Stormwater Management Report

Estill Innovation Community

Puslinch Development GP Inc.

07 February 2025

→ **The Power of Commitment**

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GHD Ltd.
Contact: Michelle Li, Team Lead Land Development Storm Water Engineer | GHD
140 Allstate Parkway, Suite 210
Markham, Ontario L3R 5Y8, Canada
T +1 905 752 4300 | **F** +1 905 752 4301 | **E** info-northamerica@ghd.com | **ghd.com**

Contents

Table index

Figure index

Appendices

1. Introduction

GHD has been retained by Puslinch Development GP Inc. (herein referred to as the “Client”) to provide professional engineering services for the preparation of a Stormwater Management (SWM) Report in support of a proposed industrial development located at 4631 Sideroad 20 North located in the Township of Puslinch, Ontario (hereafter referred to as the ‘Site’).

1.1 Purpose of this report

The purpose of this report is to describe the SWM approach for the Site in support of the proposed development project in preparation for the Official Plan and Zoning By-law Amendment applications related to a proposed industrial development at 4631 Sideroad 20 North, Puslinch Township, Ontario.

1.2 Scope and limitations

This report has been prepared by GHD for Puslinch Development GP Inc. and may only be used and relied on by Puslinch Development GP Inc. for the purpose agreed between GHD and Puslinch Development GP Inc. as set out in this report.

GHD otherwise disclaims responsibility to any person other than Puslinch Development GP Inc. arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report. GHD disclaims liability arising from any of the assumptions being incorrect. No portion of this report may be used as a separate entity, it is to be read in its entirety and shall include all supporting drawings and appendices.

GHD has prepared the PCSWMM (“Model”) for, and for the benefit and sole use of, Puslinch Development GP Inc. to support the hydrologic and hydraulic assessment and must not be used for any other purpose or by any other person.

The Model is a representation only and does not reflect reality in every aspect. The Model contains simplified assumptions to derive a modelled outcome. The actual variables will inevitably be different to those used to prepare the Model. Accordingly, the outputs of the Model cannot be relied upon to represent actual conditions without due consideration of the inherent and expected inaccuracies. Such considerations are beyond GHD’s scope.

The information, data and assumptions (“Inputs”) used as inputs into the Model are from publicly available sources or provided by or on behalf of the Puslinch Development GP Inc., (including possibly through stakeholder engagements). GHD has not independently verified or checked Inputs beyond its agreed scope of work. GHD’s scope of work does not include review or update of the Model as further Inputs becomes available.

The Model is limited by the mathematical rules and assumptions that are set out in the Report or included in the Model and by the software environment in which the Model is developed.

The Model is a customised model and not intended to be amended in any form or extracted to other software for amending. Any change made to the Model, other than by GHD, is undertaken on the express understanding that GHD is not responsible, and has no liability, for the changed Model including any outputs.

GHD has prepared this report on the basis of information provided by Puslinch Development GP Inc. and others who provided information to GHD (including Government authorities), which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

Accessibility of documents

If this report is required to be accessible in any other format, this can be provided by GHD upon request and at an additional cost if necessary.

2. Background

2.1 Supporting documentation

A variety of previous studies, municipal and provincial standards, as well as field investigations were reviewed in preparation of this report. The background information from these documents was used to develop the SWM plan described in this report.

– Municipal Development Standards, Township of Puslinch, dated September 2019
– Stormwater Management Planning and Design Manual (SWMP Manual) prepared by the Ministry of Environment Conservation and Park, dated March 2003
– Development Engineering Manual, City of Guelph Engineering and Transportation Services, dated October 2023
– Preliminary Hydrogeological Assessment, by GHD Ltd., dated January 31, 2025
– Preliminary Geotechnical Investigation Report, by GHD Ltd., dated January 31, 2025

2.2 General Site information

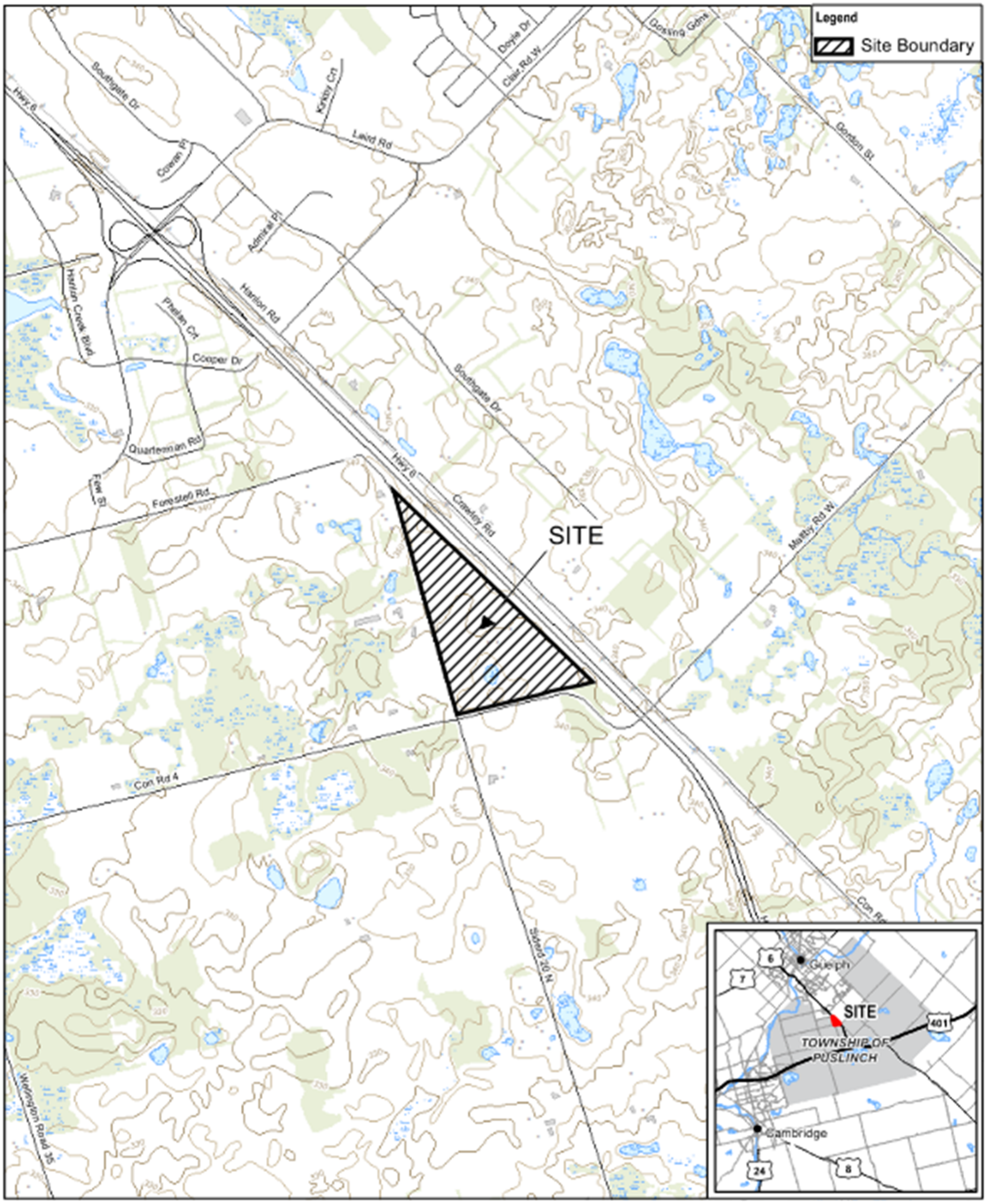
The Site is triangular in shape with an approximate area of 25.47 hectares (ha) and is bounded by Provincial Highway 6 (Hanlon Parkway) to the east, Concession Road 4 to the south and Side Road 20 N to the west. The Site is currently comprised of undeveloped, vacant property used for agricultural purposes. There is a small vegetated/wetland area just north of Concession Road 4 that is part of the Cranberry Oil Well Bog Wetland Complex, a provincially significant wetland complex. It is understood that the proposed development at the Site will include three slab-on-grade industrial structures surrounded by parking lot and paved aprons, and it is assumed the proposed structures will be one to two storey with no basements. A Site location map is provided on Figure 1.

A preliminary topographical survey was completed by GHD on December 18, 2023. The survey indicates that the Site generally slopes to the south and southwest gently, with surface elevations ranging from 333.0 to 346.0 m.

The Site is located within a Tier 2 Significant Groundwater Recharge Area (SGRA), a Well Head Protection Area (WHPA), and a regulated zone for the on-Site wetland as per the Grand River Source Protection Plan.

A preliminary geotechnical investigation was completed in November 2023 and consisted of advancing a total of thirteen (13) exploratory geotechnical boreholes, with eight (8) boreholes being instrumented with monitoring wells. As noted in the Preliminary Geotechnical Investigation Report (GHD, January 2025), the boreholes generally encountered topsoil followed by fill materials mainly composed of a non-cohesive layer of sandy silt/silty sand/sand/gravel. The fill material was generally followed by a non-cohesive deposit of sand/silt/gravel deposits. The majority of boreholes were terminated within the native soil layers (non-cohesive till deposit of sandy silt/silty sand/sand/gravel) from 5.2 m and 11.3 m (ranging between elevations 328.3 m and 337.6 m). Refer to the Preliminary Geotechnical Investigation Report prepared by GHD for this project under a separate cover for additional information.

Groundwater levels were measured between November 2023 and October 2024. Groundwater was not encountered both during drilling and between two (2) measurement periods. Refer to the Preliminary Geotechnical Report prepared by GHD for this project for additional information.



Paper Size ANSI A

0 200 400 600

Metres

Map Projection: Transverse Mercator
Horizontal Datum: North American 1983
Grid: NAD 1983 UTM Zone 17N

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GHD

PUSLINCH DEVELOPMENT LIMITED PARTNERSHIP
4631 SIDEROAD 20 NORTH,
PUSLINCH TOWNSHIP, ONTARIO
HYDROGEOLOGICAL INVESTIGATION

Project No. **12618927**
Revision No. -
Date **Jan 30, 2025**

SITE LOCATION MAP

FIGURE 1

Data source: MNDMNRF NRVIS, 2021. Produced by GHD under licence from Ontario Ministry of Natural Resources and Forestry, © King's Printer 2025.

3. Site drainage

3.1 Pre-development conditions

The Site is located within the Irish Creek Sub-basin in the Speed River (Lower) Subwatershed within the Grand River Watershed, under the jurisdiction of Grand River Conservation Authority (GRCA). The Speed River, located approximately 5 m northwest of the Site, flows southwest before draining into the Grand River that is approximately 17 kilometres (km) southwest of the Site. A provincially significant wetland feature, part of the Cranberry Oil Well Bog Wetland Complex, sits within the southern limits of the Site.

The existing drainage conditions of the Site were confirmed through a combination of Geographic Information System (GIS) maps, topographic survey, desktop investigation and review of the background reports. The existing Site topography splits the Site into six (6) drainage areas. Per the existing topography of the site, 24.47 ha generally slopes into the site, which surface runoff drains toward the existing wetland feature and depression areas, while the remaining 1.01 ha generally slopes to the southeast and northeast direction. A portion of the drainage area at the northeast boundary drains to the depression area between the Site and the Provincial Highway 6 (Hanlon Parkway), which ultimately infiltrates into the ground. For simplicity, this area has been accounted as part of the peak flow that drains into the Site.

The Pre-Development Drainage Plan is provided in Appendix B for reference.

Table 1 Existing subcatchment summary

Area ID	Area (ha)	Imperviousness (%)	Remarks
101	0.15	25	Open space, drains external
102	24.47	25	Open space, drains to internal wetland and depression areas
103	0.03	25	Open space, drains external
104	0.06	25	Open space, drains external
105	0.67	25	Open space, drains external
106	0.10	25	Open space, drains external

The pre-development design peak flows for the site were modelled using PCSWMM model, in which a 3-hour duration Chicago storm distribution was used for each storm events (2, 5, 10, 25, 50, 100-year), based on the City of Guelph IDF curves. Since there are multiple depression areas on-site that capture and retain the surface runoff on-Site, these depression areas store surface runoff and allow runoff to infiltrate into the ground. Therefore, only a small portion of the runoff drains off-Site. Table 2 below summarizes the existing peak runoff volume.

Catchment hydrology was characterized based on area, flow length, slope, roughness, depression storage, and infiltration parameters. Areas, flow lengths, and catchment slopes were calculated from Site contours generated from a topographic survey. Manning's 'n' and depression storage values were selected based on the land cover types and aggregated over the catchment areas.

Infiltration was modelled using the Horton's Method, which is an empirical method that assumes an exponential relationship between a maximum and minimum infiltration rate. The infiltration rate of the soil decreases over time. The maximum and minimum infiltration rates were referenced from the hydrogeological assessment prepared by GHD dated December 2024.

Table 2 Pre-development peak flows

Storm event	Pre-development peak flows that drain externally (m^3/s)	Pre-development peak flows that retain internally (m^3/s)
2-Year	0.11	1.14
5-Year	0.17	1.75
10-Year	0.22	2.19
25-Year	0.26	2.78
50-Year	0.31	3.21
100-Year	0.37	3.64

3.2 Post-development conditions

Under the post-development conditions, the Site will consist of three (3) slab-on-grade industrial structures and two (2) slab-on-grade commercial structures surrounded by parking lots, paved aprons, walkways, and roadways. A SWM pond will also be included to meet stormwater control criteria. It is assumed the proposed structures will be one- to two-storeys with no basements. These areas are based on the Puslinch Industrial Development Concept Plan prepared by Sweeny & Co Architects in Appendix B.

The overall grading pattern will be consistent with the existing grading, which slopes toward the southeast direction. The Site will be graded to retain stormwater runoff on-Site. Roof drainage will be diverted into low-impact development systems via roof drain systems to promote infiltration. Excess flow from the low-impact development units will then be captured into the storm sewer system and conveyed downstream. Runoff from the paved areas and open space areas will be routed into the storm sewer system via area drains or catch basins, and conveyed to the proposed SWM pond and the existing wetland for water retention. Refer to the Post-Development Drainage Plan in Appendix B and the drainage area summary in Appendix A for details.

4. Stormwater management design criteria

The design criteria for the proposed SWM system are based on the municipality (Township of Puslinch), Conservation Authority (GRCA), and the provincial (MECP) standards for stormwater quantity, stormwater quality, water balance and erosion control. The proposed SWM system will be designed to meet the applicable standards, based on the Site location, geotechnical information, and current Site conditions, detailed in Table 3.

Table 3 Stormwater management criteria

Criteria	Notes
Hydrologic modelling	– All proposed developments are required to use hydrologic modelling software – As per the Township's SWM criteria, the intensity-duration-frequency (IDF) curves provided by the City of Guelph should be used
Quantity control	– Control post-development peak flows to pre-development peak flows (pre-development drainage pattern) for all storms up to and including the 100-year storm (2, 5, 10, 25, 50, 100-year storm) as per MECP requirements (major system) – Provide quantity control to match existing drainage scheme – The minor conveyance system (storm sewers) shall be designed to convey a 5-year storm with no surcharging, per the Township's requirements
Quality control	– Provide an Enhanced Level of Protection (minimum 80% total suspended solids (TSS) removal) as defined in the MOE SWM Design Manual (2003)

Criteria	Notes
Water balance	– Control of post-development infiltration volumes to pre-development condition levels through an annual water budget, as per the Townships requirements

5. Stormwater management plan

5.1 Proposed stormwater management measures

A comprehensive stormwater management strategy is proposed to meet the water quality, water quantity and water balance requirements. An integrated treatment train approach will be adopted to provide control at the lot level and in conveyance followed by an end-of-pipe control (stormwater management wet pond). Roof drainage is proposed to be collected by roof drains and will be conveyed to multiple low-impact development system across the Site as the start of the treatment train to retain runoff. Any excess flow from the low-impact development units and the runoff from the paved and landscaped areas will be collected via the storm sewer system which will convey the flow to the proposed SWM pond as an end-of-pipe measure to further provide treatment and to reduce peak flows into the existing wetland to retain water for infiltration. During major storm events that exceed the 100-year storm event or if there is clogging within the system, excess flow from the SWM pond will be directed to the emergency outlet structure to discharge flow off-Site at the south boundary by overtopping Concession Road 4.

5.1.1 Catchment Parameters

The drainage area plan is delineated based on the preliminary grading design and the servicing plan. For roof, parking lot and roadway subcatchment areas, a runoff coefficient of 0.90 is assigned. For open landscape and pervious subcatchment areas, a runoff coefficient of 0.90 is assigned. A weighted average runoff coefficient is assigned to subcatchment areas that consist of both landscape and hardscape areas accordingly. A total drainage area of 22.44 ha will be directed into the SWM pond, a drainage area of 2.71 ha will be directed to the wetland directly, and a drainage area of 0.32 ha will be discharging off-Site as uncontrolled runoff.

Infiltration was modelled using the Horton's Method, which is an empirical method that assumes an exponential relationship between a maximum and minimum infiltration rate. The maximum and minimum infiltration rates were obtained from the Hydrogeological Assessment Report prepared by GHD dated December 2024, in which the maximum infiltration rate is 90 mm/hr and the minimum infiltration rate is 45 mm/hr.

5.1.2 Storm sewers

Storm sewers were designed to convey up to the 5-year design storms without surcharging, with adequate size and depth in accordance with the design standards and specifications for the Township of Puslinch. The storm sewers were designed using Rational Method. The proposed storm sewer system will discharge into the proposed SWM pond and the existing wetland.

For preliminary sizing of the storm sewer system, refer to the storm sewer design sheet provided in Appendix A.

5.1.3 Overland flow

The 100-year flow, less the 5-year flow, will flow along the roadways as overland flow to the proposed SWM pond. The road network is designed to safely convey the 100-year minus 5-year flow from the Site. A small portion of the Site (0.32 ha) will be discharging off-site as uncontrolled runoff.

Overland flow routes are indicated on the grading plan using arrows (Appendix B).

5.1.4 Stormwater management pond

A SWM pond facility is proposed to be located at the south boundary of the Site. The proposed SWM pond is intended to provide water quality enhancement of stormwater runoff, as well as provide extended detention and controlled release of stormwater to maintain the local drainage regime and mitigate impacts on the environment due to the increased imperviousness. As per the existing drainage condition, all flows up to 100-year storm will be retained on-Site through low-impact development systems and the existing wetland to promote infiltration.

The SWM pond is designed as a conventional wet pond incorporating a permanent pool, sediment forebay, and an extended detention and flood control component, with the layout of the pond satisfying the MOE geometric guidelines for wet ponds. The stormwater management pond is designed to receive runoff from the Site to service a total drainage area of 22.44 ha and a lumped imperviousness of 66%. For details of the drainage area breakdown, refer to the drainage area breakdown calculation in Appendix A.

The side slopes of the proposed pond are designed at a ratio of 4:1 (horizontal:vertical) below the top of the permanent pool, and a 9.7:1 slope above the permanent pool elevation.

The SWM pond is designed according to the following criteria:

- The permanent pool is sized to provide an “Enhanced” level of treatment for water quality purposes
- Sediment Forebay is designed to MOE 2003 SWMP Manual Standards
- Extended detention of the 25mm storm for a minimum of 48 hours is to be provided
- A minimum of 0.30 m of freeboard will exist between the 100-year storm water level and the top of the pond
- It is identified that the bottom of the pond will be below the groundwater elevation. It is necessary to place a hydraulic barrier to control groundwater flow through the base and sides of the stormwater management system. Given that suitable on-Site source of clay may not be available, a geosynthetic clay liner is to be installed to limit groundwater seepage.

5.2 Quantity control

Water quantity control requirements for the Site are provided by both the Township of Puslinch and the GRCA. The Township requires to control post-development peak flows from all storms up to and including the 100-year storm event to pre-development levels. The post-development design peak flows for the Site were modelled using a PCSWMM model, in which a 3-hour duration Chicago storm distribution was used for each storm events (2, 5, 10, 25, 50, 100-year), based on the City of Guelph IDF curves. Note that under the existing condition, the existing topography indicated that there are multiple depression areas which provide storage capture runoff to promote infiltration with only a small fraction of the Site runoff that discharges off-Site. In order to maintain the existing drainage pattern, the quantity control objective is to provide sufficient storage to detain runoff into the existing wetland to promote infiltration and to minimize the peak runoff being discharged off-Site to meet the existing peak discharge flow rate.

5.2.1 Quantity control volume

According to Table 3.2 of the MECP SWM Manual (2003), a SWM pond is proposed to mitigate the impact from the increased imperviousness. The proposed SWM pond is designed to be a wet pond to provide quantity control to discharge water into the existing wetland to promote on-Site infiltration. For details, refer to the water balance assessment prepared by GHD dated January, 2025.

Given the Site's imperviousness of 66%, a permanent storage requirement of 172 m^3/ha is applicable. This results in a total permanent pool volume requirement of 3,855 m^3. The proposed SWM pond exceeds this requirement by providing a permanent pool volume of 4,881 m^3, with the water surface elevation at 331.67 m and the pond bottom elevation at 328.67 m. Detailed calculations for the permanent pool volume are provided in Appendix A.

A PCSWMM model was developed to assess the required SWM pond storage volume under post-development conditions. The model evaluates the discharge of stormwater both into the existing wetland and the adjacent roadside ditch, ensuring that the peak flow rates do not exceed pre-development runoff conditions. Based on the PCSWMM model results, an active storage volume of 6,868 m³ is required to attenuate runoff and facilitate a slow release into the wetland. Table 4 summarizes the required storage volumes of the proposed SWM pond.

The access road is designed at an elevation of 333.18 m, providing a minimum freeboard of 0.30 m between the top of the pond (333.12 m) and the 100-year pond water elevation.

Detailed calculations for the outlet structure will be provided during the site plan application stage.

Table 4 Stormwater management pond summary

Components	Elevation (m)	Required storage volume (m^3)	Provided storage volume (m^3)
Top of permanent pool (Water Quality Control)	331.67	3,594	4,881
Top of extended detention (Water Quality and Erosion Control)	332.00	1,382	1,403
100-year (Quantity Control)	332.86	6,868	6,928
Top of Pond	333.12	-	9,087

5.2.2 Outlet control structures

Two outlet structures are proposed to manage the runoff discharge from the SWM pond. A low-flow orifice with a diameter of 375 mm at elevation 331.67 m is designed to release water from the SWM pond at a controlled flow rate, that discharges directly into the existing wetland. An emergency spillway is proposed at elevation 332.68 m. This spillway will convey excess water from the SWM pond during high-flow events to an overland spillway, which directs runoff southerly toward the roadside ditch located just north of Concession Road 4.

A small portion of the Site (0.32 ha) will be discharging offsite uncontrolled. The peak flow being discharged off-Site will not exceed the allowable peak flow as per the existing condition.

It is important to note that during the detailed design stage, both the outlet structures and the overall configuration of the proposed SWM pond will be re-evaluated to ensure compliance with regulatory and site-specific requirements.

Please refer to the engineering drawings in Appendix B for details of the outlet control structures and refer to Appendix A for the storage-discharge table of the SWM pond. For preliminary sizing of the orifice control structure, refer to the PCSWMM model output file provided in Appendix C.

Table 5 Outlet control structure details

Structure	Structure size	Elevation (m)
Low-flow orifice	375 mm orifice	331.67 to discharge to wetland
Emergency Spillway	Trapezoid spillway 2.5 m bottom width, 3:1 side slope	332.86

Table 6 Uncontrolled peak flow, controlled peak flows and storage requirements

Storm event	Allowable peak flow discharge off-Site (m^3/s)	Controlled peak flows to wetland (m^3/s)	Uncontrolled Peak flows to discharge off-Site (m^3/s)	Required SWM pond active storage volume (m^3)
2-Year	0.11	0.198	0.031	2,006
5-Year	0.17	0.260	0.047	3,044
10-Year	0.22	0.295	0.058	3,841
25-Year	0.26	0.338	0.074	5,034
50-Year	0.31	0.364	0.085	5,917
100-Year	0.37	0.387	0.096	6,868

5.3 Quality control

5.3.1 Quality control volume

To achieve the Enhanced Level water quality treatment (minimum 80% Total Suspended Solids (TSS) removal) as outlined in the MECP Guidelines, a treatment train approach has been implemented using infiltration systems combined with the proposed SWM pond.

The majority of stormwater runoff from the development Site will be treated by a wet pond facility. Design calculations for the pond's quality control components—including the forebay, permanent pool, and extended detention—are provided in Appendix B and summarized in the table below.

An extended detention volume of 40 m^3/ha is required to meet water quality enhancement targets. For a drainage area of 22.44 ha, this translates to a total extended detention requirement of 898 m^3. In addition, the extended detention volume for erosion control has been estimated using PCSWMM. From the result of PCSWMM hydrologic analysis, an active storage volume of 1,382 m^3 is required during the 25 mm rainfall event. Note that the extended detention volume for water quality control is smaller than that for the erosion control volume, therefore the required erosion control volume will govern the required volume.

The proposed SWM pond has been designed to provide 1,403 m^3 of extended detention and erosion control volume, measured at the water elevation above the permanent pool. This exceeds the required volume, ensuring compliance with the water quality standards.

Refer to Appendix A for detailed calculations of both the required and provided volumes.

Table 7 Water quality requirements

Tributary area to Pond (ha)	Required permanent pool volume (m^3)	Required extended detention volume (m^3)	Required erosion control volume (m^3)
22.44	3,855	898	1,382

5.3.2 Forebay design

The proposed SWM pond design incorporates a 3.0 m deep sediment forebay to facilitate the pre-treatment of stormwater runoff. Inflowing stormwater will enter the sediment forebay, where suspended solids will settle within the permanent pool. The sediment forebay is connected to the main wet cell via a submerged berm set at an elevation of 331.60 m.

The forebay has been designed with approximate dimensions of 40 m in length and 18 m in width, resulting in a length-to-width ratio of 2.22:1. This ratio complies with the requirements outlined in the MECP Guidelines, ensuring optimal sedimentation efficiency.

Detailed calculations for the sediment forebay design are provided in Appendix A.

5.4 Water balance

Increasing the imperviousness of the surface under post-development conditions will result in a significant infiltration (recharge-to-groundwater) deficit. A Site-specific and feature-based water balance analysis was undertaken for the Site to determine the amount of water surplus generated for the pre- and post-development conditions of the Site and on-Site wetland feature.

A separate water balance assessment prepared by GHD dated 7 February 2025 and associated calculations are provided in Appendix D.

Based on the water balance calculations by comparing the post-development conditions to the pre-development conditions, the average annual surplus over the Site area will increase by 22,075 m^3/yr (88 mm/yr) under the post-development (uncontrolled) conditions. The average annual infiltration over the site area will decrease by 23,605 m^3/yr and the average runoff over the site area will increase by 45,680 m^3/yr under the post-development (uncontrolled) conditions. To mitigate the impact of the proposed development on groundwater recharge in comparison to the pre-development conditions, low-impact development measures such as underground infiltration chamber, infiltration trenches, overland depression areas, and diverting drainage to the existing wetland are proposed to promote on-Site infiltration.

The infiltration systems will only collect roof drainage, and to provide storage to retain water to promote infiltration. These infiltration systems are sized to retain the roof runoff from a minimum of 25 mm rainfall event. These infiltration systems are to be placed to provide a minimum of 1m vertical clearance between the bottom of the facilities to the high groundwater elevation. A detailed water balance analysis will be required during detailed design to confirm the hydrologic conditions.

Table 8 Low-impact development system summary

Infiltration ID	Contributing drainage area (ha)	Unit height (m)	Unit width (m)	Unit length (m)	Provided volume (m^3)	Provided footprint area (m^2)	Est. groundwater elevation (m)
LID #1A Underground Infiltration Chamber	1.93	0.5	25	42	525	1,050	335.5
LID #1B Underground Infiltration Trench	0.66	0.5	3	85	51 (40% porosity)	255	334.0
LID #2 Underground Infiltration Chamber	2.63	0.9	10	70	630	700	336.5
LID #3 Underground Infiltration Chamber	1.32	1.0	10	36	360	360	337.0

Infiltration ID	Contributing drainage area (ha)	Unit height (m)	Unit width (m)	Unit length (m)	Provided volume (m^3)	Provided footprint area (m^2)	Est. groundwater elevation (m)
LID #5 Overland Depression Area	0.32	0.3	Surface Area = 380		114	380	334.0
LID #6 Overland Depression Area	0.43	0.3	Surface Area = 290		87	290	334.5

5.4.1 Wetland Assessment

Downstream of the storm sewer system, a SWM pond is proposed to provide both quantity and quality control before discharging runoff into the existing wetland for water retention to maintain the hydrologic condition.

A PCSWMM model was developed to account for the hydraulic conductivity of the existing ground conditions and to assess the hydrologic performance of diverting runoff to the wetland. Based on the model results for a single storm event simulation of the 100-year storm, the drawdown time for the wetland is approximately 72 hours, ensuring adequate time for infiltration and settling of suspended solids.

For detailed model outputs and simulations, refer to the PCSWMM output file provided in Appendix C. For details of the water balance assessment, refer to the attached technical memorandum provided in Appendix D.

6. Erosion and sediment control

The purpose of erosion and sediment control measures (ESC) is to minimize the potential release of pollutants, primarily sediments, directly or indirectly into downstream receiving waters during construction. Generally, all on-Site siltation control measures are designed to the latest Ministry of Natural Resources (MNR) Erosion and Sediment Guidelines while considering GRCA and Township of Puslinch's standards and inspection procedures. Prior to construction, open areas and treed areas to be preserved should be delineated with tree-protection fencing. Additional sediment control fencing should be placed around the limits of the development area to prevent sediment transport onto adjacent properties. All fencing/hoarding shall be maintained in good condition throughout the duration of the construction operations. A mud mat for each temporary construction access should be used by the contractor to keep public roadways free of debris during the construction periods. The SWM pond should be rough-graded prior to deep servicing. The SWM pond will be used as a temporary sediment control pond. Straw bales, check dams or other suitable sediment traps shall be installed and maintained to prevent localized erosion. Accumulated sediment shall be removed, and structures inspected and repaired after every storm event.

7. Operations and maintenance

An operations and maintenance plan will be in place to verify the proposed SWM facility is operating as designed, per the *Municipal Development Standards of the Township of Puslinch* (2019). The SWM system at the Site has several components that require routine inspection and maintenance in order to maintain the performance of the system. In general, manufacturer's instructions and recommendations for inspections and maintenance must be followed. A summary of the components and the inspections are provided below. Inspection frequencies must be adjusted based on operational experience built up over time.

Visual inspections are intended to survey the overall condition of the SWM facility and the surrounding areas. It is recommended that visual inspections to be conducted four (4) times per year (one per season) and after any significant rainfall events (> 2-year return frequency). If the seasonal inspections are completed in conjunction with the significant rain events, inspections that address additional significant rain events may result in an additional two or three inspections per year. It is recommended that at a minimum, two (2) visual inspections should be conducted each year.

Inspections can be conducted by a single person over a period of 1-3 hours. A detailed inspection checklist can be used to identify the status of inspection items. Photographs of the inlet, outlet, access points, pond structures, and any areas with concerns should be taken during visual inspections. Copies of completed inspection checklists, as well as any associated photographs, should be documented and stored together by the operators to form complete documentation of the ongoing condition of the SWM facility. Recommendations or requirements for pond maintenance are to be clearly communicated to the facility Owner for implementation. Documentation associated with any maintenance or cleanout activities is to be stored with the inspection reports.

In general, items that should be observed and noted during a visual inspection of the facility include:

- Litter, debris and trash buildup in and around the facility
- Invasive or excess vegetation buildup within the facility
- Clogging of the inlet and outlet structures, including interior of the maintenance hole
- Erosion at the facility's inlet or outlet structures
- Landscaping conditions
- Obvious sediment buildup or sediment plumes, particularly at the pond inlet
- Condition of structures (headwall, weirs, control outlet manhole etc.)
- Water level in the pond

If the water level in the pond remains high for more than 2-3 days, outlet inspections for clogging are required. In addition, items that are unsafe, could cause damage to properties, or injury to the public should be identified and noted. These may include, but are not limited to:

- Vandalism to components within the facility (e.g. safety grates/lids were removed or damaged).
- Settlement along areas accessible to pedestrians
- Slope erosion or other scouring in areas that pedestrians may access.
- Grate across maintenance access in disrepair
- Missing gates and chamber cover
- Unauthorized access to the pond

8. Conclusion

The stormwater management system for the proposed industrial development located at 4631 Sideroad 20 North located in the Township of Puslinch, Ontario is designed to meet or exceed the regulatory requirements for water quantity, water quality, water balance, and erosion protection requirements. With proper operation, inspection and maintenance, the system will minimize impacts to the natural environment. The conclusions are summarized below:

– A proposed storm sewer system will convey minor (5-year) flows from the proposed development to the SWM pond.
– A SWM wet pond will provide a volume of 4,881 m^3 for permanent pool and 1,403 m^3 for extended detention to meet water quality control requirement. A total storage volume of 6,928 m^3 is provided to meet quantity control requirement.
– The 100-year post-development release rate from the SWM pond will be 0.387 m^3/s, which will be directed into the existing wetland. The 100-year uncontrolled flow will discharge off-Site, which is below the allowable discharge rate.
– Low Impact Development units are proposed to capture roof drainage and to promote infiltration on-Site.
– Sediment and erosion control practices will be implemented during construction to minimize the transport of sediment downstream.

All of Which is Respectfully Submitted,

GHD

[redacted]

Michelle Li, P.Eng. (ON, AB)
Team Lead Land Development Storm Water Engineer

[redacted]

Felix Tsang, EIT
Stormwater Engineering Graduate

Appendices

Appendix A

Stormwater management calculations

CALCULATIONS

Prepared by F.T.
Reviewed by M.L.

Project Name Estill Innovation Community
Project No. 12618927
Subject Drainage Area Summary

Drainage Area Breakdown Calculation

Note	Drainage Area ID	Total Area (ha)	Runoff Coefficient	Remark
	201	1.49	0.25	**Pond**
Industrial Building #3	202	1.32	0.90	**Pond**
	203	0.12	0.90	**Pond**
	204	0.25	0.25	**Pond**
	205a	0.06	0.90	**Pond**
	205b	0.10	0.90	**Pond**
	205c	0.11	0.90	**Pond**
	205d	0.22	0.90	**Pond**
	206a	0.37	0.75	**Pond**
	206b	0.09	0.25	**External**
Building #2 Expansion Area	207	0.71	0.25	**Pond**
	208a	0.05	0.90	**Pond**
	208b	0.09	0.90	**Pond**
	208c	0.09	0.90	**Pond**
	208d	0.05	0.90	**Pond**
	209a	0.04	0.65	**Pond**
	209b	0.13	0.65	**Pond**
	209c	0.17	0.65	**Pond**
	209d	0.10	0.65	**Pond**
	210a	0.19	0.90	**Pond**
	210b	0.18	0.90	**Pond**
	211	0.31	0.90	**Pond**
	212	0.24	0.90	**Pond**
	213	0.43	0.25	**Pond**
	214	0.27	0.25	**Pond**
	215	0.10	0.25	**Pond**
	216a	0.06	0.90	**Pond**
	216b	0.02	0.90	**Pond**
	216c	0.06	0.90	**Pond**
	216d	0.05	0.90	**Pond**
	216e	0.06	0.90	**Pond**
	216f	0.04	0.90	**Pond**
	216g	0.05	0.90	**Pond**
Industrial Building #2	217	0.64	0.90	**Pond**
Industrial Building #2	218	0.58	0.90	**Pond**
	219a	0.15	0.75	**Pond**
	219b	0.07	0.25	**External**
	220a	0.17	0.75	**Pond**
	220b	0.06	0.25	**External**
	221	0.23	0.73	**Pond**
	222	0.21	0.73	**Pond**
	223	0.23	0.73	**Pond**
	224	0.15	0.73	**Pond**
Building #2 Expansion Area	226	0.75	0.25	**Pond**
	227	0.23	0.90	**Pond**
	228	0.16	0.90	**Pond**
	229a	0.08	0.90	**Pond**
	229b	0.05	0.90	**Pond**
	230a	0.06	0.90	**Pond**
	230b	0.06	0.90	**Pond**
	231a	0.05	0.90	**Pond**
	231b	0.04	0.90	**Pond**
	232a	0.06	0.90	**Pond**
	232b	0.06	0.90	**Pond**
	233a	0.07	0.90	**Pond**
	233b	0.06	0.90	**Pond**
	234a	0.05	0.90	**Pond**
	234b	0.05	0.90	**Pond**
Industrial Building #1	235	0.89	0.90	**Pond**
Industrial Building #1	236	0.47	0.90	**Pond**
Industrial Building #1	237	0.43	0.90	**Pond**
Industrial Building #1	238	0.41	0.90	**Pond**
Industrial Building #1	239	0.39	0.90	**Pond**

CALCULATIONS

Prepared by F.T.
Reviewed by M.L.

