
1	Frame Use for Construction of Unit	Coefficient related to type of construction (C)	Type V - Wood Frame Construction	1.5	Ordinary Construction	**1.0**	%	N/A	
			Type IVA - Mass Timber Construction	0.8					
			Type IVB - Mass Timber Construction	0.9					
			Type IVC - Mass Timber Construction	1.0					
			Type IVD - Mass Timber Construction	1.5					
			Ordinary Construction	1.0					
			Non-combustible Construction	0.8					
			Fire Resistive Construction	0.6					
2	Total Effective Area	Largest Floor Area				**260**	m^2	N/A	
		Percentage of the Total Area of the Other Floors for Coefficient 1.0 to 1.5			**100%**	**260**			
		Percentage of the Total Area of the Other Floors for Coefficient below 1.0:							
		a) If any vertical opening in the building are unprotected, consider the two largest adjoining floor areas plus 50% of all floors immediately above them up to a maximum of eight, **or**			**50%**				
		b) If all vertical openings and exterior vertical communications are properly protected in accordance with the National Building Code, consider only the single largest Floor Area plus 25% of each of the two immediately adjoining floors.			**25%**				
					Total Effective Area	**520**			
3	Required Fire Flow without Reductions or Increases	Required Fire Flows without Reductions or Increases per FUS): (RFF= 220 x C x $A^{0.5}$)						5,000	
4	Factors Affecting Burning	**Reductions / Increases Due to Factors Affecting Burning**							
4.1	Combustibility of Building Contents	Occupancy content hazard reduction or surcharge	Non-combustible	-0.25	Limited combustible	-0.15	%	(750)	4,250
			Limited combustible	-0.15					
			Combustible	0.00					
			Free burning	0.15					
			Rapid burning	0.25					
4.2	Reduction Due to Presence of Sprinklers	Sprinkler reduction	For a fully supervised system the conditions a), b) and c) below must be met.			0	%	-	4,250
			a) Automatic sprinkler protection designed and installed in accordance with NFPA 13	-0.3	No				
			b) Water supply is standard for both the system and the Fire Department hose lines	-0.1	No				
			c) Fully supervised system	-0.1	No				
			None	0.0	No				
4.3	Separation Distance Between Units (Use 10% for 2 hour Fire Separation between adjacent units)	Exposure distance between units	North Side	0 to 3.0 m	0.25	0.4	%	1,700	5,950
			East Side	10.1 to 20.0 m	0.15				
			South Side	Greater than 30.0 m	0.00				
			West Side	Greater than 30.0 m	0.00				
4.4	Combustibility of Wood Shingle or Shake Roof Material	Surcharge for potential to spread fire	Non-combustible roofing material	0	Non-combustible roofing material	0	L/min	0	5,950
			Low risk of fire spread	2000					
			Moderate risk of fire spread	3000					
			High risk of fire spread	4000					
	Total Required Fire Flow, rounded to nearest 1000 L/min, with max/min limits applied:							6,000	
5	Required Fire Flow, Duration and Volume	Total Required Fire Flow (above) in L/s:						100	
		Required Duration of Fire Flow of 6,000 L/min (hrs):						2	
		Required volume for Fire Flow of 6,000 L/min (m^3):						720	

TATHAM ENGINEERING	Project: 983 Yonge Street	Date: May 24, 2024	
	File No.: 324829	Designed: JN	
	Subject: Fire Flow Calculations Semi-Detatched - Ordinary Construction	Checked	
	Revisions:		

Fire Underwriters Survey Fire Flow Calculations

Calculation Based on 2020 Publication "Water Supply for Public Fire Protection" by Fire Underwriters Survey (FUS).

Step	Description	Term	Options	Multiplier Associated with Option	Choose	Value used	Unit	Total Fire Flow (L/min)	
1	Frame Use for Construction of Unit		**Framing Material**						
		Coefficient related to type of construction (C)	Type V - Wood Frame Construction	1.5	Ordinary Construction	**1.0**	%	N/A	
			Type IVA - Mass Timber Construction	0.8					
			Type IVB - Mass Timber Construction	0.9					
			Type IVC - Mass Timber Construction	1.0					
			Type IVD - Mass Timber Construction	1.5					
			Ordinary Construction	1.0					
			Non-combustible Construction	0.8					
			Fire Resistive Construction	0.6					
2	Total Effective Area	Largest Floor Area				**285**	m^2	N/A	
		Percentage of the Total Area of the Other Floors for Coefficient 1.0 to 1.5			**100%**	**285**			
		Percentage of the Total Area of the Other Floors for Coefficient below 1.0:							
		a) If any vertical opening in the building are unprotected, consider the two largest adjoining floor areas plus 50% of all floors immediately above them up to a maximum of eight, **or**			**50%**				
		b) If all vertical openings and exterior vertical communications are properly protected in accordance with the National Building Code, consider only the single largest Floor Area plus 25% of each of the two immediately adjoining floors.			**25%**				
					Total Effective Area	**570**			
3	Required Fire Flow without Reductions or Increases	Required Fire Flows without Reductions or Increases per FUS): (RFF= 220 x C x $A^{0.5}$)						5,000	
4	Factors Affecting Burning	**Reductions / Increases Due to Factors Affecting Burning**							
4.1	Combustibility of Building Contents	Occupancy content hazard reduction or surcharge	Non-combustible	-0.25	Limited combustible	-0.15	%	(750)	4,250
			Limited combustible	-0.15					
			Combustible	0.00					
			Free burning	0.15					
			Rapid burning	0.25					
4.2	Reduction Due to Presence of Sprinklers	Sprinkler reduction	For a fully supervised system the conditions a), b) and c) below must be met.			0	%	-	4,250
			a) Automatic sprinkler protection designed and installed in accordance with NFPA 13	-0.3	No				
			b) Water supply is standard for both the system and the Fire Department hose lines	-0.1	No				
			c) Fully supervised system	-0.1	No				
			None	0.0	No				
4.3	Separation Distance Between Units (Use 10% for 2 hour Fire Separation between adjacent units)	Exposure distance between units	North Side	0 to 3.0 m	0.25	0.65	%	2,763	7,013
			East Side	Greater than 30.0 m	0.00				
			South Side	0 to 3.0 m	0.25				
			West Side	10.1 to 20.0 m	0.15				
4.4	Combustibility of Wood Shingle or Shake Roof Material	Surcharge for potential to spread fire	Non-combustible roofing material	0	Non-combustible roofing material	0	L/min	0	7,013
			Low risk of fire spread	2000					
			Moderate risk of fire spread	3000					
			High risk of fire spread	4000					
	Total Required Fire Flow, rounded to nearest 1000 L/min, with max/min limits applied:							7,000	
5	Required Fire Flow, Duration and Volume	Total Required Fire Flow (above) in L/s:						117	
		Required Duration of Fire Flow of				7,000	L/min (hrs):	2	
		Required volume for Fire Flow of				7,000	L/min (m^3):	840	

Project: 983 Yonge Street		Date: May 24, 2024	
File No.: 324829		Designed: JN	
Subject: Fire Flow Calculations Semi-Detatched - 2-hour Firewall Between Dwellings		Checked	
Revisions:			

Fire Underwriters Survey Fire Flow Calculations

Calculation Based on 2020 Publication "Water Supply for Public Fire Protection" by Fire Underwriters Survey (FUS).

Step	Description	Term	Options	Multiplier Associated with Option	Choose	Value used	Unit	Total Fire Flow (L/min)	
		Framing Material							
1	Frame Use for Construction of Unit	Coefficient related to type of construction (C)	Type V - Wood Frame Construction	1.5	Ordinary Construction	**1.0**	%	N/A	
			Type IVA - Mass Timber Construction	0.8					
			Type IVB - Mass Timber Construction	0.9					
			Type IVC - Mass Timber Construction	1.0					
			Type IVD - Mass Timber Construction	1.5					
			Ordinary Construction	1.0					
			Non-combustible Construction	0.8					
			Fire Resistive Construction	0.6					
2	Total Effective Area	Largest Floor Area				**143**	m^2	N/A	
		Percentage of the Total Area of the Other Floors for Coefficient 1.0 to 1.5			**100%**	**143**			
		Percentage of the Total Area of the Other Floors for Coefficient below 1.0:							
		a) If any vertical opening in the building are unprotected, consider the two largest adjoining floor areas plus 50% of all floors immediately above them up to a maximum of eight, **or**			**50%**				
		b) If all vertical openings and exterior vertical communications are properly protected in accordance with the National Building Code, consider only the single largest Floor Area plus 25% of each of the two immediately adjoining floors.			**25%**				
					Total Effective Area	**286**			
3	Required Fire Flow without Reductions or Increases	Required Fire Flows without Reductions or Increases per FUS): (RFF= 220 x C x $A^{0.5}$)						4,000	
4	Factors Affecting Burning	**Reductions / Increases Due to Factors Affecting Burning**							
4.1	Combustibility of Building Contents	Occupancy content hazard reduction or surcharge	Non-combustible	-0.25	Limited combustible	-0.15	%	(600)	3,400
			Limited combustible	-0.15					
			Combustible	0.00					
			Free burning	0.15					
			Rapid burning	0.25					
4.2	Reduction Due to Presence of Sprinklers	Sprinkler reduction	For a fully supervised system the conditions a), b) and c) below must be met.			0	%	-	3,400
			a) Automatic sprinkler protection designed and installed in accordance with NFPA 13	-0.3	No				
			b) Water supply is standard for both the system and the Fire Department hose lines	-0.1	No				
			c) Fully supervised system	-0.1	No				
			None	0.0	No				
4.3	Separation Distance Between Units (Use 10% for 2 hour Fire Separation between adjacent units)	Exposure distance between units	North Side	0 to 3.0 m	0.25	0.65	%	2,210	5,610
			East Side	Greater than 30.0 m	0.00				
			South Side	0 to 3.0 m	0.25				
			West Side	10.1 to 20.0 m	0.15				
4.4	Combustibility of Wood Shingle or Shake Roof Material	Surcharge for potential to spread fire	Non-combustible roofing material	0	Non-combustible roofing material	0	L/min	0	5,610
			Low risk of fire spread	2000					
			Moderate risk of fire spread	3000					
			High risk of fire spread	4000					
	Total Required Fire Flow, rounded to nearest 1000 L/min, with max/min limits applied:							6,000	
5	Required Fire Flow, Duration and Volume	Total Required Fire Flow (above) in L/s:						100	
		Required Duration of Fire Flow of 6,000 L/min (hrs):						2	
		Required volume for Fire Flow of 6,000 L/min (m^3):						720	

Project: 983 Yonge Street		Date:	May 24, 2024
File No.: 324829		Designed:	JN
Subject: Fire Flow Calculations Single Family Home - Ordinary Construction		Checked	
Revisions:			

Fire Underwriters Survey Fire Flow Calculations

Calculation Based on 2020 Publication "Water Supply for Public Fire Protection" by Fire Underwriters Survey (FUS).

Step	Description	Term	Options	Multiplier Associated with Option	Choose	Value used	Unit	Total Fire Flow (L/min)	
		Framing Material							
1	Frame Use for Construction of Unit	Coefficient related to type of construction (C)	Type V - Wood Frame Construction	1.5	Ordinary Construction	**1.0**	%	N/A	
			Type IVA - Mass Timber Construction	0.8					
			Type IVB - Mass Timber Construction	0.9					
			Type IVC - Mass Timber Construction	1.0					
			Type IVD - Mass Timber Construction	1.5					
			Ordinary Construction	1.0					
			Non-combustible Construction	0.8					
			Fire Resistive Construction	0.6					
2	Total Effective Area	Largest Floor Area				**190**	m^2	N/A	
		Percentage of the Total Area of the Other Floors for Coefficient 1.0 to 1.5			**100%**	**190**			
		Percentage of the Total Area of the Other Floors for Coefficient below 1.0:							
		a) If any vertical opening in the building are unprotected, consider the two largest adjoining floor areas plus 50% of all floors immediately above them up to a maximum of eight, **or**			**50%**				
		b) If all vertical openings and exterior vertical communications are properly protected in accordance with the National Building Code, consider only the single largest Floor Area plus 25% of each of the two immediately adjoining floors.			**25%**				
					Total Effective Area	**380**			
3	Required Fire Flow without Reductions or Increases	Required Fire Flows without Reductions or Increases per FUS): (RFF= 220 x C x $A^{0.5}$)						4,000	
4	Factors Affecting Burning	**Reductions / Increases Due to Factors Affecting Burning**							
4.1	Combustibility of Building Contents	Occupancy content hazard reduction or surcharge	Non-combustible	-0.25	Limited combustible	-0.15	%	(600)	3,400
			Limited combustible	-0.15					
			Combustible	0.00					
			Free burning	0.15					
			Rapid burning	0.25					
4.2	Reduction Due to Presence of Sprinklers	Sprinkler reduction	For a fully supervised system the conditions a), b) and c) below must be met.			0	%	-	3,400
			a) Automatic sprinkler protection designed and installed in accordance with NFPA 13	-0.3	No				
			b) Water supply is standard for both the system and the Fire Department hose lines	-0.1	No				
			c) Fully supervised system	-0.1	No				
			None	0.0	No				
4.3	Separation Distance Between Units (Use 10% for 2 hour Fire Separation between adjacent units)	Exposure distance between units	North Side	3.1 to 10.0 m	0.20	0.7	%	2,380	5,780
			East Side	0 to 3.0 m	0.25				
			South Side	Greater than 30.0 m	0.00				
			West Side	0 to 3.0 m	0.25				
4.4	Combustibility of Wood Shingle or Shake Roof Material	Surcharge for potential to spread fire	Non-combustible roofing material	0	Non-combustible roofing material	0	L/min	0	5,780
			Low risk of fire spread	2000					
			Moderate risk of fire spread	3000					
			High risk of fire spread	4000					
	Total Required Fire Flow, rounded to nearest 1000 L/min, with max/min limits applied:							6,000	
5	Required Fire Flow, Duration and Volume	Total Required Fire Flow (above) in L/s:						100	
		Required Duration of Fire Flow of 6,000 L/min (hrs):						2	
		Required volume for Fire Flow of 6,000 L/min (m^3):						720	

TATHAM ENGINEERING

PROJECT	983 Yonge Street, Midland	FILE	324829
		DATE	24-May-2024
SUBJECT	Water Supply Calculations Municipal Criteria	NAME	JN CHECK -
		PAGE	1 OF 2

SITE DESCRIPTION

Watermain from connection on Yonge Street to Pressure Reducing Valve (PRV). Subdivision development consisting of the following:

- 2 x 48 unit apartment dwelling - at 2.0 people/unit, population = 192 people
- 29 Townhouse Units - at 2.5 people/unit, population = 72.5 people
- 20 Single Family/Semi-Detatched Homes - at 3.0 people/unit, population = 60 people

DAILY DEMAND DESIGN PARAMATERS

No. of Units	118	
Pop. Density	2.75	people/unit
Demand	450	L/person/day
Population	325	people
Fire Flow	100	L/s

Max Day Factor	2.0
Peak Hour Factor	4.5

Q = PxDxPF, where:
P = Population
D = Per Capita Demand
PF = Peaking Factor

Design Demand	Per Unit		Total	
	L/day	L/s	L/day	L/s
Average Daily	1,238	0.01	146,250	1.69
Maximum Day	2,475	0.03	292,500	3.39
Peak Hour	5,569	0.06	658,125	7.62

WATERMAIN SERVICE SIZING AND FRICTION LOSS

Service Type	D (mm)	Q (L/s)	A (m^2)	V (m/s)	C	L (m)	Friction Loss (m)	Friction Loss psi	Friction Loss kPa
Service (M. Day)									
Service (Peak)									
Domestic W/M	150	3.81	0.0177	0.22	120	135.0	0.070	0.099	0.69
Fire Protection									
Combined W/M	150	51.69	0.0177	2.93	120	135.0	8.705	12.378	85.35

D - Pipe Diameter
Q - Demand Flow
A - Pipe Flow Area
V - Flow Velocity
C - Pipe Coefficient
L - Pipe Length

Notes:
- Flows reduced by a factor of 2 in recognition supply downgradient of PRV can be provided from two directions.
- Peak flow utilized for dedicated domestic watermain while maximum day and fire flow are applied for combined watermains.
- $A = (\pi D^2)/4$; where D is converted to m.
- $V = Q/A$; where Q is converted to m^3/s.
- $h_f = L \times \left(\frac{Q}{0.278 \times C \times D^{2.63}}\right)^{1/0.54}$; where Q is converted to m^3/s.

STATIC HEAD LOSS

	Road C/L Elev (m)	Depth to W/M (m)	Road C/L Elev (m)	Depth to W/M (m)	Total Head Loss (m)	Total Head Loss (psi)	Total Head Loss (kPa)
Static Head Loss	229.80	1.80	221.80	1.80	-8.00	-11.376	-78.44

TOTAL LOSSES

Service Type	Static Pressure		Static Loss	W/M Loss	Service Loss	Total Loss	Service Pressure	
	(psi)	(kPa)	(kPa)	(kPa)	(kPa)	(kPa)	(kPa)	(psi)
Service (Peak)	84	579.16	-78.44	0.69		-77.75	656.91	95.28
Fire Protection	84	579.16	-78.44	85.35		6.91	572.25	83
Serv. (Max.D +FF)	84	579.16	-78.44	85.35		6.91	572.25	83

SUMMARY

Under typical residential peak demand, there will be sufficient pressure to service the highest floor of the development with residual pressure of 95.28 psi in the ceiling space of the uppermost floor of the proposed building.

Under maximum day plus fire flow demand, there will be sufficient pressure to service the highest floor of the development with residual pressure of 83 psi in the ceiling space of the uppermost floor of the proposed building.

Under maximum day plus fire flow demand, there will be sufficient pressure to provide fire protection service to the highest floor of the development with residual pressure of 83 psi in the ceiling space of the uppermost floor of the proposed building.

SITE DESCRIPTION

Watermain from Pressure Reducing Valve (PRV) to Russ Howard Drive. Subdivision development consisting of the following:
- 2 x 48 unit apartment dwelling - at 2.0 people/unit, population = 192 people
- 29 Townhouse Units - at 2.5 people/unit, population = 72.5 people
- 20 Single Family/Semi-Detatched Homes - at 3.0 people/unit, population = 60 people

DAILY DEMAND DESIGN PARAMATERS

No. of Units	118	
Pop. Density	2.75	people/unit
Demand	450	L/person/day
Population	325	people
Fire Flow	100	L/s

Max Day Factor	2.0
Peak Hour Factor	4.5

Q = PxDxPF, where:
P = Population
D = Per Capita Demand
PF = Peaking Factor

Design Demand	Per Unit		Total	
	L/day	L/s	L/day	L/s
Average Daily	1,238	0.01	146,250	1.69
Maximum Day	2,475	0.03	292,500	3.39
Peak Hour	5,569	0.06	658,125	7.62

WATERMAIN SERVICE SIZING AND FRICTION LOSS

Service Type	D (mm)	Q (L/s)	A (m^2)	V (m/s)	C	L (m)	Friction Loss (m)	Friction Loss psi	Friction Loss kPa
Service (M. Day)									
Service (Peak)									
Domestic W/M	150	3.81	0.0177	0.22	120	170.0	0.088	0.125	0.87
Fire Protection									
Combined W/M	150	51.69	0.0177	2.93	120	170.0	10.961	15.587	107.47

D - Pipe Diameter
Q - Demand Flow
A - Pipe Flow Area
V - Flow Velocity
C - Pipe Coefficient
L - Pipe Length

Notes:
- Flows reduced by a factor of 2 in recognition supply downgradient of PRV can be provided from two directions.
- Peak flow utilized for dedicated domestic watermain while maximum day and fire flow are applied for combined watermains.
- $A = (\pi D^2)/4$; where D is converted to m.
- $V = Q/A$; where Q is converted to m^3/s.
- $h_f = L \times \left(\frac{Q}{0.278 \times C \times D^{2.63}}\right)^{1/0.54}$; where Q is converted to m^3/s.

STATIC HEAD LOSS

	Road C/L Elev	Depth to W/M	Road C/L Elev	Depth to W/M	Total Head Loss		
	(m)	(m)	(m)	(m)	(m)	(psi)	(kPa)
Static Head Loss	221.80	1.80	208.20	1.80	-13.60	-19.339	-133.34

TOTAL LOSSES

Service Type	Static Pressure		Static Loss	W/M Loss	Service Loss	Total Loss	Service Pressure	
	(psi)	(kPa)	(kPa)	(kPa)	(kPa)	(kPa)	(kPa)	(psi)
Service (Peak)	50	344.74	-133.34	0.87		-132.47	477.21	69.22
Fire Protection	50	344.74	-133.34	107.47		-25.87	370.61	53.76
Serv. (Max.D +FF)	50	344.74	-133.34	107.47		-25.87	370.61	53.76

SUMMARY

Under typical residential peak demand, there will be sufficient pressure to service the highest floor of the development with residual pressure of 69.22 psi in the ceiling space of the uppermost floor of the proposed building.

Under maximum day plus fire flow demand, there will be sufficient pressure to service the highest floor of the development with residual pressure of 53.76 psi in the ceiling space of the uppermost floor of the proposed building.

Under maximum day plus fire flow demand, there will be sufficient pressure to provide fire protection service to the highest floor of the development with residual pressure of 53.76 psi in the ceiling space of the uppermost floor of the proposed building.

