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37 Years

Klondike Road – Block 10

Site Servicing and Stormwater Management Report

MAPLE LEAF HOMES

KLONDIKE ROAD – BLOCK 10

SITE SERVICING AND STORMWATER MANAGEMENT REPORT

Prepared for:

Maple Leaf Homes

Prepared By:

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Suite 200, 240 Michael Cowpland Drive
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Issued: May 17, 2021

Novatech File: 117034-10
Report Ref: R-2021-068

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Engineers, Planners & Landscape Architects

May 17, 2021

City of Ottawa
Planning, Infrastructure and Economic Development Department
Planning Services Branch
110 Laurier Ave. West, 4th Floor
Ottawa, Ontario
K1P 1J1

Attention: **Lisa Stern, Planner**

Reference: **Klondike Road – Block 10**
Site Servicing and Stormwater Management Report
Novatech File No.: 117034-10

Novatech has prepared this Site Servicing and Stormwater Management Report on behalf of Maple Leaf Homes for Klondike Road – Block 10.

The report outlines the detailed sanitary, water, and storm servicing / stormwater management for the proposed site plan.

Should you have any questions or comments, please do not hesitate to contact us.

Sincerely,

NOVATECH

Lucas Wilson, P.Eng.
Project Coordinator

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1.0 INTRODUCTION

Novatech has been retained by Maple Leaf Homes to prepare a Site Servicing and Stormwater Management Report for Klondike Road – Block 10 in North Kanata, Ottawa.

This report outlines the servicing and proposed storm drainage and stormwater management strategy for the site.

1.1 Background

The proposed development is located within the Kanata North Community west of the intersection of Klondike Road and Sandhill Road. The development is approximately 0.60ha and is bounded by Klondike Road to the south, Shirley's Brook to the west, and the future 1055 Klondike Road – Orr Ridge subdivision to the north and east. Refer to **Figure 1** – Site Location and **Figure 2** – Site Plan.

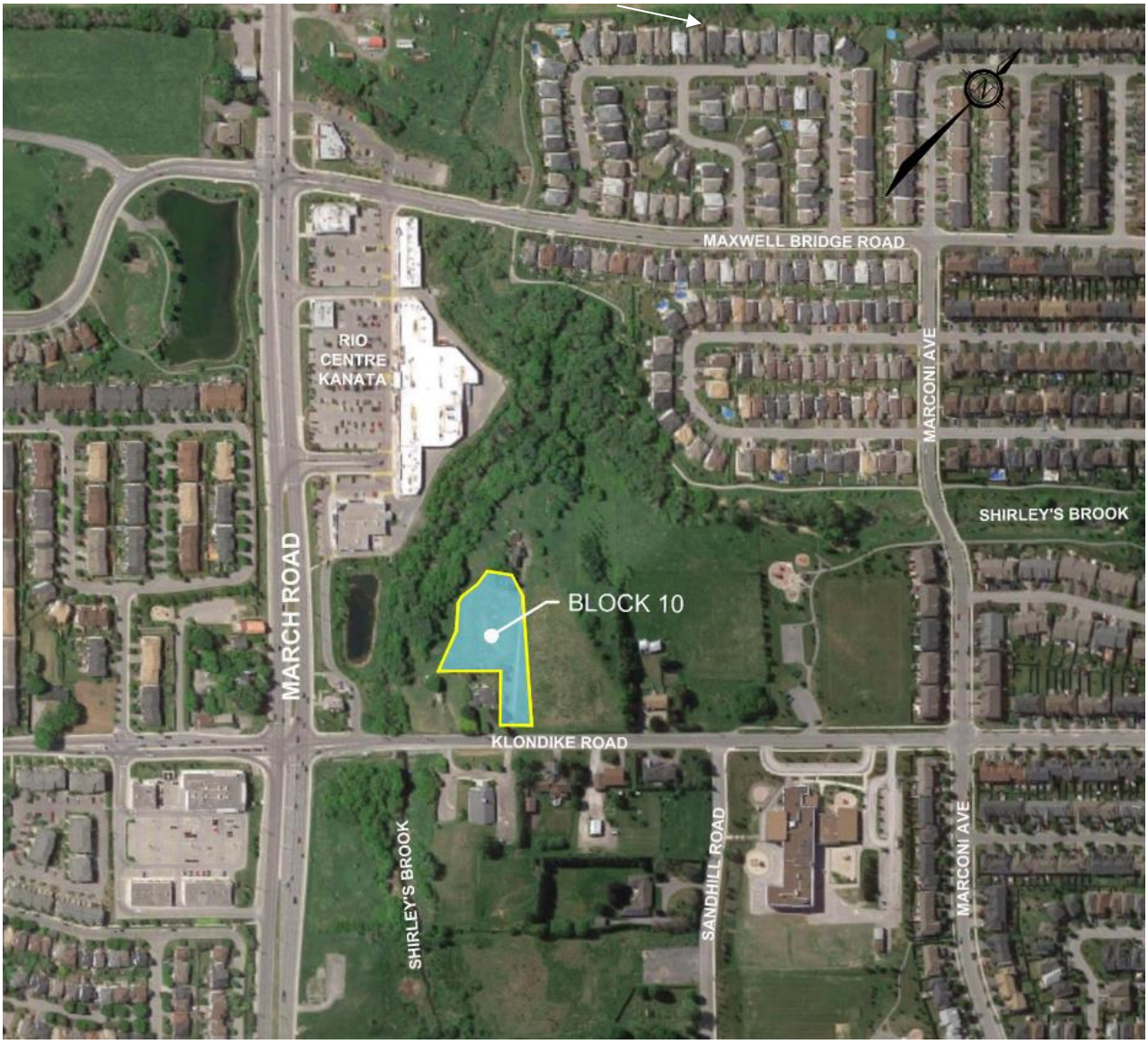

Figure 1 – Site Location: Klondike Rd – Block 10

The proposed development will consist of one 4-storey apartment building with underground parking consisting of 53 units. The proposed site plan is shown in **Figure 2**.