Project Name	Estill Innovation Community
Project No.	12618927
Subject	Drainage Area Summary

Drainage Area Breakdown Calculation

Note	Drainage Area ID	Total Area (ha)	Runoff Coefficient	Remark	
	240a	0.06	0.90	**Pond**	
	240b	0.12	0.25	**Pond**	
	241a	0.13	0.90	**Pond**	
	241b	0.06	0.25	**Pond**	
	242a	0.13	0.90	**Pond**	
	242b	0.06	0.25	**Pond**	
	243a	0.10	0.90	**Pond**	
	243b	0.08	0.25	**Pond**	
	244a	0.31	0.90	**Pond**	
	244b	0.14	0.25	**Pond**	
	245	0.39	0.25	**Pond**	
	246	0.76	0.90	**Pond**	
	247	0.19	0.25	**Pond**	
	248a	0.12	0.90	**Pond**	
	248b	0.05	0.90	**Pond**	
	248c	0.23	0.90	**Pond**	
	248d	0.05	0.90	**Pond**	
SWM Pond	249	1.09	0.50	**Pond**	
	250a	0.21	0.25	**Wetland**	
	250b	0.06	0.90	**Pomd**	
	250c	0.04	0.65	**Pond**	
	250d	0.03	0.90	**Pond**	
	250e	0.10	0.90	**External**	
	250f	0.08	0.80	**Pond**	
Daycare	251	0.09	0.90	**Wetland**	
	252a	0.08	0.75	**Wetland**	
	252b	0.05	0.90	**Pond**	
	252c	0.03	0.90	**Pond**	
	252d	0.02	0.90	**Pond**	
	253	0.05	0.90	**Pond**	
Wetland	254	1.90	0.25	**Wetland**	
Gym	255	0.12	0.90	**Wetland**	
	256	0.31	0.64	**Wetland**	
	257	0.81	0.25	**Pond**	
	258	0.08	0.25	**Pond**	
	259	0.03	0.25	**Pond**	
	260	0.04	0.25	**Pond**	
	261	0.79	0.25	**Pond**	
	262	0.80	0.25	**Pond**	
	263	1.15	0.25	**Pond**	
Total Site Area		**25.47**	**0.58**	**55%**	IMP
Total Drainage Area to Pond		**22.44**	**0.66**	**66%**	IMP
Total Drainage Uncontrolled Offsite		**0.32**	**0.45**	**36%**	IMP
Total Drainage To Wetland Directly		**2.71**	**0.36**	**23%**	

CALCULATIONS

Prepared by F.T.
Reviewed by M.L.

Project Name	Estill Innovation Community
Project No.	12618927
Subject	LID Discharge Rate Calculations

LID #1A

LID Configurations

LID#	1A	
Description	Underground Parking Lot Storage Tank	
Groundwater Level	335.5	m
Ground Level	338.5	m
Min. Tank Invert	336.5	m
Max. Tank Obvert	337.0	m
Design Tank Invert	336.5	m
Design Tank Obvert	337.0	m
Tank Height	0.5	m
Provided Bottom Area, A	1050	m^2
Tank Volume	525	m^3
Tank Width	25	m
Tank Length	42	m

Orifice Configurations

Diameter	250	mm
Discharge Coeff, C_d	0.62	-
Flow Area, A	0.049	m^2
Orifice Invert	336.75	m
Max. Head	1.625	m
Max. Orifice Flow	0.172	m^3/s

5-year Event

Drainage Area	1.7	ha
Runoff Coefficient	0.95	-
Rainfall Intensity	104.9	mm/hr
5-year Flow	0.47	m^3/s

Orifice Equation

$$Q_{orif} = C_d A \sqrt{2gh}$$

Q_{orif}	= Orifice discharge rate	m^3/s
C_d	= Orifice discharge coeff.	-
A	= Flow Area	m^2
h	= head above the centreline of orifice	m

Soil Infiltration Rate Assessment, Prepared by GHD Hydrogeological Assessment, dated January 31, 2025

Percolation rate	7 min/cm
Infiltration rate	45 mm/hr
Hydraulic Conductiviy	32 cm/s

LID SWM Guide Table C1

Hydraulic Conductivity (cm/s)	Percolation Time (min/cm)	Infiltration Rate (mm/hr)
0.1	2	300
0.01	3	150
0.001	8	75
0.0001	12	50
0.00001	20	30
0.000001	50	12

Rainfall Depth to be Infiltrated	25	mm
Runoff volume to be Infiltrated	425	m^3
Infiltration Rate of Bedding, P	45	mm/hr
Porosity of the Storage Media	1	-
Retention Time	48	hours
Required Bottom Area of the Tank	196.8	m^2
Provided Bottom Area is larger than the Required Bottom Area		

Project Name	Estill Innovation Community
Project No.	12618927
Subject	LID Discharge Rate Calculations

LID #1 B

LID Configurations

LID#	1B	
Description	Underground Infiltration Trench	
Groundwater Level	334	m
Ground Level	337.8	m
Min. Trench Invert	335	m
Max. Trench Obvert	336.3	m
Design Trench Invert	335.8	m
Design Trench Obvert	336.3	m
Trench Height	0.5	m
Provided Bottom Area, A	255	m^2
Trench Volume	51	m^3
Trench Width	3	m
Trench Length	85	m

Orifice Configurations

Diameter	250	mm
Discharge Coeff, C_d	0.62	-
Flow Area, A	0.049	m^2
Orifice Invert	336.05	m
Max. Head	1.625	m
Max. Orifice Flow	0.172	m^3/s

5-year Event

Drainage Area	0.89	ha
Runoff Coefficient	0.95	-
Rainfall Intensity	104.9	mm/hr
5-year Flow	0.25	m^3/s

Orifice Equation

$$Q_{orif} = C_d A \sqrt{2gh}$$

Q_{orif}	= Orifice discharge rate	m^3/s
C_d	= Orifice discharge coeff.	-
A	= Flow Area	m^2
h	= head above the centreline of orifice	m

Soil Infiltration Rate Assessment, Prepared by GHD Hydrogeological Assessment, dated January 31, 2025

Percolation rate	7 min/cm
Infiltration rate	45 mm/hr
Hydraulic Conductiviy	32 mm/hr

LID SWM Guide Table C1

Hydraulic Conductivity (cm/s)	Percolation Time (min/cm)	Infiltration Rate (mm/hr)
0.1	2	300
0.01	3	150
0.001	8	75
0.0001	12	50
0.00001	20	30
0.000001	50	12

Rainfall Depth to be Infiltrated	25	mm
Runoff volume to be Infiltrated	222.5	m^3
Infiltration Rate of Bedding, P	45	mm/hr
Porosity of the Storage Media	0.4	-
Retention Time	48	hours
Required Bottom Area of the Trenc	257.5	m^2
Insufficient Bottom Area		

CALCULATIONS

Prepared by F.T.
Reviewed by M.L.

Project Name	Estill Innovation Community
Project No.	12618927
Subject	LID Discharge Rate Calculations

LID #2

LID Configurations

LID#	2	
Description	Underground Parking Lot Storage Tank	
Groundwater Level	336.5	m
Ground Level	340.0	m
Min. Tank Invert	337.5	m
Max. Tank Obvert	338.5	m
Design Tank Invert	337.6	m
Design Tank Obvert	338.5	m
Tank Height	0.9	m
Provided Bottom Area, A	700	m^2
Tank Volume	630	m^3
Tank Width	10	m
Tank Length	70	m

Orifice Configurations

Diameter	250	mm
Discharge Coeff, C_d	0.62	-
Flow Area, A	0.049	m^2
Orifice Invert	338.25	m
Max. Head	1.625	m
Max. Orifice Flow	0.172	m^3/s

5-year Event

Drainage Area	2.64	ha
Runoff Coefficient	0.95	-
Rainfall Intensity	104.9	mm/hr
5-year Flow	0.73	m^3/s

Orifice Equation

$$Q_{orif} = C_d A\sqrt{2gh}$$

Q_{orif}	= Orifice discharge rate	m^3/s
C_d	= Orifice discharge coeff.	-
A	= Flow Area	m^2
h	= head above the centreline of orifice	m

Soil Infiltration Rate Assessment, Prepared by GHD Hydrogeological Assessment, dated January 31, 2025

Percolation rate	7	min/cm
Infiltration rate	45	mm/hr
Hydraulic Conductiviy	32	mm/hr

LID SWM Guide Table C1

Hydraulic Conductivity (cm/s)	Percolation Time (min/cm)	Infiltration Rate (mm/hr)
0.1	2	300
0.01	3	150
0.001	8	75
0.0001	12	50
0.00001	20	30
0.000001	50	12

Rainfall Depth to be Infiltrated	25	mm
Runoff volume to be Infiltrated	660	m^3
Infiltration Rate of Bedding, P	45	mm/hr
Porosity of the Storage Media	1	-
Retention Time	48	hours
Required Bottom Area of the Tank	305.6	m^2

Provided Bottom Area is larger than the Required Bottom Area

CALCULATIONS

Prepared by F.T.
Reviewed by M.L.

Project Name	Estill Innovation Community
Project No.	12618927
Subject	LID Discharge Rate Calculations

LID #3

LID Configurations

LID#	3	
Description	Underground Lanscaped Storage Tank	
Groundwater Level	337	m
Ground Level	343.98	m
Min. Tank Invert	338	m
Max. Tank Obvert	342.5	m
Design Tank Invert	341.5	m
Design Tank Obvert	342.5	m
Tank Height	1.0	m
Provided Bottom Area, A	360	m^2
Tank Volume	352.8	m^3
Tank Width	10	m
Tank Length	36	m

Orifice Configurations

Diameter	250	mm
Discharge Coeff, C_d	0.62	-
Flow Area, A	0.049	m^2
Orifice Invert	342.23	m
Max. Head	1.625	m
Max. Orifice Flow	0.172	m^3/s

5-year Event

Drainage Area	1.44	ha
Runoff Coefficient	0.95	-
Rainfall Intensity	104.9	mm/hr
5-year Flow	0.40	m^3/s

Orifice Equation

$$Q_{orif} = C_d A \sqrt{2gh}$$

Q_{orif}	= Orifice discharge rate	m^3/s
C_d	= Orifice discharge coeff.	-
A	= Flow Area	m^2
h	= head above the centreline of orifice	m

Soil Infiltration Rate Assessment, Prepared by GHD Hydrogeological Assessment, dated January 31, 2025

Percolation rate	7 min/cm
Infiltration rate	45 mm/hr
Hydraulic Conductiviy	32 mm/hr

LID SWM Guide Table C1

Hydraulic Conductivity (cm/s)	Percolation Time (min/cm)	Infiltration Rate (mm/hr)
0.1	2	300
0.01	3	150
0.001	8	75
0.0001	12	50
0.00001	20	30
0.000001	50	12

Rainfall Depth to be Infiltrated	25	mm
Runoff volume to be Infiltrated	360	m^3
Infiltration Rate of Bedding, P	45	mm/hr
Porosity of the Storage Media	1	-
Retention Time	48	hours
Required Bottom Area of the Tank	166.7	m^2

Provided Bottom Area is larger than the Required Bottom Area

CALCULATIONS

Prepared by F.T.
Reviewed by M.L.

Project Name	Estill Innovation Community
Project No.	12618927
Subject	LID Discharge Rate Calculations

LID #5

LID Configurations

LID#	5	
Description	Overland Infiltration Depression	
Groundwater Level	334.5	m
Ground Level	338.42	m
Min. Depression Invert	335.5	m
Max. Depression Obvert	336.9	m
Design Depression Invert	336.6	m
Design Depression Obvert	336.9	m
Depression Height	0.3	m
Provided Bottom Area, A	380	m^2
Depression Volume	121.6	m^3

5-year Event

Drainage Area	0.43	ha
Runoff Coefficient	0.95	-
Rainfall Intensity	104.9	mm/hr
5-year Flow	0.12	m^3/s

Orifice Equation

$$Q_{orif} = C_d A \sqrt{2gh}$$

Q_{orif}	= Orifice discharge rate	m^3/s
C_d	= Orifice discharge coeff.	-
A	= Flow Area	m^2
h	= head above the centreline of orifice	m

Soil Infiltration Rate Assessment, Prepared by GHD Hydrogeological Assessment, dated January 31, 2025

Percolation rate	7	min/cm
Infiltration rate	45	mm/hr
Hydraulic Conductiviy	32	mm/hr

LID SWM Guide Table C1

Hydraulic Conductivity (cm/s)	Percolation Time (min/cm)	Infiltration Rate (mm/hr)
0.1	2	300
0.01	3	150
0.001	8	75
0.0001	12	50
0.00001	20	30
0.000001	50	12

Rainfall Depth to be Infiltrated	25	mm
Runoff volume to be Infiltrated	107.5	m^3
Infiltration Rate of Bedding, P	45	mm/hr
Porosity of the Storage Media	0.4	-
Retention Time	48	hours
Required Bottom Area of the Depression	124.4	m^2

Provided Bottom Area is larger than the Required Bottom Area

Project Name	Estill Innovation Community
Project No.	12618927
Subject	LID Discharge Rate Calculations

LID #6

LID Configurations

LID#	6	
Description	Overland Infiltration Depression	
Groundwater Level	334	m
Ground Level	336.11	m
Min. Depression Invert	335.8	m
Max. Depression Obvert	336.1	m
Design Depression Invert	335.8	m
Design Depression Obvert	336.1	m
Depression Height	0.3	m
Provided Bottom Area, A	290	m^2
Depression Volume	87	m^3

Orifice Equation

$$Q_{orif} = C_d A \sqrt{2gh}$$

Q_{orif}	= Orifice discharge rate	m^3/s
C_d	= Orifice discharge coeff.	-
A	= Flow Area	m^2
h	= head above the centreline of orifice	m

Soil Infiltration Rate Assessment, Prepared by GHD Hydrogeological Assessment, dated January 31, 2025

Percolation rate	7 min/cm
Infiltration rate	45 mm/hr
Hydraulic Conductiviy	32 mm/hr

LID SWM Guide Table C1

Hydraulic Conductivity (cm/s)	Percolation Time (min/cm)	Infiltration Rate (mm/hr)
0.1	2	300
0.01	3	150
0.001	8	75
0.0001	12	50
0.00001	20	30
0.000001	50	12

5-year Event

Drainage Area	0.32	ha
Runoff Coefficient	0.95	-
Rainfall Intensity	104.9	mm/hr
5-year Flow	0.09	m^3/s

Rainfall Depth to be Infiltrated	25	mm
Runoff volume to be Infiltrated	80	m^3
Infiltration Rate of Bedding, P	45	mm/hr
Porosity of the Storage Media	0.4	-
Retention Time	48	hours
Required Bottom Area of the Depression	92.6	m^2

Provided Bottom Area is larger than the Required Bottom Area

CALCULATIONS

Prepared by F.T.
Reviewed by M.L.

Project Name	Estill Innovation Community
Project No.	12618927
Subject	SWMF Length to Width Ratio

SWM Pond Characteristics

Description	Value	
Provided Permanent Pool Volume (m^3)	4881	
Required Permanent Pool Volume (m^3)	3855	**(Drainage area to Pond of 22.44 ha, 66% Imp)**

Length to Width Ratio Calculation

Description	Forebay	Overall Cell
Length (m)	40.0	120.0
Width (m)	18.0	40.0
Length:Width Ratio	2.22 : 1	3 : 1
MOE Minimum Length Width Ratio	2 : 1	3 : 1

The design length:width Raio meets MOE's Guidelines

CALCULATIONS

Prepared by F.T.
Reviewed by M.L.

Project Name	Estill Innovation Community
Project No.	12618927
Subject	SWMF Stage-Storage Summary Table

Accumulative Volume of the SWM Pond

Description	Elevation (m)	Depth to Bottom of Pond (m)	Depth to Bottom of Forebay (m)	Area (m^2)			Volume (m^3)		
				Forebay	Main Cell	TOTAL	Forebay	Main Cell	TOTAL
Bottom of Pond	**328.67**	**0.00**	-1.00	**0**	**28**	**28**	**0**	**0**	**0**
	328.70	0.03	-0.97	0	437	437	0	11	11
	328.80	0.13	-0.87	0	482	482	0	57	57
	328.90	0.23	-0.77	0	529	529	0	107	107
	329.00	0.33	-0.67	0	577	577	0	163	163
	329.10	0.43	-0.57	0	627	627	0	223	223
	329.20	0.53	-0.47	0	678	678	0	288	288
	329.30	0.63	-0.37	0	730	730	0	358	358
	329.40	0.73	-0.27	0	784	784	0	434	434
	329.50	0.83	-0.17	0	839	839	0	515	515
	329.60	0.93	-0.07	0	895	895	0	602	602
Bottom of Sediment Forebay	**329.67**	**1.00**	0.00	**19**	936	**955**	**0**	**666**	666
	329.70	1.03	0.03	63	953	1,016	2	694	696
	329.80	1.13	0.13	90	1,013	1,103	9	793	802
	329.90	1.23	0.23	120	1,074	1,194	20	897	916
	330.00	1.33	0.33	**153**	1,136	1,289	33	1,007	1,041
	330.10	1.43	0.43	188	1,199	1,388	50	1,124	1,174
	330.20	1.53	0.53	227	1,264	1,491	71	1,247	1,318
	330.30	1.63	0.63	268	1,331	1,599	96	1,377	1,473
	330.40	1.73	0.73	312	1,399	1,710	125	1,513	1,638
	330.50	1.83	0.83	359	1,468	1,826	158	1,657	1,815
	330.60	1.93	0.93	408	1,538	1,947	197	1,807	2,004
	330.70	2.03	1.03	460	1,610	2,071	240	1,964	2,204
	330.80	2.13	1.13	516	1,684	2,199	289	2,129	2,418
	330.90	2.23	1.23	574	1,759	2,332	343	2,301	2,644
	331.00	2.33	1.33	634	1,835	2,469	404	2,481	2,884
	331.10	2.43	1.43	698	1,912	2,610	470	2,668	3,138
	331.20	2.53	1.53	764	1,991	2,755	543	2,863	3,407
	331.30	2.63	1.63	833	2,072	2,905	623	3,067	3,690
	331.40	2.73	1.73	905	2,154	3,058	710	3,278	3,988
	331.50	2.83	1.83	979	2,237	3,216	804	3,497	4,301
	331.60	2.93	1.93	1,083	2,362	3,445	907	3,727	4,634
Permanent Pool	331.67	3.00	2.00	1,164	2,460	**3,624**	985	3,896	4,881
	331.70	3.03	2.03	3,803.27		3,803	96.00		96
	331.80	3.13	2.13	4,176.80		4,177	495.07		495
	331.90	3.23	2.23	4,542.63		4,543	931.10		931
	332.00	3.33	2.33	4,900.72		4,901	1,403.36		1,403
	332.10	3.43	2.43	5,248.49		5,248	1,910.86		1,911
	332.20	3.53	2.53	5,596.74		5,597	2,453.08		2,453
	332.30	3.63	2.63	5,948.86		5,949	3,030.32		3,030
	332.40	3.73	2.73	6,304.54		6,305	3,642.95		3,643
	332.50	3.83	2.83	6,663.96		6,664	4,291.34		4,291
	332.60	3.93	2.93	7,027.06		7,027	4,975.85		4,976
	332.70	4.03	3.03	7,394.95		7,395	5,696.88		5,697
	332.80	4.13	3.13	7,766.89		7,767	6,454.90		6,455
Emergency Spillway	332.86	4.19	3.19	7,990.90		**7,991**	6,927.63		6,928
	332.90	4.23	3.23	8,140.72		8,141	7,250.26		7,250
	333.00	4.33	3.33	8,515.55		8,516	8,083.09		8,083
	333.10	4.43	3.43	8,884.52		8,885	8,953.19		8,953
Top of Pond	333.12	4.45	3.45	1,650.91		**1,651**	9,086.81		9,087

Storage Summary Table

Description	Start Elevation (m)	End Elevation (m)
Permanent Pool	328.67	331.67
Active Storage	331.67	332.86
Freeboard	332.86	333.12

Description	Value	Notes
Site Area to Pond (ha)	22.44	
Composite Runoff Coefficient	0.66	
Site Imperivousness	66%	
Required Permanent Pool (m^3/ha)	172	
Total Required Permanent Pool (m^3)	3,855	MOE's Requirement
Required Extended Detention (m^3/ha)	40	
Total Required Extended Detention (m^3)	898	

65 Sunray St.
Whitby, Ontario
L1N 8Y3
905-686-6402

10 MINUTE ENTRY TIME

5yr-Design Storm

TOWNSHIP OF PUSLINCH
STORM SEWER DESIGN SHEET - 5YR

Project Name: Estill Innovation Community
Project No. 12618927

PREPARED BY: F. TSANG
CHECKED BY: M. LI
DATE: January 2025

5-yr IDF Parameters	CITY OF GUELPH
A	980.848
B	6.013
C	0.806

Drainage Area	From MH	To MH	A Area (ha)	Accum. Area (ha)	R Runoff Coeff.	2.78AR	Accum. 2.78AR	Time of Conc. (min)	Rainfall (mm/hr)	Q Peak Flow (m3/s)	Pipe Diameter (mm)	Design Slope (%)	Length (m)	Capacity (m3/s)	Capacity at Critical Slope (m3/s)	Capacity Problem	Velocity (m/s)	Time in Section (min)	Total Time (min)	Remarks	5 YR Qact Qcap
206a, 206b	MH44	MH21	0.46	0.46	0.65	0.0008	0.0008	10.00	104.91	0.087	375	1.00	72.4	0.175	0.204	No	1.59	0.76	10.76		50%
219a, 219b, 220a, 220b, 221	MH21	MH20	0.68	1.14	0.65	0.0012	0.0021	10.76	101.06	0.208	525	0.50	100.0	0.304	0.473	No	1.40	1.19	11.95		68%
222, 223, 224	MH20	MH19	0.59	1.73	0.73	0.0012	0.0033	11.95	95.64	0.311	600	0.50	100.0	0.434	0.660	No	1.54	1.09	13.03		72%
	MH19	MH18	0.00	1.73	0.00		0.0033	13.03	91.22	0.297	750	0.50	51.8	0.787	1.153	No	1.78	0.48	13.52		38%
227, 228, 229a, 229b	MH18	MH6	0.52	2.25	0.90	0.0013	0.0046	13.52	89.39	0.407	750	0.50	77.5	0.787	1.153	No	1.78	0.72	14.24		52%
201	CBMH15	CBMH14	1.49	1.49	0.25	0.0010	0.0010	10.00	104.91	0.109	375	1.00	100.0	0.175	0.204	No	1.59	1.05	11.05		62%
204	CBMH14	CBMH13	0.25	1.74	0.25	0.0002	0.0012	11.05	99.67	0.121	450	0.50	54.7	0.202	0.321	No	1.27	0.72	11.77		60%
202, 203	LID#3	CBMH13		Area = 1.44 ha	0.90			10.00	104.91	0.172										1.32 ha + 0.12 ha (LID#3); Controlled Flow = 0.172 cms	
205a, 205b	CBMH13	MH12	0.16	1.90	0.90	0.0004	0.0016	11.77	96.41	0.327	675	0.50	50.5	0.594	0.886	No	1.66	0.51	12.28		55%
205d,209a	MH12	MH11	0.26	2.16	0.89	0.0006	0.0023	12.28	94.25	0.384	675	0.50	10.3	0.594	0.886	No	1.66	0.10	12.38		65%
	MH11	MH10	0.00	2.16	0.00		0.0023	12.38	93.82	0.383	675	0.50	30.4	0.594	0.886	No	1.66	0.31	12.68		64%
205c, 208a, 210a	MH10	MH42	0.35	2.51	0.90	0.0009	0.0031	12.68	92.59	0.461	750	0.50	30.4	0.787	1.153	No	1.78	0.28	12.97		59%
207, 208b, 209b,210b	MH42	MH9	1.10	3.61	0.47	0.0014	0.0045	12.97	91.47	0.588	825	0.50	62.3	1.015	1.463	No	1.90	0.55	13.52		58%
209c	MH16	MH9	0.17	0.17	0.65	0.0003	0.0003	12.97	91.47	0.200	375	1.00	54.2	0.175	0.204	Yes	1.59	0.57	13.54		114%
208c, 208d, 211, 212	MH9	MH8	0.69	4.47	0.91	0.0018	0.0066	13.52	89.40	0.763	900	0.50	62.4	1.280	1.819	No	2.01	0.52	14.03		60%
209d	MH17	MH8	0.11	0.11	0.65	0.0002	0.0002	10.00	104.91	0.021	525	1.00	85.4	0.430	0.473	No	1.99	0.72	10.72		5%
217, 218	LID#2	MH8		Area = 1.22 ha	0.90			10.00	104.91	0.172										0.58 + 0.64 ha (LID#2); Controlled Flow = 0.172 cms	
216a, 216b	MH8	MH7	0.08	4.66	0.90	0.0002	0.0070	14.03	87.53	0.957	900	0.50	50.6	1.280	1.819	No	2.01	0.42	14.45		75%
216c, 216d, 216e, 216f, 216g, 226	MH7	MH6	1.01	5.67	0.90	0.0025	0.0095	14.45	86.09	1.165	975	0.50	100.0	1.585	2.221	No	2.12	0.79	15.24		73%
236, 237, 238, 239	LID#1A	MH6		Area = 1.70 ha	0.90			10.00	104.91	0.172										0.47 + 0.43 + 0.41 + 0.39 ha (LID #1A); Controlled Flow = 0.172 cms	
230a, 230b	MH6	MH5	0.12	8.04	0.90	0.0003	0.0144	15.24	83.51	1.718	1200	0.50	76.7	2.757	3.733	No	2.44	0.52	15.76		62%
231a, 231b , 232a, 232b, 233a, 233b	MH5	MH4	0.34	8.38	0.90	0.0009	0.0152	15.76	81.89	1.764	1200	0.50	100.0	2.757	3.733	No	2.44	0.68	16.44		64%
234a, 234b, 248a, 248b	MH4	MH3	0.27	8.65	0.90	0.0007	0.0159	16.44	79.87	1.787	1200	0.50	100.0	2.757	3.733	No	2.44	0.68	17.13		65%
235	LID#1B	MH3		Area = 0.89 ha	0.90			10.00	104.91	0.172										0.89 ha (LID#1B); Controlled Flow = 0.172 cms	
	MH3	MH2	0.00	8.65	0.00		0.0159	17.13	77.97	1.929	1200	0.50	20.6	2.757	3.733	No	2.44	0.14	17.27		70%
245	CBMH45	CBMH28	0.39	0.39	0.25	0.0003	0.0003	10.00	104.91	0.028	300	1.00	55.9	0.097	0.117	No	1.37	0.68	10.68		29%
247	CBMH28	MH25	0.19	0.58	0.25	0.0001	0.0004	10.68	101.44	0.041	300	0.50	31.1	0.068	0.117	No	0.97	0.54	11.22		60%
Upper Pathway																					
240a, 240b, 241a, 241b	MH43	MH22	0.37	0.37	0.69	0.0007	0.0007	10.00	104.91	0.074	375	1.00	60.7	0.175	0.204	No	1.59	0.64	10.64		42%
242a, 242b, 243a, 243b	MH22	MH23	0.37	0.74	0.55	0.0006	0.0013	10.64	101.66	0.129	375	0.50	100.0	0.124	0.204	Yes	1.12	1.48	12.12		104%
244a, 244b	MH23	MH27	0.45	1.19	0.70	0.0009	0.0021	12.12	94.89	0.204	375	0.50	100.0	0.124	0.204	Yes	1.12	1.48	13.61		164%
	MH27	MH26	0.00	1.19	0.00		0.0021	13.61	89.06	0.191	375	0.50	28.1	0.124	0.204	Yes	1.12	0.42	14.02		154%
246	MH26	MH25	0.76	1.95	0.90	0.0019	0.0040	14.02	87.56	0.354	600	0.50	79.8	0.434	0.660	No	1.54	0.87	14.89		82%
	MH25	MH24	0.00	2.53	0.90		0.0045	14.89	84.63	0.377	600	0.50	18.2	0.434	0.660	No	1.54	0.20	15.09		87%
	MH24	MH2	0.00	2.53	0.90		0.0045	15.09	83.99	0.374	600	0.50	31.6	0.434	0.660	No	1.54	0.34	15.43		86%
248c, 248d	MH2	MH1	0.28	11.46	0.90	0.0007	0.0211	17.27	77.58	2.322	1350	0.50	17.8	3.774	5.011	No	2.64	0.11	17.38		62%
	MH1	SWM Pond	0.00	11.46	0.50		0.0211	17.38	77.28	2.316	1350	1.00	32.2	5.337	5.011	No	3.73	0.14	17.53		46%
213, 214, 215, 257, 258, 259, 260, 253, 252b, 252c, 252d, 261, 262, 263	MH32	MH31	4.65	4.65	0.27	0.0035	0.0035	10.00	104.91	0.367	600	0.50	100.0	0.434	0.660	No	1.54	1.09	11.09		85%
250c, 250d, 250e, 250f	MH31	MH30	0.25	4.90	0.83	0.0006	0.0041	11.09	99.50	0.406	675	0.50	62.2	0.594	0.886	No	1.66	0.62	11.71		68%
250a, 250b	MH30	MH29	0.27	5.17	0.39	0.0003	0.0044	11.71	96.67	0.423	675	0.50	28.7	0.594	0.886	No	1.66	0.29	12.00		71%

65 Sunray St.
Whitby, Ontario
L1N 8Y3
905-686-6402

10 MINUTE ENTRY TIME

5yr-Design Storm

TOWNSHIP OF PUSLINCH
STORM SEWER DESIGN SHEET - 5YR

Project Name: **Estill Innovation Community**
Project No. **12618927**

PREPARED BY: F. TSANG
CHECKED BY: M. LI
DATE: January 2025

5-yr IDF Parameters	CITY OF GUELPH
A	980.848
B	6.013
C	0.806

Drainage Area	From MH	To MH	A Area (ha)	Accum. Area (ha)	R Runoff Coeff.	2.78AR	Accum. 2.78AR	Time of Conc. (min)	Rainfall (mm/hr)	Q Peak Flow (m3/s)	Pipe Diameter (mm)	Design Slope (%)	Length (m)	Capacity (m3/s)	Capacity at Critical Slope (m3/s)	Capacity Problem	Velocity (m/s)	Time in Section (min)	Total Time (min)	Remarks	5 YR Qact Qcap
	MH29	SWM Pond	0.00	5.17	0.00		0.0044	12.00	95.42	0.417	675	1.00	30.4	0.841	0.886	No	2.35	0.22	12.21		50%
255, 256	LID#5	Wetland		Area = 0.43 ha	0.49			10.00	104.91	0.172											
251, 252a	LID#6	Wetland		Area = 0.17 ha	0.40			10.00	104.91	0.048											
249		SWM Pond	1.09	LID#1A	1.70	LID#5	0.4300														
254		Wetland	1.90	LID#1B	0.89	LID#6	0.1700														
		LID Total	5.85	LID#2	1.22																
		Total Area	25.47	LID#3	1.44																

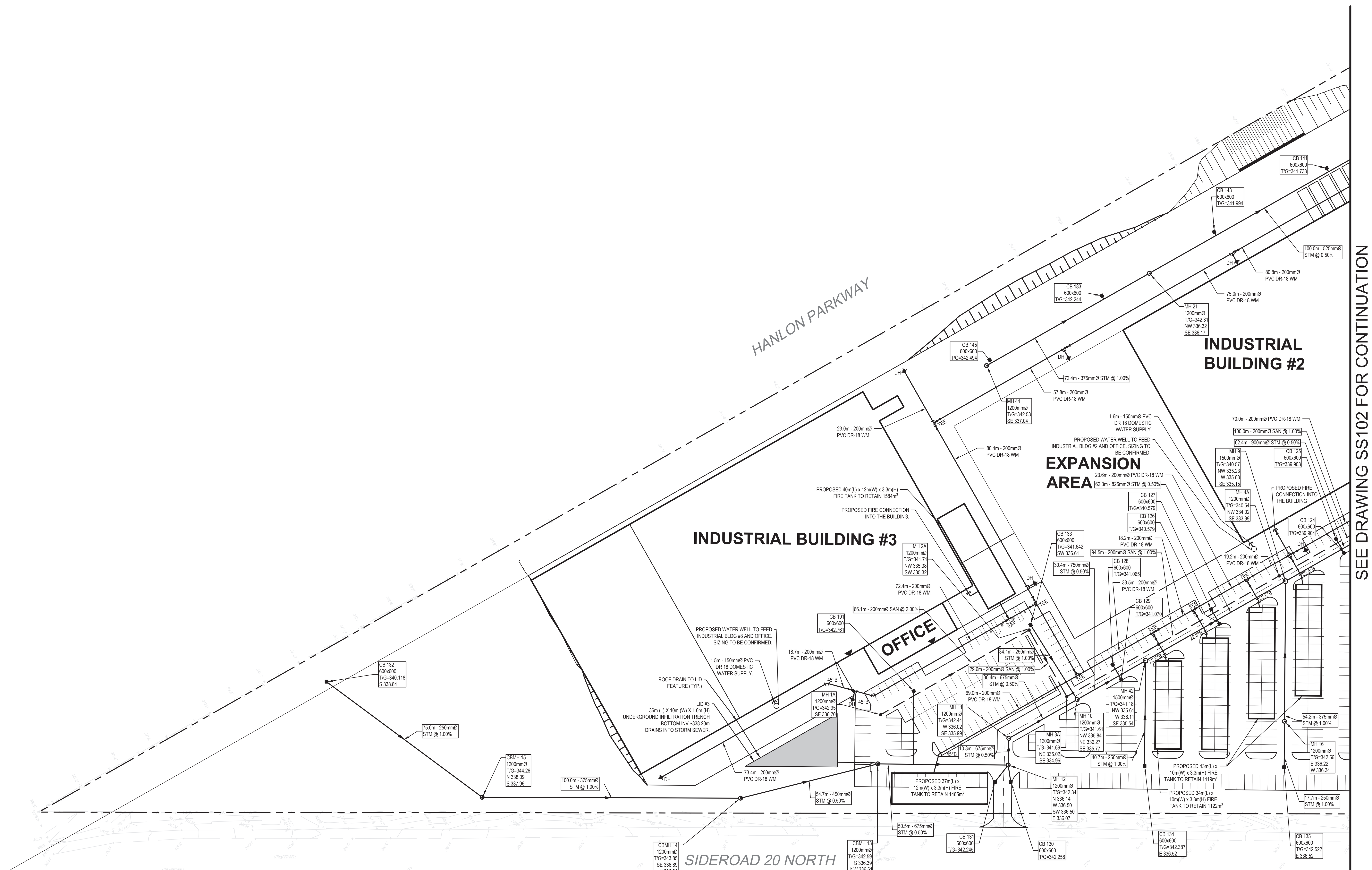
Date	Submission	
FEB 2025	Issued For OPA ZBA	

Appendix B

Engineering drawings

LEGEND

- DENOTES PROPOSED SANITARY MANHOLE
- DENOTES PROPOSED STORM MANOLE
- DENOTES PROPOSED CATCHBASIN
- DENOTES PROPOSED STORM SEWER
- DENOTES PROPOSED SANITARY SEWER
- DENOTES PROPOSED WATERMAIN
- DENOTES PROPOSED DRY HYDRANT
- DENOTES PROPOSED WATER WELL
- DENOTES PROPOSED WATER VALVE



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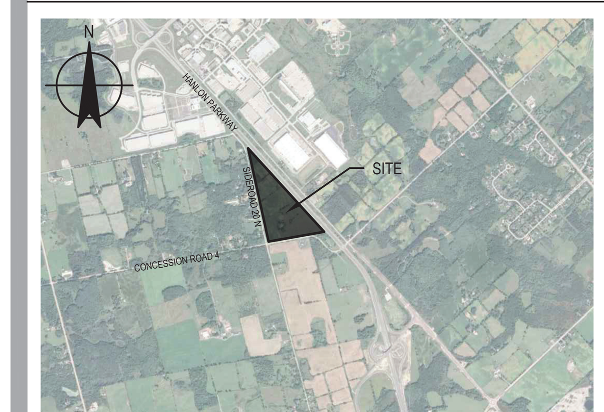


KEY PLAN
N.T.S

[redacted]

No.	Issue	Checked	Approved	Date
1	ISSUED FOR OPA ZBA	J.P.	M.M.	2025.02.07

Author	C.SUTCLIFFE	Designer	C.SUTCLIFFE
Drafting Check	C.SUTCLIFFE	Design Check	S.STARCEVIC
Project Manager	M.MIKHAIL	Project Director	M.MIKHAIL

Client
PUSLINCH DEVELOPMENT GP INC.