TATHAM ENGINEERING

PROJECT	983 Yonge Street, Midland	FILE	324829		
		DATE	24-May-2024		
SUBJECT	Water Supply Calculations MECP Criteria	NAME	JN	CHECK	-
		PAGE	1	OF	2

SITE DESCRIPTION

Watermain from connection on Yonge Street to Pressure Reducing Valve (PRV). Subdivision development consisting of the following:

- 2 x 48 unit apartment dwelling - at 2.0 people/unit, population = 192 people
- 29 Townhouse Units - at 2.5 people/unit, population = 72.5 people
- 20 Single Family/Semi-Detatched Homes - at 3.0 people/unit, population = 60 people

DAILY DEMAND DESIGN PARAMATERS

No. of Units	118	
Pop. Density	2.75	people/unit
Demand	450	L/person/day
Population	325	people
Fire Flow	100	L/s

Max Day Factor	3.5
Peak Hour Factor	5.3

Q = PxDxPF, where:

P = Population

D = Per Capita Demand

PF = Peaking Factor

Design Demand	Per Unit		Total	
	L/day	L/s	L/day	L/s
Average Daily	1,238	0.01	146,250	1.69
Maximum Day	4,331	0.05	511,875	5.92
Peak Hour	6,559	0.08	775,125	8.97

WATERMAIN SERVICE SIZING AND FRICTION LOSS

Service Type	D (mm)	Q (L/s)	A (m^2)	V (m/s)	C	L (m)	Friction Loss (m)	Friction Loss psi	Friction Loss kPa
Service (M. Day)									
Service (Peak)									
Domestic W/M	150	4.49	0.0177	0.26	120	135.0	0.094	0.134	0.93
Fire Protection									
Combined W/M	150	52.96	0.0177	3.00	120	135.0	9.105	12.947	89.27

D - Pipe Diameter
Q - Demand Flow
A - Pipe Flow Area
V - Flow Velocity
C - Pipe Coefficient
L - Pipe Length

Notes:
- Flows reduced by a factor of 2 in recognition supply downgradient of PRV can be provided from two directions.
- Peak flow utilized for dedicated domestic watermain while maximum day and fire flow are applied for combined watermains.
- $A = (\pi D^2)/4$; where D is converted to m.
- $V = Q/A$; where Q is converted to m^3/s.
- $h_f = L \times \left(\frac{Q}{0.278 \times C \times D^{2.63}}\right)^{1/0.54}$; where Q is converted to m^3/s.

TATHAM ENGINEERING

PROJECT	983 Yonge Street, Midland	FILE	324829		
		DATE	24-May-2024		
SUBJECT	Water Supply Calculations MECP Criteria	NAME	JN	CHECK	-
		PAGE	2	OF	2

STATIC HEAD LOSS

	Road C/L Elev (m)	Depth to W/M (m)	Road C/L Elev (m)	Depth to W/M (m)	Total Head Loss		
					(m)	(psi)	(kPa)
Static Head Loss	229.80	1.80	221.80	1.80	-8.00	-11.376	-78.44

TOTAL LOSSES

Service Type	Static Pressure		Static Loss	W/M Loss	Service Loss	Total Loss	Service Pressure	
	(psi)	(kPa)	(kPa)	(kPa)	(kPa)	(kPa)	(kPa)	(psi)
Service (Peak)	84	579.16	-78.44	0.93		-77.51	656.67	95.25
Fire Protection	84	579.16	-78.44	89.27		10.83	568.33	82.43
Serv. (Max.D +FF)	84	579.16	-78.44	89.27		10.83	568.33	82.43

SUMMARY

Under typical residential peak demand, there will be sufficient pressure to service the highest floor of the development with residual pressure of 95.25 psi in the ceiling space of the uppermost floor of the proposed building.

Under maximum day plus fire flow demand, there will be sufficient pressure to service the highest floor of the development with residual pressure of 82.43 psi in the ceiling space of the uppermost floor of the proposed building.

Under maximum day plus fire flow demand, there will be sufficient pressure to provide fire protection service to the highest floor of the development with residual pressure of 82.43 psi in the ceiling space of the uppermost floor of the proposed building.

TATHAM ENGINEERING

PROJECT	983 Yonge Street, Midland	FILE	324829
		DATE	24-May-2024
SUBJECT	Water Supply Calculations MECP Criteria	NAME	JN CHECK -
		PAGE	1 OF 2

SITE DESCRIPTION

Watermain from Pressure Reducing Valve (PRV) to Russ Howard Drive. Subdivision development consisting of the following:
- 2 x 48 unit apartment dwelling - at 2.0 people/unit, population = 192 people
- 29 Townhouse Units - at 2.5 people/unit, population = 72.5 people
- 20 Single Family/Semi-Detatched Homes - at 3.0 people/unit, population = 60 people

DAILY DEMAND DESIGN PARAMATERS

No. of Units	118	
Pop. Density	2.75	people/unit
Demand	450	L/person/day
Population	325	people
Fire Flow	100	L/s

Max Day Factor	3.5
Peak Hour Factor	5.3

Q = PxDxPF, where:
P = Population
D = Per Capita Demand
PF = Peaking Factor

Design Demand	Per Unit		Total	
	L/day	L/s	L/day	L/s
Average Daily	1,238	0.01	146,250	1.69
Maximum Day	4,331	0.05	511,875	5.92
Peak Hour	6,559	0.08	775,125	8.97

WATERMAIN SERVICE SIZING AND FRICTION LOSS

Service Type	D (mm)	Q (L/s)	A (m^2)	V (m/s)	C	L (m)	Friction Loss (m)	Friction Loss psi	Friction Loss kPa
Service (M. Day)									
Service (Peak)									
Domestic W/M	150	4.49	0.0177	0.26	120	170.0	0.119	0.169	1.17
Fire Protection									
Combined W/M	150	52.96	0.0177	3.00	120	170.0	11.465	16.303	112.41

D - Pipe Diameter
Q - Demand Flow
A - Pipe Flow Area
V - Flow Velocity
C - Pipe Coefficient
L - Pipe Length

Notes:
- Flows reduced by a factor of 2 in recognition supply downgradient of PRV can be provided from two directions.
- Peak flow utilized for dedicated domestic watermain while maximum day and fire flow are applied for combined watermains.
- $A = (\pi D^2)/4$; where D is converted to m.
- $V = Q/A$; where Q is converted to m^3/s.
- $h_f = L \times \left(\frac{Q}{0.278 \times C \times D^{2.63}}\right)^{1/0.54}$; where Q is converted to m^3/s.

STATIC HEAD LOSS

	Road C/L Elev	Depth to W/M	Road C/L Elev	Depth to W/M	Total Head Loss		
	(m)	(m)	(m)	(m)	(m)	(psi)	(kPa)
Static Head Loss	221.80	1.80	208.20	1.80	-13.60	-19.339	-133.34

TOTAL LOSSES

Service Type	Static Pressure		Static Loss	W/M Loss	Service Loss	Total Loss	Service Pressure	
	(psi)	(kPa)	(kPa)	(kPa)	(kPa)	(kPa)	(kPa)	(psi)
Service (Peak)	50	344.74	-133.34	1.17		-132.17	476.91	69.17
Fire Protection	50	344.74	-133.34	112.41		-20.93	365.67	53.04
Serv. (Max.D +FF)	50	344.74	-133.34	112.41		-20.93	365.67	53.04

SUMMARY

Under typical residential peak demand, there will be sufficient pressure to service the highest floor of the development with residual pressure of 69.17 psi in the ceiling space of the uppermost floor of the proposed building.

Under maximum day plus fire flow demand, there will be sufficient pressure to service the highest floor of the development with residual pressure of 53.04 psi in the ceiling space of the uppermost floor of the proposed building.

Under maximum day plus fire flow demand, there will be sufficient pressure to provide fire protection service to the highest floor of the development with residual pressure of 53.04 psi in the ceiling space of the uppermost floor of the proposed building.

SITE DESCRIPTION

48 unit apartment dwelling - Non-Sprinklered

DAILY DEMAND DESIGN PARAMATERS

No. of Units	48	
Pop. Density	2	people/unit
Demand	450	L/person/day
Population	96	people
Fire Flow	150	L/s

Max Day Factor	2.0
Peak Hour Factor	4.5

Q = PxDxPF, where:
P = Population
D = Per Capita Demand
PF = Peaking Factor

Design Demand	Per Unit		Total	
	L/day	L/s	L/day	L/s
Average Daily	900	0.01	43,200	0.50
Maximum Day	1,800	0.02	86,400	1.00
Peak Hour	4,050	0.05	194,400	2.25

WATERMAIN SERVICE SIZING AND FRICTION LOSS

Service Type	D (mm)	Q (L/s)	A (m^2)	V (m/s)	C	L (m)	Friction Loss (m)	Friction Loss psi	Friction Loss kPa
Service (M. Day)	50	1.00	0.0020	0.50	120	20.0	0.182	0.260	1.80
Service (Peak)	50	2.25	0.0020	1.13	120	20.0	0.819	1.165	8.04
Domestic W/M	200	2.25	0.0315	0.08	120	30.0	0.001	0.003	0.03
Fire Protection	200	150.00	0.0315	4.77	120	20.0	2.284	3.249	22.41
Combined W/M	200	151.00	0.0315	4.80	120	30.0	3.469	4.933	34.02

D - Pipe Diameter
Q - Demand Flow
A - Pipe Flow Area
V - Flow Velocity
C - Pipe Coefficient
L - Pipe Length

Notes:
- Peak flow utilized for dedicated domestic watermain while maximum day and fire flow are applied for combined watermains.
- $A = (\pi D^2)/4$; where D is converted to m.
- $V = Q/A$; where Q is converted to m^3/s.
- $h_f = L \times \left(\frac{Q}{0.278 \times C \times D^{2.63}}\right)^{1/0.54}$; where Q is converted to m^3/s.

TATHAM ENGINEERING

PROJECT	983 Yonge Street, Midland	FILE	324829		
		DATE	24-May-2024		
SUBJECT	Water Supply Calculations Apartment - Municipal Criteria	NAME	JN	CHECK	-
		PAGE	2	OF	4

STATIC HEAD LOSS

	Road C/L Elev	Depth to W/M	Finished Floor	Building Height	Total Head Loss		
	(m)	(m)	(m)	(m)	(m)	(psi)	(kPa)
Static Head Loss	229.80	1.80	229.00	9.60	10.60	15.073	103.93

TOTAL LOSSES

Service Type	Static Pressure		Static Loss	W/M Loss	Service Loss	Total Loss	Service Pressure	
	(psi)	(kPa)	(kPa)	(kPa)	(kPa)	(kPa)	(kPa)	(psi)
Service (Peak)	84	579.16	103.93	0.03	8.04	112.00	467.16	67.76
Fire Protection	84	579.16	103.93	34.02	22.41	160.36	418.80	60.75
Serv. (Max.D +FF)	84	579.16	103.93	34.02	1.80	139.75	439.41	63.74

SUMMARY

Under typical residential peak demand, there will be sufficient pressure to service the highest floor of the development with residual pressure of 67.76 psi in the ceiling space of the uppermost floor of the proposed building.

Under maximum day plus fire flow demand, there will be sufficient pressure to service the highest floor of the development with residual pressure of 63.74 psi in the ceiling space of the uppermost floor of the proposed building.

Under maximum day plus fire flow demand, there will be sufficient pressure to provide fire protection service to the highest floor of the development with residual pressure of 60.75 psi in the ceiling space of the uppermost floor of the proposed building.

TATHAM ENGINEERING

PROJECT	983 Yonge Street, Midland	FILE	324829		
		DATE	24-May-2024		
SUBJECT	Water Supply Calculations Apartment - Municipal Criteria	NAME	JN	CHECK	-
		PAGE	3	OF	4

SITE DESCRIPTION

48 unit apartment dwelling - Sprinklered

DAILY DEMAND DESIGN PARAMATERS

No. of Units	48	
Pop. Density	2	people/unit
Demand	450	L/person/day
Population	96	people
Fire Flow	83	L/s

Max Day Factor	2.0
Peak Hour Factor	4.5

Q = PxDxPF, where:
P = Population
D = Per Capita Demand
PF = Peaking Factor

Design Demand	Per Unit		Total	
	L/day	L/s	L/day	L/s
Average Daily	900	0.01	43,200	0.50
Maximum Day	1,800	0.02	86,400	1.00
Peak Hour	4,050	0.05	194,400	2.25

WATERMAIN SERVICE SIZING AND FRICTION LOSS

Service Type	D	Q	A	V	C	L	Friction Loss		
	(mm)	(L/s)	(m^2)	(m/s)		(m)	(m)	psi	kPa
Service (M. Day)	50	1.00	0.0020	0.50	120	20.0	0.182	0.260	1.80
Service (Peak)	50	2.25	0.0020	1.13	120	20.0	0.819	1.165	8.04
Domestic W/M	150	2.25	0.0177	0.13	120	30.0	0.006	0.009	0.07
Fire Protection	150	83.00	0.0177	4.69	120	20.0	3.099	4.408	30.40
Combined W/M	150	84.00	0.0177	4.75	120	30.0	4.753	6.760	46.61

D - Pipe Diameter
Q - Demand Flow
A - Pipe Flow Area
V - Flow Velocity
C - Pipe Coefficient
L - Pipe Length

Notes:
- Peak flow utilized for dedicated domestic watermain while maximum day and fire flow are applied for combined watermains.
- $A = (\pi D^2)/4$; where D is converted to m.
- $V = Q/A$; where Q is converted to m^3/s.
- $h_f = L \times \left(\frac{Q}{0.278 \times C \times D^{2.63}}\right)^{1/0.54}$; where Q is converted to m^3/s.

TATHAM ENGINEERING

PROJECT	983 Yonge Street, Midland	FILE	324829		
		DATE	24-May-2024		
SUBJECT	Water Supply Calculations Apartment - Municipal Criteria	NAME	JN	CHECK	-
		PAGE	4	OF	4

STATIC HEAD LOSS

	Road C/L Elev	Depth to W/M	Finished Floor	Building Height	Total Head Loss		
	(m)	(m)	(m)	(m)	(m)	(psi)	(kPa)
Static Head Loss	229.80	1.80	229.00	9.60	10.60	15.073	103.93

TOTAL LOSSES

Service Type	Static Pressure		Static Loss	W/M Loss	Service Loss	Total Loss	Service Pressure	
	(psi)	(kPa)	(kPa)	(kPa)	(kPa)	(kPa)	(kPa)	(psi)
Service (Peak)	84	579.16	103.93	0.07	8.04	112.04	467.12	67.76
Fire Protection	84	579.16	103.93	46.61	30.40	180.94	398.22	57.76
Serv. (Max.D +FF)	84	579.16	103.93	46.61	1.80	152.34	426.82	61.91

SUMMARY

Under typical residential peak demand, there will be sufficient pressure to service the highest floor of the development with residual pressure of 67.76 psi in the ceiling space of the uppermost floor of the proposed building.

Under maximum day plus fire flow demand, there will be sufficient pressure to service the highest floor of the development with residual pressure of 61.91 psi in the ceiling space of the uppermost floor of the proposed building.

Under maximum day plus fire flow demand, there will be sufficient pressure to provide fire protection service to the highest floor of the development with residual pressure of 57.76 psi in the ceiling space of the uppermost floor of the proposed building.

TATHAM ENGINEERING

PROJECT	983 Yonge Street, Midland	FILE	324829		
		DATE	24-May-2024		
SUBJECT	Water Supply Calculations Apartment - MECP Criteria	NAME	JN	CHECK	-
		PAGE	1	OF	4

SITE DESCRIPTION

48 unit apartment dwelling - Non-Sprinklered

DAILY DEMAND DESIGN PARAMATERS

			Max Day Factor	7.0
No. of Units	48		Peak Hour Factor	10.6
Pop. Density	2	people/unit		
Demand	450	L/person/day	Q = PxDxPF, where:	
Population	96	people	P = Population	
Fire Flow	150	L/s	D = Per Capita Demand	
			PF = Peaking Factor	

Design Demand	Per Unit		Total	
	L/day	L/s	L/day	L/s
Average Daily	900	0.01	43,200	0.50
Maximum Day	6,300	0.07	302,400	3.50
Peak Hour	9,540	0.11	457,920	5.30

WATERMAIN SERVICE SIZING AND FRICTION LOSS

Service Type	D (mm)	Q (L/s)	A (m^2)	V (m/s)	C	L (m)	Friction Loss (m)	Friction Loss psi	Friction Loss kPa
Service (M. Day)	50	3.50	0.0020	1.75	120	20.0	1.857	2.641	18.21
Service (Peak)	50	5.30	0.0020	2.65	120	20.0	4.003	5.693	39.26
Domestic W/M	200	5.30	0.0315	0.17	120	30.0	0.007	0.010	0.07
Fire Protection	200	150.00	0.0315	4.77	120	20.0	2.284	3.249	22.41
Combined W/M	200	153.50	0.0315	4.88	120	30.0	3.576	5.085	35.06

D - Pipe Diameter
Q - Demand Flow
A - Pipe Flow Area
V - Flow Velocity
C - Pipe Coefficient
L - Pipe Length

Notes:
- Peak flow utilized for dedicated domestic watermain while maximum day and fire flow are applied for combined watermains.
- $A = (\pi D^2)/4$; where D is converted to m.
- $V = Q/A$; where Q is converted to m^3/s.
- $h_f = L \times \left(\frac{Q}{0.278 \times C \times D^{2.63}}\right)^{1/0.54}$; where Q is converted to m^3/s.

STATIC HEAD LOSS

	Road C/L Elev	Depth to W/M	Finished Floor	Building Height	Total Head Loss		
	(m)	(m)	(m)	(m)	(m)	(psi)	(kPa)
Static Head Loss	229.80	1.80	229.00	9.60	10.60	15.073	103.93

TOTAL LOSSES

Service Type	Static Pressure		Static Loss	W/M Loss	Service Loss	Total Loss	Service Pressure	
	(psi)	(kPa)	(kPa)	(kPa)	(kPa)	(kPa)	(kPa)	(psi)
Service (Peak)	84	579.16	103.93	0.07	39.26	143.26	435.90	63.23
Fire Protection	84	579.16	103.93	35.06	22.41	161.40	417.76	60.6
Serv. (Max.D +FF)	84	579.16	103.93	35.06	18.21	157.20	421.96	61.21

SUMMARY

Under typical residential peak demand, there will be sufficient pressure to service the highest floor of the development with residual pressure of 63.23 psi in the ceiling space of the uppermost floor of the proposed building.

Under maximum day plus fire flow demand, there will be sufficient pressure to service the highest floor of the development with residual pressure of 61.21 psi in the ceiling space of the uppermost floor of the proposed building.

Under maximum day plus fire flow demand, there will be sufficient pressure to provide fire protection service to the highest floor of the development with residual pressure of 60.6 psi in the ceiling space of the uppermost floor of the proposed building.

TATHAM ENGINEERING

PROJECT	983 Yonge Street, Midland	FILE	324829
		DATE	24-May-2024
SUBJECT	Water Supply Calculations Apartment - MECP Criteria	NAME	JN CHECK -
		PAGE	3 OF 4

SITE DESCRIPTION

48 unit apartment dwelling - Sprinklered

DAILY DEMAND DESIGN PARAMATERS

No. of Units	48	
Pop. Density	2	people/unit
Demand	450	L/person/day
Population	96	people
Fire Flow	83	L/s

Max Day Factor	7.0
Peak Hour Factor	10.6

Q = PxDxPF, where:
P = Population
D = Per Capita Demand
PF = Peaking Factor

Design Demand	Per Unit		Total	
	L/day	L/s	L/day	L/s
Average Daily	900	0.01	43,200	0.50
Maximum Day	6,300	0.07	302,400	3.50
Peak Hour	9,540	0.11	457,920	5.30

WATERMAIN SERVICE SIZING AND FRICTION LOSS

Service Type	D (mm)	Q (L/s)	A (m^2)	V (m/s)	C	L (m)	Friction Loss (m)	Friction Loss psi	Friction Loss kPa
Service (M. Day)	50	3.50	0.0020	1.75	120	20.0	1.857	2.641	18.21
Service (Peak)	50	5.30	0.0020	2.65	120	20.0	4.003	5.693	39.26
Domestic W/M	150	5.30	0.0177	0.30	120	30.0	0.028	0.041	0.29
Fire Protection	150	83.00	0.0177	4.69	120	20.0	3.099	4.408	30.40
Combined W/M	150	86.50	0.0177	4.89	120	30.0	5.019	7.137	49.21

D - Pipe Diameter
Q - Demand Flow
A - Pipe Flow Area
V - Flow Velocity
C - Pipe Coefficient
L - Pipe Length

Notes:
- Peak flow utilized for dedicated domestic watermain while maximum day and fire flow are applied for combined watermains.
- $A = (\pi D^2)/4$; where D is converted to m.
- $V = Q/A$; where Q is converted to m^3/s.
- $h_f = L \times \left(\frac{Q}{0.278 \times C \times D^{2.63}} \right)^{1/0.54}$; where Q is converted to m^3/s.

TATHAM ENGINEERING

PROJECT	983 Yonge Street, Midland	FILE	324829		
		DATE	24-May-2024		
SUBJECT	Water Supply Calculations Apartment - MECP Criteria	NAME	JN	CHECK	-
		PAGE	4	OF	4

STATIC HEAD LOSS

	Road C/L Elev	Depth to W/M	Finished Floor	Building Height	Total Head Loss		
	(m)	(m)	(m)	(m)	(m)	(psi)	(kPa)
Static Head Loss	229.80	1.80	229.00	9.60	10.60	15.073	103.93

TOTAL LOSSES

Service Type	Static Pressure		Static Loss	W/M Loss	Service Loss	Total Loss	Service Pressure	
	(psi)	(kPa)	(kPa)	(kPa)	(kPa)	(kPa)	(kPa)	(psi)
Service (Peak)	84	579.16	103.93	0.29	39.26	143.48	435.68	63.2
Fire Protection	84	579.16	103.93	49.21	30.40	183.54	395.62	57.38
Serv. (Max.D +FF)	84	579.16	103.93	49.21	18.21	171.35	407.81	59.15

SUMMARY

Under typical residential peak demand, there will be sufficient pressure to service the highest floor of the development with residual pressure of 63.2 psi in the ceiling space of the uppermost floor of the proposed building.

Under maximum day plus fire flow demand, there will be sufficient pressure to service the highest floor of the development with residual pressure of 59.15 psi in the ceiling space of the uppermost floor of the proposed building.

Under maximum day plus fire flow demand, there will be sufficient pressure to provide fire protection service to the highest floor of the development with residual pressure of 57.38 psi in the ceiling space of the uppermost floor of the proposed building.

MODEL 90-48

Pressure Reducing Valve with Low Flow By-Pass

- **Modulating Control**
- **Maintains Constant Outlet Pressure Over a Wide Range of Flows**
- **Durable Construction**
- **Convenient and Space Saving**

The Cla-Val Model 90-48 Pressure Reducing Valve with Low Flow By-Pass automatically reduces a higher inlet pressure to a steady lower downstream pressure, regardless of changing flow rate. The low flow by-pass capability is achieved by using the Cla-Val Model CRD-L Direct Acting Pressure Reducing Valve as an integral part of the main valve. By doing this, space is saved and installation and maintenance become much easier.