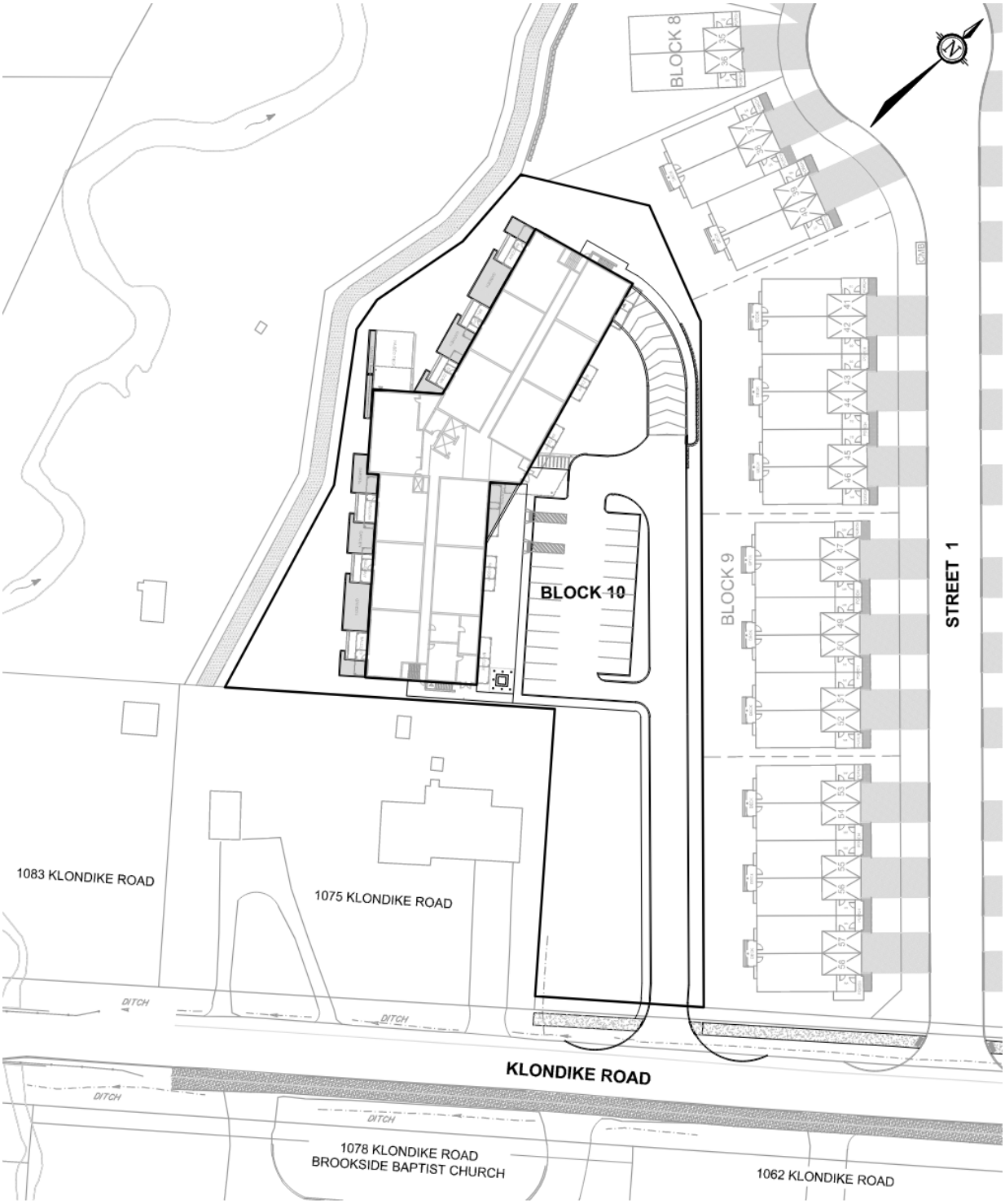

Figure 2 Site Plan

1.2 Existing / Planned Adjacent Land Uses

The following describes the existing and planned land uses adjacent to the subject site:

North / East: The lands north and east of the proposed site is the future 1055 Klondike Road – Orr Ridge Subdivision consisting of town house and semi-detached units.

South: Klondike Road, a two-lane urban collector road, bounds the Subject Site to the south. The Subject Site is located between March Road and Sandhill Road on the North Side of Klondike Road.

Southeast: To the Southeast of the Subject Site, across Klondike Road, are Brookside Baptist Church and The Greenwoods Academy.

West: The RioCentre Kanata (832-858 March Road) is located to the west of the Subject Site, separated by Shirley's Brook.

1.3 Additional Reports

This report provides information on the considerations and approach by which Novatech has designed and evaluated the proposed servicing for the Maple Leaf Homes Lands. This report should be read in conjunction with the following:

- *Maple Leaf Homes Development, 1055 Klondike Road – Orr Ridge, Site Servicing and Stormwater Management Report, completed by Novatech, Ref. No.: R-2020-013, dated March 12, 2021.*
- *Brookside Subdivision Infrastructure Servicing Study, completed by Novatech, Ref. No.: R-2006-071 dated November 2006.*
- *Shirley's Brook SWM Facility 'C', Detailed Design Report, completed by Novatech, Ref. No.: R-2006-105 dated November 2006.*

2.0 EXISTING CONDITIONS

2.1 Topography & Drainage

The proposed site is currently undeveloped and consists of grassed table land and a tree-lined municipal watercourse. Access to the site is currently provided off Klondike Road via a private gravel entrance.

The majority of the site gently slopes westerly directly towards Shirley's Brook while a small portion near Klondike Road which slopes south towards the existing north side ditch of Klondike Road. The existing ditch travels west and outlets to Shirley's Brook.

2.2 Subsurface Conditions

Gemtec completed three (3) geotechnical investigations in support of the overall development, consisting of the Subdivision and Block 10. The first geotechnical investigation was conducted to provide a preliminary geotechnical investigation and slope stability assessment of the site:

- *Preliminary Geotechnical Investigation, Proposed Residential Subdivision, 1055 Klondike Road, Ottawa, Ontario, dated April 13, 2017 (Project: 60616.46).*

A second geotechnical investigation was conducted to obtain additional borehole information to provide engineering guidelines and recommendations on the geotechnical design aspects of this project and should be read in conjunction with the preliminary report:

- *Geotechnical Investigation, Proposed Residential Subdivision, 1055 Klondike Road, Ottawa Ontario, dated April 4, 2018 (Project: 64153.85).*

A third geotechnical investigation was conducted to supplement the existing subsurface information providing additional boreholes to obtain more precise grade raise restrictions within the site:

- *Supplemental Geotechnical Investigation, Proposed Residential Development, 1055 Klondike – Ottawa, dated April 10, 2019 (File: 64153.85).*

The principal findings of the geotechnical investigations are as follows:

- The work consisted of advancing eleven (11) boreholes to depths ranging from 4.0m to 10.2 m below ground surface.
- The existing soil profile consists of having a layer of topsoil ranging from 0.10m to 0.31m thick. Deposits of grey brown silty sand were encountered at all boreholes ranging from 0.8 to 2.0m thick. Native deposits of weathered, grey brown silt and clay with trace amounts of sand were encountered underlying the sand and silty sand at all locations ranging from 3.0m to 4.6m thick.
- Bedrock is expected to range from 4m-10m below grade.
- Groundwater is expected to range from 2.2m to 6.7m based on observations.
- Grade fill restrictions of 2.0m would apply to Block 10.

The report provides engineering guidelines based on Gemtec's interpretation of the borehole information and project requirements. Refer to the above-noted report for complete details.

3.0 SANITARY SERVICING

3.1 Previous Studies

The Subject Site is located within the Briar Ridge Pump Station catchment area. The 1055 Klondike Road – Orr Ridge Site Servicing and Stormwater Management Report, prepared by Novatech, dated March 2021, accounted for a sanitary flow of 1.5 L/s from the subject site to outlet to the Klondike Road sanitary sewer.

3.2 Existing Sanitary Sewer System for the Subject Lands

Currently, there is an existing 200mm sanitary sewer along Klondike Road with an existing manhole at Sandhill Road located approximately 117m from the site entrance. Flows from the site will be routed through the Klondike Road sewers to the 450mm trunk sanitary sewer within the pump station access road outletting to the Briar Ridge Pump Station.

Septic systems may be encountered on site, in the event a septic system is discovered, it should be decommissioned in accordance with Schedule 10 Decommissioning Requirements for Out-of-Service Septic Systems from the Ottawa Septic System Office (lands to be used for other purposes after decommissioning).

3.3 Proposed Sanitary Sewer Outlet

A 200mm sanitary sewer will be installed along Klondike Road, as part of the subdivision works, connecting the subject site to the existing manhole located at Klondike Road and Sandhill Road. The proposed outlet is consistent with the approved Brookside Infrastructure Servicing Study (Novatech). The proposed sanitary layout can be seen on **Figure 3** below.

3.4 Design Criteria

Sanitary sewers, for the proposed development, are designed based on criteria established by the City of Ottawa in the following documents:

- Section 4.0 of the City of Ottawa Sewer Design Guidelines (October 2012).
- Technical Bulletin ISTB-2018-01 from the City of Ottawa regarding new sanitary design parameters. Design parameters from this technical bulletin will supersede values within the Sewer Design Guidelines (2012).

The resulting design parameters are summarized as follows:

Population Flow = 280 L/capita/day
Infiltration = 0.33 L/s/ha
Block 10 Apartment = 2.1 persons per unit
Maximum Residential Peak Factor = 4.0
Harmon Correction Factor = 0.8
Minimum velocity = 0.6m/s
Manning's n = 0.013