Project
ESTILL INNOVATION HUB PROJECT SUPPORT

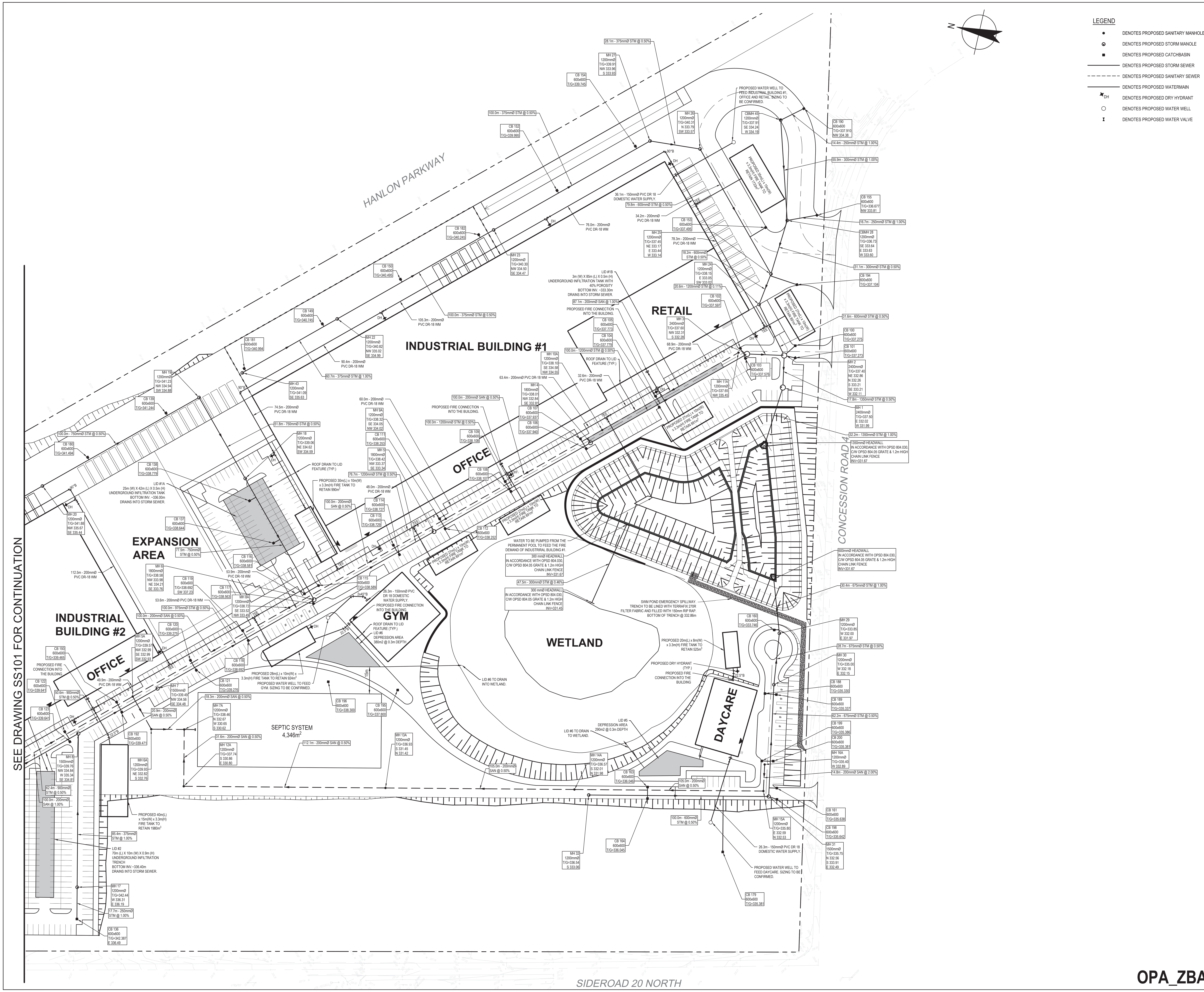
Date: 2024-12-04
Scale: 1:750
Project No. 12618927

Title
SITE SERVICING PLAN #1

Size: ARCH E1

OPA_ZBA

Sheet No. SS101
Sheet 1 of 7



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Author C.SUTCLIFFE | Designer C.SUTCLIFFE
Drafting Check C.SUTCLIFFE | Design Check S.STARCEVIC
Project Manager M.MIKHAIL | Project Director M.MIKHAIL

Client
PUSLINCH DEVELOPMENT GP INC.

Project
ESTILL INNOVATION HUB PROJECT SUPPORT

Date 2024-12-04 | Scale 1:750

Project No. 12618927

Title
SITE SERVICING PLAN #2

Size ARCH E1

Sheet No. SS102 | Sheet 2 of 7

LEGEND

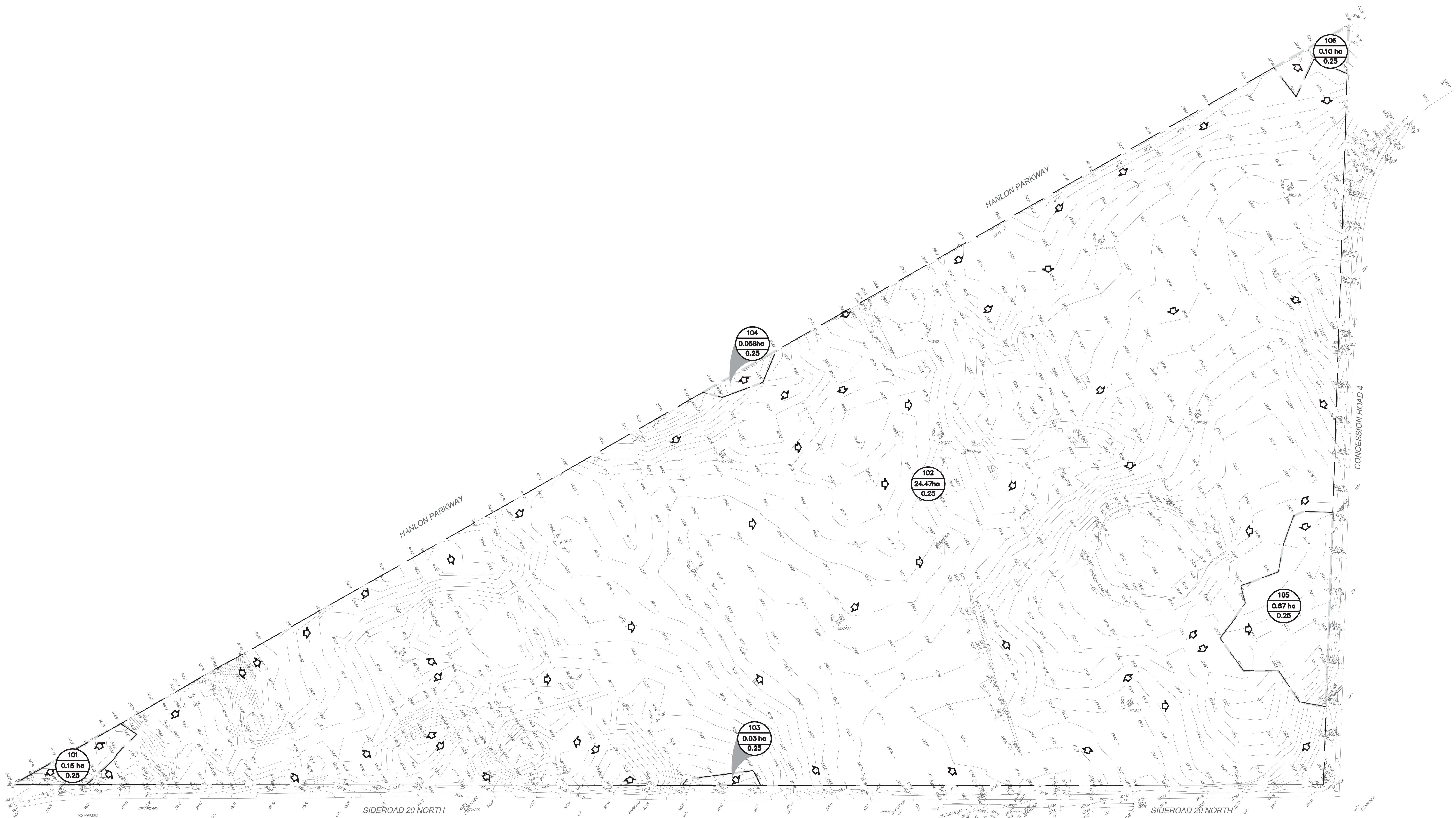
STORM WATER DRAINAGE

300 — AREA NUMBER
0.23 ha — AREA IN HECTARES
0.90 — RUNOFF COEFFICIENT

DRAINAGE AREA BOUNDARY

EXTERNAL DRAINAGE AREA BOUNDARY

OVERLAND FLOW



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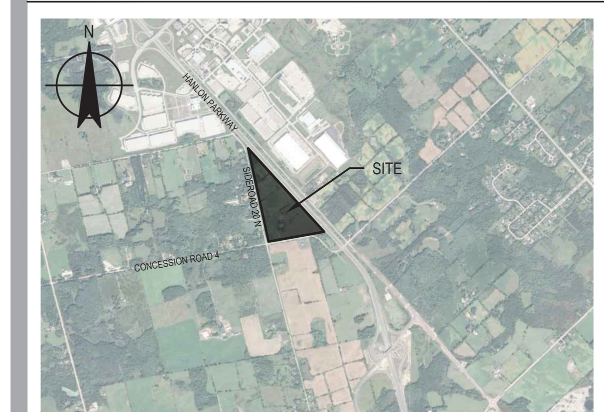


KEY PLAN
N.T.S

[redacted]

No.	Issue	Checked	Approved	Date
1	ISSUED FOR OPA ZBA	M.L.	M.M.	2025.02.07

Author	C.SUTCLIFFE	Designer	F.TSANG
Drafting Check	C.SUTCLIFFE	Design Check	M.LI
Project Manager	M.MIKHAIL	Project Director	M.MIKHAIL

Client
PUSLINCH DEVELOPMENT GP INC.

Project
ESTILL INNOVATION HUB PROJECT SUPPORT

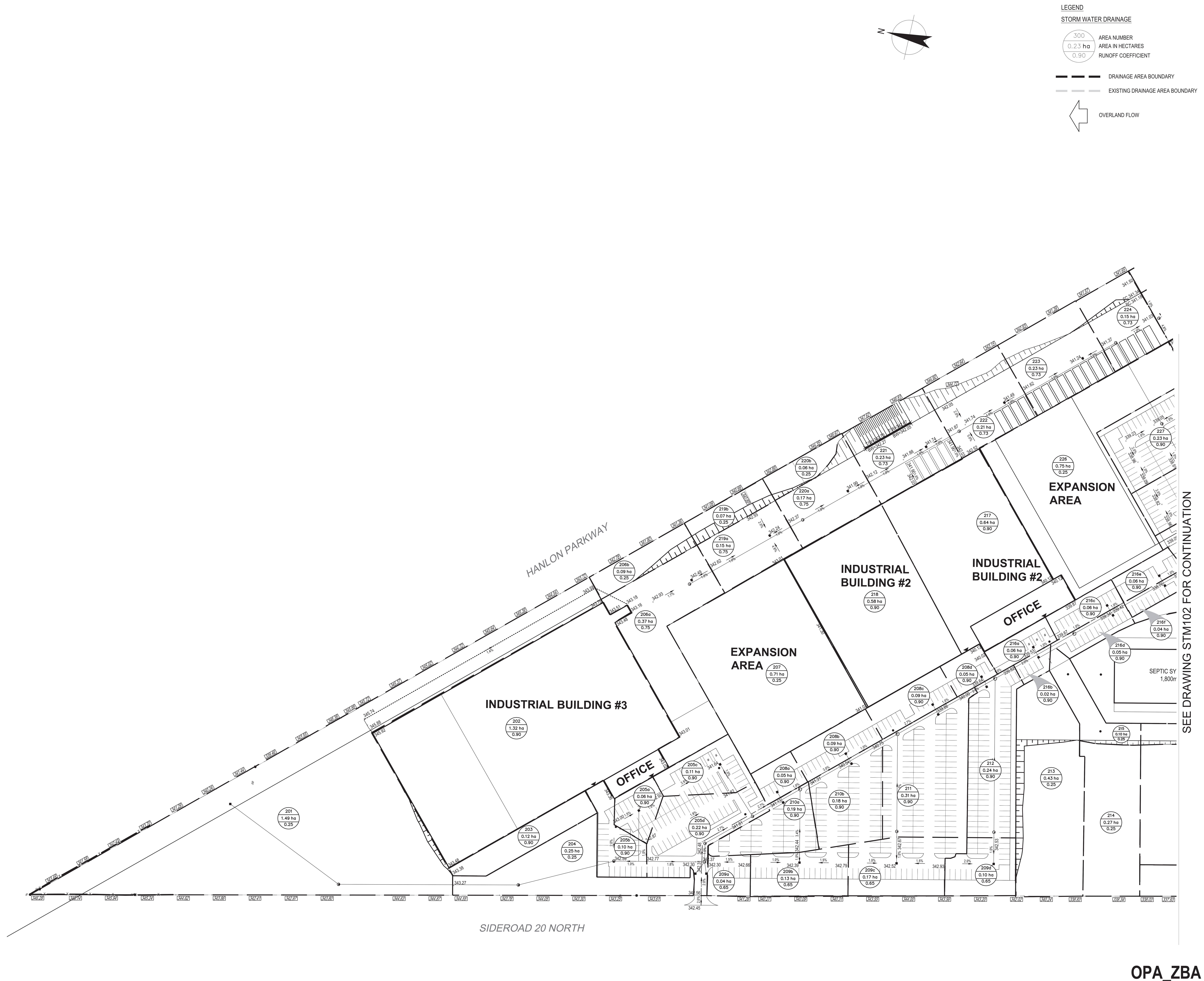
Date: 2024-12-04
Scale: 1:1250
Project No.: 12618927

Title
EXISTING STORM DRAINAGE AREA PLAN

Size: ARCH E1

OPA_ZBA

Sheet No. EX STM101
Sheet 5 of 7



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No.	Issue	Checked	Approved	Date
1	ISSUED FOR OPA ZBA	M.L.	M.M.	2025.02.07

Author	C.SUTCLIFFE	Designer	F.TSANG
Drafting Check	C.SUTCLIFFE	Design Check	M.LI
Project Manager	M.MIKHAIL	Project Director	M.MIKHAIL

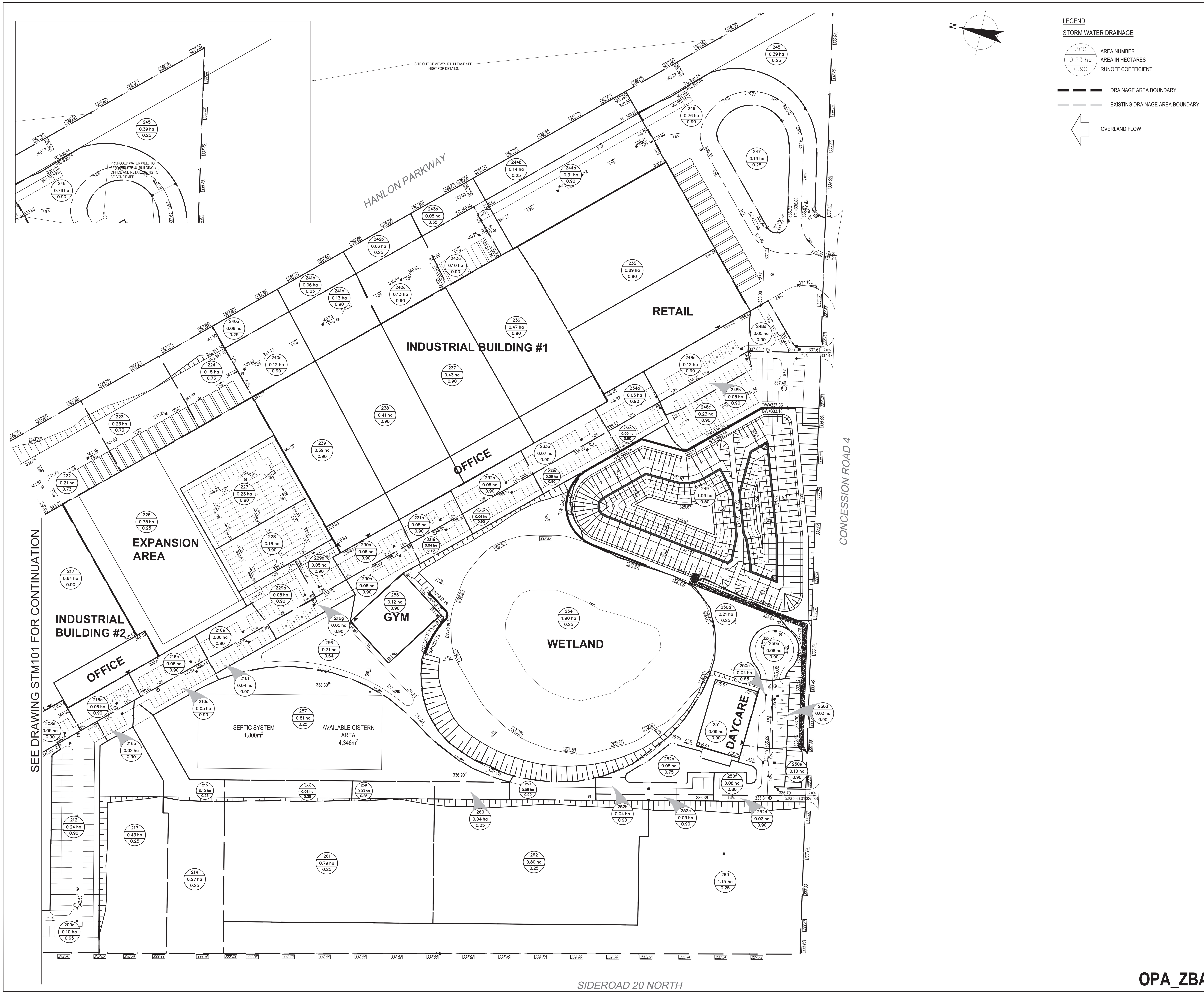
Client
PUSLINCH DEVELOPMENT GP INC.

Project
ESTILL INNOVATION HUB PROJECT SUPPORT

Date: 2024-12-04
Scale: 1:750
Project No.: 12618927

Title
STORM DRAINAGE AREA PLAN #1

Size: ARCH E1
Sheet No.: STM101
Sheet 6 of 7



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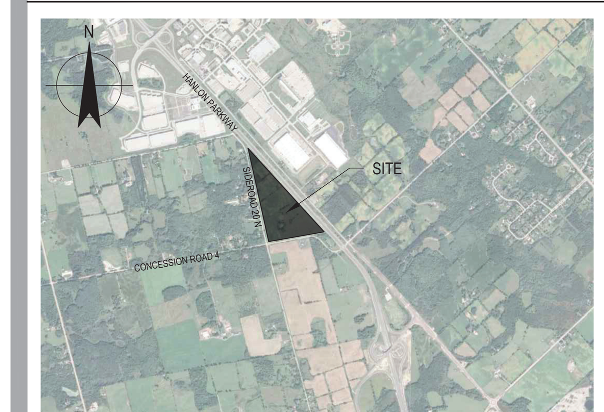

KEY PLAN
N.T.S

[redacted]

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Author	C.SUTCLIFFE	Designer	F.TSANG
Drafting Check	C.SUTCLIFFE	Design Check	M.LI
Project Manager	M.MIKHAIL	Project Director	M.MIKHAIL

Client
PUSLINCH DEVELOPMENT GP INC.

Project
ESTILL INNOVATION HUB PROJECT SUPPORT

Date 2024-12-04 | Scale 1:750

Project No. 12618927

Title
STORM DRAINAGE AREA PLAN #2

Size ARCH E1

Sheet No. STM102 | Sheet 7 of 7

Appendix C

PCSWMM model output

7/02/2025

MODELLING

Prepared by F.T.
Reviewed by M.L.

Project Name	Estill Innovation Community
Project No.	12618927
Subject	PCSWMM Model Schematic (Existing Conditions)

PCSWMM Model Schematic

```
EPA STORM WATER MANAGEMENT MODEL - VERSION 5.2 (Build 5.2.4)
------------------------------------------------------------


*************
Element Count
*************
Number of rain gages ...... 6
Number of subcatchments ... 6
Number of nodes ........... 6
Number of links ........... 0
Number of pollutants ...... 0
Number of land uses ....... 0


****************
Raingage Summary
****************
                                                    Data       Recording
Name                 Data Source                    Type       Interval
------------------------------------------------------------------------
Chicago_3h_100Year_Guelph Chicago_3h_100Year_Guelph      INTENSITY    5 min.
Chicago_3h_10Year_Guelph Chicago_3h_10Year_Guelph       INTENSITY    5 min.
Chicago_3h_25Year_Guelph Chicago_3h_25Year_Guelph       INTENSITY    5 min.
Chicago_3h_2Year_Guelph Chicago_3h_2Year_Guelph        INTENSITY    5 min.
Chicago_3h_50Year_Guelph Chicago_3h_50Year_Guelph       INTENSITY    5 min.
Chicago_3h_5Year_Guelph Chicago_3h_5Year_Guelph        INTENSITY    5 min.


********************
Subcatchment Summary
********************
Name                       Area     Width   %Imperv    %Slope Rain Gage            Outlet
-----------------------------------------------------------------------------------------------------------
101                        0.15     17.96     25.00    2.0000 Chicago_3h_100Year_Guelph EXT_01
102                       24.47    276.40     25.00    2.0000 Chicago_3h_100Year_Guelph Wetland
103                        0.03      6.03     25.00    2.0000 Chicago_3h_100Year_Guelph EXT_02
104                        0.06     13.77     25.00    2.0000 Chicago_3h_100Year_Guelph EXT_03
105                        0.67     50.76     25.00    2.0000 Chicago_3h_100Year_Guelph EXT_04
106                        0.10     19.24     25.00    2.0000 Chicago_3h_100Year_Guelph EXT_05


************
Node Summary
************
                                         Invert      Max.    Ponded    External
Name                 Type                 Elev.     Depth      Area    Inflow
-------------------------------------------------------------------------------
EXT_01               OUTFALL             341.40      0.00       0.0
EXT_02               OUTFALL             342.72      0.00       0.0
EXT_03               OUTFALL             342.41      0.00       0.0
EXT_04               OUTFALL             332.57      0.00       0.0
EXT_05               OUTFALL             339.45      0.00       0.0
Wetland              OUTFALL             331.45      0.00       0.0


****************
Analysis Options
****************
Flow Units ............... CMS
Process Models:
  Rainfall/Runoff ........ YES
  RDII ................... NO
  Snowmelt ............... NO
  Groundwater ............ NO
  Flow Routing ........... NO
  Water Quality .......... NO
Infiltration Method ...... HORTON
Surcharge Method ......... EXTRAN
Starting Date ............ 01/27/2025 00:00:00
Ending Date .............. 01/28/2025 00:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:01:00
Wet Time Step ............ 00:05:00
Dry Time Step ............ 00:05:00


**************************        Volume         Depth
Runoff Quantity Continuity     hectare-m            mm
**************************     ---------       -------
Total Precipitation ......         1.816        71.260
Evaporation Loss .........         0.000         0.000
Infiltration Loss ........         1.027        40.301
Surface Runoff ...........         0.792        31.083
Final Storage ............         0.007         0.286
Continuity Error (%) .....        -0.575


**************************        Volume        Volume
Flow Routing Continuity        hectare-m      10^6 ltr
**************************     ---------     ---------
Dry Weather Inflow .......         0.000         0.000
Wet Weather Inflow .......         0.792         7.919
Groundwater Inflow .......         0.000         0.000
RDII Inflow ..............         0.000         0.000
External Inflow ..........         0.000         0.000
External Outflow .........         0.792         7.919
Flooding Loss ............         0.000         0.000
Evaporation Loss .........         0.000         0.000
Exfiltration Loss ........         0.000         0.000
Initial Stored Volume ....         0.000         0.000
Final Stored Volume ......         0.000         0.000
Continuity Error (%) .....         0.000


***************************
Subcatchment Runoff Summary
***************************

  ---------------------------------------------------------------------------------------------------
-----------------------------
                            Total       Total       Total       Total      Imperv        Perv       Total
Total      Peak  Runoff
                           Precip       Runon        Evap       Infil      Runoff      Runoff      Runoff
Runoff   Runoff   Coeff
  Subcatchment                 mm          mm          mm          mm          mm          mm          mm
10^6 ltr      CMS
  ---------------------------------------------------------------------------------------------------
-----------------------------
  101                       71.26        0.00        0.00       33.74       17.69       20.89       38.58
0.06     0.06   0.541
  102                       71.26        0.00        0.00       40.56       17.78       13.01       30.79
7.53     3.64   0.432
  103                       71.26        0.00        0.00       33.30       17.61       21.98       39.59
0.01     0.01   0.556
  104                       71.26        0.00        0.00       33.20       17.60       22.33       39.93
0.02     0.03   0.560
  105                       71.26        0.00        0.00       34.34       17.78       19.88       37.66
0.25     0.22   0.529
  106                       71.26        0.00        0.00       33.33       17.62       21.88       39.50
0.04     0.05   0.554


  Analysis begun on:  Tue Jan 28 11:42:52 2025
  Analysis ended on:  Tue Jan 28 11:42:52 2025
  Total elapsed time: < 1 sec
```

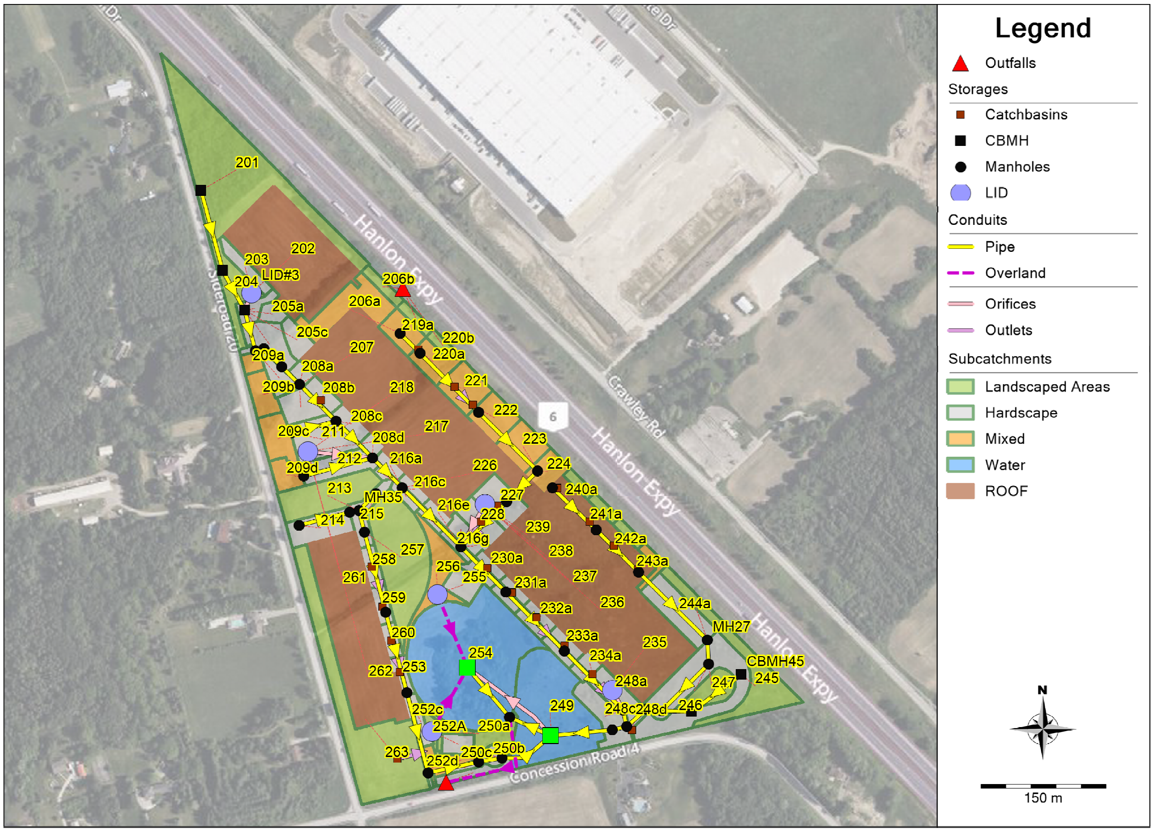
7/02/2025

MODELLING

Prepared by F.T.
Reviewed by M.L.

Project Name	Estill Innovation Community
Project No.	12618927
Subject	PCSWMM Model Schematic

PCSWMM Model Schematic



EPA STORM WATER MANAGEMENT MODEL - VERSION 5.2 (Build 5.2.4)

Proposed Drainage Areas for Estill Innovation Community
LID measures
Pipe Changes (250204)

****
Element Count
****
Number of rain gages 7
Number of subcatchments ... 103
Number of nodes 74
Number of links 73
Number of pollutants 1
Number of land uses 3

****
Pollutant Summary
****

Name	Units	Ppt. Concen.	GW Concen.	Kdecay 1/days	CoPollutant
TSS	MG/L	0.00	0.00	0.00	

****
Landuse Summary
****

Name	Sweeping Interval	Maximum Removal	Last Swept
Landscape	0.00	0.00	0.00
Paved	0.00	0.00	0.00
Roof	0.00	0.00	0.00

****
Raingage Summary
****

Name	Data Source	Data Type	Recording Interval
25mm	25	INTENSITY	10 min.
Chicago_3h_100Year_Guelph	Chicago_3h_100Year_Guelph	INTENSITY	5 min.
Chicago_3h_10Year_Guelph	Chicago_3h_10Year_Guelph	INTENSITY	5 min.
Chicago_3h_25Year_Guelph	Chicago_3h_25Year_Guelph	INTENSITY	5 min.
Chicago_3h_2Year_Guelph	Chicago_3h_2Year_Guelph	INTENSITY	5 min.
Chicago_3h_50Year_Guelph	Chicago_3h_50Year_Guelph	INTENSITY	5 min.
Chicago_3h_5Year_Guelph	Chicago_3h_5Year_Guelph	INTENSITY	5 min.