The pressure reducing valve is hydraulically operated and controlled by a Cla-Val CRD pilot control, which senses pressure at the main valve outlet. An increase in outlet pressure forces the CRD pilot control to close and a decrease in outlet pressure opens the control. This causes the main valve cover pressure to vary, modulating the main valve, thereby, maintaining constant outlet pressure.

The Model CRD-L low flow pressure reducing by-pass is set to a higher pressure than the CRD pilot control. The CRD-L responds to pressure changes at the main valve outlet. When the CRD closes, the Model CRD-L remains open, allowing low flow to by-pass the main valve. The CRD-L closes when the flow decreases and the downstream pressure reaches its set-point .

The bypass size on this valve is limited by the body tapping size on the main valve. Consequently, in applications where higher flows for the low flow bypass may be required, such as building applications for off peak flows, a larger, separate bypass may be required. Refer to Cla-Val Model 90-99 as an option.

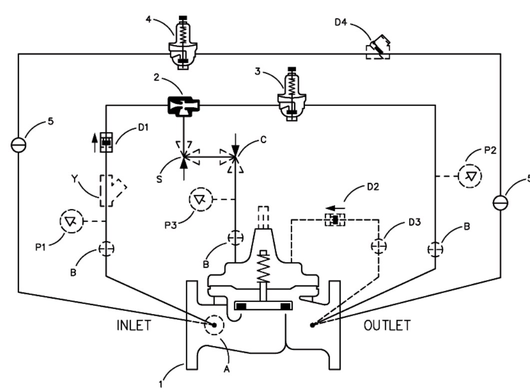
Schematic Diagram

Item	Description
1	100-01 Hytrol Main Valve
2	X47A Ejector
3	CRD Pressure Reducing Control
4	CRD-L Pressure Reducing Valve
5	CK2 Isolation Valve

Optional Features

Item	Description
A	X46A Flow Clean Strainer
B	CK2 Isolation Valve
C	CV Flow Control (Closing)*
D	Check Valves with Isolation Valve
P	X141 Pressure Gauge
S	CV Speed Control (Opening)*
V	X101 Valve Position Indicator
Y	X43 "Y" Strainer

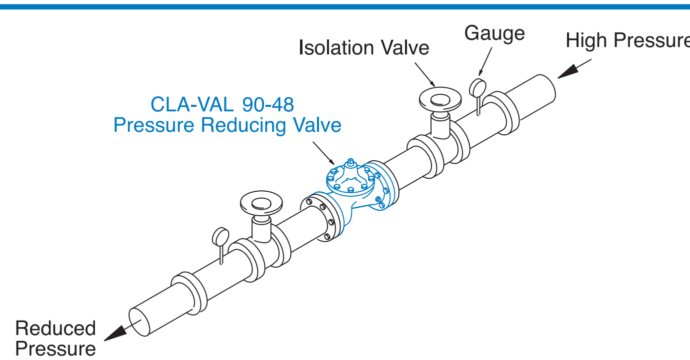
*The optional closing speed control on this valve should always be open at least three (3) turns off its seat.



Typical Applications

This valve has the flexibility to be installed in a distribution system where the demand varies over a wide range. This frequently occurs in industrial, residential, educational, high-rise buildings and other applications.

Another important feature of the valve is its space efficient configuration, allowing easy installation and maintenance. A downstream pressure relief valve is also recommended for this type of application.

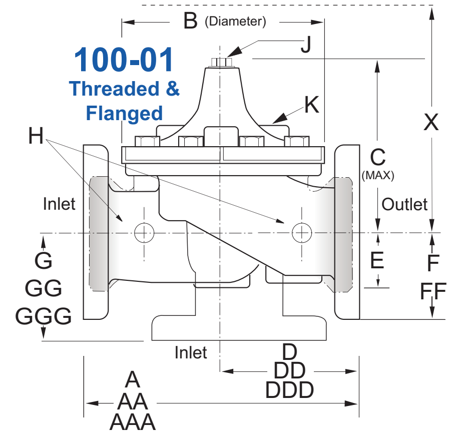


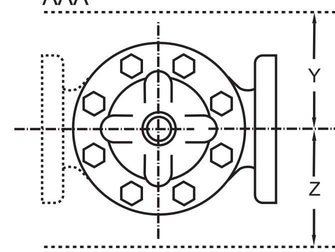
Model 90-48 (Uses 100-01 Hytrol Main Valve)

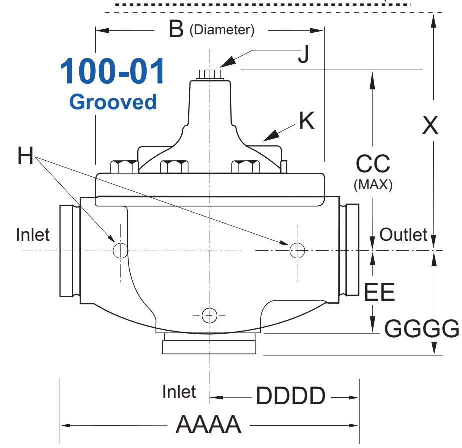
Pressure Ratings (Recommended Maximum Pressure - psi)

Valve Body & Cover		Pressure Class				
		Flanged			Grooved	Threaded
Grade	Material	ANSI Standards*	150 Class	300 Class	300 Class	End‡ Details
ASTM A536	Ductile Iron	B16.42	250	400	400	400
ASTM A216-WCB	Cast Steel	B16.5	285	400	400	400
UNS 87850	Low Lead Bronze	B16.24	225	400	400	400

Note: * ANSI standards are for flange dimensions only.
Flanged valves are available faced but not drilled.
‡ End Details machined to ANSI B2.1 specifications.
Valves for higher pressure are available; consult factory for details







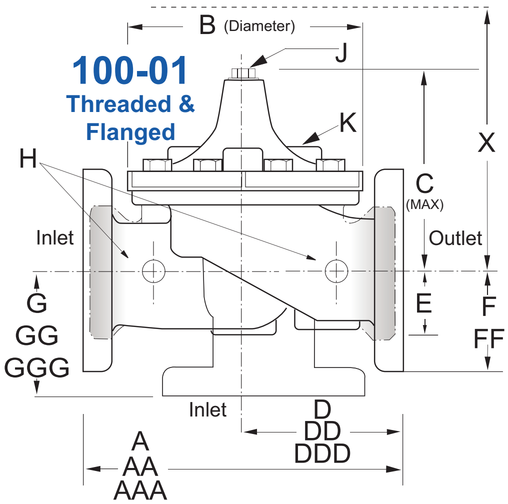
Materials

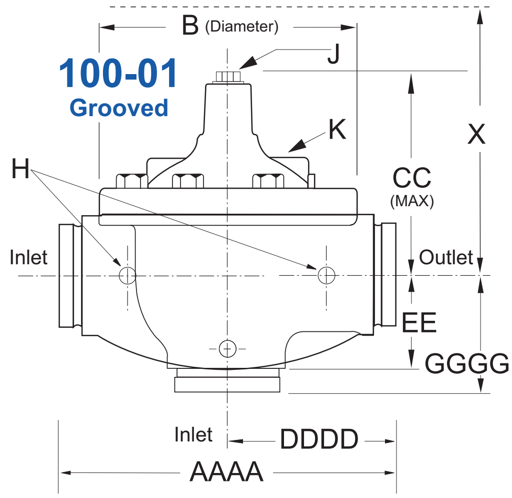
Component	Standard Material Combinations		
Body & Cover	Ductile Iron	Cast Steel	Low Lead Bronze
Available Sizes	1" - 8" 25 - 200 mm	1" - 8" 25 - 200 mm	1" - 8" 25 - 200 mm
Disc Retainer & Diaphragm Washer	Cast Iron	Cast Steel	Bronze
Trim: Disc Guide, Seat & Cover Bearing	Bronze is Standard Stainless Steel is Optional		
Disc	Buna-N® Rubber		
Diaphragm	Nylon Reinforced Buna-N® Rubber		
Stem, Nut & Spring	Stainless Steel		
For material options not listed, consult factory. Cla-Val manufactures valves in more than 50 different alloys.			

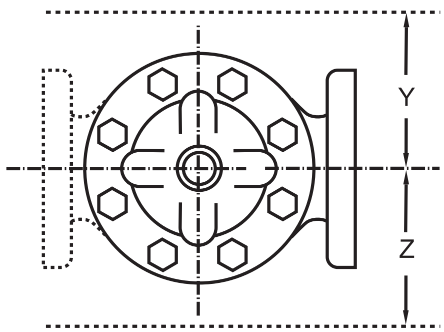
Model 90-48 Dimensions (In Inches) - For larger sizes, consult Factory

Valve Size (Inches)	1	1 1/4	1 1/2	2	2 1/2	3	4	6	8
A Threaded	7.25	7.25	7.25	9.38	11.00	12.50	—	—	—
AA 150 ANSI	—	—	8.50	9.38	11.00	12.00	15.00	20.00	25.38
AAA 300 ANSI	—	—	9.00	10.00	11.62	13.25	15.62	21.00	26.38
AAAA Grooved End	—	—	8.50	9.00	11.00	12.50	15.00	20.00	25.38
B Diameter	5.62	5.62	5.62	6.62	8.00	9.12	11.50	15.75	20.00
C Maximum	5.50	5.50	5.50	6.50	7.56	8.19	10.62	13.38	16.00
CC Maximum Grooved End	—	—	4.75	5.75	6.88	7.25	9.31	12.12	14.62
D Threaded	3.25	3.25	3.25	4.75	5.50	6.25	—	—	—
DD 150 ANSI	—	—	4.00	4.75	5.50	6.00	7.50	10.00	12.69
DDD 300 ANSI	—	—	4.25	5.00	5.88	6.38	7.88	10.50	13.25
DDDD Grooved End	—	—	—	4.75	—	6.00	7.50	—	—
E	1.12	1.12	1.12	1.50	1.69	2.06	3.19	4.31	5.31
EE Grooved End	—	—	2.00	2.50	2.88	3.12	4.25	6.00	7.56
F 150 ANSI	—	—	2.50	3.00	3.50	3.75	4.50	5.50	6.75
FF 300 ANSI	—	—	3.06	3.25	3.75	4.13	5.00	6.25	7.50
G Threaded	1.88	1.88	1.88	3.25	4.00	4.50	—	—	—
GG 150 ANSI	—	—	4.00	3.25	4.00	4.00	5.00	6.00	8.00
GGG 300 ANSI	—	—	4.25	3.50	4.31	4.38	5.31	6.50	8.50
GGGG Grooved End	—	—	—	3.25	—	4.25	5.00	—	—
H NPT Body Tapping	0.375	0.375	0.375	0.375	0.50	0.50	0.75	0.75	1.00
J NPT Cover Center Plug	0.25	0.25	0.25	0.50	0.50	0.50	0.75	0.75	1.00
K NPT Cover Tapping	0.375	0.375	0.375	0.375	0.50	0.50	0.75	0.75	1.00
Stem Travel	0.40	0.40	0.40	0.60	0.70	0.80	1.10	1.70	2.30
Approx. Ship Weight (lbs)	15	15	15	35	50	70	140	285	500
Approx. **X** Pilot System	11	11	11	13	14	15	17	29	31
Approx. **Y** Pilot System	9	9	9	9	10	11	12	20	22
Approx. **Z** Pilot System	9	9	9	9	10	11	12	20	22

Model 90-48 **Metric Dimensions** (Uses 100-01 Hytrol Main Valve)







Model 90-48 Dimensions (mm) - For larger sizes, consult Factory

Valve Size (mm)	**25**	**32**	**40**	**50**	**65**	**80**	**100**	**150**	**200**
A Threaded	184	184	184	238	279	318	—	—	—
AA 150 ANSI	—	—	216	238	279	305	381	508	645
AAA 300 ANSI	—	—	229	254	295	337	397	533	670
AAAA Grooved End	—	—	216	228	279	318	381	508	645
B Diameter	143	143	143	168	203	232	292	400	508
C Maximum	140	140	140	165	192	208	270	340	406
CC Maximum Grooved End	—	—	120	146	175	184	236	308	371
D Threaded	83	83	83	121	140	159	—	—	—
DD 150 ANSI	—	—	102	121	140	152	191	254	322
DDD 300 ANSI	—	—	108	127	149	162	200	267	337
DDDD Grooved End	—	—	—	121	—	152	191	—	—
E	29	29	29	38	43	52	81	110	135
EE Grooved End	—	—	52	64	73	79	108	152	192
F 150 ANSI	—	—	64	76	89	95	114	140	171
FF 300 ANSI	—	—	78	83	95	105	127	159	191
G Threaded	48	48	48	83	102	114	—	—	—
GG 150 ANSI	—	—	102	83	102	102	127	152	203
GGG 300 ANSI	—	—	102	89	110	111	135	165	216
GGGG Grooved End	—	—	—	83	—	108	127	—	—
H NPT Body Tapping	0.375	0.375	0.375	0.375	0.50	0.50	0.75	0.75	1.00
J NPT Cover Center Plug	0.25	0.25	0.25	0.50	0.50	0.50	0.75	0.75	1.00
K NPT Cover Tapping	0.375	0.375	0.375	0.375	0.50	0.50	0.75	0.75	1.00
Stem Travel	10	10	10	15	18	20	28	43	58
Approx. Ship Weight (kgs)	7	7	7	16	23	32	64	129	227
Approx. **X** Pilot System	280	280	280	331	356	381	432	737	788
Approx. **Y** Pilot System	229	229	229	229	254	280	305	508	559
Approx. **Z** Pilot System	229	229	229	229	254	280	305	508	559

Valve Selection Guide

90-48 Valve Selection	Inches	1	1¼	1½	2	2½	3	4	6	8
	mm	25	32	40	50	65	80	100	150	200
Main Valve 100-01	Pattern	G, A	G, A	G, A	G, A	G, A	G, A	G, A	G, A	G, A
	End Detail	T	T	T, F, Gr*	T, F, Gr	T, F, Gr*	T, F, Gr	F, Gr	F, Gr*	F, Gr*
Suggested Flow (gpm)	Maximum	55	93	125	210	300	460	800	1800	3100
	Maximum Intermittent	68	120	160	260	370	580	990	2250	3900
	Minimum	1	1	1	1	1	1	1	1	1
Suggested Flow (Liters/Sec)	Maximum	3.5	6	8	13	19	29	50	113	195
	Maximum Intermittent	4.3	7.6	10	16	23	37	62	142	246
	Minimum	.06	.06	.06	.06	.06	.06	.06	.06	.06

100-01 Pattern: Globe (G), Angle (A), **End Connections:** Threaded (T), Grooved (GR), Flanged (F) Indicate Available Sizes
100-01 Series is the full internal port Hytrol. **For Lower Flows Consult Factory** *Globe Grooved Only

Pilot System Specifications

CRD-L

CRD

Adjustment Ranges

CRD

2 to 30 psi
15 to 75 psi
20 to 105 psi
30 to 300 psi*

CRD-L (Bypass)

15 to 65 psi
25 to 100 psi
80 to 150 psi

*Supplied unless otherwise specified Other ranges available, please consult factory.

Temperature Range

Water: to 180° F/ 82° C

Materials

Standard Pilot System Materials
Pilot Control: Low Lead Bronze
Trim: Stainless Steel Type 303
Rubber:Buna-N® Synthetic Rubber

Optional Pilot System Materials
Pilot Systems are available with optional Aluminum, Stainless Steel or Monel materials.

See Cla-Val Model # 690-48 for applications requiring a reduced port valve.

When Ordering, Specify:

1. Catalog No. 90-48
2. Valve Size
3. Pattern - Globe or Angle
4. Pressure Class
5. Threaded, Flanged or Grooved
6. Trim Material
7. Adjustment Range
8. Desired Options
9. When Vertically Installed

Valve Options

X141 Pressure Gauge

X101AR Valve Position Indicator with Air Release

X101 Valve Position Indicator

X144 e-FlowMeter

X43H Strainer

Stainless Steel Pilot

1701 Placentia Ave • Costa Mesa CA 92627 • Phone: 949-722-4800 • Fax: 949-548-5441 • E-mail: info@cla-val.com • www.cla-val.com

Appendix D:
Runoff Coefficients & Storm Sewer Design Sheet

Pre-Development Condition

Catchment Parameters

Catchment ID:	101	Soil Symbol:	Vasl
Max Elev. (m):	231.00	Soil Series:	Vasey
Min Elev. (m):	202.50	Hydrologic Soils Group:	AB
Length (m):	380.00	Soil Texture:	Sand Loam
Slope (%):	7.50%	Runoff Coefficient Type:	1

Land Cover - MTO Drainage Management Manual (1997), Design Chart 1.07

Urban Runoff Coefficient				
Description	Min.	Max.	Proposed	Area (ha)
Unimproved Areas	0.10	0.30	0.20	3.70

Rural Runoff Coefficient			
Description	Suggested	Proposed	Area (ha)

Bare Rock Runoff Coefficient			
Property Coverage (%)	Suggested	Proposed	Area (ha)

Total Area:	3.70
Composite Runoff Coefficient:	0.20

Time of Concentration

Calculation Method:	Airport Method		
Time of Concentration (mins):	29.42	Proposed Time of Concentration (mins):	29.42

Post-Development Condition

Catchment Parameters

Catchment ID:	201	Soil Symbol:	Vasl
Max Elev. (m):		Soil Series:	Vasey
Min Elev. (m):		Hydrologic Soils Group:	AB
Length (m):		Soil Texture:	Sand Loam
Slope (%):		Runoff Coefficient Type:	1

Land Cover - MTO Drainage Management Manual (1997), Design Chart 1.07

Urban Runoff Coefficient				
Description	**Min.**	**Max.**	**Proposed**	**Area (ha)**
Apartments	0.50	0.70	0.20	0.44

Rural Runoff Coefficient			
Description	**Suggested**	**Proposed**	**Area (ha)**

Bare Rock Runoff Coefficient			
Property Coverage (%)	**Suggested**	**Proposed**	**Area (ha)**

Total Area: 0.44

Composite Runoff Coefficient: 0.20

Note: Catchment to incorporate separate post to pre controls.

Time of Concentration

Calculation Method: Airport Method

Time of Concentration (mins):

Proposed Time of Concentration (mins): 15.00

Post-Development Condition

Catchment Parameters

Catchment ID:	202	Soil Symbol:	Vasl
Max Elev. (m):		Soil Series:	Vasey
Min Elev. (m):		Hydrologic Soils Group:	AB
Length (m):		Soil Texture:	Sand Loam
Slope (%):		Runoff Coefficient Type:	1

Land Cover - MTO Drainage Management Manual (1997), Design Chart 1.07

Urban Runoff Coefficient				
Description	**Min.**	**Max.**	**Proposed**	**Area (ha)**
Apartments	0.50	0.70	0.20	0.43

Rural Runoff Coefficient			
Description	**Suggested**	**Proposed**	**Area (ha)**

Bare Rock Runoff Coefficient			
Property Coverage (%)	**Suggested**	**Proposed**	**Area (ha)**

Total Area: 0.43

Composite Runoff Coefficient: 0.20

Note: Catchment to incorporate separate post to pre controls.

Time of Concentration

Calculation Method: Airport Method

Time of Concentration (mins):

Proposed Time of Concentration (mins): 15.00

Post-Development Condition

Catchment Parameters

Catchment ID:	203	Soil Symbol:	Vasl
Max Elev. (m):		Soil Series:	Vasey
Min Elev. (m):		Hydrologic Soils Group:	AB
Length (m):		Soil Texture:	Sand Loam
Slope (%):		Runoff Coefficient Type:	1

Land Cover - MTO Drainage Management Manual (1997), Design Chart 1.07

Urban Runoff Coefficient				
Description	**Min.**	**Max.**	**Proposed**	**Area (ha)**
Asphalt/Concrete Pavement	0.80	0.95	0.95	0.06
Lawns	0.15	0.20	0.22	0.06

Rural Runoff Coefficient			
Description	**Suggested**	**Proposed**	**Area (ha)**

Bare Rock Runoff Coefficient			
Property Coverage (%)	**Suggested**	**Proposed**	**Area (ha)**

Total Area:	0.12
Composite Runoff Coefficient:	0.60

Time of Concentration

Calculation Method:	Bransby-Williams Formula		
Time of Concentration (mins):		Proposed Time of Concentration (mins):	15.06

TATHAM ENGINEERING

PROJECT	983 Yonge Street, Midland	FILE	324829
		DATE	11-Jun-2024
SUBJECT	Runoff Coefficient Calculations	NAME	JN
		PAGE	5 OF 13

Post-Development Condition

Catchment Parameters

Catchment ID:	204	Soil Symbol:	Vasl
Max Elev. (m):		Soil Series:	Vasey
Min Elev. (m):		Hydrologic Soils Group:	AB
Length (m):		Soil Texture:	Sand Loam
Slope (%):		Runoff Coefficient Type:	1

Land Cover - MTO Drainage Management Manual (1997), Design Chart 1.07

Urban Runoff Coefficient				
Description	**Min.**	**Max.**	**Proposed**	**Area (ha)**
Asphalt/Concrete Pavement	0.80	0.95	0.95	0.07
Lawns	0.15	0.20	0.20	0.06

Rural Runoff Coefficient			
Description	**Suggested**	**Proposed**	**Area (ha)**

Bare Rock Runoff Coefficient			
Property Coverage (%)	**Suggested**	**Proposed**	**Area (ha)**

Total Area:	0.13
Composite Runoff Coefficient:	0.60

Time of Concentration

Calculation Method:	Bransby-Williams Formula		
Time of Concentration (mins):		Proposed Time of Concentration (mins):	15.46

Post-Development Condition

Catchment Parameters

Catchment ID:	205	Soil Symbol:	Vasl
Max Elev. (m):		Soil Series:	Vasey
Min Elev. (m):		Hydrologic Soils Group:	AB
Length (m):		Soil Texture:	Sand Loam
Slope (%):		Runoff Coefficient Type:	1

Land Cover - MTO Drainage Management Manual (1997), Design Chart 1.07

Urban Runoff Coefficient				
Description	**Min.**	**Max.**	**Proposed**	**Area (ha)**
Multiple residential, attached	0.60	0.75	0.75	0.49

Rural Runoff Coefficient			
Description	**Suggested**	**Proposed**	**Area (ha)**

Bare Rock Runoff Coefficient			
Property Coverage (%)	**Suggested**	**Proposed**	**Area (ha)**

Total Area:	0.49
Composite Runoff Coefficient:	0.75

Time of Concentration

Calculation Method: Bransby-Williams Formula

Time of Concentration (mins):