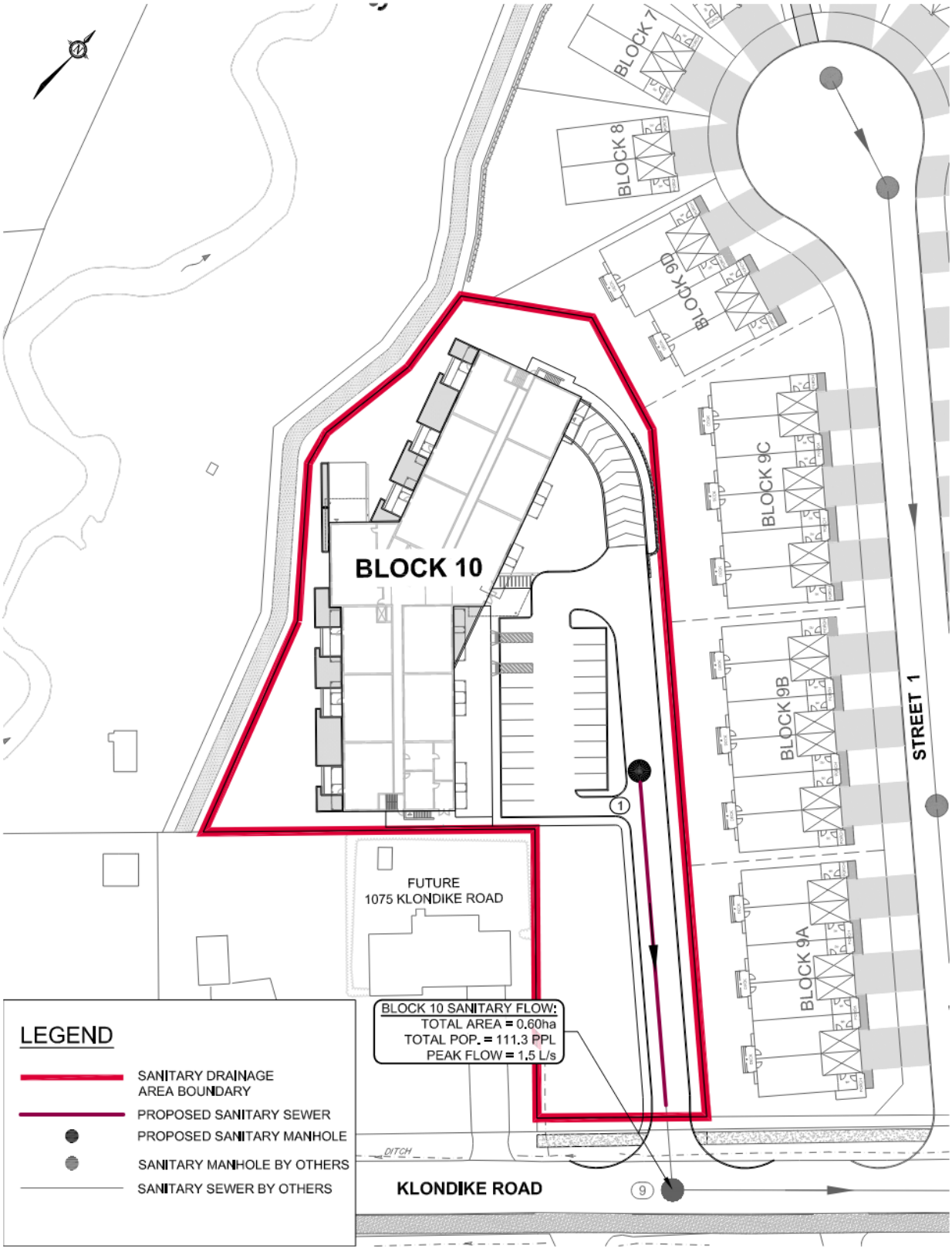

Figure 3 Proposed Sanitary System

3.5 Proposed Sanitary Sewer System

The calculated peak sanitary design flow for the development is 1.5 L/s meeting the flow accounted for in the subdivision servicing report mentioned above. For detailed calculations refer to the Sanitary Sewer Design Sheet located in **Appendix B**.

As previously noted, sanitary flows from the site will be directed to an existing 200mm diameter sanitary sewer on Klondike Road at Sandhill Road.

The downstream sanitary sewers within Klondike Road and the Briar Ridge Pump Station Access Road have adequate capacity to accommodate the proposed development as shown in the sanitary design sheet provided in **Appendix B**.

4.0 WATERMAIN

4.1 Existing Conditions

The proposed development is located inside the 2W Pressure Zone. An existing 400mm watermain stub is located at the intersections of Klondike Road and Sandhill Road and an existing 300mm watermain runs within Sandhill Road.

4.2 Proposed Watermain System

The development will be serviced with a combination of 150mm and 250mm pipes with a connection to the proposed 250mm diameter watermain stub at the entrance to the site. The proposed 250mm diameter stub will be installed as part of the adjacent subdivision works. **Figure 4** highlights the proposed works and connection point. All existing watermain boundary conditions were provided by the City of Ottawa and are included in **Appendix C**.

4.3 Design Criteria

A fire flow demand of 350 L/s has been calculated as per the Fire Underwriter's Survey (FUS) and calculations are included in **Appendix C**. Watermain analysis was completed based on the following criteria:

Demands:

- Apartment Density 2.1 persons/unit
- Average Daily Demand 280 L/capita/day
- Max. Daily Demand 2.5 x Average Daily Demand
- Peak Hour Demand 2.2 x Maximum Daily Demand
- Fire Flow Demand Fire Underwriters Survey

System Requirements:

- Max. Pressure (Unoccupied Areas) 690 kPa (100 psi)
- Max. Pressure (Occupied Areas) 552 kPa (80 psi)
- Min. Pressure 276 kPa (40 psi) excluding fire flows
- Min. Pressure (Fire) 138 kPa (20 psi) including fire flows
- Max. Age (Quality) 192 hours (onsite)

Friction Factors:

- Watermain Size C-Factor
- 200mm 100
- 250mm 110
- 400mm 120

Hydraulic modeling of the Subject Site was completed using EPANET 2.0. EPANET is public domain software capable of modeling municipal water distribution systems by performing simulations of the water movement within a pressurized system. EPANET uses the Hazen-Williams equation to analyze the performance of the proposed watermain and considered the

following input parameters: water demand, pipe length, pipe diameter, pipe roughness, and pipe elevation.

4.4 Hydraulic Analysis

A summary of the model results are shown below in **Table 4.1**, **Table 4.2** and **Table 4.3**. Full model results are included in **Appendix C**. Refer to **Figure 4** below for details about the node and pipe network.

Table 4.1: Summary of Hydraulic Model Results - Maximum Day + Fire Flow

Operating Condition	Minimum Pressure
350 L/s	241.23 kPa (B1)

Table 4.2: Summary of Hydraulic Model Results - Peak Hour Demand

Operating Condition	Maximum Pressure	Minimum Pressure
1.984 L/s through system	476.77 kPa (T4)	450.00 kPa (H3)

The hydraulic modeling summarized above highlights the maximum and minimum system pressures during Peak Hour conditions, and the minimum system pressures during the Maximum Day + Fire condition. Since the Maximum Day + Fire Flow pressures are above the minimum 140 kPa, and the Peak Hour Pressures onsite fall within the normal operating pressure range (345 kPa to 552 kPa) the proposed development can be adequately serviced.

Table 4.3: Summary of Hydraulic Model Results – Maximum Pressure Check

Operating Condition	Maximum Pressure	Minimum Pressure	Maximum Age
0.902 L/s through system	513.06 kPa (T4)	506.98 kPa (B1)	13.88 Hours (HYD4)

The average day pressures throughout the system are below 552 kPa, therefore pressure reducing valves are not required.

Water retention was analyzed at each node during average day demand. The maximum age throughout the system is within City standards.

A copy of the boundary conditions provided by the City of Ottawa, fire flow calculations, and detailed hydraulic analysis results are included in **Appendix C**.

There are no deviations from the City of Ottawa Design Guidelines – Water Distribution (2010).