****
Subcatchment Summary
****

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
201	1.49	83.66	0.00	1.0000	Chicago_3h_100Year_Guelph	CBMH15
202	1.32	93.14	100.00	1.0000	Chicago_3h_100Year_Guelph	LID#3
203	0.12	14.28	100.00	1.0000	Chicago_3h_100Year_Guelph	LID#3
204	0.25	90.52	0.00	1.0000	Chicago_3h_100Year_Guelph	CBMH14
205a	0.06	11.41	100.00	1.0000	Chicago_3h_100Year_Guelph	CBMH13
205b	0.10	19.02	100.00	1.0000	Chicago_3h_100Year_Guelph	CBMH13
205c	0.11	20.92	100.00	1.0000	Chicago_3h_100Year_Guelph	CBMH13
205d	0.22	41.84	100.00	1.0000	Chicago_3h_100Year_Guelph	CBMH13
206a	0.37	38.15	79.00	1.0000	Chicago_3h_100Year_Guelph	MH44
206b	0.09	9.28	0.00	1.0000	Chicago_3h_100Year_Guelph	OF1
207	0.71	77.73	100.00	1.0000	Chicago_3h_100Year_Guelph	MH42
208a	0.05	29.26	100.00	1.0000	Chicago_3h_100Year_Guelph	MH42
208b	0.09	52.66	100.00	1.0000	Chicago_3h_100Year_Guelph	CB126-127
208c	0.09	52.66	100.00	1.0000	Chicago_3h_100Year_Guelph	MH9
208d	0.05	29.26	100.00	1.0000	Chicago_3h_100Year_Guelph	MH8
209a	0.04	9.96	64.00	1.0000	Chicago_3h_100Year_Guelph	MH12
209b	0.13	24.72	64.00	1.0000	Chicago_3h_100Year_Guelph	MH42
209c	0.17	26.20	64.00	1.0000	Chicago_3h_100Year_Guelph	MH16
209d	0.10	39.25	64.00	1.0000	Chicago_3h_100Year_Guelph	MH17
210a	0.19	47.31	100.00	1.0000	Chicago_3h_100Year_Guelph	MH12
210b	0.18	34.22	100.00	1.0000	Chicago_3h_100Year_Guelph	MH42
211	0.31	47.78	100.00	1.0000	Chicago_3h_100Year_Guelph	MH16
212	0.24	94.19	100.00	1.0000	Chicago_3h_100Year_Guelph	MH17
213	0.43	120.19	0.00	1.0000	Chicago_3h_100Year_Guelph	MH35
214	0.27	91.94	100.00	1.0000	Chicago_3h_100Year_Guelph	MH38
215	0.10	60.66	100.00	1.0000	Chicago_3h_100Year_Guelph	MH36
216a	0.06	25.10	100.00	1.0000	Chicago_3h_100Year_Guelph	MH7
216b	0.02	8.37	100.00	1.0000	Chicago_3h_100Year_Guelph	MH7
216c	0.06	25.10	100.00	1.0000	Chicago_3h_100Year_Guelph	MH7
216d	0.05	20.92	100.00	1.0000	Chicago_3h_100Year_Guelph	MH7
216e	0.06	19.84	100.00	1.0000	Chicago_3h_100Year_Guelph	MH6
216f	0.04	13.23	100.00	1.0000	Chicago_3h_100Year_Guelph	MH6
216g	0.05	16.53	100.00	1.0000	Chicago_3h_100Year_Guelph	MH6
217	0.64	66.83	100.00	1.0000	Chicago_3h_100Year_Guelph	LID#2
218	0.58	63.72	100.00	1.0000	Chicago_3h_100Year_Guelph	LID#2
219a	0.15	34.73	79.00	1.0000	Chicago_3h_100Year_Guelph	MH44
219b	0.07	16.21	0.00	1.0000	Chicago_3h_100Year_Guelph	OF1
220a	0.17	38.83	79.00	1.0000	Chicago_3h_100Year_Guelph	CB145
220b	0.06	13.70	0.00	1.0000	Chicago_3h_100Year_Guelph	OF1
221	0.23	53.63	76.00	1.0000	Chicago_3h_100Year_Guelph	CB143
222	0.21	48.75	76.00	1.0000	Chicago_3h_100Year_Guelph	CB141
223	0.23	56.45	76.00	1.0000	Chicago_3h_100Year_Guelph	MH19
224	0.15	34.55	76.00	1.0000	Chicago_3h_100Year_Guelph	MH19
226	0.75	77.19	100.00	1.0000	Chicago_3h_100Year_Guelph	MH7
227	0.23	41.91	100.00	1.0000	Chicago_3h_100Year_Guelph	CB138
228	0.16	28.70	100.00	1.0000	Chicago_3h_100Year_Guelph	CB137
229a	0.08	26.45	100.00	1.0000	Chicago_3h_100Year_Guelph	MH6
229b	0.05	16.53	100.00	1.0000	Chicago_3h_100Year_Guelph	MH6
230a	0.06	21.25	100.00	1.0000	Chicago_3h_100Year_Guelph	CB113-114
230b	0.06	21.25	100.00	1.0000	Chicago_3h_100Year_Guelph	CB113-114
231a	0.05	19.68	100.00	1.0000	Chicago_3h_100Year_Guelph	CB111-112
231b	0.04	15.74	100.00	1.0000	Chicago_3h_100Year_Guelph	CB111-112
232a	0.06	24.02	100.00	1.0000	Chicago_3h_100Year_Guelph	CB108-109
232b	0.06	24.02	100.00	1.0000	Chicago_3h_100Year_Guelph	CB108-109
233a	0.07	27.13	100.00	1.0000	Chicago_3h_100Year_Guelph	CB106-107
233b	0.06	23.25	100.00	1.0000	Chicago_3h_100Year_Guelph	CB106-107
234a	0.05	16.63	100.00	1.0000	Chicago_3h_100Year_Guelph	CB104-105
234b	0.05	16.63	100.00	1.0000	Chicago_3h_100Year_Guelph	CB104-105
235	0.89	98.21	100.00	1.0000	Chicago_3h_100Year_Guelph	LID#1B
236	0.47	49.29	100.00	1.0000	Chicago_3h_100Year_Guelph	LID#1A
237	0.43	44.70	100.00	1.0000	Chicago_3h_100Year_Guelph	LID#1A
238	0.41	42.54	100.00	1.0000	Chicago_3h_100Year_Guelph	LID#1A
239	0.39	40.36	100.00	1.0000	Chicago_3h_100Year_Guelph	LID#1A
240a	0.12	27.91	100.00	1.0000	Chicago_3h_100Year_Guelph	CB181
240b	0.06	13.95	0.00	1.0000	Chicago_3h_100Year_Guelph	240a
241a	0.13	30.16	100.00	1.0000	Chicago_3h_100Year_Guelph	CB149
241b	0.06	13.92	0.00	1.0000	Chicago_3h_100Year_Guelph	241a
242a	0.13	30.69	100.00	1.0000	Chicago_3h_100Year_Guelph	CB150
242b	0.06	14.16	0.00	1.0000	Chicago_3h_100Year_Guelph	242a
243a	0.10	23.41	100.00	1.0000	Chicago_3h_100Year_Guelph	CB152
243b	0.08	18.73	21.00	1.0000	Chicago_3h_100Year_Guelph	243a
244a	0.31	32.35	100.00	1.0000	Chicago_3h_100Year_Guelph	MH27
244b	0.14	14.61	0.00	1.0000	Chicago_3h_100Year_Guelph	MH27
245	0.39	44.70	0.00	1.0000	Chicago_3h_100Year_Guelph	CBMH45
246	0.76	265.59	100.00	1.0000	Chicago_3h_100Year_Guelph	MH26
247	0.19	14.81	0.00	1.0000	Chicago_3h_100Year_Guelph	MH26
248a	0.12	26.03	100.00	1.0000	Chicago_3h_100Year_Guelph	MH3
248b	0.05	10.85	100.00	1.0000	Chicago_3h_100Year_Guelph	MH3
248c	0.23	49.89	100.00	1.0000	Chicago_3h_100Year_Guelph	MH3
248d	0.05	10.85	100.00	1.0000	Chicago_3h_100Year_Guelph	CB100-101
249	1.09	143.48	43.00	1.0000	Chicago_3h_100Year_Guelph	FB01
250a	0.21	29.79	0.00	1.0000	Chicago_3h_100Year_Guelph	LID#6
250b	0.06	11.60	100.00	1.0000	Chicago_3h_100Year_Guelph	MH29
250c	0.04	7.73	64.00	1.0000	Chicago_3h_100Year_Guelph	MH31
250d	0.03	5.80	100.00	1.0000	Chicago_3h_100Year_Guelph	MH30
250e	0.10	19.33	100.00	1.0000	Chicago_3h_100Year_Guelph	MH39
250f	0.08	15.47	86.00	1.0000	Chicago_3h_100Year_Guelph	MH31
251	0.09	39.92	100.00	1.0000	Chicago_3h_100Year_Guelph	LID#6
252A	0.08	11.35	0.00	1.0000	Chicago_3h_100Year_Guelph	LID#6
252b	0.05	7.09	100.00	1.0000	Chicago_3h_100Year_Guelph	MH32
252c	0.03	5.80	100.00	1.0000	Chicago_3h_100Year_Guelph	MH32
252d	0.02	3.87	100.00	1.0000	Chicago_3h_100Year_Guelph	MH31
253	0.05	29.33	100.00	1.0000	Chicago_3h_100Year_Guelph	CB165-166
254	1.90	143.88	0.00	1.0000	Chicago_3h_100Year_Guelph	Wetland
255	0.12	40.81	100.00	1.0000	Chicago_3h_100Year_Guelph	LID#5
256	0.31	29.83	63.00	1.0000	Chicago_3h_100Year_Guelph	LID#5
257	0.81	54.78	0.00	1.0000	Chicago_3h_100Year_Guelph	MH34
258	0.08	49.72	100.00	1.0000	Chicago_3h_100Year_Guelph	CB171-172
259	0.03	19.19	100.00	1.0000	Chicago_3h_100Year_Guelph	CB169-170
260	0.04	26.44	100.00	1.0000	Chicago_3h_100Year_Guelph	CB167-168
261	0.79	70.29	100.00	1.0000	Chicago_3h_100Year_Guelph	LID#2
262	0.80	74.17	100.00	1.0000	Chicago_3h_100Year_Guelph	LID#2
263	1.15	136.28	0.00	1.0000	Chicago_3h_100Year_Guelph	CB179

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Node Summary
****

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
MH39	OUTFALL	332.85	0.30	0.0	
OF1	OUTFALL	333.00	0.00	0.0	
CB100-101	STORAGE	337.27	1.00	0.0	
CB104-105	STORAGE	337.77	1.00	0.0	
CB106-107	STORAGE	337.94	1.00	0.0	
CB108-109	STORAGE	338.11	1.00	0.0	
CB111-112	STORAGE	338.25	1.00	0.0	
CB113-114	STORAGE	338.73	1.00	0.0	
CB126-127	STORAGE	340.58	1.00	0.0	
CB137	STORAGE	338.64	1.00	0.0	
CB138	STORAGE	338.78	1.00	0.0	
CB141	STORAGE	341.74	1.00	0.0	

CB143	STORAGE	341.99	1.00	0.0
CB145	STORAGE	340.11	1.00	0.0
CB149	STORAGE	340.74	1.00	0.0
CB150	STORAGE	340.69	1.00	0.0
CB152	STORAGE	340.50	1.00	0.0
CB165-166	STORAGE	336.37	1.00	0.0
CB167-168	STORAGE	336.58	1.00	0.0
CB169-170	STORAGE	336.81	1.00	0.0
CB171-172	STORAGE	337.09	1.00	0.0
CB179	STORAGE	335.38	1.00	0.0
CB181	STORAGE	340.99	1.00	0.0
CBMH13	STORAGE	336.39	6.21	0.0
CBMH14	STORAGE	336.89	6.96	0.0
CBMH15	STORAGE	337.96	6.29	0.0
CBMH28	STORAGE	334.98	1.75	0.0
CBMH45	STORAGE	335.57	2.35	0.0
FB01	STORAGE	331.67	1.45	0.0
LID#1A	STORAGE	336.00	2.91	0.0
LID#1B	STORAGE	333.30	4.53	0.0
LID#2	STORAGE	336.40	6.20	0.0
LID#3	STORAGE	338.20	4.00	0.0
LID#5	STORAGE	335.00	1.30	0.0
LID#6	STORAGE	334.30	1.30	0.0
MH1	STORAGE	331.99	5.51	0.0
MH10	STORAGE	335.77	5.84	0.0
MH11	STORAGE	335.99	6.44	0.0
MH12	STORAGE	336.07	6.26	0.0
MH16	STORAGE	336.22	6.33	0.0
MH17	STORAGE	336.19	6.24	0.0
MH18	STORAGE	334.60	4.46	0.0
MH19	STORAGE	334.88	6.34	0.0
MH2	STORAGE	332.11	5.24	0.0
MH20	STORAGE	335.44	6.44	0.0
MH21	STORAGE	336.17	6.14	0.0
MH22	STORAGE	336.38	4.44	0.0
MH23	STORAGE	335.85	4.45	0.0
MH24	STORAGE	334.40	3.75	0.0
MH25	STORAGE	334.52	2.92	0.0
MH26	STORAGE	334.95	5.35	0.0
MH27	STORAGE	335.32	4.59	0.0
MH29	STORAGE	331.97	1.88	0.0
MH3	STORAGE	332.28	5.32	0.0
MH30	STORAGE	332.15	2.85	0.0
MH31	STORAGE	332.49	3.27	0.0
MH32	STORAGE	333.06	3.47	0.0
MH33	STORAGE	333.59	3.33	0.0
MH34	STORAGE	334.17	3.29	0.0
MH35	STORAGE	334.30	3.44	0.0
MH36	STORAGE	334.82	3.94	0.0
MH37	STORAGE	334.36	3.67	0.0
MH38	STORAGE	335.27	3.88	0.0
MH4	STORAGE	332.81	5.19	0.0
MH41	STORAGE	332.64	1.52	0.0
MH42	STORAGE	335.54	5.64	0.0
MH43	STORAGE	337.02	4.08	0.0
MH44	STORAGE	337.04	5.48	0.0
MH5	STORAGE	333.34	5.08	0.0
MH6	STORAGE	333.76	4.83	0.0
MH7	STORAGE	334.48	5.01	0.0
MH8	STORAGE	334.81	4.83	0.0
MH9	STORAGE	335.15	5.40	0.0
Wetland	STORAGE	331.55	1.51	0.0

****
Link Summary
****

Name	From Node	To Node	Type	Length	%Slope	Roughness
C1	MH44	MH21	CONDUIT	72.4	1.0004	0.0130
C10	CBMH45	CBMH28	CONDUIT	55.9	1.0007	0.0130
C11	CBMH28	MH25	CONDUIT	31.1	0.4990	0.0130
C3	MH23	MH27	CONDUIT	100.0	0.5000	0.0130
C5	LID#6	Wetland	CONDUIT	17.3	5.3835	0.1000
C6	LID#5	Wetland	CONDUIT	59.4	1.6837	0.1000
C7	Wetland	MH41	CONDUIT	64.7	1.2212	0.0100
C8	FB01	MH41	CONDUIT	15.0	1.4668	0.0200
Pipe_-_(38)_(C-STRM)	MH27	MH26	CONDUIT	28.1	0.5010	0.0130
Pipe_-_(39)_(C-STRM)	MH26	MH25	CONDUIT	79.8	0.4999	0.0130
Pipe_-_(41)_(C-STRM)	MH25	MH24	CONDUIT	18.2	0.4994	0.0130
Pipe_-_(42)_(C-STRM)	MH24	MH2	CONDUIT	31.6	0.5001	0.0130
Pipe_-_(43)_(C-STRM)	MH2	MH1	CONDUIT	17.8	0.4996	0.0130
Pipe_-_(44)_(C-STRM)	MH1	FB01	CONDUIT	32.2	0.9997	0.0130
Pipe_-_(45)_(C-STRM)	MH3	MH2	CONDUIT	20.6	0.4992	0.0130
Pipe_-_(46)_(C-STRM)	MH4	MH3	CONDUIT	100.0	0.5000	0.0130
Pipe_-_(47)_(C-STRM)	MH5	MH4	CONDUIT	100.0	0.5000	0.0130
Pipe_-_(48)_(C-STRM)	MH6	MH5	CONDUIT	76.7	0.4997	0.0130
Pipe_-_(49)_(C-STRM)	MH7	MH6	CONDUIT	100.0	0.5000	0.0130
Pipe_-_(51)_(C-STRM)	MH8	MH7	CONDUIT	50.6	0.4996	0.0130
Pipe_-_(52)_(C-STRM)	MH42	MH9	CONDUIT	62.3	0.5007	0.0130
Pipe_-_(53)_(C-STRM)	MH10	MH42	CONDUIT	30.4	0.4111	0.0130
Pipe_-_(54)_(C-STRM)	MH11	MH10	CONDUIT	30.4	0.4999	0.0130
Pipe_-_(55)_(C-STRM)	MH12	MH11	CONDUIT	10.3	0.5039	0.0130
Pipe_-_(57)_(C-STRM)	CBMH13	MH12	CONDUIT	50.5	0.4992	0.0130
Pipe_-_(59)_(C-STRM)	MH9	MH8	CONDUIT	62.4	0.4998	0.0130
Pipe_-_(60)_(C-STRM)	MH17	MH8	CONDUIT	85.4	0.9999	0.0130
Pipe_-_(61)_(C-STRM)	MH16	MH9	CONDUIT	54.2	1.0007	0.0130
Pipe_-_(64)_(C-STRM)	MH18	MH6	CONDUIT	77.5	0.5006	0.0130
Pipe_-_(65)_(C-STRM)	MH19	MH18	CONDUIT	52.2	0.4962	0.0130
Pipe_-_(66)_(C-STRM)	MH43	MH22	CONDUIT	60.6	1.0001	0.0130
Pipe_-_(67)_(C-STRM)	MH22	MH23	CONDUIT	100.1	0.4997	0.0130
Pipe_-_(68)_(C-STRM)	MH20	MH19	CONDUIT	100.0	0.5000	0.0130
Pipe_-_(69)_(C-STRM)	MH21	MH20	CONDUIT	100.0	0.5000	0.0130
Pipe_-_(70)_(C-STRM)	MH29	FB01	CONDUIT	30.4	1.0014	0.0130
Pipe_-_(71)_(C-STRM)	MH30	MH29	CONDUIT	28.7	0.5016	0.0130
Pipe_-_(72)_(C-STRM)	MH31	MH30	CONDUIT	62.2	0.4999	0.0130
Pipe_-_(73)_(C-STRM)	MH32	MH31	CONDUIT	100.0	0.5000	0.0130
Pipe_-_(74)_(C-STRM)	MH33	MH32	CONDUIT	100.0	0.5000	0.0130
Pipe_-_(75)_(C-STRM)	MH34	MH33	CONDUIT	100.0	0.5000	0.0130
Pipe_-_(76)_(C-STRM)	MH35	MH34	CONDUIT	26.8	0.4999	0.0130
Pipe_-_(77)_(C-STRM)	MH36	MH35	CONDUIT	28.8	0.9995	0.0130
Pipe_-_(78)_(C-STRM)	MH38	MH37	CONDUIT	62.6	0.9996	0.0130
Pipe_-_(79)_(C-STRM)	MH37	MH35	CONDUIT	11.3	-0.5030	0.0130
Pipe_-_(81)_(C-STRM)	CBMH14	CBMH13	CONDUIT	54.7	0.5008	0.0130
Pipe_-_(82)_(C-STRM)	CBMH15	CBMH14	CONDUIT	100.0	1.0001	0.0130
Pipe_-_(88)_(C-STRM)	MH41	MH39	CONDUIT	146.1	0.0068	0.0130
C2	LID#2	MH8	ORIFICE			
C4	LID#1B	MH3	ORIFICE			
OR1	LID#3	CBMH13	ORIFICE			
OR2	LID#1A	MH6	ORIFICE			
Pipe_-_(90)_(C-STRM)	FB01	Wetland	ORIFICE			
OL10	CB145	MH21	OUTLET			
OL11	CB181	MH43	OUTLET			
OL12	CB143	MH20	OUTLET			
OL13	CB141	MH20	OUTLET			
OL17	CB152	MH23	OUTLET			
OL18	CB150	MH22	OUTLET			
OL2	CB126-127	MH9	OUTLET			
OL20	CB149	MH22	OUTLET			
OL23	CB138	MH18	OUTLET			
OL24	CB137	MH6	OUTLET			
OL25	CB113-114	MH5	OUTLET			
OL26	CB111-112	MH5	OUTLET			
OL27	CB108-109	MH4	OUTLET			
OL28	CB106-107	MH4	OUTLET			
OL29	CB104-105	MH3	OUTLET			
OL31	CB100-101	MH2	OUTLET			
OL35	CB171-172	MH33	OUTLET			
OL36	CB169-170	MH33	OUTLET			
OL37	CB167-168	MH32	OUTLET			
OL38	CB165-166	MH32	OUTLET			
Pipe_-_(80)_(C-STRM)	CB179	MH31	OUTLET			

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Cross Section Summary
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Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow
C1	CIRCULAR	0.38	0.11	0.09	0.38	1	0.18
C10	CIRCULAR	0.30	0.07	0.07	0.30	1	0.10
C11	CIRCULAR	0.30	0.07	0.07	0.30	1	0.07
C3	CIRCULAR	0.38	0.11	0.09	0.38	1	0.12
C5	TRAPEZOIDAL	1.00	4.00	0.55	7.00	1	6.20
C6	TRAPEZOIDAL	1.00	4.00	0.55	7.00	1	3.47
C7	TRAPEZOIDAL	0.50	3.50	0.38	9.00	1	20.42
C8	TRAPEZOIDAL	0.30	1.02	0.23	4.30	1	2.33
Pipe_-_(38)_(C-STRM)	CIRCULAR	0.38	0.11	0.09	0.38	1	0.12
Pipe_-_(39)_(C-STRM)	CIRCULAR	0.60	0.28	0.15	0.60	1	0.43
Pipe_-_(41)_(C-STRM)	CIRCULAR	0.60	0.28	0.15	0.60	1	0.43
Pipe_-_(42)_(C-STRM)	CIRCULAR	0.60	0.28	0.15	0.60	1	0.43
Pipe_-_(43)_(C-STRM)	CIRCULAR	1.35	1.43	0.34	1.35	1	3.77
Pipe_-_(44)_(C-STRM)	CIRCULAR	1.35	1.43	0.34	1.35	1	5.34
Pipe_-_(45)_(C-STRM)	CIRCULAR	1.20	1.13	0.30	1.20	1	2.76
Pipe_-_(46)_(C-STRM)	CIRCULAR	1.20	1.13	0.30	1.20	1	2.76
Pipe_-_(47)_(C-STRM)	CIRCULAR	1.20	1.13	0.30	1.20	1	2.76
Pipe_-_(48)_(C-STRM)	CIRCULAR	1.20	1.13	0.30	1.20	1	2.76
Pipe_-_(49)_(C-STRM)	CIRCULAR	0.97	0.75	0.24	0.97	1	1.58
Pipe_-_(51)_(C-STRM)	CIRCULAR	0.90	0.64	0.23	0.90	1	1.28
Pipe_-_(52)_(C-STRM)	CIRCULAR	0.82	0.53	0.21	0.82	1	1.02
Pipe_-_(53)_(C-STRM)	CIRCULAR	0.75	0.44	0.19	0.75	1	0.71
Pipe_-_(54)_(C-STRM)	CIRCULAR	0.68	0.36	0.17	0.68	1	0.59
Pipe_-_(55)_(C-STRM)	CIRCULAR	0.68	0.36	0.17	0.68	1	0.60
Pipe_-_(57)_(C-STRM)	CIRCULAR	0.68	0.36	0.17	0.68	1	0.59
Pipe_-_(59)_(C-STRM)	CIRCULAR	0.90	0.64	0.23	0.90	1	1.28
Pipe_-_(60)_(C-STRM)	CIRCULAR	0.53	0.22	0.13	0.53	1	0.43
Pipe_-_(61)_(C-STRM)	CIRCULAR	0.38	0.11	0.09	0.38	1	0.18
Pipe_-_(64)_(C-STRM)	CIRCULAR	0.75	0.44	0.19	0.75	1	0.79
Pipe_-_(65)_(C-STRM)	CIRCULAR	0.75	0.44	0.19	0.75	1	0.78
Pipe_-_(66)_(C-STRM)	CIRCULAR	0.38	0.11	0.09	0.38	1	0.18
Pipe_-_(67)_(C-STRM)	CIRCULAR	0.38	0.11	0.09	0.38	1	0.12

Pipe_-_(68)_(C-STRM)	CIRCULAR	0.60	0.28	0.15	0.60	1	0.43
Pipe_-_(69)_(C-STRM)	CIRCULAR	0.53	0.22	0.13	0.53	1	0.30
Pipe_-_(70)_(C-STRM)	CIRCULAR	0.68	0.36	0.17	0.68	1	0.84
Pipe_-_(71)_(C-STRM)	CIRCULAR	0.68	0.36	0.17	0.68	1	0.60
Pipe_-_(72)_(C-STRM)	CIRCULAR	0.68	0.36	0.17	0.68	1	0.59
Pipe_-_(73)_(C-STRM)	CIRCULAR	0.60	0.28	0.15	0.60	1	0.43
Pipe_-_(74)_(C-STRM)	CIRCULAR	0.60	0.28	0.15	0.60	1	0.43
Pipe_-_(75)_(C-STRM)	CIRCULAR	0.53	0.22	0.13	0.53	1	0.30
Pipe_-_(76)_(C-STRM)	CIRCULAR	0.53	0.22	0.13	0.53	1	0.30
Pipe_-_(77)_(C-STRM)	CIRCULAR	0.30	0.07	0.07	0.30	1	0.10
Pipe_-_(78)_(C-STRM)	CIRCULAR	0.30	0.07	0.07	0.30	1	0.10
Pipe_-_(79)_(C-STRM)	CIRCULAR	0.53	0.22	0.13	0.53	1	0.31
Pipe_-_(81)_(C-STRM)	CIRCULAR	0.45	0.16	0.11	0.45	1	0.20
Pipe_-_(82)_(C-STRM)	CIRCULAR	0.38	0.11	0.09	0.38	1	0.18
Pipe_-_(88)_(C-STRM)	TRAPEZOIDAL	0.30	1.02	0.23	4.30	1	0.25

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Analysis Options
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Flow Units .... CMS
Process Models:
  Rainfall/Runoff .... YES
  RDII .... NO
  Snowmelt .... NO
  Groundwater .... YES
  Flow Routing .... YES
  Ponding Allowed .... NO
  Water Quality .... YES
Infiltration Method ...... HORTON
Flow Routing Method ...... DYNWAVE
Surcharge Method .... EXTRAN
Starting Date 01/27/2025 00:00:00
Ending Date 01/31/2025 00:00:00
Antecedent Dry Days 0.0
Report Time Step 00:01:00
Wet Time Step 00:05:00
Dry Time Step 00:05:00
Routing Time Step .... 5.00 sec
Variable Time Step .... YES
Maximum Trials 8
Number of Threads 14
Head Tolerance .... 0.001500 m

Runoff Quantity Continuity	Volume hectare-m	Depth mm
Total Precipitation	1.815	71.260
Evaporation Loss	0.029	1.130
Infiltration Loss	0.572	22.469
Surface Runoff	1.240	48.688
Final Storage	0.000	0.000
Continuity Error (%)	-1.440	

Runoff Quality Continuity	TSS kg
Initial Buildup	0.000
Surface Buildup	0.000
Wet Deposition	0.000
Sweeping Removal	0.000
Infiltration Loss	0.000
BMP Removal	0.000
Surface Runoff	0.000
Remaining Buildup	0.000
Continuity Error (%)	0.000

Flow Routing Continuity	Volume hectare-m	Volume 10^6 ltr
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	1.239	12.391
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	0.009	0.088
Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	1.230	12.301
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.001	0.006
Continuity Error (%)	-0.035	

Quality Routing Continuity	TSS kg
Dry Weather Inflow	0.000
Wet Weather Inflow	0.000
Groundwater Inflow	0.000
RDII Inflow	0.000
External Inflow	0.000
External Outflow	0.000
Flooding Loss	0.000
Exfiltration Loss	0.000
Mass Reacted	0.000
Initial Stored Mass	0.000
Final Stored Mass	0.000
Continuity Error (%)	0.000

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Time-Step Critical Elements
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Link Pipe_-_(55)_(C-STRM) (3.38%)

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Highest Flow Instability Indexes
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All links are stable.

****
Most Frequent Nonconverging Nodes
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Convergence obtained at all time steps.

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Routing Time Step Summary
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Minimum Time Step	:	0.50 sec
Average Time Step	:	4.92 sec
Maximum Time Step	:	5.00 sec
% of Time in Steady State	:	0.00
Average Iterations per Step	:	2.00
% of Steps Not Converging	:	0.02
Time Step Frequencies	:	
5.000 - 3.155 sec	:	98.13 %
3.155 - 1.991 sec	:	1.36 %
1.991 - 1.256 sec	:	0.34 %
1.256 - 0.792 sec	:	0.09 %
0.792 - 0.500 sec	:	0.08 %

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Subcatchment Runoff Summary
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Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Imperv Runoff mm	Perv Runoff mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff CMS	Runoff Coeff
201	71.26	0.00	0.07	67.52	0.00	3.92	3.92	0.06	0.05	0.055
202	71.26	0.00	1.83	0.00	70.48	0.00	70.48	0.93	0.71	0.989
203	71.26	0.00	1.72	0.00	70.84	0.00	70.84	0.09	0.08	0.994
204	71.26	0.00	0.06	61.42	0.00	11.29	11.29	0.03	0.05	0.158
205a	71.26	0.00	1.65	0.00	70.99	0.00	70.99	0.04	0.04	0.996
205b	71.26	0.00	1.65	0.00	70.99	0.00	70.99	0.07	0.07	0.996
205c	71.26	0.00	1.65	0.00	70.99	0.00	70.99	0.08	0.08	0.996
205d	71.26	0.00	1.65	0.00	70.99	0.00	70.99	0.16	0.16	0.996
206a	71.26	0.00	1.36	12.69	56.00	2.67	58.67	0.22	0.22	0.823
206b	71.26	0.00	0.08	65.71	0.00	5.93	5.93	0.01	0.01	0.083
207	71.26	0.00	1.74	0.00	70.80	0.00	70.80	0.50	0.45	0.993
208a	71.26	0.00	1.53	0.00	70.47	0.00	70.47	0.04	0.04	0.989
208b	71.26	0.00	1.53	0.00	70.47	0.00	70.47	0.06	0.08	0.989
208c	71.26	0.00	1.53	0.00	70.47	0.00	70.47	0.06	0.08	0.989

208d	71.26	0.00	1.53	0.00	70.47	0.00	70.47	0.04	0.04	0.989
209a	71.26	0.00	1.02	21.42	45.28	5.16	50.45	0.02	0.03	0.708
209b	71.26	0.00	1.04	21.67	45.38	4.69	50.07	0.07	0.08	0.703
209c	71.26	0.00	1.05	21.91	45.42	4.34	49.77	0.08	0.10	0.698
209d	71.26	0.00	1.00	21.00	45.08	5.92	51.00	0.05	0.07	0.716
210a	71.26	0.00	1.61	0.00	70.97	0.00	70.97	0.13	0.15	0.996
210b	71.26	0.00	1.65	0.00	70.99	0.00	70.99	0.13	0.13	0.996
211	71.26	0.00	1.68	0.00	70.95	0.00	70.95	0.22	0.22	0.996
212	71.26	0.00	1.56	0.00	70.75	0.00	70.75	0.17	0.20	0.993
213	71.26	0.00	0.07	62.34	0.00	10.09	10.09	0.04	0.06	0.142
214	71.26	0.00	1.58	0.00	70.84	0.00	70.84	0.19	0.22	0.994
215	71.26	0.00	1.53	0.00	70.44	0.00	70.44	0.07	0.08	0.989
216a	71.26	0.00	1.56	0.00	70.71	0.00	70.71	0.04	0.05	0.992
216b	71.26	0.00	1.56	0.00	70.71	0.00	70.71	0.01	0.02	0.992
216c	71.26	0.00	1.56	0.00	70.71	0.00	70.71	0.04	0.05	0.992
216d	71.26	0.00	1.56	0.00	70.71	0.00	70.71	0.04	0.04	0.992
216e	71.26	0.00	1.58	0.00	70.85	0.00	70.85	0.04	0.05	0.994
216f	71.26	0.00	1.58	0.00	70.85	0.00	70.85	0.03	0.03	0.994
216g	71.26	0.00	1.58	0.00	70.85	0.00	70.85	0.04	0.04	0.994
217	71.26	0.00	1.75	0.00	70.77	0.00	70.77	0.45	0.40	0.993
218	71.26	0.00	1.74	0.00	70.80	0.00	70.80	0.41	0.37	0.994
219a	71.26	0.00	1.27	12.25	56.02	3.47	59.49	0.09	0.11	0.835
219b	71.26	0.00	0.07	62.92	0.00	9.25	9.25	0.01	0.01	0.130
220a	71.26	0.00	1.27	12.25	56.02	3.45	59.48	0.10	0.12	0.835
220b	71.26	0.00	0.07	62.97	0.00	9.19	9.19	0.01	0.01	0.129
221	71.26	0.00	1.22	14.06	53.88	3.82	57.70	0.13	0.16	0.810
222	71.26	0.00	1.22	14.07	53.88	3.82	57.70	0.12	0.15	0.810
223	71.26	0.00	1.22	14.04	53.86	3.88	57.74	0.13	0.16	0.810
224	71.26	0.00	1.22	14.07	53.88	3.81	57.69	0.09	0.10	0.810
226	71.26	0.00	1.75	0.00	70.76	0.00	70.76	0.53	0.47	0.993
227	71.26	0.00	1.65	0.00	70.99	0.00	70.99	0.16	0.17	0.996
228	71.26	0.00	1.65	0.00	70.99	0.00	70.99	0.11	0.12	0.996
229a	71.26	0.00	1.58	0.00	70.85	0.00	70.85	0.06	0.06	0.994
229b	71.26	0.00	1.58	0.00	70.85	0.00	70.85	0.04	0.04	0.994
230a	71.26	0.00	1.57	0.00	70.82	0.00	70.82	0.04	0.05	0.994
230b	71.26	0.00	1.57	0.00	70.82	0.00	70.82	0.04	0.05	0.994
231a	71.26	0.00	1.56	0.00	70.75	0.00	70.75	0.04	0.04	0.993
231b	71.26	0.00	1.56	0.00	70.75	0.00	70.75	0.03	0.03	0.993
232a	71.26	0.00	1.56	0.00	70.74	0.00	70.74	0.04	0.05	0.993
232b	71.26	0.00	1.56	0.00	70.74	0.00	70.74	0.04	0.05	0.993
233a	71.26	0.00	1.57	0.00	70.76	0.00	70.76	0.05	0.06	0.993
233b	71.26	0.00	1.57	0.00	70.76	0.00	70.76	0.04	0.05	0.993
234a	71.26	0.00	1.58	0.00	70.85	0.00	70.85	0.04	0.04	0.994
234b	71.26	0.00	1.58	0.00	70.85	0.00	70.85	0.04	0.04	0.994
235	71.26	0.00	1.73	0.00	70.80	0.00	70.80	0.63	0.57	0.994
236	71.26	0.00	1.74	0.00	70.77	0.00	70.77	0.33	0.30	0.993
237	71.26	0.00	1.75	0.00	70.76	0.00	70.76	0.30	0.27	0.993
238	71.26	0.00	1.75	0.00	70.76	0.00	70.76	0.29	0.26	0.993
239	71.26	0.00	1.75	0.00	70.76	0.00	70.76	0.28	0.24	0.993
240a	71.26	4.63	1.62	0.00	75.54	0.00	75.54	0.09	0.09	0.995
240b	71.26	0.00	0.07	62.90	0.00	9.27	9.27	0.01	0.01	0.130
241a	71.26	4.27	1.62	0.00	75.18	0.00	75.18	0.10	0.10	0.995
241b	71.26	0.00	0.07	62.91	0.00	9.26	9.26	0.01	0.01	0.130
242a	71.26	4.31	1.62	0.00	75.21	0.00	75.21	0.10	0.10	0.995
242b	71.26	0.00	0.07	62.85	0.00	9.34	9.34	0.01	0.01	0.131
243a	71.26	12.06	1.62	0.00	82.91	0.00	82.91	0.08	0.08	0.995
243b	71.26	0.00	0.37	56.97	14.72	15.08	15.08	0.01	0.01	0.212
244a	71.26	0.00	1.75	0.00	70.77	0.00	70.77	0.22	0.19	0.993
244b	71.26	0.00	0.07	65.67	0.00	5.97	5.97	0.01	0.01	0.084
245	71.26	0.00	0.08	65.36	0.00	6.33	6.33	0.02	0.03	0.089
246	71.26	0.00	1.58	0.00	70.82	0.00	70.82	0.54	0.62	0.994
247	71.26	0.00	0.07	66.60	0.00	4.95	4.95	0.01	0.01	0.069
248a	71.26	0.00	1.63	0.00	70.99	0.00	70.99	0.09	0.09	0.996
248b	71.26	0.00	1.63	0.00	70.99	0.00	70.99	0.04	0.04	0.996
248c	71.26	0.00	1.63	0.00	70.99	0.00	70.99	0.16	0.17	0.996
248d	71.26	0.00	1.63	0.00	70.99	0.00	70.99	0.04	0.04	0.996
249	71.26	0.00	0.72	35.87	30.48	5.27	35.75	0.39	0.45	0.502
250a	71.26	0.00	0.07	64.68	0.00	7.17	7.17	0.02	0.02	0.101
250b	71.26	0.00	1.64	0.00	70.99	0.00	70.99	0.04	0.04	0.996
250c	71.26	0.00	1.04	21.66	45.38	4.72	50.10	0.02	0.02	0.703
250d	71.26	0.00	1.64	0.00	70.99	0.00	70.99	0.02	0.02	0.996
250e	71.26	0.00	1.64	0.00	70.99	0.00	70.99	0.07	0.07	0.996
250f	71.26	0.00	1.40	8.10	61.05	2.45	63.50	0.05	0.06	0.891
251	71.26	0.00	1.55	0.00	70.67	0.00	70.67	0.06	0.07	0.992
252A	71.26	0.00	0.07	64.68	0.00	7.17	7.17	0.01	0.01	0.101
252b	71.26	0.00	1.69	0.00	70.93	0.00	70.93	0.04	0.03	0.995
252c	71.26	0.00	1.64	0.00	70.99	0.00	70.99	0.02	0.02	0.996
252d	71.26	0.00	1.64	0.00	70.99	0.00	70.99	0.01	0.01	0.996
253	71.26	0.00	1.53	0.00	70.47	0.00	70.47	0.04	0.04	0.989
254	71.26	0.00	0.07	66.69	0.00	4.85	4.85	0.09	0.09	0.068
255	71.26	0.00	1.58	0.00	70.84	0.00	70.84	0.09	0.10	0.994
256	71.26	0.00	1.08	23.13	44.70	3.61	48.31	0.15	0.15	0.678
257	71.26	0.00	0.08	67.02	0.00	4.48	4.48	0.04	0.03	0.063
258	71.26	0.00	1.53	0.00	70.42	0.00	70.42	0.06	0.07	0.988
259	71.26	0.00	1.53	0.00	70.40	0.00	70.40	0.02	0.03	0.988
260	71.26	0.00	1.52	0.00	70.38	0.00	70.38	0.03	0.03	0.988
261	71.26	0.00	1.78	0.00	70.66	0.00	70.66	0.56	0.47	0.992
262	71.26	0.00	1.77	0.00	70.69	0.00	70.69	0.57	0.48	0.992
263	71.26	0.00	0.07	65.25	0.00	6.46	6.46	0.07	0.08	0.091

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Subcatchment Washoff Summary
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Subcatchment	TSS kg
201	0.000
202	0.000
203	0.000
204	0.000
205a	0.000
205b	0.000
205c	0.000
205d	0.000
206a	0.000
206b	0.000
207	0.000
208a	0.000
208b	0.000
208c	0.000
208d	0.000
209a	0.000
209b	0.000
209c	0.000
209d	0.000
210a	0.000
210b	0.000
211	0.000
212	0.000
213	0.000
214	0.000
215	0.000
216a	0.000
216b	0.000
216c	0.000
216d	0.000
216e	0.000
216f	0.000
216g	0.000
217	0.000
218	0.000
219a	0.000
219b	0.000
220a	0.000
220b	0.000
221	0.000
222	0.000
223	0.000
224	0.000
226	0.000
227	0.000
228	0.000
229a	0.000
229b	0.000
230a	0.000
230b	0.000
231a	0.000
231b	0.000
232a	0.000
232b	0.000
233a	0.000
233b	0.000
234a	0.000
234b	0.000
235	0.000
236	0.000
237	0.000
238	0.000
239	0.000
240a	0.000
240b	0.000
241a	0.000
241b	0.000
242a	0.000
242b	0.000
243a	0.000
243b	0.000
244a	0.000
244b	0.000
245	0.000
246	0.000
247	0.000
248a	0.000
248b	0.000
248c	0.000
248d	0.000
249	0.000
250a	0.000
250b	0.000
250c	0.000
250d	0.000
250e	0.000
250f	0.000
251	0.000
252A	0.000
252b	0.000
252c	0.000
252d	0.000
253	0.000
254	0.000
255	0.000
256	0.000
257	0.000
258	0.000
259	0.000
260	0.000
261	0.000
262	0.000
263	0.000
System	0.000