Proposed Time of Concentration (mins): 15.83

Post-Development Condition

Catchment Parameters

Catchment ID:	206	Soil Symbol:	Vasl
Max Elev. (m):		Soil Series:	Vasey
Min Elev. (m):		Hydrologic Soils Group:	AB
Length (m):		Soil Texture:	Sand Loam
Slope (%):		Runoff Coefficient Type:	1

Land Cover - MTO Drainage Management Manual (1997), Design Chart 1.07

Urban Runoff Coefficient				
Description	Min.	Max.	Proposed	Area (ha)
Multiple residential, attached	0.60	0.75	0.75	0.44
Multiple Residential, detached	0.40	0.60	0.60	0.28
Single Family Residential (Urban)	0.30	0.50	0.50	0.13

Rural Runoff Coefficient			
Description	Suggested	Proposed	Area (ha)

Bare Rock Runoff Coefficient			
Property Coverage (%)	Suggested	Proposed	Area (ha)

Total Area:	0.85
Composite Runoff Coefficient:	0.66

Time of Concentration

Calculation Method:	Bransby-Williams Formula		
Time of Concentration (mins):		Proposed Time of Concentration (mins):	16.14

TATHAM ENGINEERING

PROJECT	983 Yonge Street, Midland	FILE	324829
		DATE	11-Jun-2024
SUBJECT	Runoff Coefficient Calculations	NAME	JN
		PAGE	8 OF 13

Post-Development Condition

Catchment Parameters

Catchment ID:	207	Soil Symbol:	Vasl
Max Elev. (m):		Soil Series:	Vasey
Min Elev. (m):		Hydrologic Soils Group:	AB
Length (m):		Soil Texture:	Sand Loam
Slope (%):		Runoff Coefficient Type:	1

Land Cover - MTO Drainage Management Manual (1997), Design Chart 1.07

Urban Runoff Coefficient				
Description	**Min.**	**Max.**	**Proposed**	**Area (ha)**
Multiple residential, attached	0.60	0.75	0.75	0.15
Multiple Residential, detached	0.40	0.60	0.60	0.15
Single Family Residential (Urban)	0.30	0.50	0.50	0.28

Rural Runoff Coefficient			
Description	**Suggested**	**Proposed**	**Area (ha)**

Bare Rock Runoff Coefficient			
Property Coverage (%)	**Suggested**	**Proposed**	**Area (ha)**

Total Area: 0.58

Composite Runoff Coefficient: 0.59

Time of Concentration

Calculation Method: Bransby-Williams Formula

Time of Concentration (mins):

Proposed Time of Concentration (mins): 15.00

TATHAM ENGINEERING

PROJECT	983 Yonge Street, Midland	FILE	324829
		DATE	11-Jun-2024
SUBJECT	Runoff Coefficient Calculations	NAME	JN
		PAGE	9 OF 13

Post-Development Condition

Catchment Parameters

Catchment ID:	208	Soil Symbol:	Vasl
Max Elev. (m):		Soil Series:	Vasey
Min Elev. (m):		Hydrologic Soils Group:	AB
Length (m):		Soil Texture:	Sand Loam
Slope (%):		Runoff Coefficient Type:	1

Land Cover - MTO Drainage Management Manual (1997), Design Chart 1.07

Urban Runoff Coefficient				
Description	**Min.**	**Max.**	**Proposed**	**Area (ha)**
Multiple Residential, detached	0.40	0.60	0.60	0.13
Single Family Residential (Urban)	0.30	0.50	0.50	0.19

Rural Runoff Coefficient			
Description	**Suggested**	**Proposed**	**Area (ha)**

Bare Rock Runoff Coefficient			
Property Coverage (%)	**Suggested**	**Proposed**	**Area (ha)**

Total Area: 0.32

Composite Runoff Coefficient: 0.54

Time of Concentration

Calculation Method: Bransby-Williams Formula

Time of Concentration (mins):

Proposed Time of Concentration (mins): 16.53

TATHAM ENGINEERING

PROJECT	983 Yonge Street, Midland	FILE	324829
		DATE	11-Jun-2024
SUBJECT	Runoff Coefficient Calculations	NAME	JN
		PAGE	10 OF 13

Post-Development Condition

Catchment Parameters

Catchment ID:	209	Soil Symbol:	Vasl
Max Elev. (m):		Soil Series:	Vasey
Min Elev. (m):		Hydrologic Soils Group:	AB
Length (m):		Soil Texture:	Sand Loam
Slope (%):		Runoff Coefficient Type:	1

Land Cover - MTO Drainage Management Manual (1997), Design Chart 1.07

Urban Runoff Coefficient				
Description	**Min.**	**Max.**	**Proposed**	**Area (ha)**
Single Family Residential (Urban)	0.30	0.50	0.50	0.06
Lawns	0.15	0.20	0.20	0.03

Rural Runoff Coefficient			
Description	**Suggested**	**Proposed**	**Area (ha)**

Bare Rock Runoff Coefficient			
Property Coverage (%)	**Suggested**	**Proposed**	**Area (ha)**

Total Area:	0.09
Composite Runoff Coefficient:	0.40

Time of Concentration

Calculation Method:	Airport Method		
Time of Concentration (mins):		Proposed Time of Concentration (mins):	15.00

Post-Development Condition

Catchment Parameters

Catchment ID:	210	Soil Symbol:	Vasl
Max Elev. (m):		Soil Series:	Vasey
Min Elev. (m):		Hydrologic Soils Group:	AB
Length (m):		Soil Texture:	Sand Loam
Slope (%):		Runoff Coefficient Type:	1

Land Cover - MTO Drainage Management Manual (1997), Design Chart 1.07

Urban Runoff Coefficient				
Description	Min.	Max.	Proposed	Area (ha)
Multiple Residential, detached	0.40	0.60	0.60	0.03
Single Family Residential (Urban)	0.30	0.50	0.50	0.09
Lawns	0.15	0.20	0.20	0.13

Rural Runoff Coefficient			
Description	Suggested	Proposed	Area (ha)

Bare Rock Runoff Coefficient			
Property Coverage (%)	Suggested	Proposed	Area (ha)

Total Area: 0.25

Composite Runoff Coefficient: 0.36

Time of Concentration

Calculation Method: Airport Method

Time of Concentration (mins):

Proposed Time of Concentration (mins): 15.00

Storm Sewer Design Sheet

Version Date:	May 15, 2025
Version Number:	1

Project Information

983 Yonge Street	324829

Drawing Reference

Post Deelopment Storm Drainage Area - STM-2	May 24/24

Prepared By

JN	May 15/24

Reviewed By

Municipality

Town of Midland

Runoff Coefficient Adjustment

Equation	3	
Year	**A**	**B**
10	1.00	0.00
25	1.10	0.00
50	1.20	0.00
100	1.25	0.00

Time of Concentration

10 mins	for C≥0.60
15 mins	for C<0.60

IDF Curve Coefficients

Year	A	B	C
2	807.44	6.75	0.83
5	1135.40	7.50	0.84
10	1387.00	7.97	0.85
25	1676.20	8.30	0.86
50	1973.10	9.00	0.87
100	2193.10	9.04	0.87

Manning's Coefficient

Material	Value
CSP	0.024
Concrete	0.013
PVC	0.013

Notes

1)

Engineer Stamp

Street Name	Area ID / Label	Upstream Maintenance Hole	Downstream Maintenance Hole	Area (ha)	5 Year Runoff Coefficient (C)	Design Storm (Year)	Adjusted Runoff Coefficient (C)	Area × Runoff Coefficient	Cumulative Area (ha)	Cumulative Area × Adjusted Runoff Coefficient	Time of Concentration (min)	Rainfall Intensity (mm/hr)	Peak Flow (m^3/s)	Manning's Roughness Coefficient	Sewer Length (m)	Sewer Slope (%)	Actual Sewer Diameter (mm)	Full Flow Velocity (m/s)	Full Flow Capacity (L/s)	Actual Velocity (m/s)	Travel Time (min)	Calculated Sewer Diameter (mm)	Percentage of Full Flow Capacity (%)	Total Time of Travel (min)
Street A	201	Block 1	CBMH 2	0.44	0.20	100	0.25	0.11	0.44	0.11	15.00	137.49	0.042	0.013	6.0	4.2%	300	2.80	0.198	2.10	0.05	168	21.2%	15.05
	202	Block 2	CBMH 1	0.43	0.20	100	0.25	0.11	0.43	0.11	15.00	137.49	0.041	0.013	6.0	2.6%	300	2.21	0.156	1.74	0.06	182	26.3%	15.06
	203	CBMH 1	CBMH 2	0.12	0.60	5	0.60	0.07	0.55	0.18	15.06	82.61	0.057	0.013	8.0	4.2%	300	2.80	0.198	2.28	0.06	189	29.0%	15.12
		CBMH 2	STM MH 2	0.00	0.00	5	0.00	0.00	0.99	0.29	15.12	82.43	0.099	0.013	62.9	6.0%	300	3.35	0.237	3.01	0.35	216	41.9%	15.46
	204	STM MH 2	STM MH 3	0.13	0.60	5	0.60	0.08	1.12	0.37	15.46	81.38	0.116	0.013	68.5	6.0%	300	3.35	0.237	3.14	0.36	229	48.8%	15.83
	205	STM MH 3	STM MH 4	0.49	0.75	5	0.75	0.37	1.61	0.74	15.83	80.31	0.196	0.013	63.0	5.0%	**375**	3.55	0.392	3.35	0.31	289	50.0%	16.14
	206	STM MH 4	DCBMH 1	0.85	0.66	5	0.66	0.56	2.46	1.30	16.14	79.42	0.318	0.013	64.7	2.2%	**525**	2.95	0.638	2.77	0.39	404	49.8%	16.53
	207	CBMH 3	STM MH 5	0.58	0.59	5	0.59	0.34	0.58	0.34	15.00	82.79	0.079	0.013	36.3	1.4%	**375**	1.88	0.207	1.63	0.37	261	37.9%	15.37
		STM MH 5	DCBMH 1	0.00	0.00	5	0.00	0.00	0.58	0.34	15.37	81.66	0.078	0.013	33.2	1.4%	**375**	1.88	0.207	1.63	0.34	259	37.4%	15.71
	208	DCBMH 1	OGS MH	0.32	0.54	5	0.54	0.17	3.36	1.81	16.53	78.33	0.425	0.013	38.9	1.0%	**675**	2.35	0.841	2.21	0.29	523	50.6%	16.82
		OGS MH	Pond	0.00	0.00	5	0.00	0.00	3.36	1.81	16.82	77.54	0.421	0.013	9.0	0.5%	**750**	1.78	0.787	1.70	0.09	593	53.5%	16.91

TATHAM ENGINEERING

Storm Sewer Design Sheet

Version Date:	May 15, 2025
Version Number:	1

Project Information

983 Yonge Street	324829

Drawing Reference

Post Deelopment Storm Drainage Area - STM-2	May 24/24

Prepared By

JN	May 15/24

Reviewed By

Municipality

Town of Midland

Runoff Coefficient Adjustment

Equation	3	
Year	**A**	**B**
10	1.00	0.00
25	1.10	0.00
50	1.20	0.00
100	1.25	0.00

Time of Concentration

10 mins	for C≥0.60
15 mins	for C<0.60

IDF Curve Coefficients

Year	A	B	C
2	807.44	6.75	0.83
5	1135.40	7.50	0.84
10	1387.00	7.97	0.85
25	1676.20	8.30	0.86
50	1973.10	9.00	0.87
100	2193.10	9.04	0.87

Manning's Coefficient

Material	Value
CSP	0.024
Concrete	0.013
PVC	0.013

Notes

1)

Engineer Stamp

Street Name	Area ID / Label	Upstream Maintenance Hole	Downstream Maintenance Hole	Area (ha)	5 Year Runoff Coefficient (C)	Design Storm (Year)	Adjusted Runoff Coefficient (C)	Area × Runoff Coefficient	Cumulative Area (ha)	Cumulative Area × Adjusted Runoff Coefficient	Time of Concentration (min)	Rainfall Intensity (mm/hr)	Peak Flow (m^3/s)	Manning's Roughness Coefficient	Sewer Length (m)	Sewer Slope (%)	Actual Sewer Diameter (mm)	Full Flow Velocity (m/s)	Full Flow Capacity (L/s)	Actual Velocity (m/s)	Travel Time (min)	Calculated Sewer Diameter (mm)	Percentage of Full Flow Capacity (%)	Total Time of Travel (min)
Street A	201	Block 1	CBMH 2	0.44	0.20	100	0.25	0.11	0.44	0.11	15.00	137.49	0.042	0.013	6.0	4.2%	300	2.80	0.198	2.10	0.05	168	21.2%	15.05
	202	Block 2	CBMH 1	0.43	0.20	100	0.25	0.11	0.43	0.11	15.00	137.49	0.041	0.013	6.0	2.6%	300	2.21	0.156	1.74	0.06	182	26.3%	15.06
	203	CBMH 1	CBMH 2	0.12	0.60	100	0.75	0.09	0.55	0.20	15.06	137.20	0.075	0.013	8.0	4.2%	**300**	2.80	0.198	2.45	0.05	209	38.0%	15.11
		CBMH 2	STM MH 2	0.00	0.00	100	0.00	0.00	0.99	0.31	15.11	136.93	0.117	0.013	62.9	6.0%	**300**	3.35	0.237	3.15	0.33	230	49.4%	15.44
	204	STM MH 2	STM MH 3	0.13	0.60	100	0.75	0.10	1.12	0.41	15.44	135.31	0.152	0.013	68.5	6.0%	**300**	3.35	0.237	3.35	0.34	254	64.3%	15.78
	205	STM MH 3	STM MH 4	0.49	0.75	100	0.94	0.46	1.61	0.86	15.78	133.69	0.321	0.013	63.0	5.0%	**375**	3.55	0.392	3.55	0.30	348	81.9%	16.08
	206	STM MH 4	DCBMH 1	0.85	0.66	100	0.83	0.70	2.46	1.57	16.08	132.32	0.575	0.013	64.7	2.2%	**525**	2.95	0.638	2.95	0.37	505	90.2%	16.45
	207	CBMH 3	STM MH 5	0.58	0.59	100	0.74	0.43	0.58	0.43	10.00	168.45	0.200	0.013	36.3	1.4%	**375**	1.88	0.207	1.88	0.32	370	96.5%	10.32
		STM MH 5	DCBMH 1	0.00	0.00	100	0.00	0.00	0.58	0.43	10.32	166.01	0.197	0.013	33.2	1.4%	**375**	1.88	0.207	1.88	0.29	368	95.1%	10.62
	208	DCBMH 1	OGS MH	0.32	0.54	100	0.68	0.22	3.36	2.21	16.45	130.66	0.802	0.013	38.9	1.0%	**675**	2.35	0.841	2.35	0.28	663	95.4%	16.72
		OGS MH	Pond	0.00	0.00	100	0.00	0.00	3.36	2.21	16.72	129.44	0.794	0.013	9.0	0.5%	**750**	1.78	0.787	1.78	0.08	752	100.9%	16.81

Post-Development Condition

Catchment Parameters

Catchment ID:	Sewer Outlet	Soil Symbol:	Vasl
Max Elev. (m):		Soil Series:	Vasey
Min Elev. (m):		Hydrologic Soils Group:	AB
Length (m):		Soil Texture:	Sand Loam
Slope (%):		Runoff Coefficient Type:	1

Land Cover - MTO Drainage Management Manual (1997), Design Chart 1.07

Urban Runoff Coefficient				
Description	**Min.**	**Max.**	**Proposed**	**Area (ha)**
Apartments	0.50	0.70	0.20	0.87
Asphalt/Concrete Pavement	0.80	0.95	0.95	0.13
Lawns	0.15	0.20	0.20	0.12
Multiple residential, attached	0.60	0.75	0.75	1.08
Multiple Residential, detached	0.40	0.60	0.60	0.56
Single Family Residential (Urban)	0.30	0.50	0.50	0.60

Rural Runoff Coefficient			
Description	**Suggested**	**Proposed**	**Area (ha)**

Bare Rock Runoff Coefficient			
Property Coverage (%)	**Suggested**	**Proposed**	**Area (ha)**

Total Area:	3.36
Composite Runoff Coefficient:	0.53

Time of Concentration

Calculation Method:	Bransby-Williams Formula		
Time of Concentration (mins):		Proposed Time of Concentration (mins):	16.82

Post-Development Condition

Catchment Parameters

Catchment ID:	Parkette OLF	Soil Symbol:	Vasl
Max Elev. (m):		Soil Series:	Vasey
Min Elev. (m):		Hydrologic Soils Group:	AB
Length (m):		Soil Texture:	Sand Loam
Slope (%):		Runoff Coefficient Type:	1

Land Cover - MTO Drainage Management Manual (1997), Design Chart 1.07

Urban Runoff Coefficient				
Description	**Min.**	**Max.**	**Proposed**	**Area (ha)**
Apartments	0.50	0.70	0.70	0.87
Asphalt/Concrete Pavement	0.80	0.95	0.95	0.13
Lawns	0.15	0.20	0.20	0.12
Multiple residential, attached	0.60	0.75	0.75	1.08
Multiple Residential, detached	0.40	0.60	0.60	0.56
Single Family Residential (Urban)	0.30	0.50	0.50	0.60

Rural Runoff Coefficient			
Description	**Suggested**	**Proposed**	**Area (ha)**

Bare Rock Runoff Coefficient			
Property Coverage (%)	**Suggested**	**Proposed**	**Area (ha)**

Total Area:	3.36
Composite Runoff Coefficient:	0.66

Time of Concentration

Calculation Method:	Bransby-Williams Formula		
Time of Concentration (mins):		Proposed Time of Concentration (mins):	16.82

Post-Development Condition

Catchment Parameters

Catchment ID:	Inf. Cell Outlet	Soil Symbol:	Vasl
Max Elev. (m):		Soil Series:	Vasey
Min Elev. (m):		Hydrologic Soils Group:	AB
Length (m):		Soil Texture:	Sand Loam
Slope (%):		Runoff Coefficient Type:	1

Land Cover - MTO Drainage Management Manual (1997), Design Chart 1.07

Urban Runoff Coefficient				
Description	**Min.**	**Max.**	**Proposed**	**Area (ha)**
Apartments	0.50	0.70	0.20	0.87
Asphalt/Concrete Pavement	0.80	0.95	0.95	0.13
Lawns	0.15	0.20	0.20	0.15
Multiple residential, attached	0.60	0.75	0.75	1.08
Multiple Residential, detached	0.40	0.60	0.60	0.56
Single Family Residential (Urban)	0.30	0.50	0.50	0.66

Rural Runoff Coefficient			
Description	**Suggested**	**Proposed**	**Area (ha)**

Bare Rock Runoff Coefficient			
Property Coverage (%)	**Suggested**	**Proposed**	**Area (ha)**

Total Area:	3.45
Composite Runoff Coefficient:	0.52

Time of Concentration

Calculation Method:	Bransby-Williams Formula		
Time of Concentration (mins):		Proposed Time of Concentration (mins):	16.82

TATHAM ENGINEERING

PROJECT	983 Yonge Street, Midland	FILE	324829
		DATE	18-Jun-2024
SUBJECT	Runoff Coefficient Calculations	NAME	JN
		PAGE	15 OF 15

Post-Development Condition

Catchment Parameters

Catchment ID:	Inf. Cell OLF	Soil Symbol:	Vasl
Max Elev. (m):		Soil Series:	Vasey
Min Elev. (m):		Hydrologic Soils Group:	AB
Length (m):		Soil Texture:	Sand Loam
Slope (%):		Runoff Coefficient Type:	1

Land Cover - MTO Drainage Management Manual (1997), Design Chart 1.07

Urban Runoff Coefficient				
Description	**Min.**	**Max.**	**Proposed**	**Area (ha)**
Apartments	0.50	0.70	0.70	0.87
Asphalt/Concrete Pavement	0.80	0.95	0.95	0.13
Lawns	0.15	0.20	0.20	0.15
Multiple residential, attached	0.60	0.75	0.75	1.08
Multiple Residential, detached	0.40	0.60	0.60	0.56
Single Family Residential (Urban)	0.30	0.50	0.50	0.66

Rural Runoff Coefficient			
Description	**Suggested**	**Proposed**	**Area (ha)**

Bare Rock Runoff Coefficient			
Property Coverage (%)	**Suggested**	**Proposed**	**Area (ha)**

Total Area:	3.45
Composite Runoff Coefficient:	0.65

Time of Concentration

Calculation Method: Bransby-Williams Formula

Time of Concentration (mins):

Proposed Time of Concentration (mins): 16.82

Municipality / IDF Curve Source:	Town of Midland				
Pre-Development		**Post-Development**	Controllable		Uncontrolled
Catchment ID:	101	Catchment ID:	201 to 209		210
Catchment Area (ha):	3.70	Catchment Area (ha):	3.45		0.25
1:5-Year Runoff Coef:	0.20	1:5-Year Runoff Coef:	0.52		0.40
Time of Conc. (min):	29.4	Time of Conc. (min):	16.8		15.0

Rational Method Calculations

Design Storm		2	5	10	25	50	100
IDF Curve	A	807.440	1135.400	1387.000	1676.200	1973.100	2193.100
	B	6.750	7.500	7.970	8.300	9.000	9.040
	C	0.828	0.841	0.852	0.858	0.868	0.871
Pre-Dev.	i (mm/hr)	41.38	54.59	63.40	74.41	83.13	91.31
	C	0.20	0.20	0.20	0.22	0.24	0.25
Post-Dev. Controllable	i (mm/hr)	58.99	77.54	89.98	105.47	117.37	129.02
	C	0.52	0.52	0.52	0.57	0.62	0.65
Post-Dev. Un-controlled	i (mm/hr)	63.05	82.79	96.02	112.50	125.06	137.49
	C	0.40	0.40	0.40	0.44	0.48	0.50

Peak Flow Summary (L/s)

Storm	$Q_{Existing}$	$Q_{Uncontrolled}$	$Q_{Controllable}$	$Q_{Sub-Total}$	Q_{Ex} - Q_{Sub}	$Q_{Controls}$	Q_{Total}	Q_{Ex} - Q_{Tot}
2	85.06	17.51	293.98	311.49	-226.43	293.98	311.49	-226.43
5	112.20	23.00	386.43	409.43	-297.22	386.43	409.43	-297.22
10	130.32	26.67	448.41	475.08	-344.76	448.41	475.08	-344.76
25	168.25	34.37	578.12	612.50	-444.25	578.12	612.50	-444.25
50	205.05	41.69	701.90	743.58	-538.53	701.90	743.58	-538.53
100	234.61	47.74	803.69	851.43	-616.82	803.69	851.43	-616.82