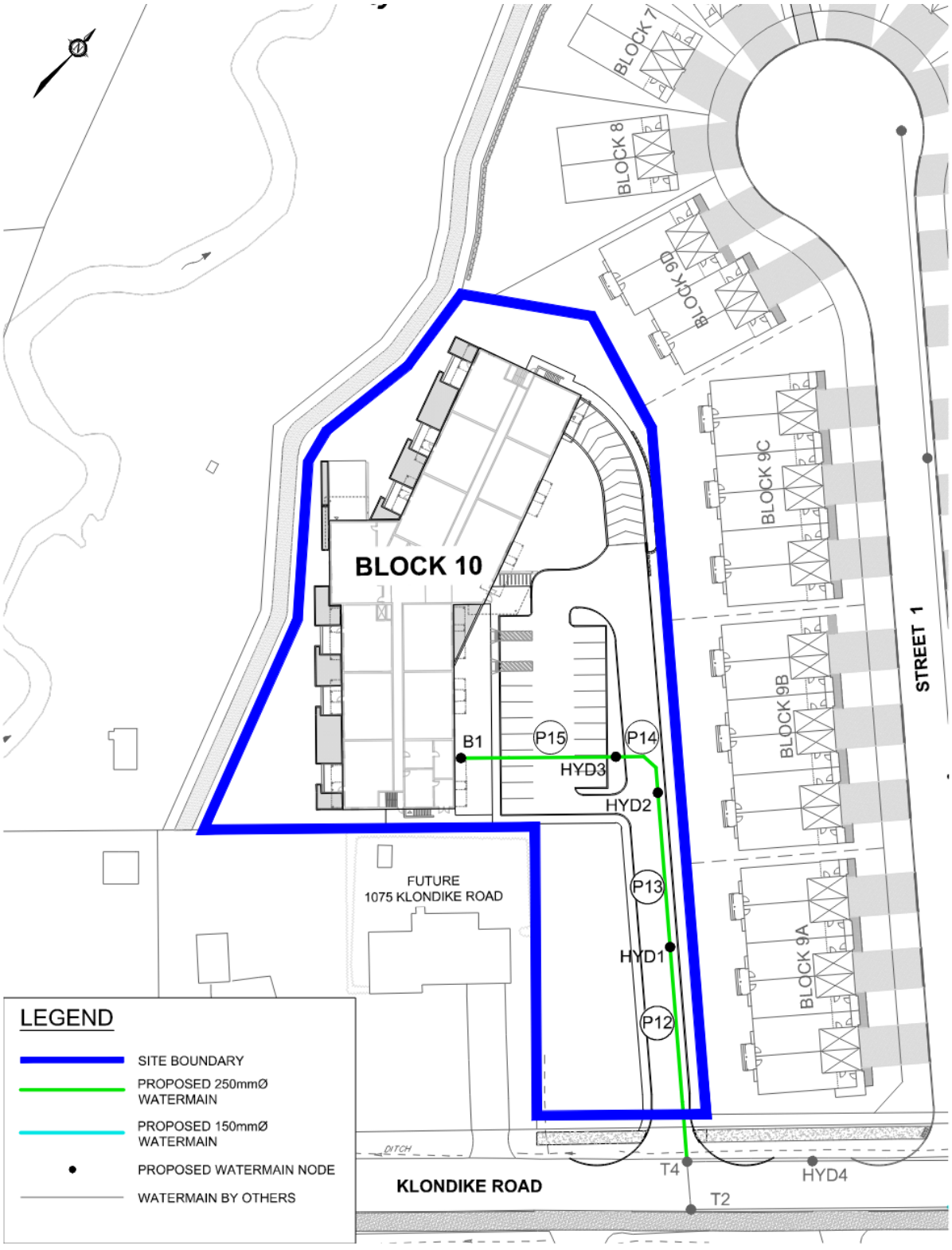

Figure 4 Proposed Watermain Network

5.0 STORM SEWER SYSTEM AND STORMWATER MANAGEMENT

5.1 Stormwater Management Criteria

The following stormwater management criteria for the proposed development was prepared in accordance with the City of Ottawa Sewer Design Guidelines (October 2012) and the 1055 Klondike Road – Orr Ridge Site Servicing and Stormwater Management Report (Novatech, March 2021). This report was prepared in accordance with the Brookside Subdivision Infrastructure Servicing Study (Novatech, 2006) and the Shirley's Brook SWM Facility 'C' Detailed Design Report (Novatech, 2006).

- Provide a dual drainage system (i.e. minor and major system flows);
- Maximize the use of surface storage available on site;
- Control the runoff to MH9 to the allowable release rate specified in **Section 5.1.1** using on-site storage;
- Ensure that no surface ponding will occur on the paved surfaces (i.e. private drive aisles or parking areas) during the 2-year storm event; and,
- Ensure that ponding is confined within the parking areas at a maximum depth of 0.35m for both static ponding and dynamic flow.

For the approval of the 1055 Klondike Road – Orr Ridge Subdivision, the following assumptions were made for the future development of Block 10 (see **Appendix D** for 1055 Klondike Road – Orr Ridge report excerpts);

- Restricted minor system flow = 51 L/s;
- Major system storage = 81.6 m^3; and,
- No major system overland flow to Shirley's Brook during the 100-year storm event.

5.1.1 Allowable Release Rate

The allowable release rate for Block 10 (0.60 ha) was established based on the restricted minor system flow of 85 L/s/ha (51 L/s) for all storms up-to and including the 100-year storm event.

5.2 Existing and Proposed Storm Infrastructure

Existing Conditions

Under existing conditions, storm runoff from the site generally flows overland to the main branch of Shirley's Brook along the west side of the site. A small amount of drainage is directed to the north side ditch along Klondike Road.

There is an existing 825mm storm sewer on Klondike Road. The existing storm sewer stops at the intersection of Klondike Road and Sandhill Road (existing MH 159).

Proposed Conditions

As part of the subdivision works, the existing storm sewer on Klondike Road will be extended 163 m west in order to service both the proposed subdivision and Block 10. A future storm sewer to service the Subject Site and adjacent lands was identified in the Novatech (2006) design. Refer to **Figure 5** for the storm servicing layout.

5.2.1 Stormwater Quality Control Criteria

Shirley's Brook SWM Facility 'C' provides a normal level of water quality treatment (70% long-term TSS removal) for Block 10. The proposed site has a drainage area of 0.60 ha and a runoff coefficient of 0.58. The site was previously referred to as area A-18 in the 1055 Klondike Road – Orr Ridge Design, which had a drainage area of 0.60 ha and runoff coefficient of 0.80 (refer to excerpt provided in **Appendix D**). When comparing the area x runoff coefficient values the proposed site has the same area, but a lower runoff coefficient than what was previously allocated, as shown below:

Parameter	*1055 Klondike Road – Orr Ridge Design*	*Current Design*
Drainage Area	0.60 ha	0.60 ha
Runoff Coefficient	0.80	0.58
Area x Runoff Coefficient	0.48	0.35

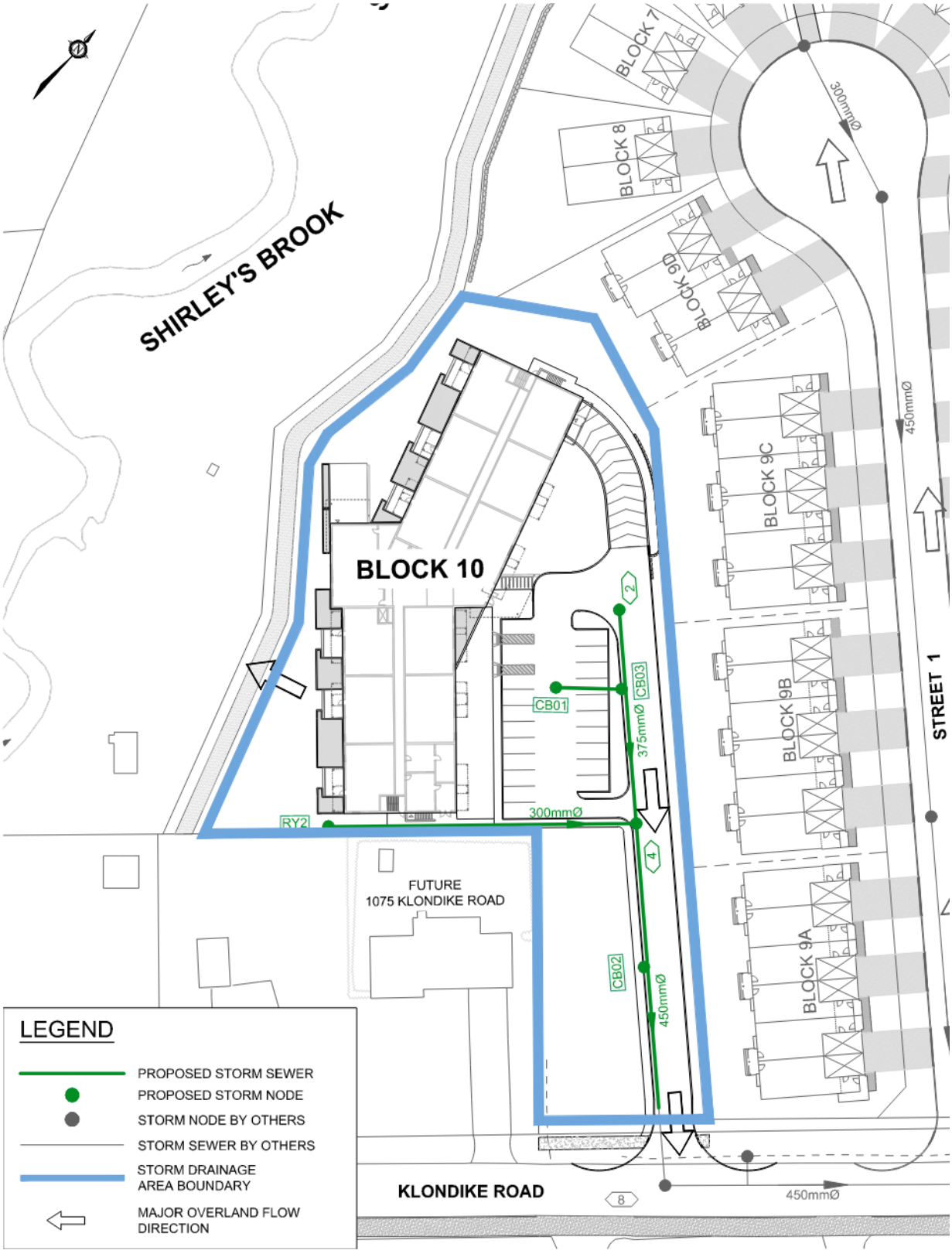

Figure 5 Proposed Storm System

5.2.2 Stormwater Quantity Control Criteria

The 1055 Klondike Road – Orr Ridge Design established a 100-year release rate to Shirley's Brook of 297.2 L/s. Allocating 100% of the release rate to the subdivision portion and requiring Block 10 to contain the 100-year storm event on site while providing a minimum major system storage volume of 81.6 m^3. The subdivision portion releases 274.0 L/s of major system flow to Shirley's Brook, which would allow an additional 23.2 L/s of major system flow to be released from Block 10 while ensuring 81.6 m^3 of major system storage is provided on-site.