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Node Depth Summary
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Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days	Time of Max Occurrence hr:min	Reported Max Depth Meters
MH39	OUTFALL	0.00	0.00	332.85	0	00:00	0.00
OF1	OUTFALL	0.00	0.00	333.00	0	00:00	0.00
CB100-101	STORAGE	0.00	0.06	337.34	0	01:05	0.06
CB104-105	STORAGE	0.00	0.09	337.87	0	01:05	0.09
CB106-107	STORAGE	0.00	0.11	338.05	0	01:05	0.11
CB108-109	STORAGE	0.00	0.11	338.21	0	01:05	0.10
CB111-112	STORAGE	0.00	0.09	338.34	0	01:05	0.09
CB113-114	STORAGE	0.00	0.10	338.83	0	01:05	0.10
CB126-127	STORAGE	0.00	0.09	340.67	0	01:05	0.09
CB137	STORAGE	0.00	0.15	338.79	0	01:05	0.15
CB138	STORAGE	0.00	0.34	339.12	0	01:05	0.28
CB141	STORAGE	0.00	0.18	341.92	0	01:05	0.18
CB143	STORAGE	0.00	0.22	342.21	0	01:05	0.21
CB145	STORAGE	0.00	0.15	340.26	0	01:05	0.15
CB149	STORAGE	0.00	0.13	340.88	0	01:05	0.13
CB150	STORAGE	0.00	0.13	340.82	0	01:05	0.13
CB152	STORAGE	0.00	0.11	340.61	0	01:05	0.11
CB165-166	STORAGE	0.00	0.07	336.43	0	01:05	0.07
CB167-168	STORAGE	0.00	0.06	336.64	0	01:05	0.06
CB169-170	STORAGE	0.00	0.05	336.87	0	01:05	0.05
CB171-172	STORAGE	0.00	0.09	337.17	0	01:05	0.08
CB179	STORAGE	0.00	0.11	335.49	0	01:05	0.11
CB181	STORAGE	0.00	0.12	341.12	0	01:05	0.12
CBMH13	STORAGE	0.01	1.12	337.51	0	01:09	1.12
CBMH14	STORAGE	0.00	0.68	337.57	0	01:09	0.67
CBMH15	STORAGE	0.00	0.14	338.10	0	01:06	0.14
CBMH28	STORAGE	0.00	0.89	335.87	0	01:07	0.88
CBMH45	STORAGE	0.00	0.36	335.93	0	01:07	0.35
FB01	STORAGE	0.22	1.18	332.85	0	03:05	1.18
LID#1A	STORAGE	0.04	0.68	336.68	0	01:42	0.68
LID#1B	STORAGE	0.05	2.14	335.44	0	01:14	2.14
LID#2	STORAGE	0.11	1.60	338.00	0	01:34	1.60
LID#3	STORAGE	0.12	1.27	339.47	0	01:19	1.27
LID#5	STORAGE	0.03	0.38	335.38	0	01:44	0.38
LID#6	STORAGE	0.01	0.19	334.49	0	01:48	0.19
MH1	STORAGE	0.11	1.40	333.39	0	01:06	1.40
MH10	STORAGE	0.02	1.47	337.23	0	01:08	1.47
MH11	STORAGE	0.01	1.34	337.34	0	01:08	1.34
MH12	STORAGE	0.02	1.32	337.40	0	01:08	1.32
MH16	STORAGE	0.01	1.79	338.01	0	01:06	1.78
MH17	STORAGE	0.00	0.55	336.74	0	01:08	0.54
MH18	STORAGE	0.01	1.39	335.98	0	01:08	1.39
MH19	STORAGE	0.01	1.27	336.16	0	01:08	1.27
MH2	STORAGE	0.08	1.54	333.65	0	01:07	1.54
MH20	STORAGE	0.01	1.31	336.76	0	01:08	1.31
MH21	STORAGE	0.01	1.07	337.24	0	01:08	1.07
MH22	STORAGE	0.02	2.51	338.89	0	01:09	2.51
MH23	STORAGE	0.02	2.53	338.38	0	01:09	2.53
MH24	STORAGE	0.01	1.02	335.42	0	01:08	1.02
MH25	STORAGE	0.01	1.30	335.82	0	01:07	1.30
MH26	STORAGE	0.02	2.06	337.01	0	01:06	2.05
MH27	STORAGE	0.02	2.36	337.68	0	01:07	2.36
MH29	STORAGE	0.11	0.88	332.85	0	03:04	0.88
MH3	STORAGE	0.05	1.75	334.03	0	01:07	1.75
MH30	STORAGE	0.06	0.70	332.85	0	03:05	0.70
MH31	STORAGE	0.02	0.63	333.12	0	01:07	0.63
MH32	STORAGE	0.01	0.63	333.70	0	01:07	0.63
MH33	STORAGE	0.01	0.44	334.03	0	01:06	0.44
MH34	STORAGE	0.01	0.48	334.65	0	01:07	0.48

MH35	STORAGE	0.01	0.49	334.79	0	01:06	0.49
MH36	STORAGE	0.00	0.24	335.06	0	01:05	0.24
MH37	STORAGE	0.06	0.50	334.86	0	01:06	0.50
MH38	STORAGE	0.01	1.55	336.82	0	01:06	1.55
MH4	STORAGE	0.03	1.84	334.65	0	01:08	1.83
MH41	STORAGE	0.00	0.00	332.64	0	00:00	0.00
MH42	STORAGE	0.02	1.63	337.17	0	01:08	1.63
MH43	STORAGE	0.01	1.91	338.92	0	01:09	1.90
MH44	STORAGE	0.01	1.67	338.71	0	01:06	1.67
MH5	STORAGE	0.03	1.87	335.21	0	01:08	1.87
MH6	STORAGE	0.03	1.89	335.64	0	01:08	1.89
MH7	STORAGE	0.02	1.81	336.29	0	01:09	1.81
MH8	STORAGE	0.02	1.85	336.66	0	01:09	1.85
MH9	STORAGE	0.02	1.78	336.93	0	01:09	1.78
Wetland	STORAGE	0.21	0.85	332.40	0	07:55	0.85

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Node Inflow Summary
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Node	Type	Maximum Lateral Inflow CMS	Maximum Total Inflow CMS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 ltr	Total Inflow Volume 10^6 ltr	Flow Balance Error Percent
MH39	OUTFALL	0.074	0.074	0 01:05	0.0709	0.0709	0.000
OF1	OUTFALL	0.022	0.022	0 01:05	0.0173	0.0173	0.000
CB100-101	STORAGE	0.038	0.038	0 01:05	0.0355	0.0355	0.004
CB104-105	STORAGE	0.081	0.081	0 01:05	0.0708	0.0708	-0.001
CB106-107	STORAGE	0.106	0.106	0 01:05	0.0919	0.0919	-0.007
CB108-109	STORAGE	0.098	0.098	0 01:05	0.0848	0.0848	-0.006
CB111-112	STORAGE	0.074	0.074	0 01:05	0.0636	0.0636	-0.004
CB113-114	STORAGE	0.097	0.097	0 01:05	0.0849	0.0849	-0.007
CB126-127	STORAGE	0.075	0.075	0 01:05	0.0634	0.0634	-0.004
CB137	STORAGE	0.117	0.117	0 01:05	0.113	0.113	-0.001
CB138	STORAGE	0.169	0.169	0 01:05	0.163	0.163	-0.007
CB141	STORAGE	0.146	0.146	0 01:05	0.121	0.121	-0.005
CB143	STORAGE	0.160	0.160	0 01:05	0.133	0.133	-0.007
CB145	STORAGE	0.121	0.121	0 01:05	0.101	0.101	-0.000
CB149	STORAGE	0.100	0.100	0 01:05	0.0977	0.0977	0.001
CB150	STORAGE	0.100	0.100	0 01:05	0.0977	0.0977	0.001
CB152	STORAGE	0.077	0.077	0 01:05	0.0828	0.0828	0.002
CB165-166	STORAGE	0.042	0.042	0 01:05	0.0352	0.0352	0.003
CB167-168	STORAGE	0.033	0.033	0 01:05	0.0281	0.0281	0.004
CB169-170	STORAGE	0.025	0.025	0 01:05	0.0211	0.0211	0.003
CB171-172	STORAGE	0.067	0.067	0 01:05	0.0563	0.0563	-0.001
CB179	STORAGE	0.079	0.079	0 01:05	0.0742	0.0742	0.011
CB181	STORAGE	0.092	0.092	0 01:05	0.0906	0.0906	0.001
CBMH13	STORAGE	0.363	0.444	0 01:05	0.348	1.1	-0.255
CBMH14	STORAGE	0.046	0.121	0 01:06	0.0282	0.0877	0.680
CBMH15	STORAGE	0.050	0.050	0 01:05	0.0584	0.0584	-0.059
CBMH28	STORAGE	0.000	0.046	0 01:04	0	0.0279	0.224
CBMH45	STORAGE	0.026	0.026	0 01:05	0.0247	0.0247	-0.075
FB01	STORAGE	0.453	4.606	0 01:08	0.389	10.4	0.026
LID#1A	STORAGE	1.066	1.066	0 01:05	1.2	1.2	-0.001
LID#1B	STORAGE	0.570	0.570	0 01:05	0.63	0.63	0.003
LID#2	STORAGE	1.721	1.721	0 01:05	1.99	1.99	0.002
LID#3	STORAGE	0.789	0.789	0 01:05	1.01	1.01	0.002
LID#5	STORAGE	0.251	0.251	0 01:05	0.235	0.235	-0.007
LID#6	STORAGE	0.098	0.098	0 01:05	0.0843	0.0843	-0.011
MH1	STORAGE	0.000	3.712	0 01:08	0	9.2	-0.037
MH10	STORAGE	0.000	0.507	0 01:14	0	1.26	-0.194
MH11	STORAGE	0.000	0.530	0 01:05	0	1.26	-0.037
MH12	STORAGE	0.173	0.582	0 01:05	0.155	1.26	0.206
MH16	STORAGE	0.316	0.316	0 01:05	0.304	0.304	1.496
MH17	STORAGE	0.264	0.264	0 01:05	0.221	0.221	1.515
MH18	STORAGE	0.000	0.863	0 01:05	0	1.04	0.714
MH19	STORAGE	0.266	0.738	0 01:05	0.219	0.873	-0.222
MH2	STORAGE	0.000	3.704	0 01:08	0	9.2	-0.020
MH20	STORAGE	0.000	0.608	0 01:04	0	0.653	-0.264
MH21	STORAGE	0.000	0.358	0 01:05	0	0.401	0.593
MH22	STORAGE	0.000	0.242	0 01:04	0	0.286	0.901
MH23	STORAGE	0.000	0.193	0 01:05	0	0.366	-0.936
MH24	STORAGE	0.000	0.684	0 01:07	0	1.17	-0.081
MH25	STORAGE	0.000	0.697	0 01:06	0	1.17	-0.427
MH26	STORAGE	0.624	0.779	0 01:05	0.547	1.15	0.429
MH27	STORAGE	0.203	0.269	0 01:11	0.228	0.597	-0.261
MH29	STORAGE	0.045	0.626	0 01:07	0.0426	0.759	-0.380
MH3	STORAGE	0.304	2.994	0 01:09	0.284	7.99	-0.010
MH30	STORAGE	0.022	0.598	0 01:07	0.0213	0.714	-0.262
MH31	STORAGE	0.097	0.591	0 01:06	0.085	0.698	0.681
MH32	STORAGE	0.057	0.473	0 01:06	0.0567	0.537	-0.347
MH33	STORAGE	0.000	0.371	0 01:06	0	0.418	0.403
MH34	STORAGE	0.033	0.323	0 01:05	0.0363	0.341	-0.012
MH35	STORAGE	0.064	0.295	0 01:05	0.0434	0.304	-0.138
MH36	STORAGE	0.084	0.084	0 01:05	0.0704	0.0704	0.827
MH37	STORAGE	0.000	0.164	0 01:06	0	0.191	0.017
MH38	STORAGE	0.218	0.218	0 01:05	0.191	0.191	0.066
MH4	STORAGE	0.000	2.772	0 01:05	0	7.05	-0.084

MH41	STORAGE	0.000	0.000	0 00:00	0	0	0.000

ltr

MH42	STORAGE	0.706	1.060	0 01:04	0.73	1.99	0.037
MH43	STORAGE	0.000	0.092	0 01:05	0	0.0906	0.016
MH44	STORAGE	0.322	0.322	0 01:05	0.306	0.306	1.913
MH5	STORAGE	0.000	2.889	0 01:05	0	6.87	-0.050
MH6	STORAGE	0.226	2.865	0 01:05	0.198	6.72	-0.010
MH7	STORAGE	0.625	1.870	0 01:05	0.665	4.72	0.085
MH8	STORAGE	0.042	1.487	0 01:05	0.0352	4.05	-0.348
MH9	STORAGE	0.075	1.320	0 01:04	0.0634	2.42	0.214
Wetland	STORAGE	0.085	0.393	0 02:40	0.0921	10.5	-0.002

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Node Surcharge Summary
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No nodes were surcharged.

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Node Flooding Summary
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No nodes were flooded.

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Storage Volume Summary
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Storage Unit	Average Volume 1000 m³	Avg Pcnt Full	Evap Pcnt Loss	Exfil Pcnt Loss	Maximum Volume 1000 m³	Max Pcnt Full	Time of Max Occurrence days hr:min	Maximum Outflow CMS
CB100-101	0.000	0.1	0.0	0.0	0.000	6.5	0 01:05	0.038
CB104-105	0.000	0.1	0.0	0.0	0.000	9.4	0 01:05	0.081
CB106-107	0.000	0.1	0.0	0.0	0.000	11.0	0 01:05	0.106
CB108-109	0.000	0.1	0.0	0.0	0.000	10.5	0 01:05	0.098
CB111-112	0.000	0.1	0.0	0.0	0.000	9.0	0 01:05	0.074
CB113-114	0.000	0.1	0.0	0.0	0.000	10.5	0 01:05	0.097
CB126-127	0.000	0.1	0.0	0.0	0.000	9.0	0 01:05	0.075
CB137	0.000	0.2	0.0	0.0	0.000	14.7	0 01:05	0.117
CB138	0.000	0.2	0.0	0.0	0.000	34.4	0 01:05	0.162
CB141	0.000	0.2	0.0	0.0	0.000	18.3	0 01:05	0.146
CB143	0.000	0.2	0.0	0.0	0.000	21.7	0 01:05	0.158
CB145	0.000	0.2	0.0	0.0	0.000	15.1	0 01:05	0.121
CB149	0.000	0.2	0.0	0.0	0.000	13.1	0 01:05	0.100
CB150	0.000	0.2	0.0	0.0	0.000	13.1	0 01:05	0.100
CB152	0.000	0.1	0.0	0.0	0.000	11.2	0 01:05	0.077
CB165-166	0.000	0.1	0.0	0.0	0.000	6.8	0 01:05	0.042
CB167-168	0.000	0.1	0.0	0.0	0.000	6.1	0 01:05	0.033
CB169-170	0.000	0.0	0.0	0.0	0.000	5.4	0 01:05	0.025
CB171-172	0.000	0.1	0.0	0.0	0.000	8.5	0 01:05	0.067
CB179	0.000	0.1	0.0	0.0	0.000	11.4	0 01:05	0.079
CB181	0.000	0.2	0.0	0.0	0.000	12.4	0 01:05	0.092
CBMH13	0.000	0.2	0.0	0.0	0.001	18.1	0 01:09	0.431
CBMH14	0.000	0.1	0.0	0.0	0.001	9.8	0 01:09	0.118
CBMH15	0.000	0.0	0.0	0.0	0.000	2.2	0 01:06	0.051
CBMH28	0.000	0.3	0.0	0.0	0.001	50.9	0 01:07	0.049
CBMH45	0.000	0.1	0.0	0.0	0.000	15.3	0 01:07	0.035
FB01	1.078	11.8	0.0	0.0	6.868	75.1	0 03:05	0.387
LID#1A	0.042	1.4	0.0	45.4	0.715	23.4	0 01:42	0.088
LID#1B	0.005	1.1	0.0	7.4	0.218	47.2	0 01:14	0.180
LID#2	0.078	1.8	0.0	30.4	1.122	25.8	0 01:34	0.188
LID#3	0.042	2.9	0.0	34.1	0.458	31.8	0 01:19	0.201
LID#5	0.010	2.0	0.0	77.4	0.145	29.3	0 01:44	0.014
LID#6	0.003	0.7	0.0	100.0	0.055	14.6	0 01:48	0.004
MH1	0.000	2.0	0.0	0.0	0.002	25.5	0 01:06	3.742
MH10	0.000	0.3	0.0	0.0	0.002	25.1	0 01:08	0.539
MH11	0.000	0.2	0.0	0.0	0.002	20.9	0 01:08	0.507
MH12	0.000	0.2	0.0	0.0	0.001	21.1	0 01:08	0.530
MH16	0.000	0.2	0.0	0.0	0.002	28.3	0 01:06	0.259
MH17	0.000	0.1	0.0	0.0	0.001	8.9	0 01:08	0.259
MH18	0.000	0.3	0.0	0.0	0.002	31.1	0 01:08	0.790
MH19	0.000	0.2	0.0	0.0	0.001	20.1	0 01:08	0.700
MH2	0.000	1.6	0.0	0.0	0.002	29.3	0 01:07	3.712
MH20	0.000	0.2	0.0	0.0	0.001	20.4	0 01:08	0.489
MH21	0.000	0.1	0.0	0.0	0.001	17.5	0 01:08	0.313
MH22	0.000	0.5	0.0	0.0	0.003	56.4	0 01:09	0.137
MH23	0.000	0.5	0.0	0.0	0.003	56.8	0 01:09	0.192
MH24	0.000	0.4	0.0	0.0	0.001	27.1	0 01:08	0.682
MH25	0.000	0.5	0.0	0.0	0.001	44.4	0 01:07	0.684
MH26	0.000	0.3	0.0	0.0	0.002	38.4	0 01:06	0.697
MH27	0.000	0.4	0.0	0.0	0.003	51.5	0 01:07	0.303
MH29	0.000	5.6	0.0	0.0	0.001	46.6	0 03:04	0.627
MH3	0.000	1.0	0.0	0.0	0.002	32.9	0 01:07	3.017
MH30	0.000	2.2	0.0	0.0	0.001	24.6	0 03:05	0.597
MH31	0.000	0.6	0.0	0.0	0.001	19.3	0 01:07	0.582
MH32	0.000	0.2	0.0	0.0	0.001	18.3	0 01:07	0.447

MH33	0.000	0.2	0.0	0.0	0.000	13.2	0	01:06	0.371
MH34	0.000	0.2	0.0	0.0	0.001	14.6	0	01:07	0.308
MH35	0.000	0.2	0.0	0.0	0.001	14.3	0	01:06	0.291
MH36	0.000	0.1	0.0	0.0	0.000	6.2	0	01:05	0.082
MH37	0.000	1.7	0.0	0.0	0.001	13.6	0	01:06	0.164
MH38	0.000	0.2	0.0	0.0	0.002	40.0	0	01:06	0.164
MH4	0.000	0.5	0.0	0.0	0.002	35.4	0	01:08	2.689
MH41	0.000	0.0	0.0	0.0	0.000	0.0	0	00:00	0.000
MH42	0.000	0.3	0.0	0.0	0.002	28.9	0	01:08	0.950
MH43	0.000	0.3	0.0	0.0	0.002	46.7	0	01:09	0.072
MH44	0.000	0.2	0.0	0.0	0.002	30.4	0	01:06	0.251
MH5	0.000	0.5	0.0	0.0	0.002	36.8	0	01:08	2.580
MH6	0.000	0.6	0.0	0.0	0.002	39.1	0	01:08	2.730
MH7	0.000	0.5	0.0	0.0	0.002	36.1	0	01:09	1.739
MH8	0.000	0.5	0.0	0.0	0.002	38.2	0	01:09	1.319
MH9	0.000	0.3	0.0	0.0	0.002	32.9	0	01:09	1.180
Wetland	1.155	13.6	0.0	100.0	4.791	56.5	0	07:55	0.070

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Outfall Loading Summary
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Outfall Node	Flow Freq Pcnt	Avg Flow CMS	Max Flow CMS	Total Volume 10^6 ltr	Total TSS kg
MH39	5.84	0.007	0.074	0.071	0.000
OF1	1.50	0.009	0.022	0.017	0.000
System	3.67	0.016	0.096	0.088	0.000

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Link Flow Summary
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Link	Type	Maximum |Flow| CMS	Time of Max Occurrence days	hr:min	Maximum |Veloc| m/sec	Max/ Full Flow	Max/ Full Depth
C1	CONDUIT	0.251	0	01:06	2.28	1.43	1.00
C10	CONDUIT	0.035	0	01:11	0.93	0.36	1.00
C11	CONDUIT	0.049	0	01:11	0.70	0.72	1.00
C3	CONDUIT	0.192	0	01:15	1.74	1.55	1.00
C5	CONDUIT	0.000	0	00:00	0.00	0.00	0.00
C6	CONDUIT	0.010	0	01:44	0.17	0.00	0.05
C7	CONDUIT	0.000	0	00:00	0.00	0.00	0.00
C8	CONDUIT	0.000	0	00:00	0.00	0.00	0.00
Pipe_-_(38)_(C-STRM)	CONDUIT	0.303	0	01:10	2.75	2.44	1.00
Pipe_-_(39)_(C-STRM)	CONDUIT	0.697	0	01:06	2.46	1.60	1.00
Pipe_-_(41)_(C-STRM)	CONDUIT	0.684	0	01:07	2.42	1.58	1.00
Pipe_-_(42)_(C-STRM)	CONDUIT	0.682	0	01:08	2.47	1.57	0.94
Pipe_-_(43)_(C-STRM)	CONDUIT	3.712	0	01:08	2.63	0.98	1.00
Pipe_-_(44)_(C-STRM)	CONDUIT	3.742	0	01:08	3.85	0.70	0.76
Pipe_-_(45)_(C-STRM)	CONDUIT	3.017	0	01:09	2.67	1.10	1.00
Pipe_-_(46)_(C-STRM)	CONDUIT	2.689	0	01:10	2.38	0.98	1.00
Pipe_-_(47)_(C-STRM)	CONDUIT	2.580	0	01:10	2.38	0.94	1.00
Pipe_-_(48)_(C-STRM)	CONDUIT	2.730	0	01:05	2.44	0.99	1.00
Pipe_-_(49)_(C-STRM)	CONDUIT	1.739	0	01:05	2.34	1.10	1.00
Pipe_-_(51)_(C-STRM)	CONDUIT	1.319	0	01:06	2.07	1.03	1.00
Pipe_-_(52)_(C-STRM)	CONDUIT	0.950	0	01:04	1.82	0.94	1.00
Pipe_-_(53)_(C-STRM)	CONDUIT	0.539	0	01:15	1.57	0.75	1.00
Pipe_-_(54)_(C-STRM)	CONDUIT	0.507	0	01:14	1.68	0.85	1.00
Pipe_-_(55)_(C-STRM)	CONDUIT	0.530	0	01:05	1.56	0.89	1.00
Pipe_-_(57)_(C-STRM)	CONDUIT	0.431	0	01:14	1.46	0.72	1.00
Pipe_-_(59)_(C-STRM)	CONDUIT	1.180	0	01:04	1.87	0.92	1.00
Pipe_-_(60)_(C-STRM)	CONDUIT	0.259	0	01:05	1.80	0.60	1.00
Pipe_-_(61)_(C-STRM)	CONDUIT	0.259	0	01:05	2.35	1.48	1.00
Pipe_-_(64)_(C-STRM)	CONDUIT	0.790	0	01:05	1.81	1.00	1.00
Pipe_-_(65)_(C-STRM)	CONDUIT	0.700	0	01:05	1.73	0.89	1.00
Pipe_-_(66)_(C-STRM)	CONDUIT	0.072	0	01:04	0.88	0.41	1.00
Pipe_-_(67)_(C-STRM)	CONDUIT	0.137	0	01:03	1.25	1.11	1.00
Pipe_-_(68)_(C-STRM)	CONDUIT	0.489	0	01:05	1.73	1.13	1.00
Pipe_-_(69)_(C-STRM)	CONDUIT	0.313	0	01:04	1.51	1.03	1.00
Pipe_-_(70)_(C-STRM)	CONDUIT	0.627	0	01:07	2.45	0.74	1.00
Pipe_-_(71)_(C-STRM)	CONDUIT	0.597	0	01:07	1.86	1.00	1.00
Pipe_-_(72)_(C-STRM)	CONDUIT	0.582	0	01:07	1.73	0.98	0.91
Pipe_-_(73)_(C-STRM)	CONDUIT	0.447	0	01:08	1.61	1.03	0.96
Pipe_-_(74)_(C-STRM)	CONDUIT	0.371	0	01:07	1.50	0.85	0.86
Pipe_-_(75)_(C-STRM)	CONDUIT	0.308	0	01:07	1.64	1.01	0.81
Pipe_-_(76)_(C-STRM)	CONDUIT	0.291	0	01:05	1.50	0.96	0.92
Pipe_-_(77)_(C-STRM)	CONDUIT	0.082	0	01:05	1.40	0.85	0.80
Pipe_-_(78)_(C-STRM)	CONDUIT	0.164	0	01:06	2.34	1.70	0.98
Pipe_-_(79)_(C-STRM)	CONDUIT	0.164	0	01:06	0.87	0.54	0.83
Pipe_-_(81)_(C-STRM)	CONDUIT	0.118	0	01:14	0.98	0.58	1.00
Pipe_-_(82)_(C-STRM)	CONDUIT	0.051	0	01:06	1.33	0.29	0.68
Pipe_-_(88)_(C-STRM)	CONDUIT	0.000	0	00:00	0.00	0.00	0.00
C2	ORIFICE	0.179	0	01:34			1.00
C4	ORIFICE	0.179	0	01:15			1.00
OR1	ORIFICE	0.196	0	01:19			1.00
OR2	ORIFICE	0.075	0	01:42			1.00
Pipe_-_(90)_(C-STRM)	ORIFICE	0.387	0	02:40			1.00
OL10	DUMMY	0.121	0	01:05			
OL11	DUMMY	0.092	0	01:05			
OL12	DUMMY	0.158	0	01:05			
OL13	DUMMY	0.146	0	01:05			
OL17	DUMMY	0.077	0	01:05			
OL18	DUMMY	0.100	0	01:05			
OL2	DUMMY	0.075	0	01:05			
OL20	DUMMY	0.100	0	01:05			
OL23	DUMMY	0.162	0	01:05			
OL24	DUMMY	0.117	0	01:05			
OL25	DUMMY	0.097	0	01:05			
OL26	DUMMY	0.074	0	01:05			
OL27	DUMMY	0.098	0	01:05			
OL28	DUMMY	0.106	0	01:05			
OL29	DUMMY	0.081	0	01:05			
OL31	DUMMY	0.038	0	01:05			
OL35	DUMMY	0.067	0	01:05			
OL36	DUMMY	0.025	0	01:05			
OL37	DUMMY	0.033	0	01:05			
OL38	DUMMY	0.042	0	01:05			
Pipe_-_(80)_(C-STRM)	DUMMY	0.079	0	01:05			

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Flow Classification Summary
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Conduit	Adjusted /Actual Length	---------- Fraction of Time in Flow Class ---------- Dry	Up Dry	Down Dry	Sub Crit	Sup Crit	Up Crit	Down Crit	Norm Ltd	Inlet Ctrl
C1	1.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00
C10	1.00	0.01	0.00	0.00	0.00	0.00	0.00	0.99	0.00	0.00
C11	1.00	0.01	0.00	0.00	0.00	0.00	0.00	0.98	0.00	0.00
C3	1.00	0.00	0.00	0.00	0.02	0.00	0.00	0.98	0.01	0.00
C5	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C6	1.00	0.97	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00
C7	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C8	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pipe_-_(38)_(C-STRM)	1.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00
Pipe_-_(39)_(C-STRM)	1.00	0.00	0.00	0.00	0.01	0.00	0.00	0.99	0.00	0.00
Pipe_-_(41)_(C-STRM)	1.00	0.00	0.00	0.00	0.01	0.00	0.00	0.99	0.00	0.00
Pipe_-_(42)_(C-STRM)	1.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00
Pipe_-_(43)_(C-STRM)	1.00	0.73	0.04	0.00	0.23	0.00	0.00	0.00	0.77	0.00
Pipe_-_(44)_(C-STRM)	1.00	0.00	0.71	0.00	0.28	0.01	0.00	0.00	0.72	0.00
Pipe_-_(45)_(C-STRM)	1.00	0.80	0.05	0.00	0.15	0.00	0.00	0.01	0.85	0.00
Pipe_-_(46)_(C-STRM)	1.00	0.86	0.05	0.00	0.08	0.00	0.00	0.00	0.98	0.00
Pipe_-_(47)_(C-STRM)	1.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00
Pipe_-_(48)_(C-STRM)	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.99	0.00	0.00
Pipe_-_(49)_(C-STRM)	1.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00
Pipe_-_(51)_(C-STRM)	1.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00
Pipe_-_(52)_(C-STRM)	1.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00
Pipe_-_(53)_(C-STRM)	1.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00
Pipe_-_(54)_(C-STRM)	1.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00
Pipe_-_(55)_(C-STRM)	1.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00
Pipe_-_(57)_(C-STRM)	1.00	0.00	0.00	0.00	0.01	0.00	0.00	0.99	0.00	0.00
Pipe_-_(59)_(C-STRM)	1.00	0.00	0.00	0.00	0.05	0.00	0.00	0.95	0.04	0.00
Pipe_-_(60)_(C-STRM)	1.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00
Pipe_-_(61)_(C-STRM)	1.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00
Pipe_-_(64)_(C-STRM)	1.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00
Pipe_-_(65)_(C-STRM)	1.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00
Pipe_-_(66)_(C-STRM)	1.00	0.00	0.00	0.00	0.02	0.01	0.00	0.97	0.02	0.00
Pipe_-_(67)_(C-STRM)	1.00	0.00	0.00	0.00	0.01	0.00	0.00	0.99	0.00	0.00
Pipe_-_(68)_(C-STRM)	1.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00
Pipe_-_(69)_(C-STRM)	1.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00
Pipe_-_(70)_(C-STRM)	1.00	0.00	0.70	0.00	0.29	0.01	0.00	0.00	0.71	0.00
Pipe_-_(71)_(C-STRM)	1.00	0.72	0.06	0.00	0.21	0.00	0.00	0.01	0.79	0.00
Pipe_-_(72)_(C-STRM)	1.00	0.80	0.09	0.00	0.10	0.00	0.00	0.01	0.93	0.00
Pipe_-_(73)_(C-STRM)	1.00	0.00	0.00	0.00	0.05	0.00	0.00	0.95	0.04	0.00
Pipe_-_(74)_(C-STRM)	1.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00
Pipe_-_(75)_(C-STRM)	1.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00
Pipe_-_(76)_(C-STRM)	1.00	0.00	0.04	0.00	0.95	0.01	0.00	0.00	0.97	0.00
Pipe_-_(77)_(C-STRM)	1.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00
Pipe_-_(78)_(C-STRM)	1.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00
Pipe_-_(79)_(C-STRM)	1.00	0.00	0.89	0.00	0.00	0.00	0.11	0.00	0.00	0.00
Pipe_-_(81)_(C-STRM)	1.00	0.01	0.00	0.00	0.01	0.00	0.00	0.98	0.00	0.00
Pipe_-_(82)_(C-STRM)	1.00	0.01	0.00	0.00	0.00	0.00	0.00	0.99	0.00	0.00
Pipe_-_(88)_(C-STRM)	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

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Conduit Surcharge Summary
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Hours Hours

Conduit	Hours Full Both Ends	Hours Full Upstream	Hours Full Dnstream	Hours Above Full Normal Flow	Hours Capacity Limited
C1	0.10	0.13	0.11	0.12	0.08
C10	0.03	0.03	0.16	0.01	0.01
C11	0.17	0.17	0.24	0.01	0.01
C3	0.39	0.39	0.42	0.29	0.30
Pipe_-_(38)_(C-STRM)	0.22	0.43	0.22	0.44	0.22
Pipe_-_(39)_(C-STRM)	0.21	0.22	0.22	0.19	0.21
Pipe_-_(41)_(C-STRM)	0.19	0.24	0.19	0.22	0.19
Pipe_-_(42)_(C-STRM)	0.01	0.22	0.01	0.21	0.01
Pipe_-_(43)_(C-STRM)	0.02	0.11	0.02	0.01	0.02
Pipe_-_(44)_(C-STRM)	0.01	0.04	0.01	0.01	0.01
Pipe_-_(45)_(C-STRM)	0.15	0.24	0.15	0.13	0.15
Pipe_-_(46)_(C-STRM)	0.21	0.21	0.24	0.01	0.16
Pipe_-_(47)_(C-STRM)	0.18	0.18	0.20	0.01	0.11
Pipe_-_(48)_(C-STRM)	0.17	0.17	0.18	0.01	0.12
Pipe_-_(49)_(C-STRM)	0.17	0.19	0.17	0.12	0.17
Pipe_-_(51)_(C-STRM)	0.19	0.20	0.19	0.09	0.19
Pipe_-_(52)_(C-STRM)	0.17	0.17	0.18	0.01	0.02
Pipe_-_(53)_(C-STRM)	0.16	0.16	0.17	0.01	0.01
Pipe_-_(54)_(C-STRM)	0.16	0.16	0.16	0.01	0.02
Pipe_-_(55)_(C-STRM)	0.16	0.16	0.16	0.01	0.14
Pipe_-_(57)_(C-STRM)	0.14	0.14	0.16	0.01	0.01
Pipe_-_(59)_(C-STRM)	0.18	0.18	0.19	0.01	0.03
Pipe_-_(60)_(C-STRM)	0.01	0.01	0.17	0.01	0.01
Pipe_-_(61)_(C-STRM)	0.15	0.17	0.18	0.10	0.08
Pipe_-_(64)_(C-STRM)	0.15	0.16	0.17	0.01	0.01
Pipe_-_(65)_(C-STRM)	0.13	0.13	0.15	0.01	0.01
Pipe_-_(66)_(C-STRM)	0.26	0.26	0.34	0.01	0.01
Pipe_-_(67)_(C-STRM)	0.35	0.35	0.38	0.07	0.14
Pipe_-_(68)_(C-STRM)	0.14	0.15	0.15	0.08	0.11
Pipe_-_(69)_(C-STRM)	0.11	0.11	0.13	0.01	0.03
Pipe_-_(70)_(C-STRM)	3.59	3.59	10.47	0.01	0.01
Pipe_-_(71)_(C-STRM)	1.20	1.20	3.26	0.01	0.01
Pipe_-_(73)_(C-STRM)	0.01	0.04	0.01	0.05	0.01
Pipe_-_(74)_(C-STRM)	0.01	0.01	0.01	0.01	0.01
Pipe_-_(75)_(C-STRM)	0.01	0.01	0.01	0.03	0.01
Pipe_-_(78)_(C-STRM)	0.01	0.14	0.01	0.15	0.01
Pipe_-_(81)_(C-STRM)	0.09	0.09	0.14	0.01	0.01
Pipe_-_(82)_(C-STRM)	0.01	0.01	0.09	0.01	0.01

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Link Pollutant Load Summary
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Link	TSS kg
C1	0.000
C10	0.000
C11	0.000
C3	0.000
C5	0.000
C6	0.000
C7	0.000
C8	0.000
Pipe_-_(38)_(C-STRM)	0.000
Pipe_-_(39)_(C-STRM)	0.000
Pipe_-_(41)_(C-STRM)	0.000
Pipe_-_(42)_(C-STRM)	0.000
Pipe_-_(43)_(C-STRM)	0.000
Pipe_-_(44)_(C-STRM)	0.000
Pipe_-_(45)_(C-STRM)	0.000
Pipe_-_(46)_(C-STRM)	0.000
Pipe_-_(47)_(C-STRM)	0.000
Pipe_-_(48)_(C-STRM)	0.000
Pipe_-_(49)_(C-STRM)	0.000
Pipe_-_(51)_(C-STRM)	0.000
Pipe_-_(52)_(C-STRM)	0.000
Pipe_-_(53)_(C-STRM)	0.000
Pipe_-_(54)_(C-STRM)	0.000
Pipe_-_(55)_(C-STRM)	0.000
Pipe_-_(57)_(C-STRM)	0.000
Pipe_-_(59)_(C-STRM)	0.000
Pipe_-_(60)_(C-STRM)	0.000
Pipe_-_(61)_(C-STRM)	0.000
Pipe_-_(64)_(C-STRM)	0.000
Pipe_-_(65)_(C-STRM)	0.000
Pipe_-_(66)_(C-STRM)	0.000
Pipe_-_(67)_(C-STRM)	0.000
Pipe_-_(68)_(C-STRM)	0.000
Pipe_-_(69)_(C-STRM)	0.000
Pipe_-_(70)_(C-STRM)	0.000
Pipe_-_(71)_(C-STRM)	0.000
Pipe_-_(72)_(C-STRM)	0.000
Pipe_-_(73)_(C-STRM)	0.000
Pipe_-_(74)_(C-STRM)	0.000
Pipe_-_(75)_(C-STRM)	0.000
Pipe_-_(76)_(C-STRM)	0.000
Pipe_-_(77)_(C-STRM)	0.000
Pipe_-_(78)_(C-STRM)	0.000
Pipe_-_(79)_(C-STRM)	0.000
Pipe_-_(81)_(C-STRM)	0.000
Pipe_-_(82)_(C-STRM)	0.000
Pipe_-_(88)_(C-STRM)	0.000
C2	0.000
C4	0.000
OR1	0.000
OR2	0.000
Pipe_-_(90)_(C-STRM)	0.000
OL10	0.000
OL11	0.000
OL12	0.000
OL13	0.000
OL17	0.000
OL18	0.000
OL2	0.000
OL20	0.000
OL23	0.000
OL24	0.000
OL25	0.000
OL26	0.000
OL27	0.000
OL28	0.000
OL29	0.000
OL31	0.000
OL35	0.000
OL36	0.000
OL37	0.000
OL38	0.000
Pipe_-_(80)_(C-STRM)	0.000

Analysis begun on: Fri Feb 7 11:41:12 2025
Analysis ended on: Fri Feb 7 11:41:15 2025
Total elapsed time: 00:00:03

Appendix D

Water balance assessment

Technical memorandum

07 February 2025

To	Puslinch Development GP Inc.	Contact No.	519-340-3902
Copy to		Email	sarah.andrew@ghd.com
From	Sarah Andrew, GHD Maxwell Robinson, GHD	Project No.	12618927
Project Name	Estill Innovation Community		
Subject	Preliminary Site-Specific and Feature-Based Water Balance Analysis		

1. Introduction

GHD Limited (GHD) was retained by Puslinch Development GP Inc. (Client) to complete preliminary Site-specific and feature-based water balance assessments in support of a proposed industrial and community development at 4631 Sideroad 20 North, Puslinch Township, Ontario (hereafter referred to as the 'Site'). A non-continuous hydrological model (Thornthwaite and Mather) at a monthly resolution was adopted for this approach. Both assessments were completed for pre-development and post-development (uncontrolled) conditions. The post-development (controlled) scenario will be completed once the stormwater management (SWM) plan has been developed and finalized. The Site location is shown on Figure 1.