TATHAM ENGINEERING

PROJECT	983 Yonge Street, Midland	FILE	324829
		DATE	13-Jun-2024
SUBJECT	Rational Method Calculations Emergency Overland Flow	NAME	JN
		PAGE	1 OF 1

Municipality / IDF Curve Source:	Town of Midland				
Pre-Development		**Post-Development**	Controllable		Uncontrolled
Catchment ID:	101	Catchment ID:	201 to 209		210
Catchment Area (ha):	3.70	Catchment Area (ha):	3.45		0.25
1:5-Year Runoff Coef:	0.20	1:5-Year Runoff Coef:	0.65		0.40
Time of Conc. (min):	29.4	Time of Conc. (min):	16.8		15.0

Rational Method Calculations

Design Storm		2	5	10	25	50	100
IDF Curve	A	807.440	1135.400	1387.000	1676.200	1973.100	2193.100
	B	6.750	7.500	7.970	8.300	9.000	9.040
	C	0.828	0.841	0.852	0.858	0.868	0.871
Pre-Dev.	i (mm/hr)	41.38	54.59	63.40	74.41	83.13	91.31
	C	0.20	0.20	0.20	0.22	0.24	0.25
Post-Dev. Controllable	i (mm/hr)	58.99	77.54	89.98	105.47	117.37	129.02
	C	0.65	0.65	0.65	0.72	0.78	0.81
Post-Dev. Un-controlled	i (mm/hr)	63.05	82.79	96.02	112.50	125.06	137.49
	C	0.40	0.40	0.40	0.44	0.48	0.50

Peak Flow Summary (L/s)

Storm	$Q_{Existing}$	$Q_{Uncontrolled}$	$Q_{Controllable}$	$Q_{Sub-Total}$	Q_{Ex} - Q_{Sub}	$Q_{Controls}$	Q_{Total}	Q_{Ex} - Q_{Tot}
2	85.06	17.51	367.47	384.99	-299.93	367.47	384.99	-299.93
5	112.20	23.00	483.04	506.04	-393.83	483.04	506.04	-393.83
10	130.32	26.67	560.51	587.18	-456.86	560.51	587.18	-456.86
25	168.25	34.37	722.66	757.03	-588.78	722.66	757.03	-588.78
50	205.05	41.69	877.37	919.06	-714.00	877.37	919.06	-714.00
100	234.61	47.74	1,004.61	1,052.35	-817.74	1,004.61	1,052.35	-817.74

Appendix E:
Channel Flow Calculations

PROJECT	987 Yonge Street, Midland	FILE	324829
		DATE	11-Jun-2024
SUBJECT	Overland Flow on Street A	NAME	
		PAGE	1 OF 1

Region/Municipality				
Midland				
T_C (in minutes)				
16.82				
Event	A	B	C	Intensity (mm/hr)
1-Year	0	0	0	0.00
2-Year	807.44	6.75	0.828	58.99
5-Year	1135.4	7.5	0.841	77.54
10-Year	1387	7.97	0.852	89.98
25-Year	1676.2	8.3	0.858	105.47
50-Year	1973.1	9	0.868	117.37
100-Year	2193.1	9.04	0.871	129.02

Peak Runoff Flow Rate

Area Name	Park OLF						
Area (ha)	3.36						
Runoff	0.66						
Event	Q_1	Q_2	Q_3	Q_4	Q_5	Q_6	Q_{Total}
1-Year							0.00
2-Year	363.42						181.71
5-Year	477.72						238.86
10-Year	554.33						277.16
25-Year	714.69						357.34
50-Year	867.70						433.85
100-Year	993.54						496.77

Note: Q_{Total} is divided by 2 to represent drainage contained to half of roadway.

Ditch Flows

Manning's n:	0.013
Ditch Slope:	6.00%
L. Side Slope 1:	50
R. Side Slope 1:	0.33
Base Width (m):	0.00

Event	Q (m^3/s)	depth (m)	A_{Base} (m^2)	A_{Sides} (m^2)	P_{Base} (m)	P_{Sides} (m)	V (m/s)
1-Year	0.000	0.000	0.000	0.000	0.000	0.000	#DIV/0!
2-Year	0.182	0.062	0.000	0.098	0.000	3.189	1.851
5-Year	0.239	0.069	0.000	0.121	0.000	3.534	1.982
10-Year	0.277	0.073	0.000	0.135	0.000	3.737	2.057
25-Year	0.357	0.080	0.000	0.163	0.000	4.110	2.192
50-Year	0.434	0.087	0.000	0.189	0.000	4.420	2.301
100-Year	0.497	0.091	0.000	0.209	0.000	4.651	2.380
Manual	0.000	0.001	0.000	0.000	0.000	0.034	0.000

Calculate

Note: Overland flow surface reaches road centerline at a depth of 0.09 m.

TATHAM ENGINEERING

PROJECT	987 Yonge Street, Midland	FILE	324829
		DATE	19-Jun-2024
SUBJECT	Overland Flow on Russ Howard Drive	NAME	JN
		PAGE	1 OF 1

Region/Municipality				
Midland				
T_C (in minutes)				
16.82				
Event	A	B	C	Intensity (mm/hr)
1-Year	0	0	0	0.00
2-Year	807.44	6.75	0.828	58.99
5-Year	1135.4	7.5	0.841	77.54
10-Year	1387	7.97	0.852	89.98
25-Year	1676.2	8.3	0.858	105.47
50-Year	1973.1	9	0.868	117.37
100-Year	2193.1	9.04	0.871	129.02

Peak Runoff Flow Rate

Area Name	207						
Area (ha)	0.58						
Runoff	0.59						
Event	Q_1	Q_2	Q_3	Q_4	Q_5	Q_6	Q_{Total}
1-Year							0.00
2-Year	56.08						56.08
5-Year	73.72						73.72
10-Year	85.54						85.54
25-Year	110.28						110.28
50-Year	133.90						133.90
100-Year	153.31						153.31

Ditch Flows

Manning's n:	0.013
Ditch Slope:	0.50%
L. Side Slope 1:	50
R. Side Slope 1:	0.33
Base Width (m):	0.00

Event	Q (m^3/s)	depth (m)	A_{Base} (m^2)	A_{Sides} (m^2)	P_{Base} (m)	P_{Sides} (m)	V (m/s)
1-Year	0.000	0.000	0.000	0.000	0.000	0.000	#DIV/0!
2-Year	0.056	0.064	0.000	0.103	0.000	3.267	0.544
5-Year	0.074	0.071	0.000	0.126	0.000	3.610	0.586
10-Year	0.086	0.075	0.000	0.142	0.000	3.829	0.604
25-Year	0.110	0.082	0.000	0.171	0.000	4.203	0.647
50-Year	0.134	0.089	0.000	0.198	0.000	4.533	0.675
100-Year	0.153	0.093	0.000	0.220	0.000	4.770	0.698
Manual	0.000	0.000	0.000	0.000	0.000	0.017	0.000

Calculate

TATHAM ENGINEERING

PROJECT	987 Yonge Street, Midland	FILE	324829
		DATE	11-Jun-2024
SUBJECT	Channel Flow Through Parkette	NAME	
		PAGE	1 OF 1

Region/Municipality				
Midland				
T_C (in minutes)				
16.82				
Event	A	B	C	Intensity (mm/hr)
1-Year	0	0	0	0.00
2-Year	807.44	6.75	0.828	58.99
5-Year	1135.4	7.5	0.841	77.54
10-Year	1387	7.97	0.852	89.98
25-Year	1676.2	8.3	0.858	105.47
50-Year	1973.1	9	0.868	117.37
100-Year	2193.1	9.04	0.871	129.02

Peak Runoff Flow Rate

Area Name	Park OLF						
Area (ha)	3.36						
Runoff	0.66						
Event	Q_1	Q_2	Q_3	Q_4	Q_5	Q_6	Q_{Total}
1-Year							0.00
2-Year	363.42						363.42
5-Year	477.72						477.72
10-Year	554.33						554.33
25-Year	714.69						714.69
50-Year	867.70						867.70
100-Year	993.54						993.54

Ditch Flows

Manning's n:	0.035
Ditch Slope:	2.00%
L. Side Slope 1:	3
R. Side Slope 1:	3
Base Width (m):	4.5

Event	Q (m^3/s)	depth (m)	A_{Base} (m^2)	A_{Sides} (m^2)	P_{Base} (m)	P_{Sides} (m)	V (m/s)
1-Year	0.000	0.000	0.000	0.000	4.500	0.000	#DIV/0!
2-Year	0.363	0.095	0.426	0.027	4.500	0.598	0.803
5-Year	0.478	0.111	0.501	0.037	4.500	0.704	0.888
10-Year	0.554	0.121	0.547	0.044	4.500	0.768	0.938
25-Year	0.715	0.141	0.634	0.060	4.500	0.891	1.030
50-Year	0.868	0.158	0.711	0.075	4.500	0.999	1.104
100-Year	0.994	0.171	0.770	0.088	4.500	1.082	1.159
Manual	0.000	0.003	0.012	0.000	4.500	0.017	0.000

Calculate

TATHAM ENGINEERING

PROJECT	987 Yonge Street, Midland	FILE	324829
		DATE	11-Jun-2024
SUBJECT	Channel Flow - Infiltration Cell Discharge - Design Flow	NAME	JN
		PAGE	1 OF 1

Region/Municipality				
Midland				
T_C (in minutes)				
16.82				
Event	A	B	C	Intensity (mm/hr)
1-Year	0	0	0	0.00
2-Year	807.44	6.75	0.828	58.99
5-Year	1135.4	7.5	0.841	77.54
10-Year	1387	7.97	0.852	89.98
25-Year	1676.2	8.3	0.858	105.47
50-Year	1973.1	9	0.868	117.37
100-Year	2193.1	9.04	0.871	129.02

Peak Runoff Flow Rate							
Area Name	Inf Cell Out						
Area (ha)	3.45						
Runoff	0.52						
Event	Q_1	Q_2	Q_3	Q_4	Q_5	Q_6	Q_{Total}
1-Year							0.00
2-Year	294.00						294.00
5-Year	386.46						386.46
10-Year	448.44						448.44
25-Year	578.17						578.17
50-Year	701.95						701.95
100-Year	803.75						803.75

Ditch Flows

Manning's n:	0.035
Ditch Slope:	33.33%
L. Side Slope 1:	3
R. Side Slope 1:	3
Base Width (m):	25

Event	Q (m^3/s)	depth (m)	A_{Base} (m^2)	A_{Sides} (m^2)	P_{Base} (m)	P_{Sides} (m)	V (m/s)
1-Year	0.000	0.000	0.000	0.000	25.000	0.000	#DIV/0!
2-Year	0.294	0.013	0.323	0.001	25.000	0.082	0.907
5-Year	0.386	0.015	0.381	0.001	25.000	0.096	1.012
10-Year	0.448	0.017	0.417	0.001	25.000	0.105	1.074
25-Year	0.578	0.019	0.485	0.001	25.000	0.123	1.189
50-Year	0.702	0.022	0.545	0.001	25.000	0.138	1.284
100-Year	0.804	0.024	0.591	0.002	25.000	0.150	1.355
Manual	0.000	0.000	0.009	0.000	25.000	0.002	0.000

Calculate

TATHAM ENGINEERING

PROJECT	987 Yonge Street, Midland	FILE	324829
		DATE	11-Jun-2024
SUBJECT	Channel Flow - Infiltration Cell Discharge - Overflow	NAME	JN
		PAGE	1 OF 1

Region/Municipality				
Midland				
T_C (in minutes)				
16.82				
Event	A	B	C	Intensity (mm/hr)
1-Year	0	0	0	0.00
2-Year	807.44	6.75	0.828	58.99
5-Year	1135.4	7.5	0.841	77.54
10-Year	1387	7.97	0.852	89.98
25-Year	1676.2	8.3	0.858	105.47
50-Year	1973.1	9	0.868	117.37
100-Year	2193.1	9.04	0.871	129.02

Peak Runoff Flow Rate

Area Name	Inf Cell OLF						
Area (ha)	3.45						
Runoff	0.65						
Event	Q_1	Q_2	Q_3	Q_4	Q_5	Q_6	Q_{Total}
1-Year							0.00
2-Year	367.50						367.50
5-Year	483.08						483.08
10-Year	560.55						560.55
25-Year	722.71						722.71
50-Year	877.44						877.44
100-Year	1004.69						1004.69

Ditch Flows

Manning's n:	0.035
Ditch Slope:	33.33%
L. Side Slope 1:	3
R. Side Slope 1:	3
Base Width (m):	25

Event	Q (m^3/s)	depth (m)	A_{Base} (m^2)	A_{Sides} (m^2)	P_{Base} (m)	P_{Sides} (m)	V (m/s)
1-Year	0.000	0.000	0.000	0.000	25.000	0.000	#DIV/0!
2-Year	0.368	0.015	0.370	0.001	25.000	0.094	0.992
5-Year	0.483	0.017	0.436	0.001	25.000	0.110	1.107
10-Year	0.561	0.019	0.476	0.001	25.000	0.120	1.175
25-Year	0.723	0.022	0.555	0.001	25.000	0.140	1.300
50-Year	0.877	0.025	0.623	0.002	25.000	0.158	1.404
100-Year	1.005	0.027	0.676	0.002	25.000	0.171	1.482
Manual	0.000	0.000	0.009	0.000	25.000	0.002	0.000

Calculate

Appendix F:
Weir Flow Calculations

Weir Parameters

Overflow Weir Base Elevation (m):	209.25
Overflow Weir Width, B (m):	48.6
Weir Crest Length, L (m):	0.3
Overflow Weir Material:	Asphalt
ϵ (mm):	5.4
δ/L :	0.02783

$$C_d \approx 0.544 \times (1 - \frac{\delta/L}{H/L})^{3/2}$$

$$\delta/L \approx 0.001 + 0.2 \times (\epsilon/L)^{0.5}$$

$$Q_{Weir} = C_d B g^{0.5} H^{3/2}$$

Notes: - Value of B(m) determined based on equation: 2 x (H/0.5%) - per centerline road grade.
- Value of H in weir flow equation is divided by 2 to account for centerline road grade.

100 Year Storm Ponding Depth and Weir Elevation

1:100-Year Uncontrolled Flow (L/s):	993.54
Overflow Weir Base Elevation (m):	209.25
Structure T/G Elevation (m):	209.17
Required Weir Head (m):	0.122
C_d:	0.44
Qweir, (L/s):	993.54
Max Ponding Over T/G (m):	0.202
Weir Overflow Elevation (m):	209.37

Detailed Weir Flow Table

Elevation (m)	h_{weir} (m)	Weir C_d	Q_{Weir} (L/s)
209.25	0.00		0.00
209.26	0.01		0.00
209.27	0.02	0.04	0.91
209.28	0.03	0.16	11.09
209.29	0.04	0.24	34.28
209.30	0.05	0.30	73.22
209.31	0.06	0.33	130.28
209.32	0.07	0.36	207.57
209.33	0.08	0.38	307.02
209.34	0.09	0.40	430.39
209.35	0.10	0.41	579.34
209.36	0.11	0.42	755.40
209.37	0.12	0.43	960.05
209.38	0.13	0.44	1194.67
209.39	0.14	0.45	1460.60
209.40	0.15	0.46	1759.12

TATHAM ENGINEERING

PROJECT	983 Yonge Street, Midland	FILE	324829
		DATE	19-Jun-2024
SUBJECT	Russ Howard Drive Weir Flow over Curb	NAME	JN
		PAGE	1 OF 1

Weir Parameters

Overflow Weir Base Elevation (m):	209.21
Overflow Weir Width, B (m):	8.5
Weir Crest Length, L (m):	0.3
Overflow Weir Material:	Concrete, Finished
ϵ (mm):	1
δ/L :	0.01255

$$C_d \approx 0.544 \times (1 - \frac{\delta/L}{H/L})^{3/2}$$

$$\delta/L \approx 0.001 + 0.2 \times (\epsilon/L)^{0.5}$$

$$Q_{Weir} = C_d B g^{0.5} H^{3/2}$$

100 Year Storm Ponding Depth and Weir Elevation

1:100-Year Uncontrolled Flow (L/s):	993.54
Overflow Weir Base Elevation (m):	209.21
Structure T/G Elevation (m):	209.17
Required Weir Head (m):	0.171
C_d:	0.53
Qweir, (L/s):	993.54
Max Ponding Over T/G (m):	0.211
Weir Overflow Elevation (m):	209.38

Detailed Weir Flow Table

Elevation (m)	h_{weir} (m)	Weir C_d	Q_{Weir} (L/s)
209.21	0.00		0.00
209.22	0.01	0.27	7.13
209.23	0.02	0.40	29.96
209.24	0.03	0.44	61.54
209.25	0.04	0.47	99.90
209.26	0.05	0.48	143.98
209.27	0.06	0.49	193.14
209.28	0.07	0.50	246.88
209.29	0.08	0.51	304.85
209.30	0.09	0.51	366.76
209.31	0.10	0.51	432.37
209.32	0.11	0.52	501.48
209.33	0.12	0.52	573.93
209.34	0.13	0.52	649.56
209.35	0.14	0.52	728.26
209.36	0.15	0.52	809.90

TATHAM ENGINEERING

PROJECT	983 Yonge Street, Midland	FILE	324829
		DATE	19-Jun-2024
SUBJECT	Infiltration Cell - Weir Flow Outlet Storm Sewer Discharge	NAME	JN
		PAGE	1 OF 1

Weir Parameters

Overflow Weir Base Elevation (m):	206.46
Overflow Weir Width, B (m):	25.0
Weir Crest Length, L (m):	0.3
Overflow Weir Material:	Earth Channel, Gravelly
ϵ (mm):	80
δ/L :	0.10428

$$C_d \approx 0.544 \times (1 - \frac{\delta/L}{H/L})^{3/2}$$

$$\delta/L \approx 0.001 + 0.2 \times (\epsilon/L)^{0.5}$$

$$Q_{Weir} = C_d B g^{0.5} H^{3/2}$$

100 Year Storm Ponding Depth and Weir Elevation

1:100-Year Uncontrolled Flow (L/s):	803.70
Overflow Weir Base Elevation (m):	206.46
Structure T/G Elevation (m):	206.26
Required Weir Head (m):	0.102
C_d:	0.31
Qweir, (L/s):	803.70
Max Ponding Over T/G (m):	0.302
Weir Overflow Elevation (m):	206.56

Detailed Weir Flow Table

Elevation (m)	h_{weir} (m)	Weir C_d	Q_{Weir} (L/s)
206.46	0.00		0.00
206.47	0.01		0.00
206.48	0.02		0.00
206.49	0.03		0.00
206.50	0.04	0.06	34.66
206.51	0.05	0.12	109.07
206.52	0.06	0.18	207.28
206.53	0.07	0.22	324.50
206.54	0.08	0.26	458.02
206.55	0.09	0.29	606.05
206.56	0.10	0.31	767.29
206.57	0.11	0.33	940.74
206.58	0.12	0.35	1125.58
206.59	0.13	0.36	1321.16
206.60	0.14	0.37	1526.91
206.61	0.15	0.38	1742.36

TATHAM ENGINEERING

PROJECT	983 Yonge Street, Midland	FILE	324829
		DATE	19-Jun-2024
SUBJECT	Infiltration Cell - Weir Flow Outlet Overland Flow Discharge	NAME	JN
		PAGE	1 OF 1

Weir Parameters

Overflow Weir Base Elevation (m):	206.46
Overflow Weir Width, B (m):	25.0
Weir Crest Length, L (m):	0.3
Overflow Weir Material:	Earth Channel, Gravelly
ϵ (mm):	80
δ/L :	0.10428

$$C_d \approx 0.544 \times (1 - \frac{\delta/_L}{H/_L})^{3/2}$$

$$\delta/_L \approx 0.001 + 0.2 \times (\epsilon/_L)^{0.5}$$

$$Q_{Weir} = C_d B g^{0.5} H^{3/2}$$

100 Year Storm Ponding Depth and Weir Elevation

1:100-Year Uncontrolled Flow (L/s):	1004.60
Overflow Weir Base Elevation (m):	206.46
Structure T/G Elevation (m):	206.26
Required Weir Head (m):	0.114
C_d:	0.34
Qweir, (L/s):	1004.60
Max Ponding Over T/G (m):	0.314
Weir Overflow Elevation (m):	206.57

Detailed Weir Flow Table

Elevation (m)	h_{weir} (m)	Weir C_d	Q_{Weir} (L/s)
206.46	0.00		0.00
206.47	0.01		0.00
206.48	0.02		0.00
206.49	0.03		0.00
206.50	0.04	0.06	34.66
206.51	0.05	0.12	109.07
206.52	0.06	0.18	207.28
206.53	0.07	0.22	324.50
206.54	0.08	0.26	458.02
206.55	0.09	0.29	606.05
206.56	0.10	0.31	767.29
206.57	0.11	0.33	940.74
206.58	0.12	0.35	1125.58
206.59	0.13	0.36	1321.16
206.60	0.14	0.37	1526.91
206.61	0.15	0.38	1742.36

Appendix G:
Water Quality Calculations

TATHAM ENGINEERING

PROJECT	983 Yonge Street, Midland	FILE	324809
		DATE	12-Jun-2024
SUBJECT	25 mm Runoff	NAME	JN
		PAGE	1 OF 1

25 mm Storm Intensity (MECP Equation 4.9)

i_{25mm} = 43C + 5.9 Where: i_{25mm} = rainfall intensity (mm/h)

C = 0.52 C = runoff coefficient

i_{25mm} = 43 x 0.52 + 5.9

i_{25mm} = 28.26 mm/h

Rational Method - Peak 25 mm Runoff

Q_{25mm} = CiA/360 Where: Q_{25mm} = peak flow rate (m^3/s)