5.2.3 Minor System (Storm Sewers)

Storm servicing has been provided using a dual-drainage system. Runoff from frequent events will be conveyed by the proposed storm sewers (minor system), while flows from large storm events that exceed the capacity of the minor system will be stored underground using Stormtech SC-740 arch-type chambers, on the surface in road sags, and/or conveyed overland along defined overland flow routes (major system).

Storm Sewer Design Criteria

The following is the storm sewer design criteria [Ottawa Sewer Design Guidelines (Oct. 2012)]:

- Rational Method (Q) = 2.78CIA, where
    - Q = peak flow (L/s)
    - C = runoff coefficient
        - C = (0.70 * %Imp.) + 0.20
    - I = rainfall intensity for a 2-year return period (mm/hr)
        - $I_{2yr} = 732.951 / [(Tc(min) + 6.199)]^{0.810}$
    - A = site area (ha)
- Minimum Pipe Size = 250 mm; Minimum / Maximum Full Flow Velocity = 0.8 m/s / 3.0 m/s

The on-site storm sewers are sized to convey peak flows corresponding to a 2-year return period storm event based on the Rational Method. Refer to the storm sewer design sheets provided in **Appendix D**.

Underground Storage

Underground storage will be required to attenuate runoff from the site. Underground storage will be provided using Stormtech SC-740 arch-type chambers (or approved equivalent), which are covered in 50mm dia. (D_{50}) clearstone. A total of 15 storage chambers will provide 42.0 m^3 of storage. Refer to **Appendix D** for further details. The proposed layout of underground storage chambers is shown on the General Plan of Services (drawing 117034-10-GP).

Inlet Control Devices

Inlet control devices (ICDs) are to be installed within the selected catchbasins and rear-yard catchbasins. The ICDs have been sized to control minor system peak flows to the Klondike Road storm sewer to the allowable release rate and to ensure that no ponding occurs during the 2-year storm event.

Hydraulic Grade Line

The storm sewers for the proposed site have been designed to ensure the hydraulic grade line (HGL) for a 100-year storm event will provide a minimum 0.30 m clearance from the underside of footing (USF) elevation.

5.2.4 Major System Design

The site has been designed to convey private roadway and parking area runoff from storms that exceed the minor system capacity to the Klondike Road north side ditch. The landscaped area along Shirley's Brook located on the west side of the building, has been designed to convey runoff that exceed the minor system capacity directly to Shirley's Brook. The site has been graded to ensure the 100-year peak overland flows are confined within the parking and landscaped areas and at least 81.6 m^3 of major system storage is provided on-site.

Approximately 0.025 ha of land flows uncontrolled to Shirley's Brook and accounts for the only major system flow being directed to Shirley's Brook from the proposed site. These areas are not to surpass the allowable major system release rate of 23.2 L/s outlined in **Section 5.2.2** above.

Surface/Underground Storage

The stage-storage curves for each inlet were calculated based on the proposed Grading Plan (drawing 117034-10-GR) and the proposed underground storage chamber locations. The total storage shown in the stage-storage curves at each inlet is provided in **Appendix D**. Approximately 42 m^3 of underground storage and 217.8 m^3 of surface storage is available on-site.

The total storage provided underground and on the surface is as follows:

Table 5.1: Total Available Storage

Structure ID	Number of Chambers	Underground Storage (m^3)	Surface Storage (m^3)	Total Storage (m^3)
		Provided	**Provided**	**Provided**
CB03*	9	25.7	28.2	53.9
CB01	-	-	79.5	79.5
LC03	-	-	16.0	16.0
TOTAL	**9**	**25.7**	**123.7**	**149.4**
CB02*	-	-	31.7	31.7
LC04	-	-	43.9	43.9
TOTAL	**-**	**-**	**75.6**	**75.6**
LC01	-	-	1.8	1.8
LC02	-	-	8.0	8.0
RY03	6	16.2	8.7	24.9
TOTAL	**6**	**16.2**	**18.5**	**34.7**
TOTAL OVERALL	**15**	**41.9**	**217.8**	**259.7**

*Structure with ICD.

5.3 Hydrologic & Hydraulic Modeling

The City of Ottawa Sewer Design Guidelines (October 2012) require hydrologic modeling for all dual drainage systems. The performance of the proposed storm drainage system for Block 10 was evaluated using the PCSWMM hydrologic/hydraulic modeling software.

Design Storms

The PCSWMM model includes the following design storms based on the City of Ottawa IDF data presented in the City of Ottawa Sewer Design Guidelines (October 2012):

- 3-hour Chicago Storm Distribution (10-minute time step)
- 12-hour SCS Storm Distribution (30-minute time step)

Each storm distribution includes the 2-year, 5-year, 100-year, and 100-year (+20%) return periods.

The 3-hour Chicago storm distribution was determined to be the critical design storm for the proposed development. This is also consistent in the analysis by Novatech (2006), who designed SWM Facility 'C' using the SWMHYMO hydrologic model.

PCSWMM Model Schematics, Output Data and Modeling Files

PCSWMM model schematics and output data for the 100-year 3-hour Chicago storm distribution are provided in **Appendix D**.

Table 5.2 provides a summary of the hydrologic modeling parameters (subcatchments).

Table 5.2: Hydrologic Modeling Parameters (subcatchments)

Area ID	Catchment Area (ha)	Runoff Coefficient (%)	Percent Imperviousness (%)	Zero Imperviousness (%)	Equivalent Width (m)	Average Slope (%)
B-01	0.044	0.80	85.7	0	17.6	1.5
B-02	0.070	0.20	0.0	0	35	2.5
B-03	0.004	0.20	0.0	0	40	33.33
B-04	0.007	0.20	0.0	0	35	33.33
B-05	0.041	0.78	82.9	0	20.5	1.5
B-06	0.130	0.78	82.9	34	52	1.5
B-07	0.015	0.90	100.0	0	7.5	10.5
B-08	0.009	0.51	44.3	0	45	33.33
B-09	0.008	0.20	0.0	0	40	33.33
B-10	0.054	0.60	57.1	95	36	4.5
B-11	0.022	0.33	18.6	0	14.7	2
B-12	0.086	0.58	54.3	86	43	3
B-13	0.082	0.55	50.0	90	41	3
C-01	0.011	0.20	0.0	0	22	33.33
C-02	0.009	0.64	62.9	0	18	2.5
C-03	0.002	0.20	0.0	0	20	33.33
C-04	0.003	0.20	0.0	0	30	33.33
Subdivision	**0.60**	**0.58**	**54.7**	**-**	**-**	**-**

Subcatchment Areas / Runoff Coefficients

- The proposed site has been divided into subcatchments based on the tributary drainage areas to each inlet of the proposed storm sewer system, as shown on the Storm Drainage Area Plan (Drawing 117034-10-STM).
- Weighted runoff coefficients were assigned based on the percent impervious values used in the PCSWMM model. As per the City of Ottawa Sewer Design Guidelines (October 2012), the runoff coefficient is based on the following equation:

  C = (% Imp. * 0.7) – 0.2

Infiltration

Infiltration losses for all catchment areas were modeled using Horton's infiltration equation, which defines the infiltration capacity of the soil over the duration of a precipitation event using a decay function that ranges from an initial maximum infiltration rate to a minimum rate as the storm progresses. The default values for the Sewer Design Guidelines were used for all catchments.

Horton's Equation:
$f(t) = f_c + (f_o – f_c)e^{-k(t)}$

Initial infiltration rate: f_o = 76.2 mm/hr
Final infiltration rate: f_c = 13.2 mm/hr
Decay Coefficient: k = 4.14/hr

Depression Storage

- The default values for depression storage (1.57 mm impervious / 4.67 mm pervious) have been applied to all catchments.