1.1 Purpose of this memorandum

Two (2) water balance analyses were conducted for this assessment. The objective of the Site-specific analysis is to characterize the impact of the proposed development on groundwater recharge in comparison to pre-development conditions. The objective of the feature-based assessment is to characterize the hydroperiods of the on-Site wetland feature (a part of the Cranberry Oil Well Bog Wetland Complex) and assess the impact of the proposed development on its hydrological functions. The approach used to complete the analyses is summarized below:

– Review available topographic data, climate data, hydrogeological data, and plans and drawings for the proposed development at the Site.
– Perform a subcatchment delineation to determine the contributing drainage areas of the on-Site wetland feature.
– Complete monthly water balance calculations using the Thornthwaite and Mather approach for the Site and on-Site wetland feature under pre-development and post-development (uncontrolled) conditions.
– Compare the predicted infiltration and runoff volumes between the pre- and post-development conditions to assess the impact of the proposed development on the hydrological function of the on-Site wetland feature, with and without SWM and low impact development (LID) controls in place.
– Provide recommendations to meet pre-development conditions for infiltration through LID measures, if applicable.

1.2 Scope and limitations

This technical memorandum has been prepared by GHD for Puslinch Development GP Inc.. It is not prepared as, and is not represented to be, a deliverable suitable for reliance by any person for any purpose. It is not intended for circulation or incorporation into other documents. The matters discussed in this memorandum are limited to those specifically detailed in the memorandum and are subject to any limitations or assumptions specially set out.

GHD has prepared this memorandum on the basis of information provided by the Client and others who provided information to GHD (which may also include Government authorities), which GHD has not independently verified or checked for the purpose of this memorandum. GHD does not accept liability in connection with such unverified information, including errors and omissions in the memorandum which were caused by errors or omissions in that information.

The opinions, conclusions and any recommendations in this memorandum are based on information obtained from, and testing undertaken at or in connection with, specific sample points. Site conditions at other parts of the site may be different from the site conditions found at the specific sample points.

Investigations undertaken in respect of this memorandum are constrained by the particular site conditions, such as the location of buildings, services and vegetation. As a result, not all relevant site features and conditions may have been identified in this memorandum.

Accessibility of documents

If this technical memorandum is required to be accessible in any other format this can be provided by GHD upon request and at an additional cost if necessary.

2. Site description

2.1 Pre-development conditions

Under pre-development conditions, the Site is situated in the rural area of the Township of Puslinch, Wellington County, adjacent to the City of Guelph. The Site is bounded by Provincial Highway 6 (Hanlon Parkway) to the east, Concession Road 4 to the south and Side Road 20 N to the west. The Site is triangular in shape and is approximately 25 hectares (ha) and currently consists of unoccupied land used for agricultural purposes. There is a small vegetated/wetland area just north of Concession Road 4 that is part of the Cranberry Oil Well Bog Wetland Complex, a provincially significant wetland complex. The surficial soils within the Site were primarily gravel, sandy silt, and silty sand based on the Ontario Ministry of Agriculture, Food, and Rural Affairs (OMAFRA) AgMaps database and borehole logs conducted by GHD (2024). A map of the pre-development conditions for both the Site-specific and feature-based water balance analyses is provided on Figure 2.

The Site is located within the jurisdiction of the Grand River Conservation Authority (GRCA) and is located within the Grand River sub-watershed, which ultimately drains to Lake Erie. The Site sits within a Tier 2 Significant Groundwater Recharge Area (SGRA), a Well Head Protection Area (WHPA), and a regulated zone for the on-Site wetland. The on-Site provincially significant wetland feature sits at an elevation of 331 meters above sea level (masl) and internally drains (i.e., no outlet).

To evaluate the impacts of the proposed development on the hydrological function of the on-Site wetland feature, an assessment point was placed at the center of the on-Site wetland feature. This assessment point will be used to evaluate the changes in drainage area and surplus contributing to the on-Site wetland feature.

2.2 Post-development conditions

Under post-development conditions, the Site will consist of three (3) slab-on-grade industrial structures and two (2) slab-on-grade commercial structures surrounded by parking lots, paved aprons, walkways, and roadways. A

SWM pond will also be included to meet stormwater control criteria. It is assumed the proposed structures will be one- to two-stories with no basements. These areas are based on the “Puslinch Industrial Development OPA/ZBA Site Plan” prepared by Sweeny & Co Architects (January 2025). In the southwest corner of the Site, adjacent to Sideroad 20 North, there is additional capacity to an accommodate a future slab-on-grade industrial structure and adjacent walkways/roadways/parking lots, if desired. Additionally, the expansion areas adjacent to the proposed industrial buildings will likely be developed in the future as parking lots. For the purposes of this assessment, the potential future industrial structure, adjacent walkways/roadways/parking lots, and expansion areas will be considered in the Site-specific and feature-based water balance assessments to account for the additional impervious area when designing the proposed SWM and LID measures.

As the Site Plan is currently in development, GHD understands that any changes to the Concept Plan would require the revision of the post-development (uncontrolled) condition scenario of the water balance assessment. A map of the post-development conditions, per the Site Plan to-date, for both the Site-specific and feature-based water balance analyses is provided on Figure 3.

As no finalized drainage plan for the proposed development was available at the time of the assessments, it was assumed that only the area within the adjacent walkway surrounding the on-Site wetland feature and between the SWM pond would drain towards the on-Site wetland feature.

A land use breakdown of the pre- and post-development conditions for the Site-specific water balance is provided below in Table 1.

Table 1 Site-specific land use breakdown of the pre- and post-development condition areas

Land use	Area (ha)	Total percent area (%)
Pre-development		
Moderately rooted agriculture (corn)	13.22	52.9
Meadow	4.42	17.7
Meadow (former gravel quarry)	4.27	17.1
Abandoned farm buildings	0.03	0.1
Thicket/hedgerows	2.67	10.7
On-Site wetland (shallow aquatic)	0.20	0.8
On-Site wetland (deciduous swamp)	0.16	0.7
Total Site area:	**24.97**	**100**
Post-development		
Grassed area/SWM pond banks	6.18	24.7
Grassed area/SWM pond banks (former gravel quarry)	1.13	4.5
Industrial/community buildings	6.94	27.8
Parking lots/walkways/roadways	9.07	36.3
On-Site wetland (shallow aquatic)	0.20	0.8
On-Site wetland (deciduous swamp)	0.16	0.7
Meadow (wetland buffer)	0.66	2.7
Thicket (wetland buffer)	0.31	1.2
SWM pond	0.32	1.3
Total Site area:	**24.97**	**100**

A breakdown of pre- and post-development conditions land uses for the feature-based water balance is provided below in Table 2.

Table 2 Feature-based land use breakdown of the pre- and post-development condition areas

Assessment point	AP-1	
Land use	**Area (ha)**	**Total percent area (%)**
Pre-development		
Moderately rooted agriculture (corn)	9.79	50.9
Meadow	4.88	25.4
Meadow (former gravel quarry)	2.52	13.1
Abandoned farm buildings	0.03	0.2
Thicket/hedgerows	1.03	5.3
Roadway	0.62	3.2
On-Site wetland (shallow aquatic)	0.20	1.1
On-Site wetland (deciduous swamp)	0.16	0.8
Total Site area:	**19.23**	**100**
Post-development		
Grassed area	0.56	29.5
Walkways	0.01	0.5
On-Site wetland (shallow aquatic)	0.20	10.5
On-Site wetland (deciduous swamp)	0.16	8.4
Meadow (wetland buffer)	0.66	34.7
Thicket (wetland buffer)	0.31	16.4
Total Site area:	**1.90**	**100**

3. Surface water balance

3.1 Methodology

The Site-specific and feature-based water balance assessments were conducted based on the standard methodology described in the document titled “Hydrogeological Assessment Submissions, Conservation Authority Guidelines for Development Applications (June 2013)”. The standardized water balance approach is to utilize the “Meteorological Service Data Analysis and Archive Division of Environment Canada (EC)” to provide monthly water balance summaries for different soil-water holding capacities.

Water holding capacity (WHC)

The maximum soil storage is quantified as the water holding capacity (WHC), which is defined based on a combination of land use and soil type, as presented in Table 3.1 of the MOE SWM Manual (2003). The WHC represents the total amount of water that can be stored in the soil capillaries and is defined as the water content between the field capacity and wilting point (the practical maximum and minimum soil water content, respectively). WHC values typically range from approximately 10 millimetres (mm) for bedrock and impervious areas to 400 mm for mature forest over silt loam.

Climate data

The water balance assessments presented herein are based on composite meteorological data from the Environment and Climate Change Canada (ECCC) Thornthwaite and Mather water budget. Historical records spanning 48 years between 1975 to 2023 were compiled from six nearby climate stations, with missing observations substituted with records from nearby stations. The stations are summarized in Table 3 with the ECCC data presented in Table A1 in Appendix A.

Table 3 ECCC climate stations near the Site

Climate ID	Station name	Record period(s)	Distance from Site (km)
6143069	Guelph Arboretum	1975 – 1997	8.3 NW
6149387	Waterloo Wellington Airport	1997 – 2001	15.6 SW
6143090	Guelph Turfgrass CS	2001 – 2003	8.3 NW
6149388	Region of Waterloo Int'l Airport	2003 – 2010	14.8 SW
6144239	Kitchener/Waterloo	2010 – 2021	14.8 SW
6143092	Guelph Turfgrass Institute	2021 – 2023	8.3 NW

Model approach

The results from EC water balance model presents the following monthly output: temperature (mean), precipitation, rainfall, snowmelt, potential evapotranspiration (PET), actual evapotranspiration (AET), and water surplus (WS) for each of the years in the historic record, as well as average monthly values over the entire record. The model is used to estimate the soil storage (water) surplus based on a provided soil water holding capacities.

The Thornthwaite and Mather (1957) method is used to calculate the potential and actual amounts of evapotranspiration and water surplus. The calculations are performed on a daily basis and consists of daily precipitation (rainfall and snowmelt) and temperature data to estimate evapotranspiration (ET), soil-water storage, and water surplus. The EC water balance model utilizes a daily timestep developed by the Meteorological Service of Canada (MSC), as daily data allows for more accurate modelling of snowmelt and snow storage, which are of particular importance in a cold weather/winter climate (Johnstone and Louie, 1983).

The water balance calculations are based on the following equation:

$$P = S + ET + WS$$

Where:

P = precipitation

S = change in soil water storage

ET = evapotranspiration

WS = water surplus (surface runoff and infiltration)

Precipitation (P) is either rain or snow depending on the mean daily temperature. Evapotranspiration (ET) refers to the water that is lost to the atmosphere due to evaporation from soil or water and due to transpiration from plants and trees. The Thornthwaite & Mather (1957) methodology estimates AET based on the following condition: 1) AET equals PET when there is enough water available within the soil storage (water holding capacity) to meet the evapotranspiration demand, otherwise, 2) AET equals the amount of water that is available for evapotranspiration.

The water surplus (WS) is the difference between P and AET and is calculated when the water holding capacity of the soil storage is exceeded. The WS represents the total water available in each month to runoff as surface overland flow or infiltrate to the ground and recharge the groundwater table. The average annual water surplus is separated into infiltration and runoff based on an infiltration factor. The infiltration factor is presented in Table 3.1 of the MOE SWM Manual (2003). Site-specific infiltration factors are estimated based on aggregating the infiltration factors for topography, surficial soil type, and vegetative cover factors (land use).

3.2 Catchment delineation

The “Watershed Delineation Tool” in PCSWMM was used to delineate the feature-based sub-catchment area for the pre-development condition as shown on Figure 2. Results of the analysis showed three drainage splits: 1) along the northern boundary from Sideroad 20 N going northeast across the Site to Highway 6, 2) along the southeast boundary from Concession Road 4 going northeast across the Site to Highway 6, and 3) along the southwest boundary from Sideroad 20 N going southeast across the Site to Concession Road 4. The post-development (uncontrolled) conditions sub-catchment area was delineated under the assumption that the adjacent pervious areas between the adjacent walkways and the SWM pond would gravity drain to the wetland as shown on Figure 3.

Assessment point 1 (AP-1)

Assessment point-1 (AP-1) is located within the center of the on-Site wetland feature. The sub-catchment for this assessment point has a total area of 19.23 ha, of which 17.29 ha lies within the Site boundary. The predominant land use of the sub-catchment within the Site is moderately rooted agriculture, cultural thicket/hedgerows, and cultural meadow. The proposed development will decrease the size of the sub-catchment, rediverting the majority of the drainage either offsite, to a potential LID measure or to the SWM facility for runoff attenuation prior to discharge.

3.3 Surface water balance parameters

The surficial soils are primarily sandy silt, silty sand, and gravel deposits (i.e., loam) within the surrounding area, based on the borehole drilling logs completed by GHD (2024). A former gravel quarry is present underneath the Site along the southern boundary with its surficial soil primarily consisting of fine sand, gravel, and silt (i.e., fine sandy loam) based on the borehole drilling logs GHD (2024). Available topography for the Site can be classified as rolling to hilly land with an average slope between 3.8 - 28 m/km. The maximum soil storage was quantified using a WHC based on guidelines provided in Table 3.1 of the MOE SWM Manual (2003). The infiltration factors and WHCs for the pre-development and post-development land uses, Site-specific topography, surficial soil type, and vegetative cover factors are presented for the Site-specific and feature-based water balance assessments in Table A2 and Table A3 in Appendix A, respectively.

The water balance analysis was developed under the following assumptions:

- WHCs were chosen based on Table 3.1 in the MOE SWM Manual (2003) corresponding to the loam soil type, pre- and post-development (uncontrolled) condition land uses for the Site-specific and feature-based water balances.
- For the impervious areas, WHCs of 2 mm and 10 mm were chosen to represent the roofed and paved areas, respectively. A WHC of 2 mm was chosen for roofed areas as minimal depression storage is available on sloped roofs. A WHC of 10 mm was chosen for paved areas due to the presence of depressions throughout the surface which could hold runoff.
- Assuming changes to grading and GW level, the septic tank should be at a depth that will not impact infiltration.
- For the on-Site wetland feature (i.e., the shallow aquatic wetland and deciduous swamp), WHCs of 175 and 325 mm were chosen, respectively, to represent the storage capacity provided by the depressions of the wetland and treed swamp based on the observation of standing water present throughout the majority of the year, as discussed in Section 6.0.
- For the SWM pond area, a value for the annual lake evaporation to represent the open water was obtained from the lake evaporation climate normals for Waterloo Wellington ECCC Meteorological Station between 1981 to 2010 (690 mm/year).
- For the on-Site wetland features and SWM pond, a null infiltration factor was chosen due to the presence of standing water throughout the majority of the year.

– Net surplus was estimated by multiplying the estimated monthly surplus for the assumed WHC by the associated drainage area. AET and surplus values were obtained from the meteorological data from the composite Guelph - Waterloo ECCC Meteorological Station based on the WHC assigned to each land use area.
– Runoff was calculated as the difference between surplus and infiltration.

4. Site-specific surface water balance

4.1 Water balance results

An average annual water balance was carried out on a Site-specific basis. The results for the pre-development and post-development (uncontrolled) conditions are presented in this section.

4.1.1 Pre-development conditions

Based on the results of the assessment, the average annual pre-development water balance was estimated on a Site-specific basis as summarized in Table 4, with detailed monthly values provided in Table A4 in Appendix A.

Table 4 Pre-development average annual water balance results – Site-specific

Land use	Area (ha)	Average annual volume m^3/a [1]				
		Precipitation (P)	Evapotranspiration (ET)	Surplus (S)	Infiltration (I)	Runoff (R)
Moderately rooted agriculture (corn)	13.22	112,750	76,005	36,480	20,065	16,415
Meadow	4.42	37,680	25,665	11,880	6,535	5,345
Meadow (former gravel quarry)	4.27	36,410	24,205	12,125	6,670	5,455
Abandoned farm Buildings	0.03	275	150	125	-	125
Thicket/hedgerows	2.67	22,765	15,905	6,805	4,425	2,380
On-Site wetland (shallow aquatic)	0.20	1,730	1,165	560	-	560
On-Site wetland (deciduous swamp)	0.16	1,395	970	420	-	420
Total	**24.97**	**213,005**	**144,065**	**68,395**	**37,695**	**30,700**

Notes:

1. Volumes are rounded for reporting purposes.

4.1.2 Post-development (uncontrolled) conditions

Based on the results of the assessment, the average annual post-development (uncontrolled) water balance was estimated on a Site-specific basis as summarized in Table 5, with detailed monthly values provided in Table A5 in Appendix A.

Table 5 Post-development (uncontrolled) average annual water balance results – Site-specific

Land use	Area (ha)	Average annual volume m^3/a [1]				
		Precipitation (P)	Evapotranspiration (ET)	Surplus (S)	Infiltration (I)	Runoff (R)
Grassed area/SWM pond banks	6.18	52,710	33,490	19,090	10,500	8,590
Grassed area/SWM pond banks (former gravel quarry)	1.13	9,650	5,940	3,710	2,040	1,670
Industrial/community buildings	6.94	59,170	31,285	27,955	-	27,955
Parking lots/walkways/roadways	9.07	77,330	41,795	35,535	-	35,535
On-Site wetland (shallow aquatic)	0.20	1,730	1,165	560	-	560
On-Site wetland (deciduous swamp)	0.16	1,395	970	420	-	420
Meadow (wetland buffer)	0.66	5,660	3,760	1,885	1,035	850
Thicket (wetland buffer)	0.31	2,660	1,860	795	515	280
SWM pond	0.32	2,700	2,185	520	-	520
Total	**24.97**	**213,005**	**122,450**	**90,470**	**14,090**	**76,380**

Notes:

1. Volumes are rounded for reporting purposes.

4.1.3 Post-development (controlled) conditions

Upon review of the water balance results, recommendations for the potential incorporation of LIDs, SWM facilities, or changes in grading to meet pre-development conditions will be determined, if necessary. If any control measures are proposed, the post-development (controlled) conditions scenario will be evaluated.

4.2 Summary of water balance results

A summary of the annual water balance assessment considering surplus, infiltration, and runoff for the pre-development and post-development (uncontrolled) conditions is provided in Table 6, with detailed annual values provided in Table A6 in Appendix A.

Table 6 Summary of average annual water balance results – Site-specific

Scenario	Area (ha)	Average annual volume [1]					
		Surplus (S)		Infiltration (I)		Runoff (R)	
		m^3/a	mm/a	m^3/a	mm/a	m^3/a	mm/a
Pre-development	24.97	68,395	274	37,695	151	30,700	123
Post-development (uncontrolled)	24.97	90,470	362	14,090	56	76,380	306
Difference from pre-development	-	22,075	88	(23,605)	(95)	45,680	183

Notes:

1. Volumes are rounded for reporting purposes.

Under post-development (uncontrolled) conditions, Site-specific surplus is anticipated to increase by 22,075 m^3/year (88 mm/year), representing a corresponding decrease in evapotranspiration due to changes in land use. Direct infiltration is anticipated to decrease by 23,605 m^3/year (95 mm/year) due to an increase in impervious area. This will effectively increase the runoff generated within the Site by 45,680 m^3/year (183 mm/year).

5. Feature-based surface water balance

5.1 Water balance results

An average annual water balance was carried out on a feature-based basis. The results for the pre-development and post-development (uncontrolled) conditions are presented in this section.

5.1.1 Pre-development conditions

Based on the results of the assessment, the average annual pre-development water balance was estimated on a feature-based basis as summarized in Table 7, with detailed monthly values provided in Table A7 in Appendix A.

Table 7 Pre-development average annual water balance results – feature-based

Assessment point	Area (ha)	Average annual volume m^3/a [1]				
		Precipitation (P)	Evapotranspiration (ET)	Surplus (S)	Infiltration (I)	Runoff (R)
AP-1	19.23	164,070	110,130	53,515	27,725	25,790

Notes:

1. Volumes are rounded for reporting purposes.

5.1.2 Post-development (uncontrolled) conditions

Based on the results of the assessment, the average annual post-development (uncontrolled) water balance was estimated on a feature-based basis as summarized in Table 8, with detailed monthly values provided in Table A8 in Appendix A.

Table 8 Post-development (uncontrolled) average annual water balance results – feature-based

Assessment points	Area (ha)	Average annual volume m^3/a [1]				
		Precipitation (P)	Evapotranspiration (ET)	Surplus (S)	Infiltration (I)	Runoff (R)
AP-1	1.90	16,200	10,830	5,345	2,460	2,885

Notes:

1. Volumes are rounded for reporting purposes.

5.1.3 Post-development (controlled) conditions

Upon review of the water balance results, recommendations for the potential incorporation of LIDs, SWM facilities, or changes in grading to meet pre-development conditions will be determined, if necessary. If any control measures are proposed, the post-development (controlled) conditions scenario will be evaluated.

5.2 Summary of water balance results

A summary of the annual water balance assessment considering surplus, infiltration, and runoff for the pre-development and post-development (uncontrolled) conditions is provided in Table 9 for AP-1, with detailed annual values provided in Table A9 in Appendix A.

Table 9 Summary of average annual water balance results – feature-based (AP-1)

Scenario	Area (ha)	Average annual volume [1]					
		Surplus (S)		Infiltration (I)		Runoff (R)	
		m^3/a	mm/a	m^3/a	mm/a	m^3/a	mm/a
Pre-development	19.23	53,515	278	27,725	144	25,790	134
Post-development (uncontrolled)	1.90	5,345	281	2,460	129	2,885	152
Difference from pre-development	(17.33)	(48,170)	(250)	(25,265)	(131)	(22,905)	(119)

Notes:

1. Volumes are rounded for reporting purposes.

Under post-development (uncontrolled) conditions, surplus to AP-1 is anticipated to decrease by 90% (250 mm/year) compared to pre-development conditions. The change in surplus represents a decrease in evapotranspiration caused by the change in land use and decrease in catchment area of 17.33 ha (90%). Direct infiltration is anticipated to decrease by 25,265 m^3/year (131 mm/year) and runoff to AP-1 is expected to decrease by 22,905 m^3/year (119 mm/year).

6. Assessment of the on-Site wetland features hydroperiod

6.1 Wetland water level monitoring

To understand baseline conditions, GHD initiated a surface water monitoring program in May 2024 to be conducted over a monitoring period of one (1) year to ensure seasonal data is collected (i.e., spring, summer, fall, and winter). To characterise the hydroperiods of the on-Site wetland feature, GHD established one (1) monitoring location (SW1/MP1) within the wetland as shown on Figure 2.

At this monitoring location, a staff gauge and mini piezometer were installed to measure discrete surface water and shallow groundwater levels, respectively, in conjunction with continuous measurements of water level and temperature recorded by non-vented pressure transducers at 15-minute intervals.

The continuous and manual surface water level hydrograph for the wetland, relative to local precipitation, is presented in Appendix B. As depicted in the hydrograph, surface water levels were observed within the wetland throughout the late spring to late summer with water levels going dry shortly after the beginning of September. Shallow groundwater levels were observed to be below the ground surface from the spring to early summer (May to July) and the late fall (November to December), with levels raising above the ground surface throughout the summer and early fall (July to November). These observations indicate a losing condition for the wetland feature as the shallow groundwater levels were below the ground surface for the majority of the monitoring period. Throughout the monitoring period to date, both the shallow groundwater and surface water levels showed responses to large precipitation events, with surface water showing a more exaggerated response. Based on the monitoring data to date for the water levels within the on-Site wetland feature, it can be inferred that the hydroperiod of the feature falls within the late spring to late summer months of the year (May to September) before becoming dry for the remainder of the year.

6.2 Water balance

Under post-development (uncontrolled) conditions, the on-Site wetland feature (i.e., AP-1) was estimated to experience a runoff deficit of 22,905 m^3/year (119 mm/year) and an infiltration deficit of 25,265 m^3/year (131 mm/year). Table 10 and Table 11 below show a breakdown of the monthly runoff and infiltration volumes to the on-Site wetland feature, respectively, to characterize the potential changes to its hydroperiods under post-development (uncontrolled) conditions.

Table 10 Summary of average monthly runoff volumes to on-Site wetland feature

Scenario	Area		Average monthly runoff volume to on-Site wetland feature (AP-1)					
	Pre-development	Post-development	Pre-development		Post-development (uncontrolled)		Change from pre-development	
	ha		m^3/a	mm/a	m^3/a	mm/a	m^3/a	mm/a
January	19.23	1.90	2,300	12	260	14	(2,040)	(11)
February			4,045	21	450	24	(3,595)	(19)
March			6,905	36	780	41	(6,125)	(32)
April			4,370	23	495	26	(3,875)	(20)
May			1,280	7	145	8	(1,135)	(6)
June			285	1	30	2	(255)	(1)
July			130	1	10	1	(120)	(1)
August			120	1	10	1	(110)	(1)
September			745	4	75	4	(670)	(3)
October			720	4	70	4	(650)	(3)
November			2,130	11	240	13	(1,890)	(10)
December			2,760	14	320	17	(2,440)	(13)
Total	**19.23**	**1.90**	**25,790**	**134**	**2,885**	**152**	**(22,905)**	**(119)**

Table 11 Summary of average monthly infiltration volumes to on-Site wetland feature

Scenario	Area		Average monthly infiltration volume to on-Site wetland feature (AP-1)					
	Pre-development	Post-development	Pre-development		Post-development (uncontrolled)		Change from pre-development	
	ha		m^3/a	mm/a	m^3/a	mm/a	m^3/a	mm/a
January	19.23	1.90	2,470	13	230	12	(2,240)	(12)
February			4,470	23	385	20	(4,085)	(21)
March			7,655	40	660	35	(6,995)	(36)
April			4,860	25	415	22	(4,445)	(23)
May			1,415	7	120	6	(1,295)	(7)
June			305	2	25	1	(280)	(1)
July			100	1	10	1	(90)	(0)
August			100	1	10	1	(90)	(0)
September			710	4	60	3	(650)	(3)
October			610	3	60	3	(550)	(3)
November			2,100	11	205	11	(1,895)	(10)
December			2,930	15	280	15	(2,650)	(14)
Total	**19.23**	**1.90**	27,725	144	2,460	129	(25,265)	(131)

Under pre-development conditions, the on-Site wetland feature receives the majority of its yearly surplus (infiltration and runoff) volume from late fall to the spring freshet. This observation is in line with the hydroperiods identified in the water level monitoring program results to date as detailed in Section 6.1 above. Therefore, the reduction of surplus volume to the on-Site wetland feature due to catchment loss under post-development (uncontrolled) conditions has greater potential to impact the duration of the hydroperiod for the feature.

7. Recommendations

7.1 Potential LID measures

Based on a Site-wide infiltration deficit of 23,605 m^3/year (95 mm/year), GHD recommends the use of LIDs with particular interest in capturing and infiltrating a percentage of runoff generated from the industrial and community buildings to meet pre-development conditions. A breakdown of the Site-specific annual water balance assessment considering surplus, infiltration, and runoff for the post-development (uncontrolled) condition for the industrial/community buildings, as seen on Figure 3, is provided in Table 12. Field monitored groundwater levels in the vicinity of each industrial/community building are provided in Table 13.

Table 12 Summary of average annual water balance results – industrial/community buildings

Building ID	Area (ha)	Predominant soil type in potential LID areas	Average annual volume					
			Surplus (S)		Infiltration (I)		Runoff (R)	
			m^3/a	mm/a	m^3/a	mm/a	m^3/a	mm/a
Industrial Building #1	2.71	Gravelly silty sand/ gravel and sandy silt	10,910	403	-	-	10,910	403
Industrial Building #2	1.24	Sandy silt/ silty sand	5,015		-	-	5,015	
Industrial Building #3	1.32	Sandy silt/ silty sand	5,315		-	-	5,315	
Gym	0.12	Gravelly silty sand/ gravel and sandy silt	500		-	-	500	
Daycare	0.11	Sandy silt/ silty sand	385		-	-	385	
Total	**5.50**	**-**	**22,125**	**403**	**-**	**-**	**22,125**	**403**

Table 13 Summary of nearby groundwater levels (November 2023 - October 2024)

Building ID	Nearby monitoring well	Minimum measured groundwater level (mbgs)	Maximum measured groundwater level (mbgs)
Industrial Building #3	MW1-23	4.02	4.34
Industrial Building #2	MW5-23	4.27	4.53
Industrial Building #2	MW6-23	-[1]	-[1]
Industrial Building #1	MW7-23	9.34	10.49
Daycare	MW10-23	1.77	4.51
Industrial Building #1	MW11-23	4.03	4.21
Industrial Building #1/Gym	MW12-23	-[1]	-[1]
Industrial Building #1	MW13-23	-[1]	-[1]

Notes:

1. When monitoring wells were field measured for manual groundwater levels, the wells were observed to be dry. As the well depth detailed in the installation logs were each 4.60 mbgs, it can be inferred that groundwater levels were below that level.

Based on the borehole drilling logs and groundwater level monitoring to date (GHD, 2024), the presence of gravelly silty sand south of Industrial Building #1 would aid in the implementation of LID controls to direct generated clean runoff from the building roofs to meet pre-development infiltration (24,110 m^3/year). The remaining areas of the Site with silty sand/sandy silt deposits would also aid in LID implementation. As detailed in Table 13, the separation between the existing ground surface and highest groundwater level is greater than 1 mbgs which is favourable for LID implementation. Additionally, the potential to incorporate LIDs near the southern portion of the Site with the gravelly silty sand deposits will be dependent on the proposed grading plan.

Overall, GHD recommends the use of roof downspout disconnection to bioswales and infiltration galleries to the areas surrounding the proposed Industrial Building #1 to increase post-development infiltration within the Site and to the on-Site wetland. If the Site cannot be mitigated with the currently proposed development buildings, then the future industrial structure will be considered in the LID design.

7.2 Runoff conveyance to on-Site wetland

Based on a runoff deficit of 22,905 m^3/year (119 mm/year) to the on-Site wetland due to the reduction in catchment area, GHD recommends the implementation of a runoff conveyance system to divert either clean runoff from roof areas or overflow from LIDs towards the wetland to meet pre-development conditions. The on-Site wetland can be treated as a potential LID measure as the groundwater table sits below the ground surface for the majority of the year. Additionally, water from the SWM pond could be directed to the wetland feature to aid in restoring its hydroperiod.

8. Conclusions

Site-specific and feature-based water balance analyses were completed to characterize the impact of the proposed development on groundwater recharge and the on-Site wetland feature in comparison to pre-development conditions and to recommend LID measures to meet pre-development condition infiltration volumes. The assessment resulted in the following conclusions and recommendations.

- Compared to pre-development conditions (68,395 m^3/yr), average annual surplus over the Site area will increase by 22,075 m^3/yr (88 mm/yr) under post-development (uncontrolled) conditions.
- Compared to pre-development conditions (37,695 m^3/yr), average annual infiltration over the Site area will decrease by 23,605 m^3/yr (95 mm/yr) under post-development (uncontrolled) conditions.
- Compared to pre-development conditions (30,700 m^3/yr), average annual runoff over the Site area will increase by 45,680 m^3/yr (183 m/yr) under post-development (uncontrolled) conditions.
- Compared to pre-development conditions (53,515 m^3/yr), average annual surplus to AP-1 will decrease by 48,170 m^3/yr (250 mm/yr) under post-development (uncontrolled) conditions.
- Compared to pre-development conditions (27,725 m^3/yr), average annual infiltration to AP-1 will decrease by 25,265 m^3/yr (131 mm/yr) (under post-development (uncontrolled) conditions.
- Compared to pre-development conditions (25,790 m^3/yr), average annual runoff to AP-1 will decrease by 22,905 m^3/yr (119 mm/yr) under post-development (uncontrolled) conditions.
- GHD recommends the use of LIDs to retain and infiltrate roof runoff within the vicinity of the former gravel quarry (i.e., adjacent to Industrial Building #1 and the Gym) as well as other areas across the Site, and to divert runoff to the on-Site wetland to minimize impacts to its hydroperiod.