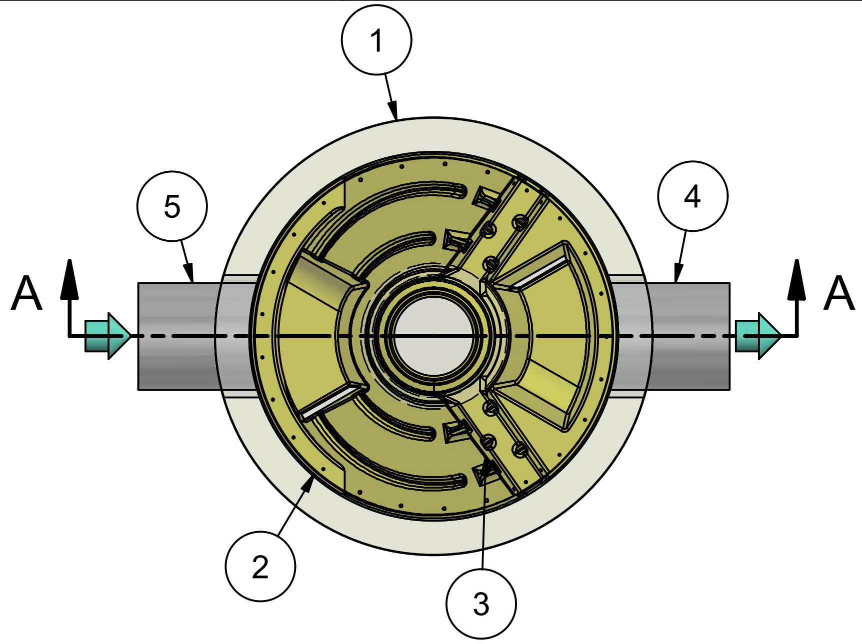
A = 3.36 ha i = rainfall intensity (mm/h)

$Q_{25mm} = \frac{0.52 \times 28.26 \times 3.36}{360}$ C = runoff coefficient

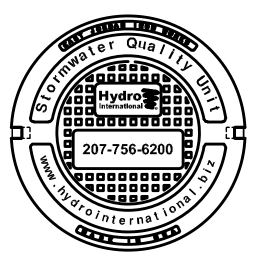
A = drainage area (ha)

Q_{25mm} = 0.1372 m^3/s

137.2 L/s

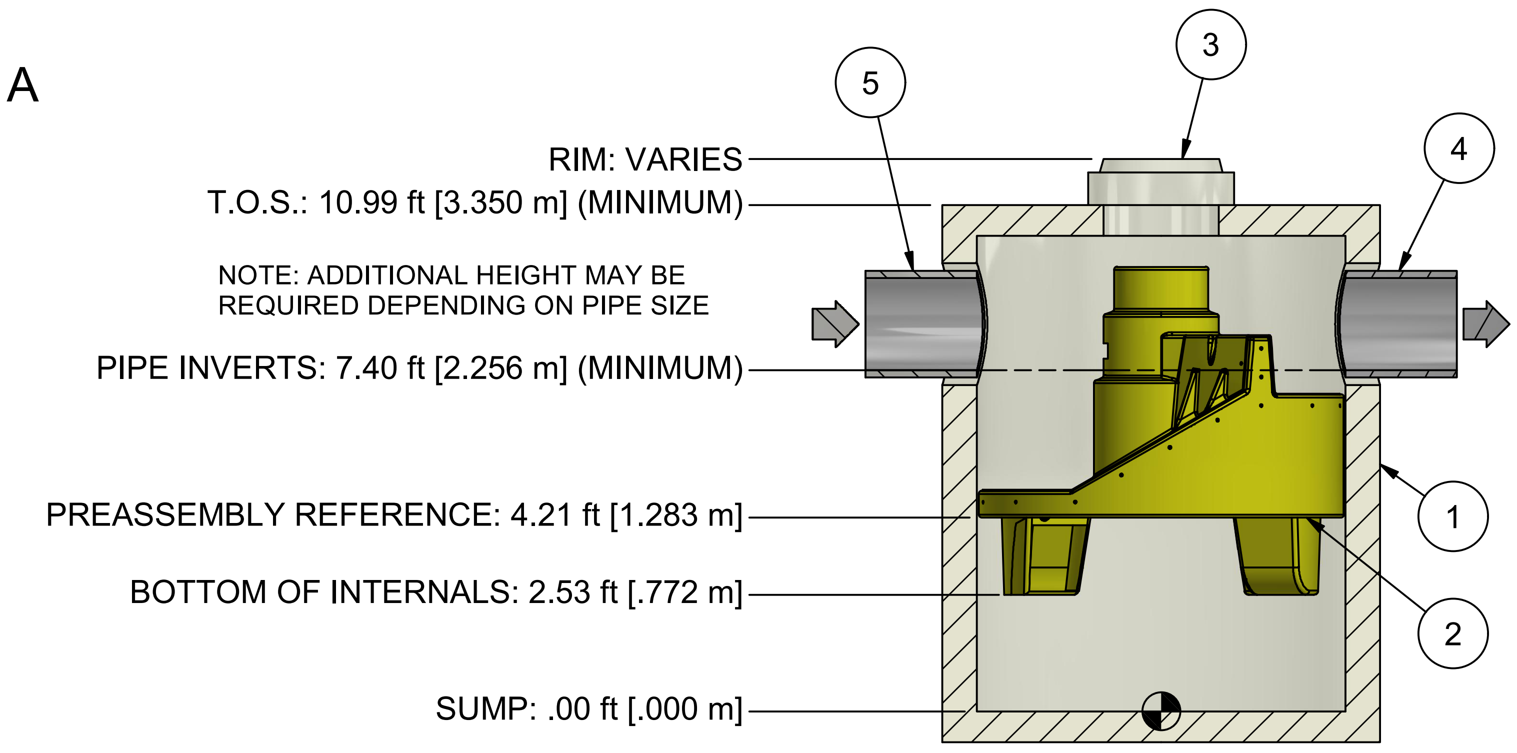


PLAN VIEW



HYDRO FRAME AND COVER (INCLUDED)

GRADE RINGS BY OTHERS AS REQUIRED



SECTION A-A

1. MANHOLE WALL AND SLAB THICKNESSES ARE NOT TO SCALE.

2. CONTACT HYDRO INTERNATIONAL FOR A BOTTOM OF STRUCTURE ELEVATION PRIOR TO SETTING FIRST DEFENSE MANHOLE.

3. CONTRACTOR TO CONFIRM RIM, PIPE INVERTS, PIPE DIA. AND PIPE ORIENTATION PRIOR TO RELEASE OF UNIT TO FABRICATION.

PRODUCT SPECIFICATION:

1. Peak Hydraulic Flow: 50.0 cfs (1415 l/s)
2. Min Sediment Storage Capacity: 2.8 cu. yd. (2.1 cu. m.)
3. Maximum Inlet/Outlet Pipe Diameters: 48 in. (1200 mm)
4. The treatment system shall use an induced vortex to separate pollutants from stormwater runoff.
5. For more product information including regulatory acceptances, please visit https://hydro-int.com/en/products/first-defense

GENERAL NOTES:
1. General Arrangement drawings only. Contact Hydro International for site specific drawings.
2. The diameter of the inlet and outlet pipes may be no more than 48".
3. Multiple inlet pipes possible (refer to project plan).
4. Inlet/outlet pipe angle can vary to align with drainage network (refer to project plans).
5. Peak flow rate and minimum height limited by available cover and pipe diameter.
6. Larger sediment storage capacity may be provided with a deeper sump depth.

PARTS LIST

ITEM	QTY	SIZE (in)	SIZE (mm)	DESCRIPTION
1	1	96	2400	I.D. PRECAST MANHOLE
2	1			INTERNAL COMPONENTS (PRE-INSTALLED)
3	1	30	750	FRAME AND COVER (ROUND)
4	1	48 (MAX)	1200 (MAX)	OUTLET PIPE (BY OTHERS)
5	1	48 (MAX)	1200 (MAX)	INLET PIPE (BY OTHERS)

PROJECTION

IF IN DOUBT ASK

DATE: 11/2/2021 | SCALE: 1:50

DRAWN BY: ER | CHECKED BY: MRJ | APPROVED BY

Title
8-ft DIAMETER
FIRST DEFENSE

GENERAL ARRANGEMENT

Hydro International®
hydro-int.com
HYDRO INTERNATIONAL

WEIGHT: | MATERIAL:

STOCK NUMBER:

DRAWING NO.: FD GA-8

SHEET SIZE: B | SHEET: 1 OF 1 | Rev: -

Verification Statement

Hydro International First Defense® HC Oil Grit Separator
Registration number: (V-2018-10-01)
Date of issue: 2018-October-15 (rev 2019-02-01)

Technology type	Oil Grit Separator
Application	Technology to remove oil, sediment, trash and debris from stormwater and snowmelt runoff as well as other pollutants that attach to sediment particles, such as nutrients and metals
Company	Hydro International
Address	94 Hutchins Drive, Portland, Maine USA 04102 **Phone** +1-207-756 6200
Website	https://www.hydro-int.com
E-mail	dscott@hydro-int.com

Verified Performance Claims

The Hydro International First Defense® High Capacity (HC) Oil Grit Separator (OGS) was tested by Good Harbour Laboratories Inc. (GHL), Mississauga, Ontario, Canada in 2018. The performance test results were verified by Toronto and Region Conservation Authority (TRCA), Vaughan, Ontario, Canada following the requirements of ISO 14034:2016 and the VerifiGlobal Performance Verification Protocol. The following performance claims were verified:

Capture test[1]:
With a false floor set to 50% of the manufacturer's recommended maximum sediment storage depth and an influent test sediment concentration of 200 mg/L, the First Defense® HC OGS device removes 67, 60, 55, 50, 45, 45, and 41 percent of influent sediment by mass at surface loading rates of 40, 80, 200, 400, 600, 1000, and 1400 L/min/m^2, respectively.

Scour test[1]:
With 10.2 cm (4 inches) of test sediment pre-loaded onto a false floor reaching 50% of the manufacturer's recommended maximum sediment storage depth, the First Defense® HC OGS device generates adjusted effluent[2] concentrations of 0, 0, 11, 2, and 0 mg/L at 5-minute duration surface loading rates of 200, 800, 1400, 2000, and 2600 L/min/m^2, respectively.

[1] The claims can be applied to other units smaller or larger than the tested unit as long as the untested units meet the scaling rule specified in the Procedure for Laboratory of Testing of Oil Grit Separators (Version 3.0, June 2014)

[2] The effluent suspended sediment concentration is adjusted based on the background concentration and the smallest 5% of particles captured during the 40 L/min/m^2 sediment capture test (see Table 2)

Technology Application

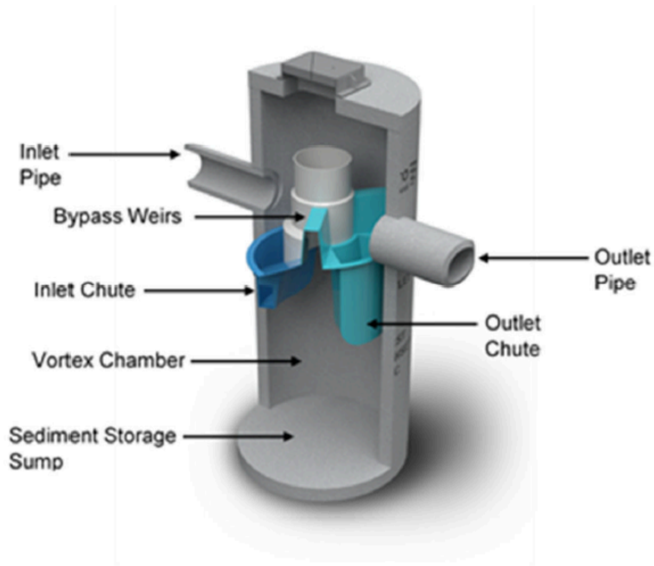
The First Defense® HC (FDHC) Oil Grit Separator can be used as a stand-alone stormwater treatment technology, depending on water quality objectives, or as a pretreatment component in a treatment train when higher TSS removals are required and polishing or volume reduction best management practices (BMPs), such as infiltration or bio-infiltration, are installed downstream. FDHC applications include: stormwater treatment at the point of entry into the drainage line; sites constrained by space, topography or drainage profiles with limited slope and depth of cover; retrofit installations where stormwater treatment is placed on or tied into an existing storm drain line; pre-treatment for filters, infiltration, other sedimentation BMPs and storage.

Technology Description

The Hydro International First Defense® HC (FDHC) is an Oil Grit Separator designed to remove oil, sediment, trash and debris from stormwater and snowmelt runoff as well as other pollutants that attach to sediment particles, such as nutrients and metals. The patented flow modifying internal components are designed to be inserted into standard precast concrete manholes where they collect and treat runoff as part of the drainage system (Figure 1).

Flow entering the manhole via an inlet pipe or inlet grate is diverted into a vortex chamber beneath a separation module that includes both inlet/outlet chutes and bypass weirs. The internal bypass weirs divert flows greater than the maximum design treatment flow rate over the separation module and away from the vortex chamber where oil, sediment, debris and attached pollutants are accumulating. This function prevents high velocities from re-suspending previously captured pollutants during large storm events. The FDHC can be designed and sized to function effectively in either online or offline configurations.

Figure 1: Hydro International First Defense® HC Oil Grit Separator



The test unit was 1.2 m (4 foot) in diameter with a 1.51 m (59 5/8 inches) sump depth measured from the outlet invert to the floor of the unit. The effective treatment area (also known as the effective sedimentation area) is 1.2 m^2 (12.6 ft^2). The maximum sediment storage depth is 0.457 m (18 inches).

Description of Test Procedure

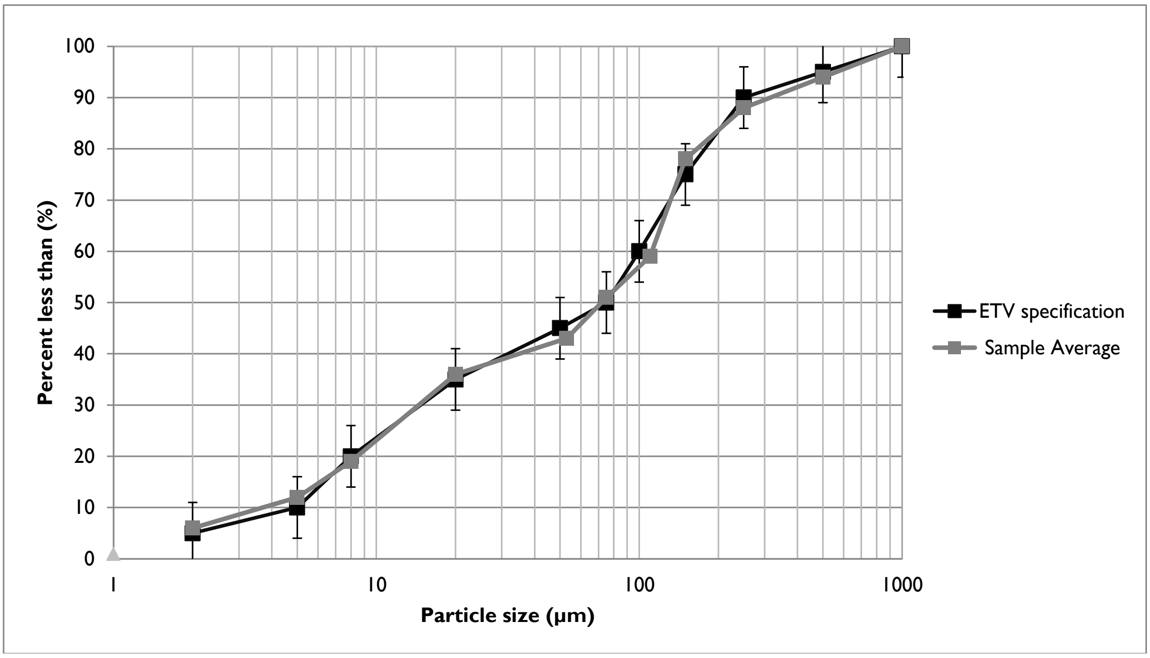
The test data and results for this verification were obtained from independent testing conducted on a 1.2 m (48 inch) diameter Hydro International First Defense® HC OGS device, in accordance with the *Procedure for Laboratory Testing of Oil-Grit Separators (Version 3.0, June 2014)*. The laboratory test procedure was originally prepared by the Toronto and Region Conservation Authority (TRCA) in association with a 31 member advisory committee from various stakeholder groups.

Verification Results

Toronto and Region Conservation Authority verified the performance test data and other information pertaining to the First Defense® HC Oil Grit Separator. A Verification Plan was prepared to guide the verification process based on the requirements of ISO 14034:2016 and the VerifiGlobal Performance Verification Protocol.

The test sediment consisted of ground silica (1 – 1000 micron) with a specific gravity of 2.65, uniformly mixed to meet the particle size distribution specified in the testing procedure. The *Procedure for Laboratory Testing of Oil Grit Separators* requires that the three sample average of the test sediment particle size distribution (PSD) meet the specified PSD percent less than values within a boundary threshold of 6%, and a median particle size no greater than 75 µm. Comparison of the individual sample and average test sediment PSD to the specified PSD shown in Figure 2 indicates that the test sediment used for the capture and scour tests met this condition. The median particle size was 73 µm. Samples from test sediment batches used for each run met the specified PSD within the required tolerance thresholds.

Figure 2 - The three sample average particle size distribution (PSD) of the test sediment used for the capture and scour test compared to the specified PSD



The capacity of the device to retain sediment was determined at seven surface loading rates using the modified mass balance method. This method involved measuring the mass and particle size distribution of the injected and retained sediment for each test run. Performance was evaluated with a false floor simulating the technology filled to 50% of the manufacturer's recommended maximum sediment storage depth. The test was carried out with clean water that maintained a sediment concentration below 20 mg/L. Based on these conditions, removal efficiencies for individual particle size classes and for the test sediment as a whole were determined for each of the tested surface loading rates (Table 1).

In some instances, the removal efficiencies were above 100% for certain particle size fractions. These discrepancies are not unique to any one test laboratory and are attributed to errors relating to the blending of sediment, collection of representative samples for laboratory submission, and laboratory analysis of PSD. Due to these errors, caution should be exercised in applying the removal efficiencies by particle size fraction for the purposes of sizing the tested device (see Bulletin # CETV 2016-11-0001). The results for “all particle sizes by mass balance” (see Table 1) are based on measurements of the total injected and retained sediment mass, and are therefore not subject to blending, sampling or PSD analysis errors.

Table 1 - Removal efficiencies (%) of the First Defence HC at specified surface loading rates

Particle size fraction (µm)	Surface loading rate (L/min/m^2)						
	40	80	200	400	600	1000	1400
>500	100*	100*	100*	81	72	86	80
250 - 500	100*	97	99	100*	100*	59	88
150 - 250	100*	91	95	93	47	100*	84
105 - 150	96	89	94	89	90	70	75
75 - 105	100*	90	95	77	-20**	100	51
53 - 75	74	100*	97	62	100*	46	37
20 - 53	60	33	10	5	4	0	0
8 - 20	29	16	8	3	3	1	1
5 – 8	8	5	8	4	4	4	3
<5	5	3	0	0	0	3	3
All particle sizes By mass balance	**66.5**	**59.9**	**55.4**	**50.2**	**44.9**	**45.2**	**40.5**

* Removal efficiencies were calculated to be above 100%. Calculated values ranged between 101 and 184% (average 115%). See text and Bulletin # CETV 2016-11-0001 for more information.
** An outlier in the retained sediment sample sieve data resulted in negative removal for this size fraction. The outlier at the 75 um particle size is shown in Figure 3.

Figure 3 - Particle size distribution of sediment retained in the First Defense HC in relation to the injected test sediment average

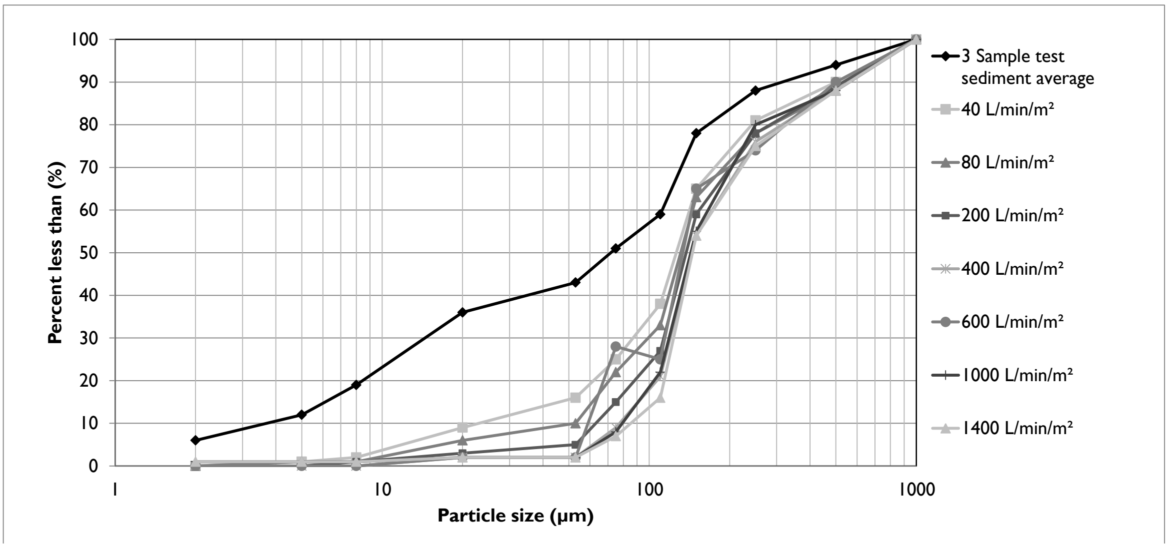


Figure 3 compares the particle size distribution (PSD) of the three sample average of the test sediment to the PSD of the sediment retained by the FDHC device at each of the tested surface loading rates. As expected, the capture efficiency for fine particles was generally found to decrease as surface loading rates increased, particularly in the 40 to 400 L/min/m^2 range.