Subarea Routing

- Subarea routing for all subcatchments has been set to 'direct to outlet'.

Equivalent Width

- The equivalent width parameter for all subcatchments is based on the measured flow length.

Minor System Conduits (Bend / Exit Losses)

- The minor system network was created in Civil3D and imported into PCSWMM.
- The following exit losses have been inputted into the model. They represent the loss coefficient based on the bend angle, as per the Appendix 6-B in the City of Ottawa Sewer Design Guidelines (October 2012).

Bend Angle	Loss Coefficient
0	0.00
15	0.09
30	0.21
45	0.39
60	0.64
75	0.96
90	1.32

Downstream Boundary Condition (Minor System)

- The storm sewer outlet for the proposed development is the existing maintenance hole (MH 159) on Klondike Road.
- Novatech (2006) estimated a 100-year Hydraulic Grade Line (HGL) elevation of 69.73 m at MH 159 on Klondike Road at Sandhill Road. This is equivalent to obvert elevation of the outgoing 825mm storm sewer (69.73 m); therefore, it is assumed that this storm sewer does not surcharge during the 100-year storm event. In addition, this HGL elevation is lower than the invert elevation of the outgoing pipe from MH 09 at the end of the private access (72.16 m). As such, a 'Normal' outfall condition was used for all model simulations.

5.3.1 PCSWMM Model Results

Inlet Control Devices (ICDs)

ICDs are provided for select catchbasins within the roadway and catchbasin in the landscaped areas. The ICD sizes and design flows are provided in **Table 5.3**. The ICDs have been sized to maximize surface storage, limit the outlet peak flows to the allowable release rate and not have surface ponding during a 2-year storm event.

Table 5.3: Inlet Control Devices and Design Flows

Structure ID	ICD Size & Inlet Rate						
	ICD Type	T/G (m)	Orifice Invert (m)	100-year Head on Orifice (m)	2-year Orifice Peak Flow* (L/s)	5-year Orifice Peak Flow* (L/s)	100-year Orifice Peak Flow* (L/s)
CB02	Tempest MHF 77mm	77.73	76.33	1.61	13.4	15.5	15.0
CB03	Tempest LMF Vortex 93	77.83	76.13	1.93	9.3	10.2	10.5
RY02	Tempest MHF 82mm	77.96	75.24	2.08	12.5	14.4	19.2

**From PCSWMM model, 3-hour Chicago storm distribution.*

Both IPEX Tempest LMF (i.e. Vortex ICD's) and MHF ICDs are proposed for the site. Sizing documentation and correspondence is provided in **Appendix D**.

Overland Flow (Major System)

The major system network was evaluated using the PCSWMM model to ensure that the ponding depths conform to the City of Ottawa Sewer Design Guidelines (Oct. 2012). A summary of ponding depths at each inlet for the 2-year, 5-year, 100-year and 100-year (+20%) events are provided in **Appendix D**. The maximum static and dynamic ponding depths are less than 0.35m during all events, thereby meeting the major system criteria. In addition, there is no cascading flow over the highpoint during the 100-year storm event.

Table 5.4: Overland Flow Results

Structure	T/G	Max. Static Ponding		100-yr Event			
		Elev.	Spill Depth	Elev.	Depth	Cascading	Cascade Depth
	(m)	(m)	(m)	(m)	(m)	Flow?	(m)
CB01	77.83	78.13	0.30	78.06	0.23	N	0.00
CB02	77.73	78.03	0.30	77.94	0.21	N	0.00
CB03	77.83	78.13	0.30	78.06	0.23	N	0.00
LC01	77.67	77.80	0.13	77.34	0.00	N	0.00
LC02	77.15	77.35	0.20	77.34	0.19	N	0.00
LC03	78.00	78.30	0.30	78.14	0.14	N	0.00
LC04	77.73	78.03	0.30	77.95	0.22	N	0.00
RY03	77.15	77.35	0.20	77.34	0.19	N	0.00

**From PCSWMM model, 3-hour Chicago storm distribution.*

An expanded table of the ponding depths at low points in the roadway (including the stress-test event) is provided in **Appendix D**. Based on these results, the proposed storm drainage system will not experience any adverse flooding even with a 20% increase to the 100-year event.

Hydraulic Grade Line

Table 5.5 provides a summary of the 100-year HGL elevations at each storm manhole. The results of this analysis were used to ensure that a minimum freeboard of 0.30m is provided between the 100-year HGL and the designed underside of footing (USF) elevation.

There is no surcharging within the on-site sewers during both the 100-year and 100-year (+20%) storm events.

Table 5.5: 100-year HGL Elevations

Manhole ID	MH Invert Elevation (m)	T/G Elevation (m)	HGL Elevation (100yr) (m)	Design USF (m)	Clearance (100yr) (m)
MH02	74.50	78.09	74.60	-	-
MH04	74.26	78.10	74.43	75.25	0.82
MH08	72.16	77.68	72.32	-	-
TD01	72.93	75.78	74.99	-	-

**From PCSWMM model, 3-hour Chicago storm distribution.*

An expanded table showing the results of the stress test (100-year +20% event) and the HGL elevations is provided in **Appendix B**. The stress test indicates that the HGL elevations will be below the USF elevations for this event.

Comparison of Peak Flows

Table 5.6 provides a comparison of the minor system flows from the proposed development to Klondike Road and major system flows / direct flows to Shirley's Brook.

Table 5.6: Comparison of Peak Flows

Proposed Development	Drainage Area (ha)	Allowable Release Rate[1] (L/s)		100-year Peak Flow (L/s)	
		Minor System (Klondike Rd.)	Major System (Shirley's Brook)	Minor System (Klondike Rd.)	Major System (Shirley's Brook)
Block 10	0.60	51.0	23.2	50.7	12.4

(1) PCSWMM model results for the 3-hour Chicago storm distribution.

The 100-year minor system peak flow to Klondike Road is controlled to just under the allowable release rate of 51 L/s for the proposed site. The total 100-year major system peak flow to Shirley's Brook from the uncontrolled areas is also less than the 100-year major system allowable release rate for the Subject Site (23.2 L/s).

Areas Directed to Subdivision Rear-yard System

A small strip of land along the east property line, approximately 0.03 ha, slopes towards the rear-yards of the subdivision and will be captured by the proposed landscape catchbasins with a 100-year peak runoff of 14 L/s. The additional flow does not result in any increase to the subdivision minor or major system peak flows calculated in the 1055 Klondike Road – Orr Ridge Design Report.

6.0 ROADWAYS

6.1 Proposed Road Infrastructure

Gemtec has prepared a Geotechnical Investigation report for the Development (April 2018) that provides recommendations for roadway structure, servicing and foundations. The site consists of a private roadway and at-grade parking; the recommended roadway structure is as follows:

Table 6.1: Roadway Structure

Roadway Material Description	Pavement Structure Layer Thickness (mm)
	Private Road
Asphalt Wear Course: Superpave 12.5 (Class B)	40
Asphalt Binder Course: Superpave 19.0 (Class B)	60
Base: Granular A	150
Sub-Base: Granular B – Type II	450
Total	**700**

7.0 EROSION AND SEDIMENT CONTROL

Erosion and sediment control measures will be implemented during construction in accordance with the "Guidelines on Erosion and Sediment Control for Urban Construction Sites" (Government of Ontario, May 1987). An Erosion and Sediment Control Plan will be prepared as part of the detailed design.

Typical erosion and sediment control measures recommended include, but are not limited to, the use of silt fences around perimeter of site (OPSD 219.110), catch basin inserts under catch basin/maintenance hole lids, heavy duty silt fence barrier (OPSD 219.130), straw bale check dams (OPSD 219.180), rock check dams (219.210 or OPSD 219.211), riprap (OPSS 511), mud mats, silt bags for dewatering operations, topsoil and sod to disturbed areas and natural grassed waterways. Dewatering and sediment control techniques will be developed for the individual situations based on the above guidelines and utilizing typical measures to ensure erosion and sediment control is controlled in an acceptable manner and there is no negative impact to adjacent Lands, water bodies or water treatment/conveyance facilities.

It will be the responsibility of the Contractor to submit a detailed construction schedule and appropriate staging, dewatering and erosion and sediment control plans to the Contract Administrator for review and approval prior to the commencement of work.