Regards

Sarah Andrew, P.Eng.
Water Resources Engineer

Maxwell Robinson, B.Eng.
Intermediate Surface Water Professional

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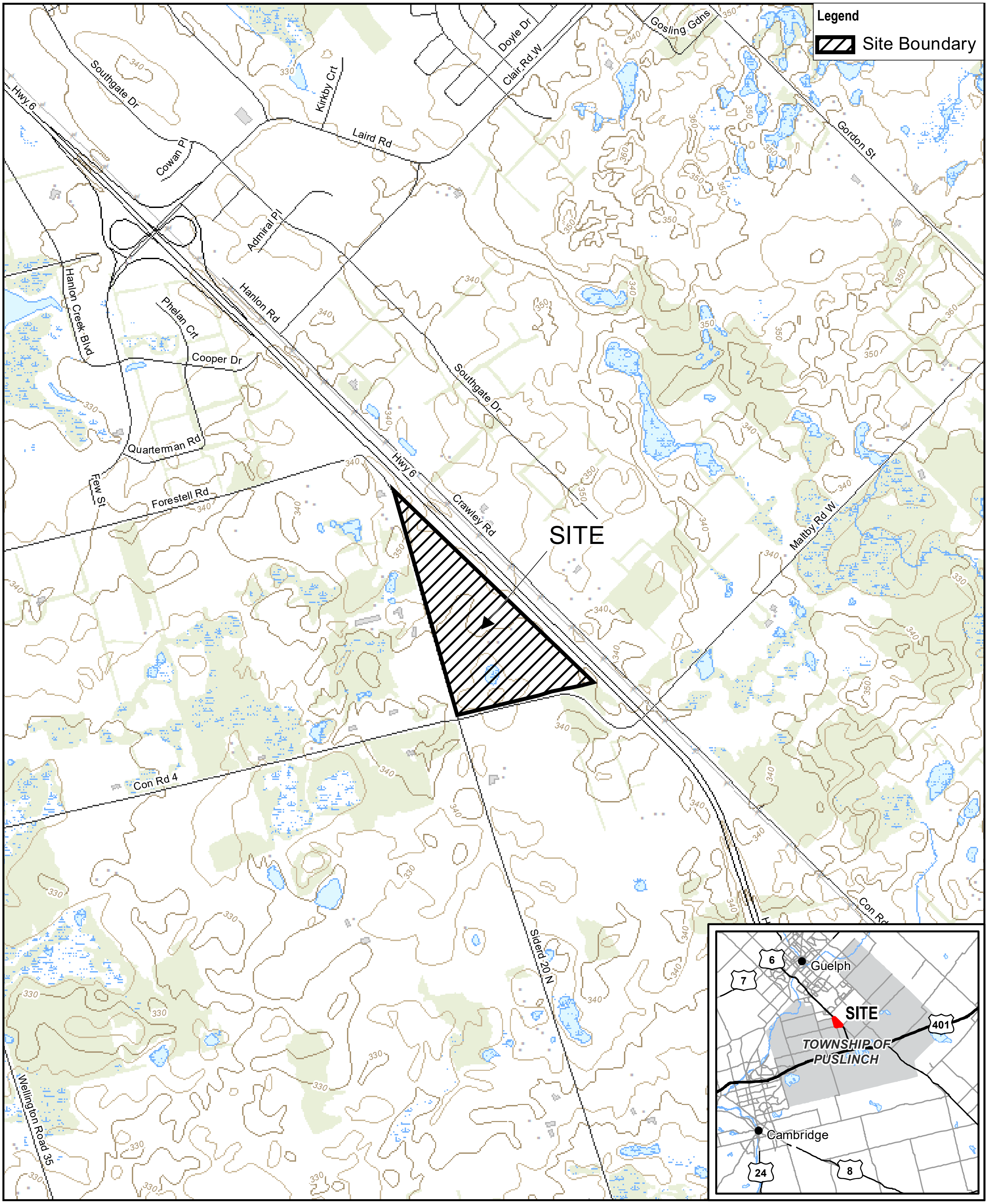
Document title	Preliminary Site-Specific & Feature-Based Water Balance Analysis Technical Memorandum
Project number	12618927
File name	12618927-MEM-02-Site-Specific & Feature-Based Water Balances.docx

Status Code	**Revision**	**Author**	**Reviewer**		**Approved for issue**		
			Name	**Signature**	**Name**	**Signature**	**Date**
S3	P01	Max Robinson	Sarah Andrew	On file			31 Jan 2025
S4	P01	Max Robinson	Sarah Andrew		Mark Moini		07 Feb 2025
[Status code]							
[Status code]							
[Status code]							

GHD Ltd.
Contact: Sarah Andrew, Water Resources Engineer | GHD
455 Phillip Street, Unit 100A
Waterloo, Ontario N2L 3X2, Canada
T +1 519 884 0510 | **F** +1 519 884 0525 | **E** info-northamerica@ghd.com | **ghd.com**

Figures



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GHD

PUSLINCH DEVELOPMENT GP INC.

4631 SIDEROAD 20 NORTH,
PUSLINCH TOWNSHIP, ONTARIO
HYDROGEOLOGICAL INVESTIGATION

SITE LOCATION MAP

Project No. **12618927**
Revision No. **-**
Date **Jan 30, 2025**

FIGURE 1

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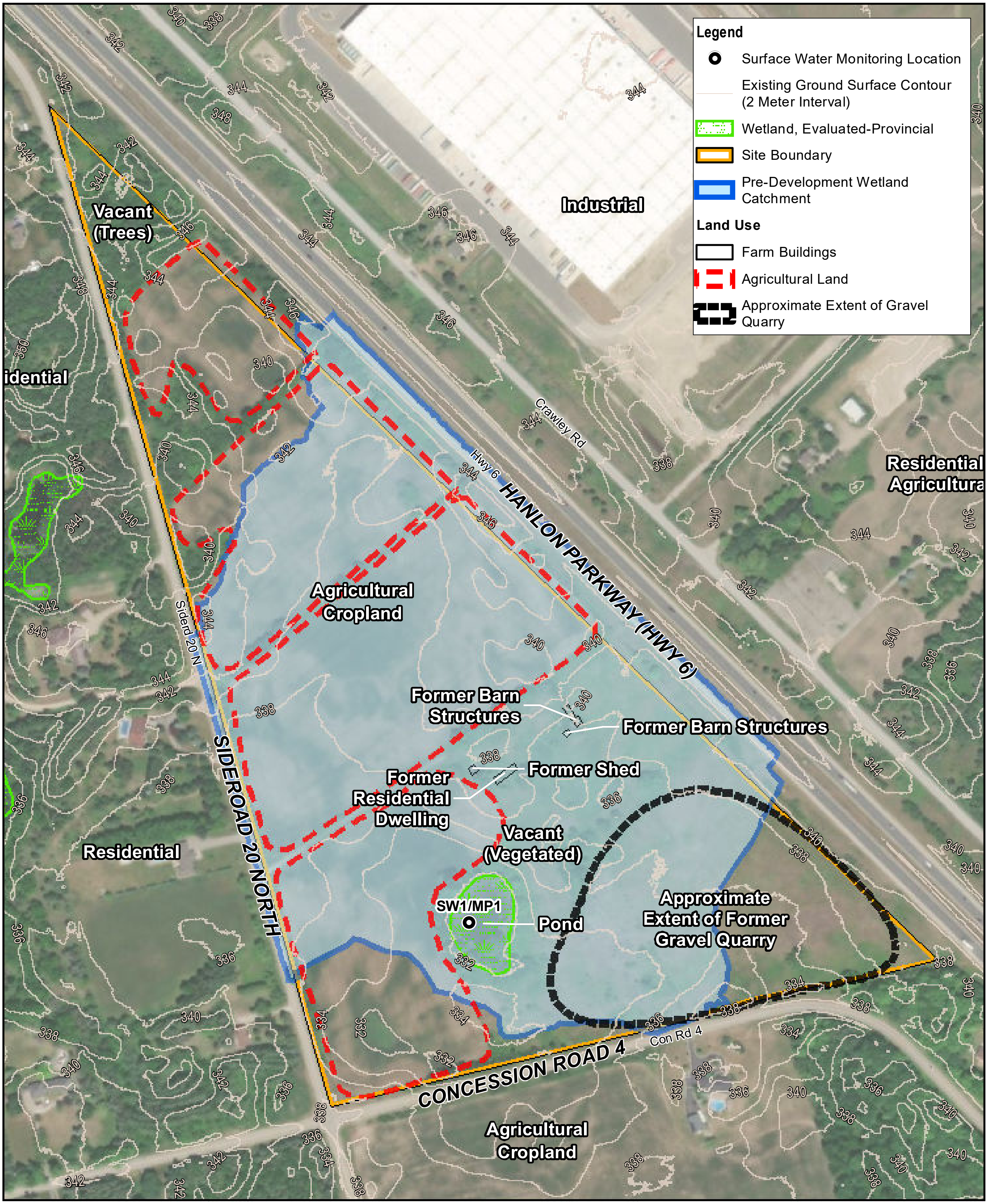
Data source: MNDMNRF NRVIS, 2021. Produced by GHD under licence from Ontario Ministry of Natural Resources and Forestry, © King's Printer 2025.



Paper Size ANSI A

0 45 90 135

Metres

Map Projection: Transverse Mercator
Horizontal Datum: North American 1983
Grid: NAD 1983 UTM Zone 17N

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GHD

PUSLINCH DEVELOPMENT GP INC.

4631 SIDEROAD 20 NORTH, PUSLINCH TOWNSHIP, ON
SITE-SPECIFIC AND FEATURE-BASED
WATER BALANCE ASSESSMENTS

PRE-DEVELOPMENT CONDITIONS

Project No. 12618927
Revision No. -
Date Jan 30, 2025

FIGURE 2

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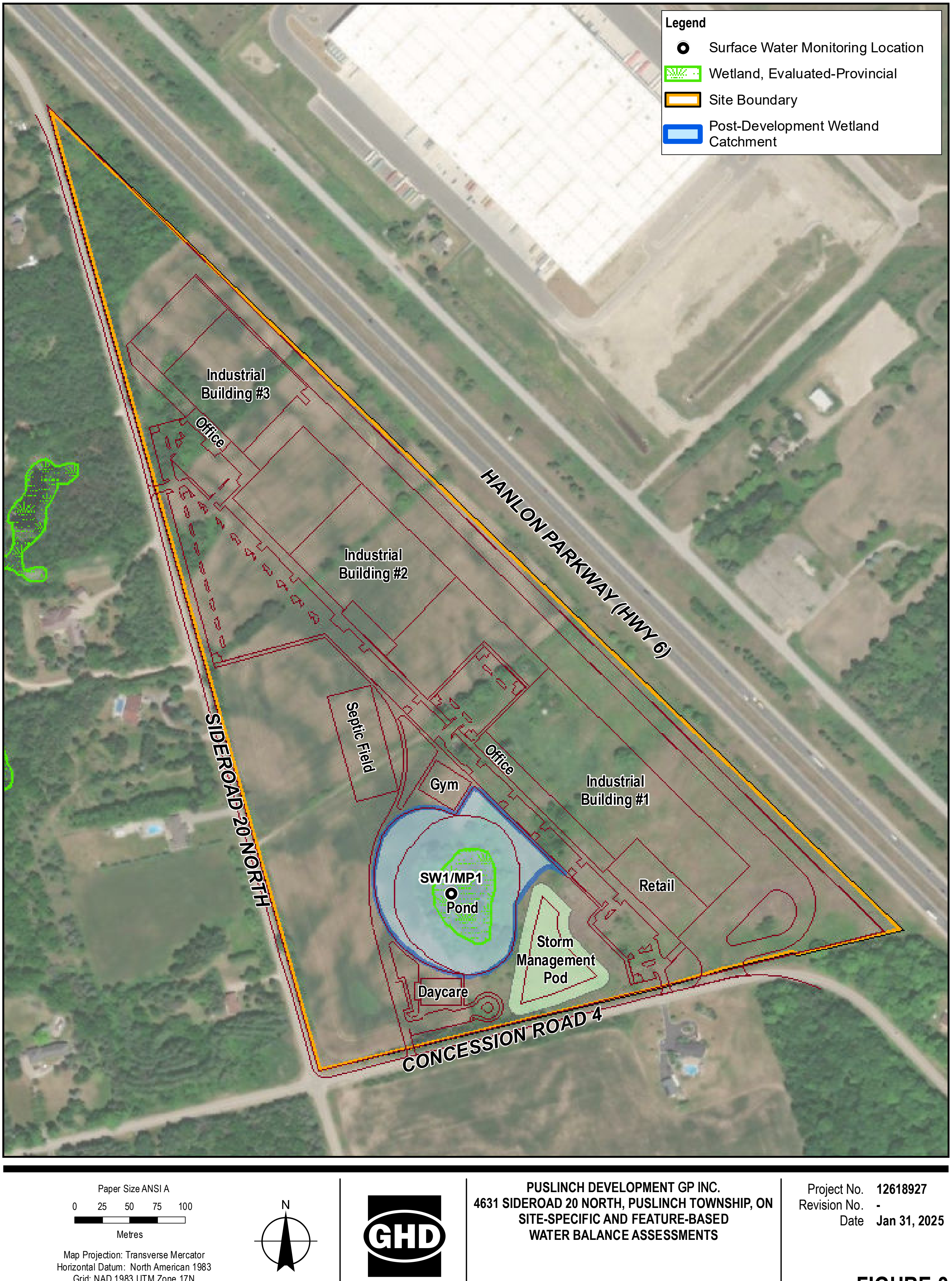
Data source: MNDMNRF, 2022. Produced by GHD under licence from Ontario Ministry of Natural Resources and Forestry, ©King's Printer 2025. Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community.



PUSLINCH DEVELOPMENT GP INC.
4631 SIDEROAD 20 NORTH, PUSLINCH TOWNSHIP, ON
SITE-SPECIFIC AND FEATURE-BASED
WATER BALANCE ASSESSMENTS

Project No. 12618927
Revision No. -
Date Jan 31, 2025

POST-DEVELOPMENT CONDITIONS

FIGURE 3

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Appendices

Appendix A

Water balance summary results

ECCC Water Budget Data
Site-Specific and Feature-Based Water Balance Analysis
4631 Sideroad 20 North, Puslinch Township, Ontario
Puslinch Development GP Inc.

Guelph - Waterloo				WATER BUDGET MEANS FOR THE PERIOD 1975 - 2023							DC20492
	LAT	43.48		WATER HOLDING CAPACITY			2 mm		HEAT INDEX		35.09
	LONG	80.2		LOWER ZONE			1 mm		A		1.055
DATE	**TEMP**	**PCPN**	**RAIN**	**MELT**	**PE**	**AE**	**DEF**	**SURP**	**SNOW**	**SOIL**	**ACC P**
1-Jan	-6.7	56	23	14	1	1	0	36	33	2	264
1-Feb	-6.2	49	23	25	1	1	0	47	33	2	312
1-Mar	-1.1	61	40	47	9	9	0	78	8	2	373
1-Apr	5.8	73	69	11	32	32	0	48	0	2	446
1-May	12.4	76	76	0	76	63	-14	14	0	1	521
1-Jun	17.3	79	79	0	109	75	-35	5	0	0	600
1-Jul	19.9	88	88	0	128	82	-46	7	0	0	689
1-Aug	18.9	79	79	0	113	75	-38	5	0	0	767
1-Sep	14.8	85	85	0	76	60	-16	24	0	1	852
1-Oct	8.5	71	70	0	39	37	-2	33	0	2	71
1-Nov	2.5	73	65	6	13	13	0	58	2	2	144
1-Dec	-3.2	63	37	14	3	3	0	48	14	2	208
AVE	**6.8 TTL**	**853**	**734**	**117**	**600**	**451**	**-151**	**403**			

Guelph - Waterloo				WATER BUDGET MEANS FOR THE PERIOD 1975 - 2023							DC20492
	LAT	43.48		WATER HOLDING CAPACITY			10 mm		HEAT INDEX		35.09
	LONG	80.2		LOWER ZONE			6 mm		A		1.055
DATE	**TEMP**	**PCPN**	**RAIN**	**MELT**	**PE**	**AE**	**DEF**	**SURP**	**SNOW**	**SOIL**	**ACC**
1-Jan	-6.7	56	23	14	1	1	0	36	33	10	264
1-Feb	-6.2	49	23	25	1	1	0	47	33	10	312
1-Mar	-1.1	61	40	47	9	9	0	78	8	10	373
1-Apr	5.8	73	69	11	32	32	0	48	0	10	446
1-May	12.4	76	76	0	76	67	-10	14	0	5	521
1-Jun	17.3	79	79	0	109	78	-31	4	0	2	600
1-Jul	19.9	88	88	0	128	83	-45	5	0	2	689
1-Aug	18.9	79	79	0	113	76	-37	4	0	1	767
1-Sep	14.8	85	85	0	76	61	-16	21	0	5	852
1-Oct	8.5	71	70	0	39	37	-2	30	0	8	71
1-Nov	2.5	73	65	6	13	13	0	57	2	10	144
1-Dec	-3.2	63	37	14	3	3	0	48	14	10	208
AVE	**6.8 TTL**	**853**	**734**	**117**	**600**	**461**	**-141**	**392**			

Entered by: MR
Reviewed by: SA

ECCC Water Budget Data
Site-Specific and Feature-Based Water Balance Analysis
4631 Sideroad 20 North, Puslinch Township, Ontario
Puslinch Development GP Inc.

Guelph - Waterloo				WATER BUDGET MEANS FOR THE PERIOD 1975 - 2023							DC20492
	LAT	43.48		WATER HOLDING CAPACITY			75 mm		HEAT INDEX		35.09
	LONG	80.2		LOWER ZONE			45 mm		A		1.055
DATE	**TEMP**	**PCPN**	**RAIN**	**MELT**	**PE**	**AE**	**DEF**	**SURP**	**SNOW**	**SOIL**	**ACC**
1-Jan	-6.7	56	23	14	1	1	0	35	33	75	264
1-Feb	-6.2	49	23	25	1	1	0	47	33	75	312
1-Mar	-1.1	61	40	47	9	9	0	78	8	75	373
1-Apr	5.8	73	69	11	32	32	0	48	0	75	446
1-May	12.4	76	76	0	76	76	0	14	0	61	521
1-Jun	17.3	79	79	0	109	103	-6	3	0	34	600
1-Jul	19.9	88	88	0	128	102	-26	1	0	18	689
1-Aug	18.9	79	79	0	113	84	-29	1	0	13	767
1-Sep	14.8	85	85	0	76	63	-13	8	0	27	852
1-Oct	8.5	71	70	0	39	38	-1	13	0	47	71
1-Nov	2.5	73	65	6	13	13	0	37	2	69	144
1-Dec	-3.2	63	37	14	3	3	0	43	14	75	208
AVE	**6.8 TTL**	**853**	**734**	**117**	**600**	**525**	**-75**	**328**			

Guelph - Waterloo				WATER BUDGET MEANS FOR THE PERIOD 1975 - 2023							DC20492
	LAT	43.48		WATER HOLDING CAPACITY			100 mm		HEAT INDEX		35.09
	LONG	80.2		LOWER ZONE			60 mm		A		1.055
DATE	**TEMP**	**PCPN**	**RAIN**	**MELT**	**PE**	**AE**	**DEF**	**SURP**	**SNOW**	**SOIL**	**ACC**
1-Jan	-6.7	56	23	14	1	1	0	34	33	100	264
1-Feb	-6.2	49	23	25	1	1	0	47	33	100	312
1-Mar	-1.1	61	40	47	9	9	0	78	8	100	373
1-Apr	5.8	73	69	11	32	32	0	48	0	100	446
1-May	12.4	76	76	0	76	76	0	14	0	85	521
1-Jun	17.3	79	79	0	109	107	-2	3	0	54	600
1-Jul	19.9	88	88	0	128	111	-17	1	0	30	689
1-Aug	18.9	79	79	0	113	88	-24	1	0	20	767
1-Sep	14.8	85	85	0	76	63	-13	7	0	35	852
1-Oct	8.5	71	70	0	39	38	-1	8	0	59	71
1-Nov	2.5	73	65	6	13	13	0	30	2	88	144
1-Dec	-3.2	63	37	14	3	3	0	38	14	98	208
AVE	**6.8 TTL**	**853**	**734**	**117**	**600**	**542**	**-57**	**309**			

ECCC Water Budget Data
Site-Specific and Feature-Based Water Balance Analysis
4631 Sideroad 20 North, Puslinch Township, Ontario
Puslinch Development GP Inc.

Guelph - Waterloo				WATER BUDGET MEANS FOR THE PERIOD 1975 - 2023							DC20492
	LAT	43.48		WATER HOLDING CAPACITY			150 mm		HEAT INDEX		35.09
	LONG	80.2		LOWER ZONE			90 mm		A		1.055
DATE	**TEMP**	**PCPN**	**RAIN**	**MELT**	**PE**	**AE**	**DEF**	**SURP**	**SNOW**	**SOIL**	**ACC**
1-Jan	-6.7	56	23	14	1	1	0	28	33	148	264
1-Feb	-6.2	49	23	25	1	1	0	46	33	149	312
1-Mar	-1.1	61	40	47	9	9	0	77	8	150	373
1-Apr	5.8	73	69	11	32	32	0	48	0	150	446
1-May	12.4	76	76	0	76	76	0	14	0	135	521
1-Jun	17.3	79	79	0	109	109	0	3	0	102	600
1-Jul	19.9	88	88	0	128	123	-5	1	0	66	689
1-Aug	18.9	79	79	0	113	97	-16	1	0	48	767
1-Sep	14.8	85	85	0	76	65	-11	7	0	60	852
1-Oct	8.5	71	70	0	39	38	-1	6	0	87	71
1-Nov	2.5	73	65	6	13	13	0	22	2	124	144
1-Dec	-3.2	63	37	14	3	3	0	31	14	141	208
AVE	**6.8 TTL**	**853**	**734**	**117**	**600**	**567**	**-33**	**284**			

Guelph - Waterloo				WATER BUDGET MEANS FOR THE PERIOD 1975 - 2023							DC20492
	LAT	43.48		WATER HOLDING CAPACITY			175 mm		HEAT INDEX		35.09
	LONG	80.2		LOWER ZONE			105 mm		A		1.055
DATE	**TEMP**	**PCPN**	**RAIN**	**MELT**	**PE**	**AE**	**DEF**	**SURP**	**SNOW**	**SOIL**	**ACC**
1-Jan	-6.7	56	23	14	1	1	0	25	33	171	264
1-Feb	-6.2	49	23	25	1	1	0	45	33	173	312
1-Mar	-1.1	61	40	47	9	9	0	76	8	175	373
1-Apr	5.8	73	69	11	32	32	0	48	0	175	446
1-May	12.4	76	76	0	76	76	0	14	0	160	521
1-Jun	17.3	79	79	0	109	109	0	3	0	127	600
1-Jul	19.9	88	88	0	128	125	-2	1	0	89	689
1-Aug	18.9	79	79	0	113	101	-12	1	0	66	767
1-Sep	14.8	85	85	0	76	67	-9	7	0	78	852
1-Oct	8.5	71	70	0	39	38	-1	6	0	104	71
1-Nov	2.5	73	65	6	13	13	0	21	2	142	144
1-Dec	-3.2	63	37	14	3	3	0	29	14	161	208
AVE	**6.8 TTL**	**853**	**734**	**117**	**600**	**575**	**-24**	**276**			

Entered by: MR
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ECCC Water Budget Data
Site-Specific and Feature-Based Water Balance Analysis
4631 Sideroad 20 North, Puslinch Township, Ontario
Puslinch Development GP Inc.

Guelph - Waterloo				WATER BUDGET MEANS FOR THE PERIOD 1975 - 2023							DC20492
	LAT	43.48		WATER HOLDING CAPACITY			200 mm		HEAT INDEX		35.09
	LONG	80.2		LOWER ZONE			120 mm		A		1.055
DATE	**TEMP**	**PCPN**	**RAIN**	**MELT**	**PE**	**AE**	**DEF**	**SURP**	**SNOW**	**SOIL**	**ACC**
1-Jan	-6.7	56	23	14	1	1	0	23	33	193	264
1-Feb	-6.2	49	23	25	1	1	0	43	33	198	312
1-Mar	-1.1	61	40	47	9	9	0	75	8	200	373
1-Apr	5.8	73	69	11	32	32	0	48	0	200	446
1-May	12.4	76	76	0	76	76	0	14	0	185	521
1-Jun	17.3	79	79	0	109	109	0	3	0	152	600
1-Jul	19.9	88	88	0	128	127	-1	1	0	112	689
1-Aug	18.9	79	79	0	113	104	-9	1	0	87	767
1-Sep	14.8	85	85	0	76	68	-8	7	0	97	852
1-Oct	8.5	71	70	0	39	38	-1	6	0	123	71
1-Nov	2.5	73	65	6	13	13	0	20	2	162	144
1-Dec	-3.2	63	37	14	3	3	0	28	14	182	208
AVE	**6.8 TTL**	**853**	**734**	**117**	**600**	**581**	**-19**	**269**			

Guelph - Waterloo				WATER BUDGET MEANS FOR THE PERIOD 1975 - 2023							DC20492
	LAT	43.48		WATER HOLDING CAPACITY			325 mm		HEAT INDEX		35.09
	LONG	80.2		LOWER ZONE			195 mm		A		1.055
DATE	**TEMP**	**PCPN**	**RAIN**	**MELT**	**PE**	**AE**	**DEF**	**SURP**	**SNOW**	**SOIL**	**ACC**
1-Jan	-6.7	56	23	14	1	1	0	18	33	309	264
1-Feb	-6.2	49	23	25	1	1	0	38	33	319	312
1-Mar	-1.1	61	40	47	9	9	0	72	8	324	373
1-Apr	5.8	73	69	11	32	32	0	48	0	324	446
1-May	12.4	76	76	0	76	76	0	14	0	310	521
1-Jun	17.3	79	79	0	109	109	0	3	0	277	600
1-Jul	19.9	88	88	0	128	128	0	1	0	236	689
1-Aug	18.9	79	79	0	113	111	-2	1	0	203	767
1-Sep	14.8	85	85	0	76	73	-3	7	0	208	852
1-Oct	8.5	71	70	0	39	38	0	6	0	234	71
1-Nov	2.5	73	65	6	13	13	0	19	2	274	144
1-Dec	-3.2	63	37	14	3	3	0	28	14	295	208
AVE	**6.8 TTL**	**853**	**734**	**117**	**600**	**594**	**-5**	**255**			

Entered by: MR
Reviewed by: SA

ECCC Water Budget Data
Site-Specific and Feature-Based Water Balance Analysis
4631 Sideroad 20 North, Puslinch Township, Ontario
Puslinch Development GP Inc.

Guelph - Waterloo				WATER BUDGET MEANS FOR THE PERIOD 1975 - 2023							DC20492
	LAT	43.48		WATER HOLDING CAPACITY			350 mm		HEAT INDEX		35.09
	LONG	80.2		LOWER ZONE			210 mm		A		1.055
DATE	**TEMP**	**PCPN**	**RAIN**	**MELT**	**PE**	**AE**	**DEF**	**SURP**	**SNOW**	**SOIL**	**ACC**
1-Jan	-6.7	56	23	14	1	1	0	18	33	333	264
1-Feb	-6.2	49	23	25	1	1	0	38	33	343	312
1-Mar	-1.1	61	40	47	9	9	0	72	8	349	373
1-Apr	5.8	73	69	11	32	32	0	48	0	349	446
1-May	12.4	76	76	0	76	76	0	14	0	335	521
1-Jun	17.3	79	79	0	109	109	0	3	0	302	600
1-Jul	19.9	88	88	0	128	128	0	1	0	261	689
1-Aug	18.9	79	79	0	113	111	-1	1	0	228	767
1-Sep	14.8	85	85	0	76	74	-2	7	0	232	852
1-Oct	8.5	71	70	0	39	39	0	6	0	258	71
1-Nov	2.5	73	65	6	13	13	0	19	2	298	144
1-Dec	-3.2	63	37	14	3	3	0	28	14	318	208
AVE	**6.8 TTL**	**853**	**734**	**117**	**600**	**596**	**-3**	**255**			

Waterloo Wellington Station Climate Normals - Lake Evaporation (1981 - 2010)			
DATE	**PCPN**	**LAKE EVAP**	**PCPN. - LAKE EVAP.**
1-Jan	56	0	56
1-Feb	49	0	49
1-Mar	61	0	61
1-Apr	73	0	73
1-May	76	130	-54
1-Jun	79	147	-68
1-Jul	88	152	-64
1-Aug	79	124	-45
1-Sep	85	84	1
1-Oct	71	53	18
1-Nov	73	0	73
1-Dec	63	0	63
TOTAL	**853**	**690**	**163**

Entered by: MR
Reviewed by: SA

Table A2

Land Type Parameters
Site-Specific Water Balance Analysis
4631 Sideroad 20 North, Puslinch Township, Ontario
Puslinch Development GP Inc.

Pre-Development Conditions

Land Use	WHC	Type of Land Use	Soil Type (HSG)	Infiltration Factor				Area (m^2)
				Topo	Soils	Cover	Total	
Moderately Rooted Agriculture (Corn)	175 mm	Agricultural Land / Tilled	Loam (BC)	0.15	0.30	0.10	0.55	132,182
Meadow	200 mm	Pasture & Shrubs	Loam (BC)	0.15	0.30	0.10	0.55	44,173
Meadow (Former Gravel Quarry)	150 mm	Pasture & Shrubs	Fine Sandy Loam (B)	0.15	0.30	0.10	0.55	42,686
Abandoned Farm Buildings	10 mm	Impervious Areas - Roof	N/A	0.00	0.00	0.00	0.00	321
Thicket / Hedgerows	350 mm	Mature Forest	Loam (BC)	0.15	0.30	0.20	0.65	26,689
On-Site Wetland (Shallow Aquatic)	175 mm	Wetland	Loam (BC)	0.00	0.00	0.00	0.00	2,027
On-Site Wetland (Deciduous Swamp)	325 mm	Treed Swamp	Loam (BC)	0.00	0.00	0.00	0.00	1,635
						Total	**0.55**	**249,714**

Post-Development (Uncontrolled) Conditions

Land Use	WHC	Type of Land Use	Soil Type (HSG)	Infiltration Factor				Area (m^2)
				Topo	Soils	Cover	Total	
Grassed Area / SWM Pond Banks	100 mm	Urban Lawns	Loam (BC)	0.15	0.30	0.10	0.55	61,792
Grassed Area / SWM Pond Banks (Former Gravel Quarry)	75 mm	Urban Lawns	Fine Sandy Loam (B)	0.15	0.30	0.10	0.55	11,317
Industrial / Community Buildings	2 mm	Impervious Areas - Roof	N/A	0.00	0.00	0.00	0.00	69,365
Parking Lots / Walkways / Roadways	10 mm	Impervious Areas - Paved	N/A	0.00	0.00	0.00	0.00	90,657
On-Site Wetland (Shallow Aquatic)	175 mm	Wetland	Loam (BC)	0.00	0.00	0.00	0.00	2,027
On-Site Wetland (Deciduous Swamp)	325 mm	Treed Swamp	Loam (BC)	0.00	0.00	0.00	0.00	1,635
Meadow (Wetland Buffer)	150 mm	Pasture & Shrubs	Loam (BC)	0.15	0.30	0.10	0.55	6,632
Thicket (Wetland Buffer)	350 mm	Mature Forest	Loam (BC)	0.15	0.30	0.20	0.65	3,119
SWM Pond	PCPN. - LAKE EVAP.	Open Water	Loam (BC)	0.00	0.00	0.00	0.00	3,171
						Total	**0.18**	**249,714**

Entered by: MR
Reviewed by: SA

Table A3

Land Type Parameters
Feature-Based Water Balance Analysis
4631 Sideroad 20 North, Puslinch Township, Ontario
Puslinch Development GP Inc.

Pre-Development Conditions

Land Use	WHC	Type of Land Use	Soil Type (HSG)	Infiltration Factor				Area of Subcatchment (m^2)
				Topo	Soils	Cover	Total	AP-1
Moderately Rooted Agriculture (Corn)	175 mm	Agricultural Land / Tilled	Loam (BC)	0.15	0.30	0.10	0.55	97,943
Meadow	200 mm	Pasture & Shrubs	Loam (BC)	0.15	0.30	0.10	0.55	48,819
Meadow (Former Gravel Quarry)	150 mm	Pasture & Shrubs	Fine Sandy Loam (B)	0.15	0.30	0.10	0.55	25,170
Abandoned Farm Buildings	10 mm	Impervious Areas - Roof	N/A	0.00	0.00	0.00	0.00	321
Thicket / Hedgerows	350 mm	Mature Forest	Loam (BC)	0.15	0.30	0.20	0.65	10,275
Roadway	2 mm	Impervious Areas - Paved	N/A	0.00	0.00	0.00	0.00	6,154
On-Site Wetland (Shallow Aquatic)	175 mm	Wetland	Loam (BC)	0.00	0.00	0.00	0.00	2,027
On-Site Wetland (Deciduous Swamp)	325 mm	Treed Swamp	Loam (BC)	0.00	0.00	0.00	0.00	1,635
						Total	**0.53**	**192,343**

Post-Development (Uncontrolled) Conditions

Land Use	WHC	Type of Land Use	Soil Type (HSG)	Infiltration Factor				Area of Subcatchment (m^2)
				Topo	Soils	Cover	Total	AP-1
Grassed Area	100 mm	Urban Lawns	Loam (BC)	0.15	0.30	0.10	0.55	5,485
Grassed Area (Former Gravel Quarry)	75 mm	Urban Lawns	Fine Sandy Loam (B)	0.15	0.30	0.10	0.55	-
Walkways	10 mm	Impervious Areas - Paved	N/A	0.00	0.00	0.00	0.00	103
On-Site Wetland (Shallow Aquatic)	175 mm	Wetland	Loam (BC)	0.00	0.00	0.00	0.00	2,027
On-Site Wetland (Deciduous Swamp)	325 mm	Treed Swamp	Loam (BC)	0.00	0.00	0.00	0.00	1,635
Meadow (Wetland Buffer)	175 mm	Pasture & Shrubs	Loam (BC)	0.15	0.30	0.10	0.55	6,632
Thicket (Wetland Buffer)	350 mm	Mature Forest	Loam (BC)	0.15	0.30	0.20	0.65	3,118
						Total	**0.46**	**19,000**

Entered by: MR
Reviewed by: SA

Table A4

Pre-Dev. Conditions Water Balance Calculations
Site-Specific Water Balance Analysis
4631 Sideroad 20 North, Puslinch Township, Ontario
Puslinch Development GP Inc.

Pre-Development Conditions

Total Area	24.97	ha

Site-Specific Water Balance Assessment

			Moderately Rooted Agriculture (Corn)			Meadow			Meadow (Former Gravel Quarry)		
			WHC	175 mm		WHC	200 mm		WHC	150 mm	
			Infiltration Factor	0.55		Infiltration Factor	0.55		Infiltration Factor	0.55	
			Area (m^2)	132,182		Area (m^2)	44,173		Area (m^2)	42,686	
Month	**Precipitation**	**Potential Evap.**	**Actual Evap.**	**Surplus**		**Actual Evap.**	**Surplus**		**Actual Evap.**	**Surplus**	
(-)	(mm)	(mm)	(mm)	(mm)	(m^3)	(mm)	(mm)	(m^3)	(mm)	(mm)	(m^3)
January	56	1	1	25	3,305	1	23	1,016	1	28	1,195
February	49	1	1	45	5,948	1	43	1,899	1	46	1,964
March	61	9	9	76	10,046	9	75	3,313	9	77	3,287
April	73	32	32	48	6,345	32	48	2,120	32	48	2,049
May	76	76	76	14	1,851	76	14	618	76	14	598
June	79	109	109	3	397	109	3	133	109	3	128
July	88	128	125	1	132	127	1	44	123	1	43
August	79	113	101	1	132	104	1	44	97	1	43
September	85	76	67	7	925	68	7	309	65	7	299
October	71	39	38	6	793	38	6	265	38	6	256
November	73	13	13	21	2,776	13	20	883	13	22	939
December	63	3	3	29	3,833	3	28	1,237	3	31	1,323
Total	**853**	**600**	**575**	**276**	**36,482**	**581**	**269**	**11,882**	**567**	**284**	**12,123**

Entered by: MR
Reviewed by: SA

Table A4

Pre-Dev. Conditions Water Balance Calculations
Site-Specific Water Balance Analysis
4631 Sideroad 20 North, Puslinch Township, Ontario
Puslinch Development GP Inc.