Table 2 shows the results of the sediment scour and re-suspension test for the First Defense® HC unit. The scour test involved preloading 10.2 cm (4 inches) of fresh test sediment into the sedimentation sump of the device. The sediment was placed on a false floor to mimic a device filled to 50% of the maximum recommended sediment storage depth. Clean water was run through the device at five surface loading rates over a 30 minute period. Each flow rate was maintained for 5 minutes with a one minute transition time between flow rates. Effluent samples were collected at one minute sampling intervals and analyzed for Suspended Sediment Concentration (SSC) and PSD by recognized methods. The effluent samples were subsequently adjusted based on the background concentration of the influent water. The smallest 5% of particles captured during the 40 L/min/m^2 sediment capture test (13.5 μm in this case) was used to further adjust the effluent sediment concentrations, as per the method described in Bulletin # CETV 2016-09-0001. Results showed average adjusted effluent sediment concentrations below 11 mg/L at all surface loading rates. Effluent concentrations would be expected to decrease at higher flow rates since bypass over the insert bypass weirs was observed to begin at 1,032 L/min/m^2.

Table 2 - Scour test adjusted effluent sediment concentration at each surface loading rate

Run	Surface loading rate (L/min/m^2)	Run time (min)	Background sample concentration (mg/L)	Average adjusted effluent suspended sediment concentration (mg/L)*
1	200	1:00 – 6:00	0.8	0
2	800	7:00 – 12:00	1.0	0
3	1400	13:00 – 18:00	1.1	10.6
4	2000	19:00 – 24:00	2.8	2.4
5	2600	25:00 – 30:00	6.6	0

*The effluent suspended sediment concentration is adjusted based on the background concentration and the smallest 5% of particles captured during the 40 L/min/m^2 sediment capture test, as per the method described in Bulletin # CETV 2016-09-0001.

Variances from the Procedure

Minor variances from the *Procedure for Laboratory Testing of Oil-Grit Separators* used as the basis of testing for this verification were as follows:

1. The *Procedure* states that the tested device "must be a full scale commercially available device with the same configuration and components as would be typical for an actual installation." The unit tested for this verification had the same internal components as would be typical for a commercial installation, but the internal components were placed inside a structure constructed of composite materials, rather than a manhole made of concrete, the latter of which is typical for most installations. The dimensions of the structure were the same as would have been the case had the manhole been concrete. The use of alternate materials for the structure was not believed to significantly affect system performance.

2. As part of the capture test, evaluation of the 40 and 80 L/min/m^2 surface loading rate was split into 3 and 2 parts, respectively. The test was conducted in parts because of the long duration (i.e. over 10 hours) needed to feed the required minimum 11.3 kg of test sediment into the unit. At the end of the first and second parts of the test, the flow rates were gradually decreased to prevent capture of particles that would have been washed out under normal circumstances. The requirement to split the test into parts was not anticipated in the *Procedure for Laboratory Testing of Oil-Grit Separators*, but has been a common feature of testing at the 40 L/min/m^2 surface loading rate. Conducting the test in two parts for the 80 L/ min/m^2 surface loading rate is less common. The testing did not assess the significance of the breaks, however, the test laboratory and verifier do not believe that the breaks significantly affected the test results.

3. During the sediment scour test, the flow rate coefficient of variation (COV) at the 200 L/min/m^2 surface loading rate of 0.045 slightly exceeded the target COV of 0.04. The average flow rate during the test remained within ±10% of the target flow rate.

Quality assurance

Performance testing and verification of the First Defense® HC Oil Grit Separator were performed in accordance with the requirements of ISO 14034:2016 and the VerifiGlobal Performance Verification Protocol. The verifier, Toronto and Region Conservation Authority, has confirmed that quality assurance requirements were addressed throughout the performance testing process and in the generation of performance test results. This includes reviewing all data sheets and data downloads, as well as overall management of the test system, quality control and data integrity.

Verification Summary

In summary, the First Defense® HC Oil Grit Separator is designed to remove oil, sediment, trash and debris from stormwater and snowmelt runoff as well as other pollutants that attach to sediment particles, such as nutrients and metals. Verification of performance claims for the Hydro International First Defense® HC Oil Grit Separator was conducted by Toronto and Region Conservation Authority based on independent third-party performance test results provided by Good Harbour Laboratories, as well as additional information provided by Hydro International. Table 3 summarizes the verification results in relation to the technology performance parameters that were identified to determine the efficacy of the First Defense® HC Oil Grit Separator.

Table 3 - Summary of Verification Results Against Performance Parameters

Performance Parameter	Verified Performance
Sediment Removal Rate	The sediment removal rate of the FDHC is dependent upon flow rate, particle density and particle size. Removal efficiency decreased with increasing surface loading rate from 67% at 40 L/min/m^2 to 41% at 1400 L/min/m^2. The weighted average removal efficiency achieved by the unit will vary depending on the rainfall distribution of the jurisdiction in which it is installed, and site characteristics.
Sediment Scour	When pre-loaded with sediment with a particle size distribution matching that of the feed sediment used in the sediment capture test, the FDHC generated effluent suspended solids concentrations of less than 11 mg/L at surface loading rates ranging from 200 to 2600 L/min/m^2.
Bypass flow rate	The flow rate at which bypass occurs will vary based on model size. For the 1.2 m (4 foot) diameter test unit, the flow rate at which bypass occurred over the insert bypass weirs was 1238 L/min (327 gpm).
Head loss	The loss of hydraulic head across the FDHC was determined by measuring the water elevation difference between the inlet and outlet sides of the insert. Head loss may vary based on model size. For the tested unit the head loss ranged from 2 mm (0.08 inches) at 93.5 L/min (12.3 gpm) to 100 mm (3.94 inches) at 1238 L/min (327 gpm) when bypass was observed to occur. At 327 gpm, when bypass occurred, the depth of the water was 177 mm upstream and 77 mm downstream for a difference of 100 mm (3.94 inches). The highest water elevation difference was 111mm (4.37 inches) at a flow rate of 1635 L/min (431.8 gpm), after which head loss declined up to the maximum measured flow rate of 3036 L/min (801.9 gpm).

What is ISO 14034?

The purpose of environmental technology verification is to provide a credible and impartial account of the performance of environmental technologies. Environmental technology verification is based on a number of principles to ensure that verifications are performed and reported accurately, clearly, unambiguously and objectively. The International Organization for Standardization (ISO) standard for environmental technology verification (ETV) is ISO 14034, which was published in November 2016.

Benefits of ETV

ETV contributes to protection and conservation of the environment by promoting and facilitating market uptake of innovative environmental technologies, especially those that perform better than relevant alternatives. ETV is particularly applicable to those environmental technologies whose innovative features or performance cannot be fully assessed using existing standards. Through the provision of objective evidence, ETV provides an independent and impartial confirmation of the performance of an environmental technology based on reliable test data. ETV aims to strengthen the credibility of new, innovative technologies by supporting informed decision-making among interested parties.

For more information on the First Defense® HC Oil Grit Separator, contact:	For more information on VerifiGlobal, contact:
Hydro International 94 Hutchins Drive, Portland, Maine USA 04102 t +1-207-756 6200 e: dscott@hydro-int.com w: www.hydro-int.com	VerifiGlobal c/o ETA-Danmark A/S Göteborg Plads 1, DK-2150 Nordhaven t +45 7224 5900 e: info@verifiglobal.com w: www.verifiglobal.com
Signed for Hydro International: *Original signed by:* *David Scott* David Scott Technical Product Manager, Americas Stormwater	Signed for VerifiGlobal: *Original signed by:* *Thomas Bruun* Thomas Bruun, Managing Director *Original signed by:* *John Neate* John Neate, Managing Director

NOTICE: Verifications are based on an evaluation of technology performance under specific, predetermined operational conditions and parameters and the appropriate quality assurance procedures. VerifiGlobal and the Verification Expert, Toronto and Region Conservation Authority, make no expressed or implied warranties as to the performance of the technology and do not certify that a technology will always operate as verified. The end user is solely responsible for complying with any and all applicable regulatory requirements. Mention of commercial product names does not imply endorsement.

VerifiGlobal and the Verification Expert, Toronto and Region Conservation Authority, provide the verification services solely on the basis of the information supplied by the applicant or vendor and assume no liability thereafter. The responsibility for the information supplied remains solely with the applicant or vendor and the liability for the purchase, installation, and operation (whether consequential or otherwise) is not transferred to any other party as a result of the verification.

State of New Jersey
DEPARTMENT OF ENVIRONMENTAL PROTECTION

PHILIP D. MURPHY
Governor

SHEILA Y. OLIVER
Lt. Governor

DIVISION OF WATERSHED PROTECTION AND RESTORATION
BUREAU OF NJPDES STORMWATER PERMITTING & WATER QUALITY MANAGEMENT
P.O. Box 420 Mail Code 401-02B
Trenton, New Jersey 08625-0420
609-633-7021 / Fax: 609-777-0432
www.njstormwater.org

SHAWN M. LATOURETTE
Commissioner

July 19, 2021

Mr. Jeremy Fink
Pr. Product Development Engineer
Hydro International
94 Hutchins Drive
Portland, ME 04102

Re: MTD Lab Certification
First Defense® Optimum Vortex Separator by Hydro International
Online Installation

TSS Removal Rate 50%

Dear Mr. Fink:

The Stormwater Management rules under N.J.A.C. 7:8-5.2(f) and 5.2(j) allow the use of manufactured treatment devices (MTDs) for compliance with the design and performance standards at N.J.A.C. 7:8-5 if the pollutant removal rates have been verified by the New Jersey Corporation for Advanced Technology (NJCAT) and have been certified by the New Jersey Department of Environmental Protection (NJDEP). Bio Clean Environmental, Inc. has requested an MTD Laboratory Certification for the First Defense® Optimum Vortex Separator (FD Optimum).

The project falls under the "Procedure for Obtaining Verification of a Stormwater Manufactured Treatment Device from New Jersey Corporation for Advance Technology" dated January 25, 2013. The applicable protocol is the "New Jersey Laboratory Testing Protocol to Assess Total Suspended Solids Removal by a Hydrodynamic Sedimentation Manufactured Treatment Device" dated January 25, 2013.

NJCAT verification documents submitted to the NJDEP indicate that the requirements of the protocol have been met or exceeded. The NJCAT letter also included a recommended certification TSS removal rate and the required maintenance plan. The NJCAT Verification Report dated June 2021 with the Verification Appendix for this device is published online at http://www.njcat.org/verification-process/technology-verification-database.html.

The NJDEP certifies the use of the First Defense® Optimum Vortex Separator by Hydro International at a TSS removal rate of 50% when designed, operated and maintained in accordance with the information provided in the Verification Appendix and the following conditions:

1. The maximum treatment flow rate (MTFR) for the manufactured treatment device (MTD) is calculated using the New Jersey Water Quality Design Storm (1.25 inches in 2 hrs) in N.J.A.C. 7:8-5.5.

2. The FD Optimum shall be installed using the same configuration reviewed by NJCAT and shall be sized in accordance with the criteria specified in in item 6 below.

3. This FD Optimum cannot be used in series with another MTD or a media filter (such as a sand filter), to achieve an enhanced removal rate for total suspended solids (TSS) removal under N.J.A.C. 7:8-5.5.

4. Additional design criteria for MTDs can be found in Chapter 11.3 of the New Jersey Stormwater Best Management Practices (NJ Stormwater BMP) Manual which can be found online at www.njstormwater.org.

5. The maintenance plan for a site using this device shall incorporate, at a minimum, the maintenance requirements for the FD Optimum, which is attached to this document. However, it is recommended to review the maintenance manual at https://www.hydro-int.com/en/resources/first-defense-operations-maintenance-manual for any changes to the maintenance requirements.

6. Sizing Requirements:

   The example below demonstrates the sizing procedure for the FD Optimum:

   Example: A 0.25-acre impervious site is to be treated to 50% TSS removal using a FD Optimum. The impervious site runoff (Q) based on the New Jersey Water Quality Design Storm was determined to be 0.79 cfs.

   Maximum Treatment Flow Rate (MTFR) Evaluation:

   The site runoff (Q) was based on the following:
   time of concentration = 10 minutes
   i=3.2 in/hr (page 21, Fig. 5-10 of Chapter 5 of the NJ Stormwater BMP Manual)
   c=0.99 (curve number for impervious)
   Q=ciA=0.99x3.2x0.25=0.79 cfs

   Given the site runoff is 0.79 cfs and based on Table 1 below, the FD Optimum 3-ft model with a MTFR of 1.02 cfs would be the smallest model approved that could be used for this site that could remove 50% of the TSS from the impervious area without exceeding the MTFR.

   The sizing table corresponding to the available system models is noted below. Additional specifications regarding each model can be found in the Verification Appendix under Table A-1 and Table A-2.

Table 1. FD Optimum Model and MTFRs

FD Optimum Model	Manhole Diameter (ft)	MTFR (cfs)
3-ft	3	1.02
4-ft	4	1.81
5-ft	5	2.83
6-ft	6	4.07
7-ft	7	5.53
8-ft	8	7.23
10-ft	10	11.33

Be advised a detailed maintenance plan is mandatory for any project with a Stormwater BMP subject to the Stormwater Management Rules, N.J.A.C. 7:8. The plan must include all the items identified in the Stormwater Management Rules, N.J.A.C. 7:8-5.8. Such items include, but are not limited to, the list of inspection and maintenance equipment and tools, specific corrective and preventative maintenance tasks, indication of problems in the system, and training of maintenance personnel. Additional information can be found in Chapter 8: Maintenance and Retrofit of Stormwater Management Measures.

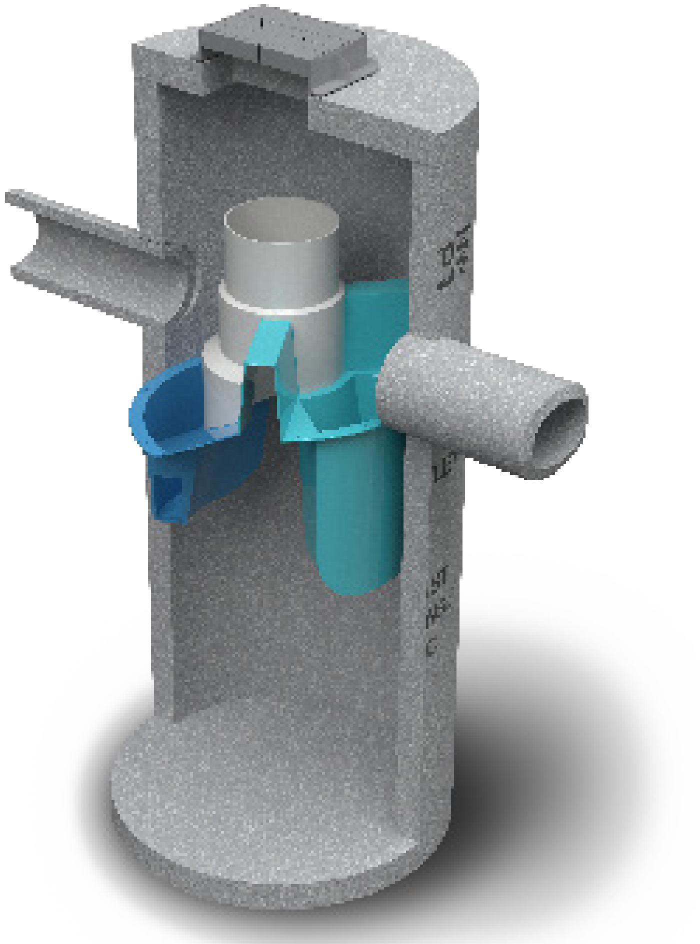
If you have any questions regarding the above information, please contact Lisa Schaefer of my office at lisa.schaefer@dep.nj.gov.

Sincerely,

Gabriel Mahon, Chief
Bureau of NJPDES Stormwater Permitting & Water Quality Management
Division of Watershed Protection and Restoration
New Jersey Department of Environmental Protection

Attachment: Maintenance Plan

cc: Richard Magee, NJCAT



Operation and Maintenance Manual

First Defense® High Capacity and First Defense® Optimum

Vortex Separator for Stormwater Treatment

Table of Contents

Hydro International (Stormwater), 94 Hutchins Drive, Portland ME 04102
Tel: (207) 756-6200 Fax: (207) 756-6212 Web: www.hydro-int.com

I. First Defense® by Hydro International

Introduction

The First Defense® is an enhanced vortex separator that combines an effective and economical stormwater treatment chamber with an integral peak flow bypass. It efficiently removes total suspended solids (TSS), trash and hydrocarbons from stormwater runoff without washing out previously captured pollutants. The First Defense® is available in several model configurations to accommodate a wide range of pipe sizes, peak flows and depth constraints.

The two product models described in this guide are the First Defense® High Capacity and the First Defense® Optimum; they are inspected and maintained identically.

Operation

The First Defense® operates on simple fluid hydraulics. It is self-activating, has no moving parts, no external power requirement and is fabricated with durable non-corrosive components. No manual procedures are required to operate the unit and maintenance is limited to monitoring accumulations of stored pollutants and periodic clean-outs. The First Defense® has been designed to allow for easy and safe access for inspection, monitoring and clean-out procedures. Neither entry into the unit nor removal of the internal components is necessary for maintenance, thus safety concerns related to confined-space-entry are avoided.

Pollutant Capture and Retention

The internal components of the First Defense® have been designed to optimize pollutant capture. Sediment is captured and retained in the base of the unit, while oil and floatables are stored on the water surface in the inner volume (Fig.1).

The pollutant storage volumes are isolated from the built-in bypass chamber to prevent washout during high-flow storm events. The sump of the First Defense® retains a standing water level between storm events. This ensures a quiescent flow regime at the onset of a storm, preventing resuspension and washout of pollutants captured during previous events.

Accessories such as oil absorbent pads are available for enhanced oil removal and storage. Due to the separation of the oil and floatable storage volume from the outlet, the potential for washout of stored pollutants between clean-outs is minimized.

Applications

- Stormwater treatment at the point of entry into the drainage line
- Sites constrained by space, topography or drainage profiles with limited slope and depth of cover
- Retrofit installations where stormwater treatment is placed on or tied into an existing storm drain line
- Pretreatment for filters, infiltration and storage

Advantages

- Inlet options include surface grate or multiple inlet pipes
- Integral high capacity bypass conveys large peak flows without the need for "offline" arrangements using separate junction manholes
- Long flow path through the device ensures a long residence time within the treatment chamber, enhancing pollutant settling
- Delivered to site pre-assembled and ready for installation

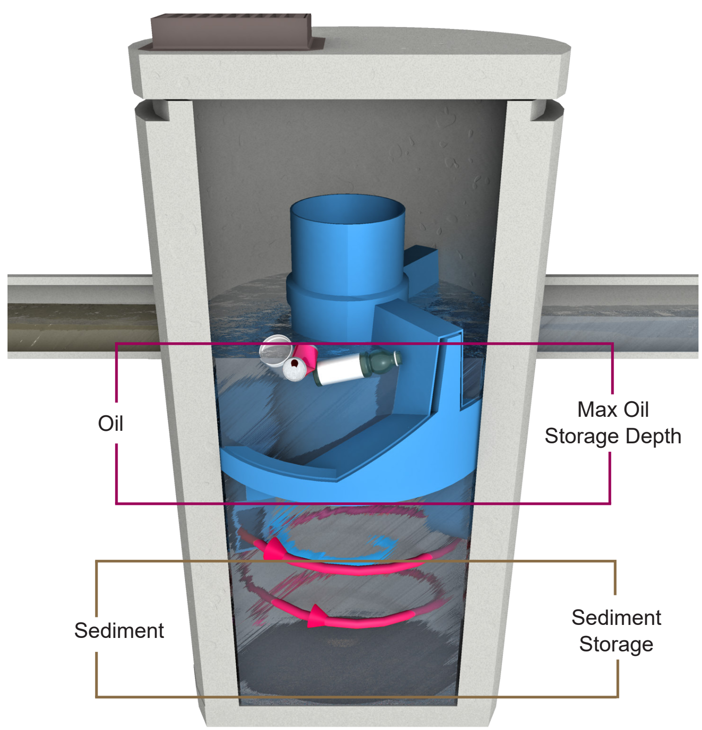


Fig.1 Pollutant storage volumes in the First Defense®.

II. Model Sizes & Configurations

The First Defense® inlet and internal bypass arrangements are available in several model sizes and configurations. The components have modified geometries allowing greater design flexibility to accommodate various site constraints.

All First Defense® models include the internal components that are designed to remove and retain total suspended solids (TSS), gross solids, floatable trash and hydrocarbons (Fig.2). First Defense® model sizes (diameter) are shown in Table 1.

III. Maintenance

First Defense® Components

1. **Built-In Bypass**
2. **Inlet Pipe**
3. **Inlet Chute**
4. **Floatables Draw-off Port**
5. **Outlet Pipe**
6. **Floatables Storage**
7. **Sediment Storage**
8. **Inlet Grate or Cover**

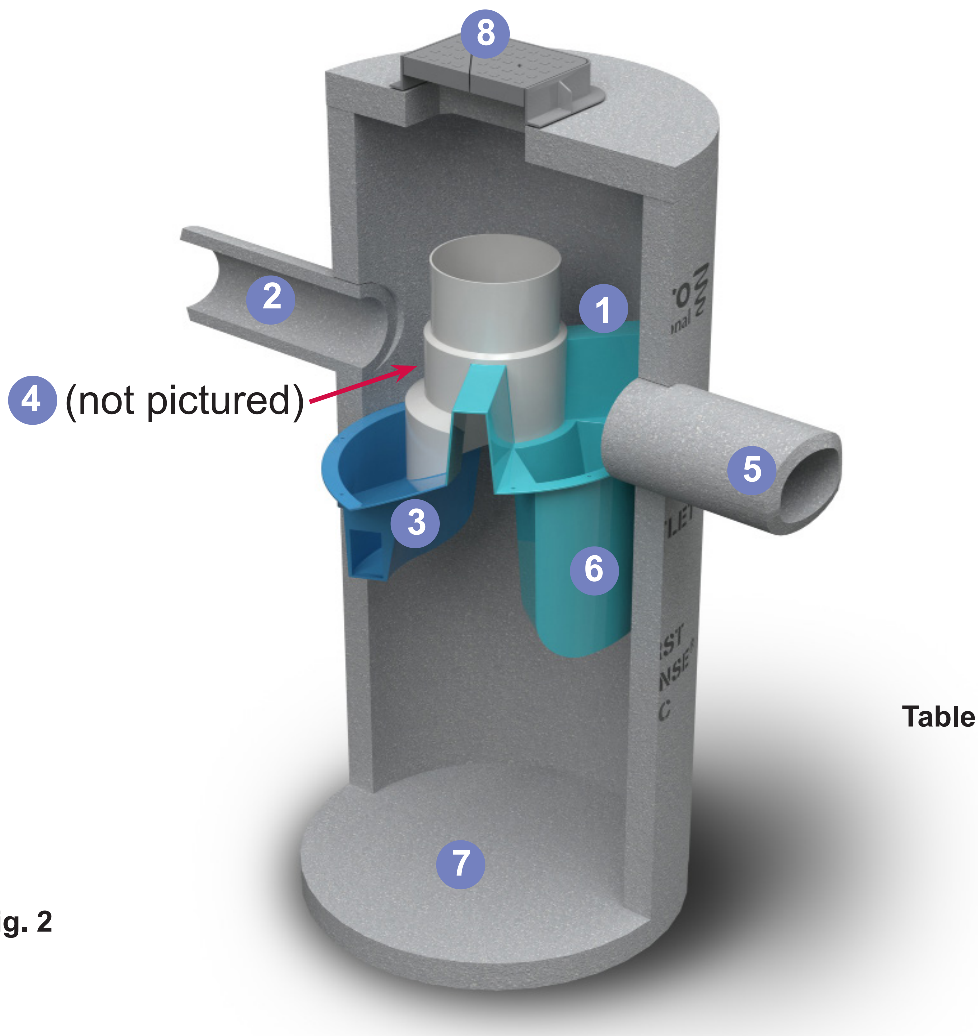


Fig. 2

Table 1

First Defense® Model Sizes
(ft / m) diameter
3 / 0.9
4 / 1.2
5 / 1.5
6 / 1.8
7 / 2.1
8 / 2.4
10 / 3.0

Overview

The First Defense® protects the environment by removing a wide range of pollutants from stormwater runoff. Periodic removal of these captured pollutants is essential to the continuous, long-term functioning of the First Defense®. The First Defense® will capture and retain sediment and oil until the sediment and oil storage volumes are full to capacity. When sediment and oil storage capacities are reached, the First Defense® will no longer be able to store removed sediment and oil.