General Erosion and Sediment Control Measures

- All erosion and sediment control measures are to be installed to the satisfaction of the engineer, the municipality and the conservation authority prior to undertaking any site alterations (filling, grading, removal of vegetation, etc.) and remain present during all phases of site preparation and construction.
- A qualified inspector, provided by the owner, should conduct daily visits during construction to ensure that the contractor is working in accordance with the design drawings and that mitigation measures are being implemented as specified.
    - A light duty silt fence barrier is to be installed in the locations shown on the Erosion and Sediment Control Plan.
    - Rock check dams and/or straw bales are to be installed in drainage ditches.
    - Catch basin inserts are to be placed under the grates of all proposed catchbasins and structures.
    - After complete build-out, all sewers are to be inspected and cleaned and all sediment and construction fencing is to be removed.
- The contractor shall ensure that proper dust control is provided with the application of water (and if required, calcium chloride) during dry periods.
- The contractor shall immediately report to the engineer or inspector any accidental discharges of sediment material into any ditch or sewer system. Appropriate response measures shall be carried out by the contractor without delay.

The contractor acknowledges that failure to implement erosion and sediment control measures may result in penalties imposed by any applicable regulatory agency.

8.0 CONCLUSIONS AND RECOMMENDATIONS

Sanitary Servicing

The analysis of the proposed sanitary servicing confirms the following:

- It is proposed that the development will outlet directly to the 200mm sanitary sewer along Klondike Road. The proposed outlet is consistent with the approved Brookside Subdivision Infrastructure Servicing Study (Novatech).
- The proposed development can be serviced with a 200mm sanitary sewer system.
- The total proposed sanitary flow from the subject lands is 1.5 L/s, which equals the calculated flows in the 1055 Klondike Road – Orr Ridge Servicing Study (1.5 L/s).
- The proposed and existing sanitary sewers have adequate capacity to accommodate the peak sanitary flow.

Watermain

The analysis of the proposed watermain network confirms the following:

- It is proposed to service the site with 150mm and 250mm pipe with a connection to the future 250mm diameter stub to be located at the site entrance.
- The analysis confirms the proposed watermain provides adequate fire protection and domestic service under all operating conditions.
- Distribution mains have been looped as part of the subdivision works by connecting to the existing 300mm and 400mm diameter watermains at Klondike Road and Sandhill Road providing redundant supply and improved circulation and water quality.

Stormwater Management

The following provides a summary of the storm servicing and stormwater management system:

- Proposed storm sewer system will convey stormwater to MH9 on Klondike Road.
    - Storm sewers (minor system) have been designed to convey the uncontrolled 2-year peak flow using the Rational Method.
    - Inflows to the minor system will be controlled using inlet control devices (ICDs) to an overall allowable release rate of 51.0 L/s.
    - A minimum clearance of 0.30m is provided between the 100-year hydraulic grade line (HGL) or storm sewer obvert and the designed underside of footing elevation.
- Surface and underground storage has been maximized to provide stormwater storage during storm events that exceed the allowable minor system inlet rate.
    - The major overland flow outlet for the site is the north side ditch along Klondike Road. No overland flow occurs up to and including the 100-year + 20% storm event, the major overland flow route is provided for emergency purposes only.
    - Ponding depths do not exceed 0.35m for all storms up to and including the 100-year event.
    - Underground storage will be provided using Stormtech SC-740 (or approved equivalent) arch-type storage chambers.

Erosion and Sediment control

- Erosion and sediment control measures (i.e. filter fabric, silt fences, etc.) will be implemented prior to construction and are to remain in place until vegetation is established.
- The Erosion and Sediment Control Plan will ensure erosion and sediment control is controlled in an acceptable manner and there is no negative impact to adjacent lands, water bodies or water treatment/conveyance facilities.

9.0 CLOSURE

The preceding report is respectfully submitted for review and approval. Please contact the undersigned should you have questions or require additional information.

NOVATECH

Prepared by:

Lucas Wilson, P.Eng.
Project Coordinator

Mark Bissett, P.Eng.
Senior Project Manager

FOR REVIEW

Appendix A

Correspondence

File No.: PC2021-0034
Date: February 23, 2021

1055 Klondike Road
Pre-Consultation Meeting Minutes
Meeting Date: Wednesday February 3, 2021

Attendee	Role	Organization
Lisa Stern	Planner, File Lead	City of Ottawa
Mark Young	Urban Design	
Josiane Gervais	Transportation	
Ahmed Elsayed	Infrastructure PM	
Justyna Garbos	Parks Planner	
Matthew Hayley	Environmental Planner	
Erica Ogden	Planner	MVCA
Christine McCuaig	Planner	Q9 Planning
Anthony Bruni	Architect	Colizza Bruni
Brian Saumure		Maple Leaf Custom Homes
Mark Bissett	Engineer	Novatech

Comments from the Applicant:

1. The subject lands are a part of subdivision rezoning application D07-16-19-0024.
2. Proposal is a 4 storey residential building with underground parking.
3. Access will be taken from Klondike Road.
4. Future Block 12 will be merged with Block 10, but it is the intent that these lands will be developed with 1075 Klondike should it be sold in the future.

Planning Comments:

1. The subject application will be a Complex Site Plan Control Application. The application form, timeline and fees can be found here.
2. There is an on-going subdivision/rezoning process on the subject lands. While the subject site plan application may be reviewed concurrently, no approvals may occur until the zoning is in place and the block is registered.
3. Although it is the intent that block 12 would eventually be merged with 1075 Klondike, there is no assurance that this will occur. Please provide a 'concept plan' for Block 12, a shared private access between Blocks 10 and 12 may be warranted to ensure developability of Block 12.
4. Please provide a pedestrian connection (private sidewalk connection) to Klondike Road.
5. Please ensure that shadow impacts on the public realm and rear yards of surrounding homes are minimized.
6. Please discuss proposed transitions and access to the creek block, and transition to the adjacent low density residential in the planning rationale.
7. Cash-in-lieu of parkland will be taken as a part of the associated subdivision.
8. Please consult with the Ward Councillor prior to submission.

Urban Design Comments:

1. Please consider a re-organization of the parking and ramp locations at grade on the west side of the proposed building as discussed in the meeting.

2. Please review and consider the width of the portion of the parcel connecting to the public right of way. The portion of the parcel that connects to Klondike Road should allow for a private sidewalk and tree planting.
3. Please ensure that the terraces and amenity areas on the east side of the building will allow for accessible connections to the future pathway located along the abutting creek corridor.
4. Please look at the proposed building as it relates to the site located to the south. Efforts to minimize the impact on the abutting property should be reviewed. A high-level review of this building and how it could relate to any future redevelopment of the abutting lands should be considered.
5. Landscaping and screening between the possible ramp location adjacent to low density rear yards should be provided.
6. The applicant is required to provide a Design Brief as part of their planning rationale. Please see the attached terms of reference.

Transportation Comments:

1. As the TIA prepared in support of the 1055 Klondike Rd Subdivision accounts for this apartment building in the Network Impact Component and is currently under review, simply addressing Modules 4.1 to 4.4 is required. This can be incorporated within the greater TIA document, an updated Step 4 report can be submitted (no need to submit Scoping and Forecasting). Alternatively, a separate supplementary technical memorandum can be provided.
2. ROW protection on Klondike between Old Second Line Rd and March Valley Rd is 24m even.
3. Clear throat requirements for <100 apartments on an major collector is 8m.
4. On site plan:
    a. Show all details of the roads abutting the site up to and including the opposite curb; include such items as pavement markings, accesses and/or sidewalks.
    b. Turning movement diagrams required for all accesses showing the largest vehicle to access/egress the site.
    c. Turning movement diagrams required for internal movements (loading areas, garbage).
    d. Show all curb radii measurements; ensure that all curb radii are reduced as much as possible
    e. Show lane/aisle widths.
    f. Sidewalk is to be continuous across access as per City Specification 7.1.
    g. Grey out any area that will not be impacted by this application.
5. Provide pedestrian connection between parking area and main access, as well as from Klondike Road to the main access.
6. Underground ramps should be limited to a 12% grade and must contain a subsurface melting device when exceeding 6%. Ramp grades greater than 15% can be psychological barriers to some drivers.
7. The City recommends development on private property be in accordance with the Accessibility Design Standards. AODA legislation applies to areas of the site that will be accessed by the general public (i.e. visitor parking rates, exterior paths of travel, etc.).
8. Noise Impact Studies required for the following:
    a. Road
    b. Stationary, due to the proximity to neighboring exposed mechanical equipment or if there will be any exposed mechanical equipment due to the proximity to neighboring noise sensitive land uses.
9. A by-Law Exemption for section 25 (p) of the Private Approach Bylaw would be required for the site access if it remains in it's current location.