Pre-Development Conditions

Total Area	24.97	ha

Site-Specific Water Balance Assessment

			Abandoned Farm Buildings			*Thicket / Hedgerows*			*On-Site Wetland (Shallow Aquatic)*		
			WHC	*10 mm*		*WHC*	*350 mm*		*WHC*	*175 mm*	
			Infiltration Factor	*0.00*		*Infiltration Factor*	*0.65*		*Infiltration Factor*	*0.00*	
			Area (m^2)	*321*		*Area (m^2)*	*26,689*		*Area (m^2)*	*2,027*	
Month	*Precipitation*	*Potential Evap.*	*Actual Evap.*	*Surplus*		*Actual Evap.*	*Surplus*		*Actual Evap.*	*Surplus*	
(-)	**(mm)**	**(mm)**	**(mm)**	**(mm)**	**(m^3)**	**(mm)**	**(mm)**	**(m^3)**	**(mm)**	**(mm)**	**(m^3)**
January	56	1	1	36	12	1	18	480	1	25	51
February	49	1	1	47	15	1	38	1,014	1	45	91
March	61	9	9	78	25	9	72	1,922	9	76	154
April	73	32	32	48	15	32	48	1,281	32	48	97
May	76	76	67	14	4	76	14	374	76	14	28
June	79	109	78	4	1	109	3	80	109	3	6
July	88	128	83	5	2	128	1	27	125	1	2
August	79	113	76	4	1	111	1	27	101	1	2
September	85	76	61	21	7	74	7	187	67	7	14
October	71	39	37	30	10	39	6	160	38	6	12
November	73	13	13	57	18	13	19	507	13	21	43
December	63	3	3	48	15	3	28	747	3	29	59
Total	**853**	**600**	**461**	**392**	**126**	**596**	**255**	**6,806**	**575**	**276**	**559**

Entered by: MR
Reviewed by: SA

Table A4

Pre-Dev. Conditions Water Balance Calculations
Site-Specific Water Balance Analysis
4631 Sideroad 20 North, Puslinch Township, Ontario
Puslinch Development GP Inc.

Pre-Development Conditions

Total Area	24.97	ha

Site-Specific Water Balance Assessment

Month	Precipitation	Potential Evap.	On-Site Wetland (Deciduous Swamp) WHC: 325 mm Infiltration Factor: 0.00 Area (m^2): 1,635 Actual Evap.	Surplus		Precip. Volume	Actual Evap. Volume	Surplus Volume	Infiltration Volume	Surface Runoff Volume
(-)	(mm)	(mm)	(mm)	(mm)	(m^3)	(m^3)	(m^3)	(m^3)	(m^3)	(m^3)
January	56	1	1	18	29	13,984	250	6,088	3,346	2,742
February	49	1	1	38	62	12,236	250	10,994	6,055	4,938
March	61	9	9	72	118	15,233	2,247	18,864	10,404	8,460
April	73	32	32	48	79	18,229	7,991	11,986	6,615	5,371
May	76	76	76	14	23	18,978	18,975	3,496	1,929	1,567
June	79	109	109	3	5	19,727	27,209	749	413	336
July	88	128	128	1	2	21,975	31,289	251	138	113
August	79	113	111	1	2	19,727	25,458	251	138	113
September	85	76	73	7	11	21,226	16,884	1,752	965	788
October	71	39	38	6	10	17,730	9,516	1,506	827	679
November	73	13	13	19	31	18,229	3,246	5,197	2,859	2,339
December	63	3	3	28	46	15,732	749	7,261	4,002	3,259
Total	**853**	**600**	**594**	**255**	**417**	**213,006**	**144,064**	**68,396**	**37,692**	**30,704**

Entered by: MR
Reviewed by: SA

Table A5

Post-Dev. (Uncontrolled) Conditions Water Balance Calculations
Site-Specific Water Balance Analysis
4631 Sideroad 20 North, Puslinch Township, Ontario
Puslinch Development GP Inc.

Post-Development (Uncontrolled) Conditions

Total Area	24.97	ha

Site-Specific Water Balance Assessment

			Grassed Area / SWM Pond Banks			*Grassed Area / SWM Pond Banks (Former Gravel Quarry)*			*Industrial / Community Buildings*		
			WHC	*100 mm*		*WHC*	*75 mm*		*WHC*	*2 mm*	
			Infiltration Factor	*0.55*		*Infiltration Factor*	*0.55*		*Infiltration Factor*	*0.00*	
			Area (m^2)	*61,792*		*Area (m^2)*	*11,317*		*Area (m^2)*	*69,365*	
Month	***Precipitation***	***Potential Evap.***	***Actual Evap.***	***Surplus***		***Actual Evap.***	***Surplus***		***Actual Evap.***	***Surplus***	
(-)	**(mm)**	**(mm)**	**(mm)**	**(mm)**	**(m^3)**	**(mm)**	**(mm)**	**(m^3)**	**(mm)**	**(mm)**	**(m^3)**
January	56	1	1	34	2,101	1	35	396	1	36	2,497
February	49	1	1	47	2,904	1	47	532	1	47	3,260
March	61	9	9	78	4,820	9	78	883	9	78	5,410
April	73	32	32	48	2,966	32	48	543	32	48	3,330
May	76	76	76	14	865	76	14	158	63	14	971
June	79	109	107	3	185	103	3	34	75	5	347
July	88	128	111	1	62	102	1	11	82	7	486
August	79	113	88	1	62	84	1	11	75	5	347
September	85	76	63	7	433	63	8	91	60	24	1,665
October	71	39	38	8	494	38	13	147	37	33	2,289
November	73	13	13	30	1,854	13	37	419	13	58	4,023
December	63	3	3	38	2,348	3	43	487	3	48	3,330
Total	**853**	**600**	**542**	**309**	**19,094**	**525**	**328**	**3,712**	**451**	**403**	**27,954**

Entered by: MR
Reviewed by: SA

Table A5

Post-Dev. (Uncontrolled) Conditions Water Balance Calculations
Site-Specific Water Balance Analysis
4631 Sideroad 20 North, Puslinch Township, Ontario
Puslinch Development GP Inc.

Post-Development (Uncontrolled) Conditions

Total Area	24.97	ha

Site-Specific Water Balance Assessment

			Parking Lots / Walkways / Roadways			On-Site Wetland (Shallow Aquatic)			On-Site Wetland (Deciduous Swamp)		
			WHC	10 mm		WHC	175 mm		WHC	325 mm	
			Infiltration Factor	0.00		Infiltration Factor	0.00		Infiltration Factor	0.00	
			Area (m^2)	90,657		Area (m^2)	2,027		Area (m^2)	1,635	
Month	**Precipitation**	**Potential Evap.**	**Actual Evap.**	**Surplus**		**Actual Evap.**	**Surplus**		**Actual Evap.**	**Surplus**	
(-)	**(mm)**	**(mm)**	**(mm)**	**(mm)**	**(m^3)**	**(mm)**	**(mm)**	**(m^3)**	**(mm)**	**(mm)**	**(m^3)**
January	56	1	1	36	3,264	1	25	51	1	18	29
February	49	1	1	47	4,261	1	45	91	1	38	62
March	61	9	9	78	7,071	9	76	154	9	72	118
April	73	32	32	48	4,352	32	48	97	32	48	79
May	76	76	67	14	1,269	76	14	28	76	14	23
June	79	109	78	4	363	109	3	6	109	3	5
July	88	128	83	5	453	125	1	2	128	1	2
August	79	113	76	4	363	101	1	2	111	1	2
September	85	76	61	21	1,904	67	7	14	73	7	11
October	71	39	37	30	2,720	38	6	12	38	6	10
November	73	13	13	57	5,167	13	21	43	13	19	31
December	63	3	3	48	4,352	3	29	59	3	28	46
Total	**853**	**600**	**461**	**392**	**35,537**	**575**	**276**	**559**	**594**	**255**	**417**

Entered by: MR
Reviewed by: SA

Table A5

Post-Dev. (Uncontrolled) Conditions Water Balance Calculations
Site-Specific Water Balance Analysis
4631 Sideroad 20 North, Puslinch Township, Ontario
Puslinch Development GP Inc.

Post-Development (Uncontrolled) Conditions

Total Area	24.97	ha

Site-Specific Water Balance Assessment

			Meadow (Wetland Buffer)			Thicket (Wetland Buffer)			SWM Pond		
			WHC	150 mm		WHC	350 mm		WHC	PCPN. - LAKE EVAP.	
			Infiltration Factor	0.55		Infiltration Factor	0.65		Infiltration Factor	0.00	
			Area (m^2)	6,632		Area (m^2)	3,119		Area (m^2)	3,171	
Month	Precipitation	Potential Evap.	Actual Evap.	Surplus		Actual Evap.	Surplus		Actual Evap.	Surplus	
(-)	(mm)	(mm)	(mm)	(mm)	(m^3)	(mm)	(mm)	(m^3)	(mm)	(mm)	(m^3)
January	56	1	1	28	186	1	18	56	0	56	178
February	49	1	1	46	305	1	38	119	0	49	155
March	61	9	9	77	511	9	72	225	0	61	193
April	73	32	32	48	318	32	48	150	0	73	231
May	76	76	76	14	93	76	14	44	130	-54	-172
June	79	109	109	3	20	109	3	9	147	-68	-216
July	88	128	123	1	7	128	1	3	152	-64	-203
August	79	113	97	1	7	111	1	3	124	-45	-143
September	85	76	65	7	46	74	7	22	84	1	3
October	71	39	38	6	40	39	6	19	53	18	58
November	73	13	13	22	146	13	19	59	0	73	231
December	63	3	3	31	206	3	28	87	0	63	200
Total	**853**	**600**	**567**	**284**	**1,884**	**596**	**255**	**795**	**690**	**163**	**517**

Entered by: MR
Reviewed by: SA

Table A5

Post-Dev. (Uncontrolled) Conditions Water Balance Calculations
Site-Specific Water Balance Analysis
4631 Sideroad 20 North, Puslinch Township, Ontario
Puslinch Development GP Inc.

Post-Development (Uncontrolled) Conditions

Total Area	24.97	ha

Site-Specific Water Balance Assessment

Month	*Precipitation*	*Potential Evap.*	*Precip. Volume*	*Actual Evap. Volume*	*Surplus Volume*	*Infiltration Volume*	*Surface Runoff Volume*
(-)	**(mm)**	**(mm)**	**(m^3)**	**(m^3)**	**(m^3)**	**(m^3)**	**(m^3)**
January	56	1	13,984	247	8,757	1,512	7,245
February	49	1	12,236	247	11,689	2,135	9,555
March	61	9	15,233	2,219	19,385	3,563	15,821
April	73	32	18,229	7,889	12,066	2,202	9,863
May	76	76	18,978	17,432	3,280	642	2,637
June	79	109	19,727	21,979	753	138	616
July	88	128	21,975	23,385	823	46	777
August	79	113	19,727	20,249	653	46	607
September	85	76	21,226	15,481	4,189	327	3,861
October	71	39	17,730	9,379	5,789	387	5,402
November	73	13	18,229	3,205	11,973	1,369	10,605
December	63	3	15,732	740	11,113	1,729	9,384
Total	**853**	**600**	**213,006**	**122,452**	**90,470**	**14,096**	**76,374**

Summary of Calculations - Annual
Site-Specific Water Balance Analysis
4631 Sideroad 20 North, Puslinch Township,
Ontario Puslinch Development GP Inc.

Land Use	Area (ha)	Precipitation (m³)	Precipitation (mm)	Evapotranspiration (m³)	Evapotranspiration (mm)	Surplus/Deficit (m³)	Surplus/Deficit (mm)	Infiltration (m³)	Infiltration (mm)	Runoff (m³)	Runoff (mm)
Pre-Development Conditions											
Moderately Rooted Agriculture (Corn)	13.22	112,750	853	76,005	575	36,480	276	20,065	152	16,415	124
Meadow	4.42	37,680	853	25,665	581	11,880	269	6,535	148	5,345	121
Meadow (Former Gravel Quarry)	4.27	36,410	853	24,205	567	12,125	284	6,670	156	5,455	128
Abandoned Farm Buildings	0.03	275	853	150	467	125	389	-	-	125	389
Thicket / Hedgerows	2.67	22,765	853	15,905	596	6,805	255	4,425	166	2,380	89
On-Site Wetland (Shallow Aquatic)	0.20	1,730	853	1,165	575	560	276	-	-	560	276
On-Site Wetland (Deciduous Swamp)	0.16	1,395	853	970	593	420	257	-	-	420	257
Total	**24.97**	**213,005**	**853**	**144,065**	**577**	**68,395**	**274**	**37,695**	**151**	**30,700**	**123**

Land Use	Area (ha)	Precipitation (m³)	Precipitation (mm)	Evapotranspiration (m³)	Evapotranspiration (mm)	Surplus/Deficit (m³)	Surplus/Deficit (mm)	Infiltration (m³)	Infiltration (mm)	Runoff (m³)	Runoff (mm)
Post-Development (Uncontrolled) Conditions											
Grassed Area / SWM Pond Banks	6.18	52,710	853	33,490	542	19,090	309	10,500	170	8,590	139
Grassed Area / SWM Pond Banks (Former Gravel Quarry)	1.13	9,650	853	5,940	525	3,710	328	2,040	180	1,670	148
Industrial / Community Buildings	6.94	59,170	853	31,285	451	27,955	403	-	-	27,955	403
Parking Lots / Walkways / Roadways	9.07	77,330	853	41,795	461	35,535	392	-	-	35,535	392
On-Site Wetland (Shallow Aquatic)	0.20	1,730	853	1,165	575	560	276	-	-	560	276
On-Site Wetland (Deciduous Swamp)	0.16	1,395	853	970	593	420	257	-	-	420	257
Meadow (Wetland Buffer)	0.66	5,660	853	3,760	567	1,885	284	1,035	156	850	128
Thicket (Wetland Buffer)	0.31	2,660	853	1,860	596	795	255	515	165	280	90
SWM Pond	0.32	2,700	853	2,185	689	520	164	-	-	520	164
Total	**24.97**	**213,005**	**853**	**122,450**	**490**	**90,470**	**362**	**14,090**	**56**	**76,380**	**306**

Annual Summary											
Pre-Development Conditions	24.97	213,005	853	144,065	577	68,395	274	37,695	151	30,700	123
Post-Development (Uncontrolled) Conditions	24.97	213,005	853	122,450	490	90,470	362	14,090	56	76,380	306
Pre- to Post- Development Difference											
Post-Development (Uncontrolled) Conditions	-	-	-	(21,615)	(87)	22,075	88	(23,605)	(95)	45,680	183
Percentage Change	0%	0%	0%	-15%	-15%	32%	32%	-63%	-63%	149%	149%

Notes:
Values are rounded for reporting purposes.
Positive value for infiltration difference is a surplus and a negative value is a deficit.
Positive value for runoff difference is an increase in runoff and a negative value is a decrease in runoff.

Entered by: MR
Reviewed by: SA

Table A7

Pre-Dev. Conditions Water Balance Calculations - Monthly Analysis
Feature-Based Water Balance Analysis
4631 Sideroad 20 North, Puslinch Township, Ontario
Puslinch Development GP Inc.

Pre-Development Conditions

Total Area	19.23	ha

Feature-Based Water Balance Analysis - AP-1

			Moderately Rooted Agriculture (Corn)			***Meadow***			***Meadow (Former Gravel Quarry)***		
			WHC	***175 mm***		***WHC***	***200 mm***		***WHC***	***150 mm***	
			Infiltration Factor	***0.55***		***Infiltration Factor***	***0.55***		***Infiltration Factor***	***0.55***	
			Area (m^2)	***97,943***		***Area (m^2)***	***48,819***		***Area (m^2)***	***25,170***	
Month	***Precipitation***	***Potential Evap.***	***Actual Evap.***	***Surplus***		***Actual Evap.***	***Surplus***		***Actual Evap.***	***Surplus***	
(-)	**(mm)**	**(mm)**	**(mm)**	**(mm)**	**(m^3)**	**(mm)**	**(mm)**	**(m^3)**	**(mm)**	**(mm)**	**(m^3)**
January	56	1	1	25	2,449	1	23	1,123	1	28	705
February	49	1	1	45	4,407	1	43	2,099	1	46	1,158
March	61	9	9	76	7,444	9	75	3,661	9	77	1,938
April	73	32	32	48	4,701	32	48	2,343	32	48	1,208
May	76	76	76	14	1,371	76	14	683	76	14	352
June	79	109	109	3	294	109	3	146	109	3	76
July	88	128	125	1	98	127	1	49	123	1	25
August	79	113	101	1	98	104	1	49	97	1	25
September	85	76	67	7	686	68	7	342	65	7	176
October	71	39	38	6	588	38	6	293	38	6	151
November	73	13	13	21	2,057	13	20	976	13	22	554
December	63	3	3	29	2,840	3	28	1,367	3	31	780
Total	**853**	**600**	**575**	**276**	**27,032**	**581**	**269**	**13,132**	**567**	**284**	**7,148**

Table A7

Pre-Dev. Conditions Water Balance Calculations - Monthly Analysis
Feature-Based Water Balance Analysis
4631 Sideroad 20 North, Puslinch Township, Ontario
Puslinch Development GP Inc.

Pre-Development Conditions

Total Area	19.23	ha

Feature-Based Water Balance Analysis - AP-1

			Abandoned Farm Buildings			Thicket / Hedgerows			Roadway		
			WHC	10 mm		WHC	350 mm		WHC	2 mm	
			Infiltration Factor	0.00		Infiltration Factor	0.65		Infiltration Factor	0.00	
			Area (m^2)	321		Area (m^2)	10,275		Area (m^2)	6,154	
Month	Precipitation	Potential Evap.	Actual Evap.	Surplus		Actual Evap.	Surplus		Actual Evap.	Surplus	
(-)	(mm)	(mm)	(mm)	(mm)	(m^3)	(mm)	(mm)	(m^3)	(mm)	(mm)	(m^3)
January	56	1	1	36	12	1	18	185	1	36	222
February	49	1	1	47	15	1	38	390	1	47	289
March	61	9	9	78	25	9	72	740	9	78	480
April	73	32	32	48	15	32	48	493	32	48	295
May	76	76	67	14	4	76	14	144	63	14	86
June	79	109	78	4	1	109	3	31	75	5	31
July	88	128	83	5	2	128	1	10	82	7	43
August	79	113	76	4	1	111	1	10	75	5	31
September	85	76	61	21	7	74	7	72	60	24	148
October	71	39	37	30	10	39	6	62	37	33	203
November	73	13	13	57	18	13	19	195	13	58	357
December	63	3	3	48	15	3	28	288	3	48	295
Total	**853**	**600**	**461**	**392**	**126**	**596**	**255**	**2,620**	**451**	**403**	**2,480**

Entered by: MR
Reviewed by: SA

Table A7

Pre-Dev. Conditions Water Balance Calculations - Monthly Analysis
Feature-Based Water Balance Analysis
4631 Sideroad 20 North, Puslinch Township, Ontario
Puslinch Development GP Inc.

Pre-Development Conditions

Total Area	19.23	ha

Feature-Based Water Balance Analysis - AP-1

			On-Site Wetland (Shallow Aquatic)			***On-Site Wetland (Deciduous Swamp)***							
			WHC	***175 mm***		***WHC***	***325 mm***						
			Infiltration Factor	***0.00***		***Infiltration Factor***	***0.00***						
			Area (m^2)	***2,027***		***Area (m^2)***	***1,635***						
Month	***Precipitation***	***Potential Evap.***	***Actual Evap.***	***Surplus***		***Actual Evap.***	***Surplus***		***Precip. Volume***	***Actual Evap. Volume***	***Surplus Volume***	***Infiltration Volume***	***Surface Runoff Volume***
(-)	**(mm)**	**(mm)**	**(mm)**	**(mm)**	**(m^3)**	**(mm)**	**(mm)**	**(m^3)**	**(m^3)**	**(m^3)**	**(m^3)**	**(m^3)**	**(m^3)**
January	56	1	1	25	51	1	18	29	10,771	192	4,774	2,472	2,302
February	49	1	1	45	91	1	38	62	9,425	192	8,513	4,469	4,043
March	61	9	9	76	154	9	72	118	11,733	1,731	14,560	7,655	6,905
April	73	32	32	48	97	32	48	79	14,041	6,155	9,232	4,860	4,373
May	76	76	76	14	28	76	14	23	14,618	14,535	2,693	1,417	1,275
June	79	109	109	3	6	109	3	5	15,195	20,746	590	304	286
July	88	128	125	1	2	128	1	2	16,926	23,848	231	101	129
August	79	113	101	1	2	111	1	2	15,195	19,424	218	101	117
September	85	76	67	7	14	73	7	11	16,349	12,922	1,456	709	747
October	71	39	38	6	12	38	6	10	13,656	7,313	1,328	607	720
November	73	13	13	21	43	13	19	31	14,041	2,500	4,231	2,100	2,131
December	63	3	3	29	59	3	28	46	12,118	577	5,691	2,930	2,760
Total	**853**	**600**	**575**	**276**	**559**	**594**	**255**	**417**	**164,069**	**110,136**	**53,515**	**27,725**	**25,790**

Entered by: MR
Reviewed by: SA

Table A8

Post-Dev. (Uncontrolled) Conditions Water Balance Calculations - Monthly Analysis
Feature-Based Water Balance Analysis
4631 Sideroad 20 North, Puslinch Township, Ontario
Puslinch Development GP Inc.

Post-Development (Uncontrolled) Conditions

Total Area	1.90	ha

Feature-Based Water Balance Analysis - AP-1

			Grassed Area			***Walkways***			***On-Site Wetland (Shallow Aquatic)***		
			WHC	***100 mm***		***WHC***	***10 mm***		***WHC***	***175 mm***	
			Infiltration Factor	***0.55***		***Infiltration Factor***	***0.00***		***Infiltration Factor***	***0.00***	
			Area (m^2)	***5,485***		***Area (m^2)***	***103***		***Area (m^2)***	***2,027***	
Month	***Precipitation***	***Potential Evap.***	***Actual Evap.***	***Surplus***		***Actual Evap.***	***Surplus***		***Actual Evap.***	***Surplus***	
(-)	**(mm)**	**(mm)**	**(mm)**	**(mm)**	**(m^3)**	**(mm)**	**(mm)**	**(m^3)**	**(mm)**	**(mm)**	**(m^3)**
January	56	1	1	34	186	1	36	4	1	25	51
February	49	1	1	47	258	1	47	5	1	45	91
March	61	9	9	78	428	9	78	8	9	76	154
April	73	32	32	48	263	32	48	5	32	48	97
May	76	76	76	14	77	67	14	1	76	14	28
June	79	109	107	3	16	78	4	0	109	3	6
July	88	128	111	1	5	83	5	1	125	1	2
August	79	113	88	1	5	76	4	0	101	1	2
September	85	76	63	7	38	61	21	2	67	7	14
October	71	39	38	8	44	37	30	3	38	6	12
November	73	13	13	30	165	13	57	6	13	21	43
December	63	3	3	38	208	3	48	5	3	29	59
Total	**853**	**600**	**542**	**309**	**1,695**	**461**	**392**	**40**	**575**	**276**	**559**

Table A8

Post-Dev. (Uncontrolled) Conditions Water Balance Calculations - Monthly Analysis
Feature-Based Water Balance Analysis
4631 Sideroad 20 North, Puslinch Township, Ontario
Puslinch Development GP Inc.

Post-Development (Uncontrolled) Conditions

Total Area	1.90	ha

Feature-Based Water Balance Analysis - AP-1

			On-Site Wetland (Deciduous Swamp)			Meadow (Wetland Buffer)			Thicket (Wetland Buffer)		
			WHC	325 mm		WHC	175 mm		WHC	350 mm	
			Infiltration Factor	0.00		Infiltration Factor	0.55		Infiltration Factor	0.65	
			Area (m^2)	1,635		Area (m^2)	6,632		Area (m^2)	3,118	
Month	Precipitation	Potential Evap.	Actual Evap.	Surplus		Actual Evap.	Surplus		Actual Evap.	Surplus	
(-)	(mm)	(mm)	(mm)	(mm)	(m^3)	(mm)	(mm)	(m^3)	(mm)	(mm)	(m^3)
January	56	1	1	18	29	1	25	166	1	18	56
February	49	1	1	38	62	1	45	298	1	38	118
March	61	9	9	72	118	9	76	504	9	72	224
April	73	32	32	48	79	32	48	318	32	48	150
May	76	76	76	14	23	76	14	93	76	14	44
June	79	109	109	3	5	109	3	20	109	3	9
July	88	128	128	1	2	125	1	7	128	1	3
August	79	113	111	1	2	101	1	7	111	1	3
September	85	76	73	7	11	67	7	46	74	7	22
October	71	39	38	6	10	38	6	40	39	6	19
November	73	13	13	19	31	13	21	139	13	19	59
December	63	3	3	28	46	3	29	192	3	28	87
Total	**853**	**600**	**594**	**255**	**417**	**575**	**276**	**1,831**	**596**	**255**	**795**

Table A8

Post-Dev. (Uncontrolled) Conditions Water Balance Calculations - Monthly Analysis
Feature-Based Water Balance Analysis
4631 Sideroad 20 North, Puslinch Township, Ontario
Puslinch Development GP Inc.

Post-Development (Uncontrolled) Conditions

Total Area	1.90	ha

Feature-Based Water Balance Analysis - AP-1

Month	*Precipitation*	*Potential Evap.*	*Precip. Volume*	*Actual Evap. Volume*	*Surplus Volume*	*Infiltration Volume*	*Surface Runoff Volume*
(-)	**(mm)**	**(mm)**	**(m^3)**	**(m^3)**	**(m^3)**	**(m^3)**	**(m^3)**
January	56	1	1,064	19	492	230	262
February	49	1	931	19	833	383	450
March	61	9	1,159	171	1,436	658	778
April	73	32	1,387	608	912	417	495
May	76	76	1,444	1,443	266	122	144
June	79	109	1,501	2,057	57	26	31
July	88	128	1,672	2,308	19	9	11
August	79	113	1,501	1,893	19	9	11
September	85	76	1,615	1,282	134	61	74
October	71	39	1,349	725	127	58	69
November	73	13	1,387	247	443	206	237
December	63	3	1,197	57	598	277	320
Total	**853**	**600**	**16,207**	**10,829**	**5,337**	**2,456**	**2,881**

Entered by: MR
Reviewed by: SA

Summary of Calculations - Monthly
Feature-Based Water Balance Analysis
4631 Sideroad 20 North, Puslinch Township, Ontario
Puslinch Development GP Inc.

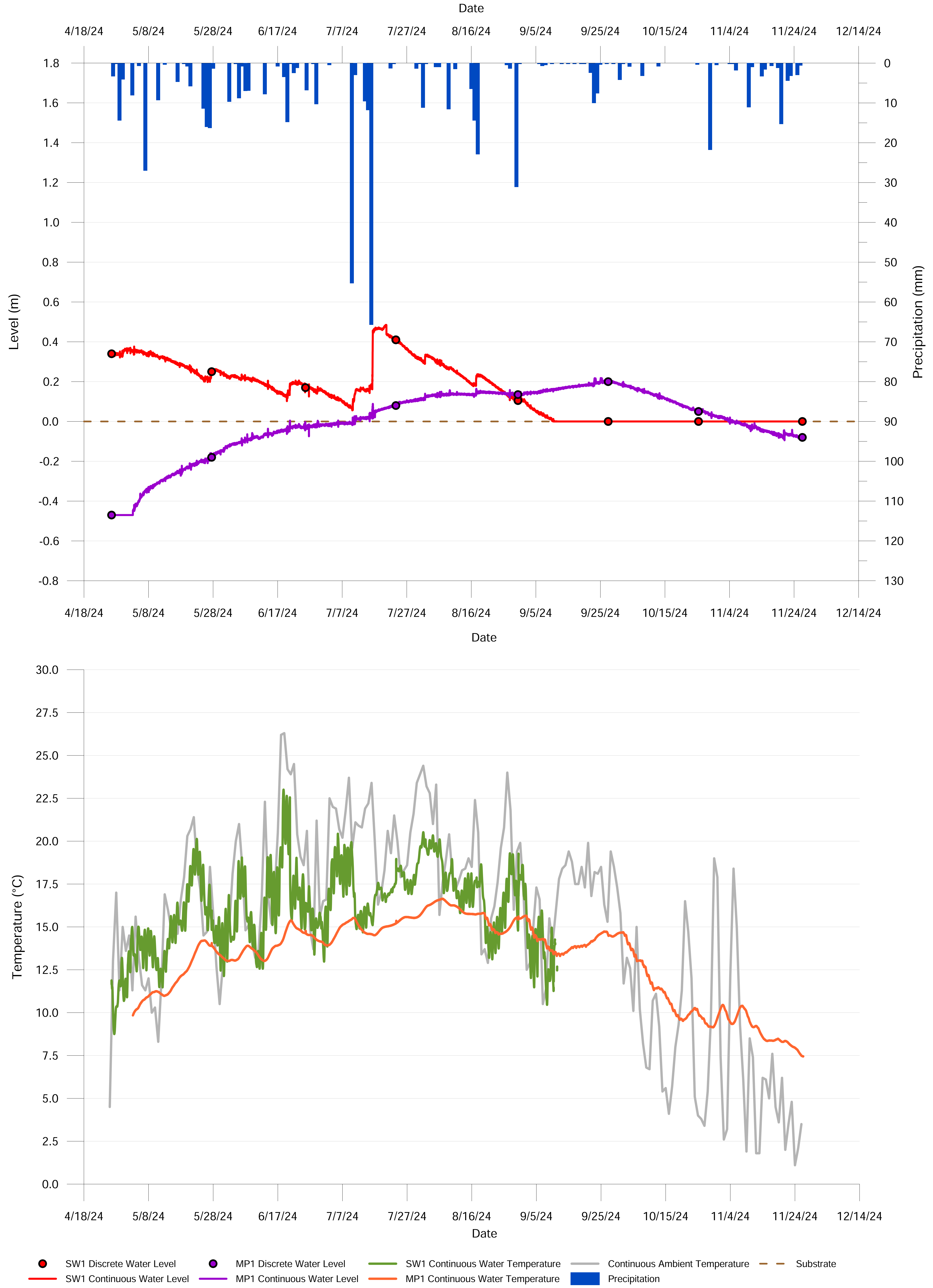
AP-1												
Month	Details	Area	Precipitation		Evapotranspiration		Surplus/Deficit		Infiltration		Runoff	
		(ha)	(m^3)	(mm)	(m^3)	(mm)	(m^3)	(mm)	(m^3)	(mm)	(m^3)	(mm)
January	Pre-Development Conditions	19.23	10,770	56	190	1	4,770	25	2,470	13	2,300	12
	Post-Development (Uncontrolled) Conditions	1.90	1,065	56	20	1	490	26	230	12	260	14
	Difference (Pre-Development to Uncontrolled)	(17.33)	(9,705)	(50)	(170)	(1)	(4,280)	(22)	(2,240)	(12)	(2,040)	(11)
February	Pre-Development Conditions	19.23	9,425	49	190	1	8,515	44	4,470	23	4,045	21
	Post-Development (Uncontrolled) Conditions	1.90	930	49	20	1	835	44	385	20	450	24
	Difference (Pre-Development to Uncontrolled)	(17.33)	(8,495)	(44)	(170)	(1)	(7,680)	(40)	(4,085)	(21)	(3,595)	(19)
March	Pre-Development Conditions	19.23	11,735	61	1,730	9	14,560	76	7,655	40	6,905	36
	Post-Development (Uncontrolled) Conditions	1.90	1,160	61	170	9	1,440	76	660	35	780	41
	Difference (Pre-Development to Uncontrolled)	(17.33)	(10,575)	(55)	(1,560)	(8)	(13,120)	(68)	(6,995)	(36)	(6,125)	(32)
April	Pre-Development Conditions	19.23	14,040	73	6,155	32	9,230	48	4,860	25	4,370	23
	Post-Development (Uncontrolled) Conditions	1.90	1,385	73	610	32	910	48	415	22	495	26
	Difference (Pre-Development to Uncontrolled)	(17.33)	(12,655)	(66)	(5,545)	(29)	(8,320)	(43)	(4,445)	(23)	(3,875)	(20)
May	Pre-Development Conditions	19.23	14,620	76	14,535	76	2,695	14	1,415	7	1,280	7
	Post-Development (Uncontrolled) Conditions	1.90	1,445	76	1,445	76	265	14	120	6	145	8
	Difference (Pre-Development to Uncontrolled)	(17.33)	(13,175)	(68)	(13,090)	(68)	(2,430)	(13)	(1,295)	(7)	(1,135)	(6)
June	Pre-Development Conditions	19.23	15,195	79	20,745	108	590	3	305	2	285	1
	Post-Development (Uncontrolled) Conditions	1.90	1,500	79	2,055	108	55	3	25	1	30	2
	Difference (Pre-Development to Uncontrolled)	(17.33)	(13,695)	(71)	(18,690)	(97)	(535)	(3)	(280)	(1)	(255)	(1)
July	Pre-Development Conditions	19.23	16,925	88	23,850	124	230	1	100	1	130	1
	Post-Development (Uncontrolled) Conditions	1.90	1,670	88	2,310	122	20	1	10	1	10	1
	Difference (Pre-Development to Uncontrolled)	(17.33)	(15,255)	(79)	(21,540)	(112)	(210)	(1)	(90)	(0)	(120)	(1)
August	Pre-Development Conditions	19.23	15,195	79	19,425	101	220	1	100	1	120	1
	Post-Development (Uncontrolled) Conditions	1.90	1,500	79	1,895	100	20	1	10	1	10	1
	Difference (Pre-Development to Uncontrolled)	(17.33)	(13,695)	(71)	(17,530)	(91)	(200)	(1)	(90)	(0)	(110)	(1)
September	Pre-Development Conditions	19.23	16,350	85	12,920	67	1,455	8	710	4	745	4
	Post-Development (Uncontrolled) Conditions	1.90	1,615	85	1,280	67	135	7	60	3	75	4
	Difference (Pre-Development to Uncontrolled)	(17.33)	(14,735)	(77)	(11,640)	(61)	(1,320)	(7)	(650)	(3)	(670)	(3)
October	Pre-Development Conditions	19.23	13,655	71	7,315	38	1,330	7	610	3	720	4
	Post-Development (Uncontrolled) Conditions	1.90	1,350	71	725	38	130	7	60	3	70	4
	Difference (Pre-Development to Uncontrolled)	(17.33)	(12,305)	(64)	(6,590)	(34)	(1,200)	(6)	(550)	(3)	(650)	(3)
November	Pre-Development Conditions	19.23	14,040	73	2,500	13	4,230	22	2,100	11	2,130	11
	Post-Development (Uncontrolled) Conditions	1.90	1,385	73	245	13	445	23	205	11	240	13
	Difference (Pre-Development to Uncontrolled)	(17.33)	(12,655)	(66)	(2,255)	(12)	(3,785)	(20)	(1,895)	(10)	(1,890)	(10)
December	Pre-Development Conditions	19.23	12,120	63	575	3	5,690	30	2,930	15	2,760	14
	Post-Development (Uncontrolled) Conditions	1.90	1,195	63	55	3	600	32	280	15	320	17
	Difference (Pre-Development to Uncontrolled)	(17.33)	(10,925)	(57)	(520)	(3)	(5,090)	(26)	(2,650)	(14)	(2,440)	(13)
Annual Summary												
Pre-Development Conditions		19.23	164,070	853	110,130	573	53,515	278	27,725	144	25,790	134
Post-Development (Uncontrolled) Conditions		1.90	16,200	853	10,830	570	5,345	281	2,460	129	2,885	152
Pre- to Post- Development Difference												
Post-Development (Uncontrolled) Conditions		(17.33)	(147,870)	(769)	(99,300)	(516)	(48,170)	(250)	(25,265)	(131)	(22,905)	(119)
Percentage Change		-90%	-90%	-90%	-90%	-90%	-90%	-90%	-91%	-91%	-89%	-89%

Notes:
Values are rounded for reporting purposes.
Positive value for infiltration difference is a surplus and a negative value is a deficit.
Positive value for runoff difference is an increase in runoff and a negative value is a decrease in runoff.

Entered by: MR
Reviewed by: SA

Appendix B

SW1/MP1 hydrograph



Notes:
- Precipitation and ambient temperature data provided from the Kitchener/Waterloo (Climate ID: 6144239) Environment Canada weather station and supplemented with the Roseville (Climate ID: 6147188) Environment Canada weather station.
- Gaps in the continuous water temperature were caused by dry conditions.

GHD

PUSLINCH DEVELOPMENT LIMITED PARTERNSHIP
PUSLINCH, ONTARIO
SURFACE WATER ASSESSMENT

SW1/MP1 - SURFACE WATER HYDROGRAPH AND TEMPERATURE DATA

Project No. 12618927
Date January 2025

ghd.com

The Power of Commitment