The First Defense® allows for easy and safe inspection, monitoring and clean-out procedures. A commercially or municipally owned sump-vac is used to remove captured sediment and floatables. Access ports are located in the top of the manhole.

Maintenance events may include Inspection, Oil & Floatables Removal, and Sediment Removal. Maintenance events do not require entry into the First Defense®, nor do they require the internal components of the First Defense® to be removed. In the case of inspection and floatables removal, a vactor truck is not required. However, a vactor truck is required if the maintenance event is to include oil removal and/or sediment removal.

Maintenance Equipment Considerations

The internal components of the First Defense® have a centrally located circular shaft through which the sediment storage sump can be accessed with a sump vac hose. The open diameter of this access shaft is 15 inches in diameter (Fig.3). Therefore, the nozzle fitting of any vactor hose used for maintenance should be less than 15 inches in diameter.

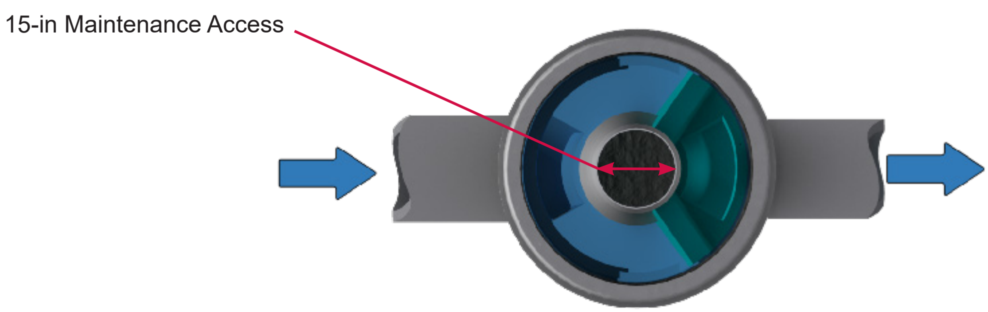


Fig.3 The central opening to the sump of the First Defense®is 15 inches in diameter.

Determining Your Maintenance Schedule

The frequency of clean out is determined in the field after installation. During the first year of operation, the unit should be inspected every six months to determine the rate of sediment and floatables accumulation. A simple probe such as a Sludge-Judge® can be used to determine the level of accumulated solids stored in the sump. This information can be recorded in the maintenance log (see page 9) to establish a routine maintenance schedule.

The vactor procedure, including both sediment and oil / flotables removal, for First Defense® typically takes less than 30 minutes and removes a combined water/oil volume of about 765 gallons.

Inspection Procedures

1. Set up any necessary safety equipment around the access port or grate of the First Defense® as stipulated by local ordinances. Safety equipment should notify passing pedestrian and road traffic that work is being done.

2. Remove the grate or lid to the manhole.

3. Without entering the vessel, look down into the chamber to inspect the inside. Make note of any irregularities. Fig.4 shows the standing water level that should be observed.

4. Without entering the vessel, use the pole with the skimmer net to remove floatables and loose debris from the components and water surface.

5. Using a sediment probe such as a Sludge Judge®, measure the depth of sediment that has collected in the sump of the vessel.

6. On the Maintenance Log (see page 9), record the date, unit location, estimated volume of floatables and gross debris removed, and the depth of sediment measured. Also note any apparent irregularities such as damaged components or blockages.

7. Securely replace the grate or lid.

8. Take down safety equipment.

9. Notify Hydro International of any irregularities noted during inspection.

Fig.4 Floatables are removed with a vactor hose

Floatables and Sediment Clean Out

Floatables clean out is typically done in conjunction with sediment removal. A commercially or municipally owned sump-vac is used to remove captured sediment and floatables (Fig.4).

Floatables and loose debris can also be netted with a skimmer and pole. The access port located at the top of the manhole provides unobstructed access for a vactor hose to be lowered to the base of the sump.

Scheduling

- Floatables and sump clean out are typically conducted once a year during any season.

- Floatables and sump clean out should occur as soon as possible following a spill in the contributing drainage area.

Recommended Equipment

- Safety Equipment (traffic cones, etc)
- Crow bar or other tool to remove grate or lid
- Pole with skimmer or net (if only floatables are being removed)
- Sediment probe (such as a Sludge Judge®)
- Vactor truck (flexible hose recommended)
- First Defense® Maintenance Log

Floatables and Sediment Clean Out Procedures

1. Set up any necessary safety equipment around the access port or grate of the First Defense® as stipulated by local ordinances. Safety equipment should notify passing pedestrian and road traffic that work is being done.

2. Remove the grate or lid to the manhole.

3. Without entering the vessel, look down into the chamber to inspect the inside. Make note of any irregularities.

4. Remove oil and floatables stored on the surface of the water with the vactor hose or with the skimmer or net

5. Using a sediment probe such as a Sludge Judge®, measure the depth of sediment that has collected in the sump of the vessel and record it in the Maintenance Log (page 9).

6. Once all floatables have been removed, drop the vactor hose to the base of the sump. Vactor out the sediment and gross debris off the sump floor

7. Retract the vactor hose from the vessel.

8. On the Maintenance Log provided by Hydro International, record the date, unit location, estimated volume of floatables and gross debris removed, and the depth of sediment measured. Also note any apparent irregularities such as damaged components, blockages, or irregularly high or low water levels.

9. Securely replace the grate or lid.

Maintenance at a Glance

Inspection	- Regularly during first year of installation - Every 6 months after the first year of installation
Oil and Floatables Removal	- Once per year, with sediment removal - Following a spill in the drainage area
Sediment Removal	- Once per year or as needed - Following a spill in the drainage area
NOTE: For most clean outs the entire volume of liquid does not need to be removed from the manhole. Only remove the first few inches of oils and floatables from the water surface to reduce the total volume of liquid removed during a clean out.	

First Defense® Installation Log

HYDRO INTERNATIONAL REFERENCE NUMBER:	
SITE NAME:	
SITE LOCATION:	
OWNER:	CONTRACTOR:
CONTACT NAME:	CONTACT NAME:
COMPANY NAME:	COMPANY NAME:
ADDRESS:	ADDRESS:
TELEPHONE:	TELEPHONE:
FAX:	FAX:

INSTALLATION DATE: / /

MODEL SIZE (CIRCLE ONE): [3-FT] [4-FT] [5-FT] [6-FT] [7-FT] [8-FT] [10-FT]

INLET (CIRCLE ALL THAT APPLY): GRATED INLET (CATCH BASIN) INLET PIPE (FLOW THROUGH)

Hydro International (Stormwater), 94 Hutchins Drive, Portland ME 04102
Tel: (207) 756-6200 Fax: (207) 756-6212 Web: www.hydro-int.com

First Defense® Inspection and Maintenance Log

Date	Initials	Depth of Floatables and Oils	Sediment Depth Measured	Volume of Sediment Removed	Site Activity and Comments

Hydro International (Stormwater), 94 Hutchins Drive, Portland ME 04102
Tel: (207) 756-6200 Fax: (207) 756-6212 Web: www.hydro-int.com

Hydro International (Stormwater), 94 Hutchins Drive, Portland ME 04102
Tel: (207) 756-6200 Fax: (207) 756-6212 Web: www.hydro-int.com

Hydro International

Stormwater Solutions

94 Hutchins Drive
Portland, ME 04102

Tel: (207) 756-6200
Fax: (207) 756-6212
stormwaterinquiry@hydro-int.com

www.hydro-int.com

Turning Water Around...®

TATHAM ENGINEERING

PROJECT	983 Yonge Street, Midland	FILE	324829
		DATE	12-Jun-2024
SUBJECT	Infiltration Trench Volume	NAME	JN
		PAGE	1 OF 2

Native Soil Characteristics

Texture Class:	Loam	Ontario AG Maps and Geotechnical Reports
Hydraulic Conductivity, (cm/hr):	1.32	- (Table 10.4 - NVCA SWM Technical Guide)
Percolation Time, (min/cm):	10.82	- (Interpolated per Table 7.1 - NVCA SWM Technical Guide)
Infiltration Rate, (mm/hr):	55.45	- (Table 7.1 - NVCA SWM Technical Guide)
Ratio of Mean Measured Infiltration:	< 1	- Estimate - Table 7.2 - NVCA SWM Technical Guide)
Safety Factor:	2.5	- Estimate - Table 7.2 - NVCA SWM Technical Guide)
Revised Infiltration Rate, (mm/hr):	22.18	>= 15 mm/hr - Underdrain Not Required.

Required Storage Volume - MECP Quality Control

Design Area, (ha):	3.45
Imperviousness, (%):	43%
MECP Protection Level:	Enhanced, 80% TSS Removal
Storage Volume, (m^3/ha):	27
Storage Volume, (m^3):	93.15

Required Storage Volume - 25 mm Storm Runoff from Impervious Surfaces

Impervious Surface Area (ha):	1.48
Storage Volume (m^3):	370.88

Infiltration Footprint for Minimum 48-hour Drawdown Time

i (mm/hr):	22.18	- Infiltration Rate of Native Soil
i (m/hr):	0.022	- Infiltration Rate of Native Soil
T_{D25mm}, (hr):	48.00	- Desired Drawdown Time
V_{25mm}, (m^3):	370.88	- Volume to be infiltrated
Q_i (m^3/hr) = V_{25mm}/T_{D25mm} =	7.73	- Required Infiltration Rate for Desired Drawdown
A_f (m^2) = Q_i/i =	348.36	- Footprint of Infiltration Basin
Void Ratio, (%):	40%	- Void Ratio of Infiltration Gallery
D, (m):	2.66	- Required Depth of Infiltration Gallery

TATHAM ENGINEERING

PROJECT		FILE	324829
	983 Yonge Street, Midland	DATE	12-Jun-2024
SUBJECT		NAME	JN
	Infiltration Trench Volume	PAGE	2 OF 2

Proposed Infiltration Trenches

Infiltration Trench

Width of Infiltration Trench, (m):	14.00
Length Iniltration Trench, (m):	25.50
Infiltration Trench Footprint, (m^2):	357.00
Elevation of Weir Discharge, (m):	206.46
Invert Elevation at Low Point, (m):	206.26
Slope of Banks, (%):	33.33%
Surface Storage Volume, (m^3):	76.21
Depth of Topsoil and Sod, (m):	0.15
Depth of Permeable Backfill, (mm):	0.30
Depth of Clear Stone Layer, (m):	1.70
Depth of Sand Layer, (m):	0.30
Combined Underground Depth, (m):	2.45
Void Ratio, (%):	40%
Storage Volume, (m^3):	349.86
Trench Base Elevation, (m):	203.81

Combined Storage

Max. Storage Required, (m^3):	370.88
Combined Storage Provided, (m^3):	426.07

Therefore, the proposed trenches have sufficient capacity for the design storage.

TATHAM ENGINEERING

PROJECT	983 Yonge Street, Midland	FILE	324829
		DATE	12-Jun-2024
SUBJECT	Water Quality - Treatment Train	NAME	JN
		PAGE	1 OF 1

Water Quality Treatment Train Calculation

Catchment Label:	201 to 208	
Total Drainage Area, (ha):	3.45	
Catchment Imperviousness, (%):	43.0%	(weighted average)

Treatment Control		Target TSS Removal	Actual Area (ha)	Actual TSS Removal
Pre-Treatment	Oil Grit Separator	66.5%	3.36	64.8%
Primary Treatment	Infiltration Cell	80.0%	3.45	80.0%
Optional Treatment				0.0%

TSS Removal = $1 - ((1 - R_1) \times (1 - R_2) \times (1 - R_3))$

Where:

R_1: % TSS Removal by Pre-Treatment

R_2: % TSS Removal by Primary Treatment

R_3: % TSS Removal by Optional Treatment

TSS Removal (Primary Controls) =	93.0%
TSS Removal (Incl. Secondary Controls):	93.0%

Notes:

TSS = Total Suspended Solids.

Refer to 2019 ETV Verification Statement confirming TSS removal efficiencies between 40.5% and 66.5% for Hydro International First Defense OGS unit.

Refer to 2021 NJDEP Certification confirming an effective treatment rate of 7.23 cfs (204.7 L/s) for the 8-ft (2,400 mm) diameter Hydro International First Defense OGS unit.

Refer to infiltration trench volume calculations confirming sufficient storage volume to capture and infiltrate the runoff from a 25 mm storm event.

Appendix H:
Water Budget Calculations

TATHAM ENGINEERING

Water Budget

Climate Normal Data

Project Details

983 Yonge Street, Midland	324829

Prepared By

JN	June 13, 2024

Water Budget Details

Methodology	Thornthwaite Method
Climate Data & Source	Shanty Bay
	Climate Normal Data for 2002 to 2021 (Environment Canada)
Thornthwaite Coefficient	1.063

Month	Temp (°C)	Precip (mm)	Heat Index	PET (mm)	Daylight Factor	Adjusted PET (mm)	AET (mm)	Surplus (mm)	Deficit (mm)
Jan.	-7.7	88.8	0.0	0.0	0.77	0.0	0.0	88.8	0.0
Feb.	-6.5	69.8	0.0	0.0	0.87	0.0	0.0	69.8	0.0
Mar.	-1.9	63.8	0.0	0.0	1.00	0.0	0.0	63.8	0.0
Apr.	5.7	65	1.2	29.7	1.12	33.3	33.3	31.7	0.0
May	12.1	79.9	3.8	74.9	1.23	92.3	79.9	0.0	12.4
Jun.	17.4	88.6	6.6	111.5	1.29	143.8	88.6	0.0	55.2
Jul.	20.1	73.2	8.2	131.4	1.26	165.8	73.2	0.0	92.6
Aug.	19.2	86.2	7.7	115.6	1.17	134.8	86.2	0.0	48.6
Sep.	15.2	92.2	5.4	78.1	1.04	81.4	81.4	10.8	0.0
Oct.	8.7	78.2	2.3	39.1	0.92	35.8	35.8	42.4	0.0
Nov.	2.6	98	0.4	9.2	0.80	7.4	7.4	90.6	0.0
Dec.	-3.6	84.3	0.0	0.0	0.74	0.0	0.0	84.3	0.0
Total	**-**	**968**	**35.6**	**589.4**	**-**	**694.7**	**485.8**	**482.2**	**208.8**

Additional Notes

PET = Potential Evapotranspiration; AET = Actual Evapotranspiration

Equations

$PET = 16\left(\frac{L}{12}\right)\left(\frac{N}{30}\right)\left(\frac{10T_d}{I}\right)^{\alpha}$ Where

PET is the estimated potential evapotranspiration (mm/month)

T_d is the average daily temperature (degrees Celsius; if this is negative, use 0) of the month being calculated

N is the number of days in the month being calculated

L is the average day length (hours) of the month being calculated

$\alpha = (6.75 \times 10^{-7})I^3 - (7.71 \times 10^{-5})I^2 + (1.792 \times 10^{-2})I + 0.49239$

$I = \sum_{i=1}^{12}\left(\frac{T_{m_i}}{5}\right)^{1.514}$ is a heat index which depends on the 12 monthly mean temperatures T_{m_i}.[1]

TATHAM ENGINEERING

Water Budget

Pre and Post Development Comparison

Project Details

983 Yonge Street, Midland	324829

Prepared By

JN	Jun-24

Pre-Development Catchment Details

Area (ha)	3.7
Pervious Area (ha)	3.7
Impervious Area (ha)	0.0

Post Development Catchment Details

Area (ha)	3.7
Pervious Area (ha)	2.2
Impervious Area (ha)	1.5

Infiltration Factor

Infiltration Factor	Pre-Development		Post Development	
	Pervious	Impervious	Pervious	Impervious
Topography	0.100	0.0	0.100	0.0
Soil	0.400	0.0	0.400	0.0
Land Cover	0.200	0.0	0.100	0.0
Infiltration Factor	0.700	0.0	0.600	0.0

Water Budget

Water Budget	Pervious	Impervious	Total	Pervious	Impervious	Total
Water Surplus (m^3)	17,841	0	17,841	10,415	7,426	17,841
Infiltration (m^3)	12,489	0	12,489	6,249	0	6,249
Runoff (m^3)	5,352	0	5,352	4,166	7,426	11,592
Reduction in Infiltration Volume (m^3)						**6,239**

Additional Notes

Infiltration Factors

Topography	Flat Land, average slope < 0.6 m/km	0.3
	Rolling Land, average slope 2.8 m to 3.8 m/km	0.2
	Hilly Land, average slope 28 m to 47 m/km	0.1
Soils	Tight impervious clay	0.1
	Medium combinations of clay and loam	0.2
	Open Sandy loam	0.4
Cover	Cultivated Land	0.1
	Woodland	0.2

(Stormwater Planning and Design Manual. MOE, 2003.)

TATHAM ENGINEERING

Water Budget
Mitigation Measures
LID Design

Project Details

983 Yonge Street, Midland	324829

Prepared By

JN	Jun-24

LID Design Details

LID Measure	Infiltration Gallery
LID Impervious Drainage Area (ha)	1.47
Number of LIDs	1
Void Ratio	0.4
Footprint of LID (m^2)	357.00
Depth of LID (m)	6.00
Storage Volume Required (m^3)	79.1
Volume Required / LID (m^3)	79.12
Volume Provided / LID (m^3)	856.80
Volume Provided (m^3)	856.80
Design Precipitation Depth (mm)	58.3
Annual Volume Captured (mm)	974.8
Annual Volume Captured excluding Evapotransiration (m^3)	14,329
Annual Volume Captured after Evapotranspiration (m^3)	11,463

Additional Notes

TATHAM ENGINEERING

Water Budget
Summary

Project Details

983 Yonge Street, Midland	324829

Prepared By

JN	Jun-24

Summary

Existing Infiltration (m^3)	12,489
Proposed Infiltration (m^3) - No Mitigtation	6,249
Infiltration Deficit Prior to Mitigation (m^3)	-6,239

Proposed Infiltration Measures

	Increase Topsoil Depth
x	Infiltration LID
	Impervious Area Routed Over Pervious Area

Mitigation - Increase Topsoil Reduction in Pervious Runoff (m^3)	0
Mitigation Measure - Implementing LID (m^3)	11,463
Mitigation Measure - Impervious Area Routed over Pervious Area (m^3)	0
Infiltration Surplus after Mitigation (m^3)	5,224

Additional Notes

Appendix I:
Phosphorous Budget Calculations

TATHAM ENGINEERING

Phosphorus Budget Assessment

Project Details

983 Yonge Street, Midland	324829

Prepared By

JN	June 18 2024

Watershed

Oro Creeks North

Treatment Method

Treatment Train

LAND USE CATEGORY	Phosphorus Loading Rate (kg/ha/yr)	Pre-Development Total Area		Post-Development Treated Area		Post-Development Untreated Area	
		Area (ha)	Loading (kg/yr)	Area (ha)	Loading (kg/year)	Area (ha)	Loading (kg/year)
Cropland	0.39	0.00	0.00	0.00	0.00	0.00	0.00
Hay-Pasture	0.12	0.00	0.00	0.00	0.00	0.00	0.00
Turf -Sod	0.24	0.00	0.00	0.00	0.00	0.00	0.00
High Intensity Development - C/I	1.82	0.00	0.00	0.00	0.00	0.00	0.00
High Intensity Development - R	1.32	0.00	0.00	2.22	2.93	0.00	0.00
Low Intensity Development	0.13	0.00	0.00	1.14	0.15	0.34	0.04
Quarry	0.08	0.00	0.00	0.00	0.00	0.00	0.00
Unpaved Road	0.83	0.00	0.00	0.00	0.00	0.00	0.00
Forest	0.10	3.70	0.37	0.00	0.00	0.00	0.00
Transition	0.16	0.00	0.00	0.00	0.00	0.00	0.00
Wetland	0.10	0.00	0.00	0.00	0.00	0.00	0.00
Open Water	0.26	0.00	0.00	0.00	0.00	0.00	0.00
Total		**3.70**	**0.37**	**3.36**	**3.08**	**0.34**	**0.04**

CONTROLS

Proposed Treatment Method	Removal Efficiency (%)	Area (ha)	Loading (kg/year)
OGS - ETV Verified	20.00	3.36	2.46
Infiltration Trench	60.00	3.36	0.79
Vegetative Filter Strip	65.00	3.36	0.28
Effective Removal Efficiency	**88.80**	**3.36**	**0.28**

SUMMARY

Existing Phosphorous Load	0.37 kg/year
Post Development Phosphorous Load (no controls)	3.12 kg/year
Post Development Phosphorous Load (with controls)	0.32 kg/year
Overall Increase in Phosphorus Load	-0.05 kg/year