Environmental Comments:

1. No need for a new EIS as the one for the subdivision is sufficient
2. Consider the bird safe design but not required due to the building not being a mid rise
3. Pathway connection – please provide a connection
4. Landscaping should be restricted to native tree species

MVCA Comments:

1. The setbacks from Shirley's Brook for this block has been established through the subdivision. We ask that the setbacks be shown in the site plan submissions as well.
2. Any works within the regulated area of Shirley's Brook will require a permit from the Conservation Authority under Ontario Regulation 153/06.
3. This block was included in the overall stormwater management plan for the subdivision. The detailed design for the site should take the following into account:
    a. Minor system inlet rate of 51 L/s (based on 85 L/s/ha)
    b. Major system storage of 30 m3 (based on 50 m3/ha)
    c. No major system overland flow is allowed to Shirley's Brook for up to and including 1:100-yr storm events.

Forestry:

1. a Tree Conservation Report (TCR) must be supplied for review along with the suite of other plans/reports required by the City
    a. an approved TCR is a requirement of Site Plan approval.
    b. The TCR may be combines with the Landscape Plan
2. As of January 1 2021, any removal of privately or publicly (City) owned trees 10cm or larger in diameter requires a tree permit issued under the Tree Protection Bylaw (Bylaw 2020 – 340); the permit will be based on an approved TCR and made available at or near plan approval.
3. The Planning Forester from Planning and Growth Management as well as foresters from Forestry Services will review the submitted TCR
    a. If tree removal is required, both municipal and privately-owned trees will be addressed in a single permit issued through the Planning Forester
    b. Compensation may be required for city owned trees – if so, it will need to be paid prior to the release of the tree permit
4. the TCR must list all trees on site by species, diameter and health condition
5. the TCR must list all trees on adjacent sites if they have a critical root zone that extends onto the development site
6. Trees should be identified by ownership – Privately owned on-site trees; Privately owned off-site trees; City owned trees; Co-owned trees (growing on a property boundary)
7. If trees are to be removed, the TCR must clearly show where they are, and document the reason they cannot be retained
8. All retained trees must be shown and all retained trees within the area impacted by the development process must be protected as per City guidelines available at Tree Protection Specification or by searching Ottawa.ca
    a. the location of tree protection fencing must be shown on a plan
    b. show the critical root zone of the retained trees
    c. if excavation will occur within the critical root zone, please show the limits of excavation

9. the City encourages the retention of healthy trees; if possible, please seek opportunities for retention of trees that will contribute to the design/function of the site.
10. For more information on the process or help with tree retention options, contact Mark Richardson mark.richardson@ottawa.ca or on City of Ottawa

For additional information on the following please contact Adam.Palmer@Ottawa.ca

Minimum Setbacks

- Maintain 1.5m from sidewalk or MUP/cycle track.
- Maintain 2.5m from curb
- Coniferous species require a minimum 4.5m setback from curb, sidewalk or MUP/cycle track/pathway.
- Maintain 7.5m between large growing trees, and 4m between small growing trees. Park or open space planting should consider 10m spacing.
- Adhere to Ottawa Hydro's planting guidelines (species and setbacks) when planting around overhead primary conductors.

Tree specifications

- Minimum stock size: 50mm tree caliper for deciduous, 200cm height for coniferous.
- Maximize the use of large deciduous species wherever possible to maximize future canopy coverage
- Tree planting on city property shall be in accordance with the City of Ottawa's Tree Planting Specification; and include watering and warranty as described in the specification (can be provided by Forestry Services).
- Plant native trees whenever possible
- No root barriers, dead-man anchor systems, or planters are permitted.
- No tree stakes unless necessary (and only 1 on the prevailing winds side of the tree)

Hard surface planting

- Curb style planter is highly recommended
- No grates are to be used and if guards are required, City of Ottawa standard (which can be provided) shall be used.
- Trees are to be planted at grade

Soil Volume

- Please ensure adequate soil volumes are met:

Tree Type/Size	Single Tree Soil Volume (m3)	Multiple Tree Soil Volume (m3/tree)
Ornamental	15	9
Columnar	15	9
Small	20	12
Medium	25	15
Large	30	18
Conifer	25	15

Please note that these soil volumes are not applicable in cases with Sensitive Marine Clay.

Sensitive Marine Clay

- Please follow the City's 2017 Tree Planting in Sensitive Marine Clay guidelines

Infrastructure Comments:

Please note the following information regarding the engineering design submission for the above noted site:

1. The Servicing Study Guidelines for Development Applications are available at the following address: https://ottawa.ca/en/city-hall/planning-and-development/information-developers/development-application-review-process/development-application-submission/guide-preparing-studies-and-plans#servicing-study-guidelines-development-applications
2. Servicing and site works shall be in accordance with the following documents:
   - Ottawa Sewer Design Guidelines (October 2012)
   - Ottawa Design Guidelines – Water Distribution (2010)
   - Geotechnical Investigation and Reporting Guidelines for Development Applications in the City of Ottawa (2007)
   - City of Ottawa Slope Stability Guidelines for Development Applications (revised 2012)
   - City of Ottawa Environmental Noise Control Guidelines (January, 2016)
   - City of Ottawa Park and Pathway Development Manual (2012)
   - City of Ottawa Accessibility Design Standards (2012)
   - Ottawa Standard Tender Documents (latest version)
   - Ontario Provincial Standards for Roads & Public Works (2013)
3. Record drawings and utility plans are also available for purchase from the City (Contact the City's Information Centre by email at InformationCentre@ottawa.ca or by phone at (613) 580-2424 x.44455).
4. The proposed site will require extension of all services (water, sanitary and stormwater).The Stormwater Management Criteria, for the subject site, is to be based on the following:
   i. There is currently no storm sewer on Klondike Road directly in front of the 1055 Klondike Property. There is a storm sewer manhole / system at the intersection of Klondike Road and Sandhill Road conveying flow to a ditch upstream of "Pond C".
   ii. Based on both the Shirley's Brook Floodplain Analysis and SWM Report (Klondike Road Development Lands, prepared by Novatech, May 2006) and the Shirley's Brook SWM Facility "C" Detailed Design Report (prepared by Novatech, 2006), it appears that Pond "C" was sized to service the 1055 Klondike parcel. Please demonstrate that the existing storm sewer and pond have capacity to service this proposed development (quantity and quality control).
   iii. Barring any additional SWM requirements from the MVCA (please see the note below), refer to the SWM design criteria in the Shirley's Brook SWM Facility "C" Detailed Design Report (prepared by Novatech, 2006) for the proposed development area (including rear yards):

- Minor system allowable release rate of 85 L/s/ha;
- Onsite major system storage of 50 m3 / ha (please see the note below);
- ICDs will be installed in the roadway catchbasins to ensure flow into the storm sewer system does not exceed the 5-year runoff rates; and
- HGL for 100-year event must have at least 0.3 m freeboard to the underside of footings.

NOTE: that MVCA is reviewing the SWM design criteria provided in the Shirley's Brook SWM Facility "C" Detailed Design Report (prepared by Novatech, 2006). The MVCA may require further stormwater management requirements be imposed on lands draining to Shirley's Brook (for example, this may include additional onsite major system storage volume, potentially requiring collection and storage of all runoff for storm events up to and including the 100-year return period). Please contact the MVCA to confirm all SWM design criteria (ESC, quality and quantity control).

iv. IDF information derived from the Meteorological Services of Canada rainfall data, taken from the MacDonald Cartier Airport, collected 1966 to 1997.
v. A calculated time of concentration (Cannot be less than 10 minutes).
vi. Flows to the storm sewer in excess of the 5-year storm release rate, must be detained on site (please confirm with MVCA whether the onsite major system storage is 50 m3 / ha, or whether storage volume must be provided to attenuate all runoff up to and including the 100-year event).
vii. SWM calculations using modified rational method is acceptable however, if a combination of surface storage (roof or at-grade / parking lot) is proposed in addition to sub-surface / cistern storage then the consultant is reminded to either:

(a) use a dynamic computer model; or
(b) use modified rational method:

1. assuming an average release rate of 50% peak flow rate for a cistern / sub-surface storage facility.
2. provide calculations for each storage facility /area (roof vs sub-surface storage) with respect to its attributing drainage area; and
3. where storage facilities are inline (or in series), please add the upstream peak release rate to the downstream storage facilities modified rational method calculator.

1. Please note that there is a Special Area Development Charge for the subject site. Please refer to the current Development Charge attached (By-Law No. 2019 – 163). Note that this is the Charge for 2019 and may change over time.
2. Deep Services (Storm, Sanitary & Water Supply)
   i. *Provide existing servicing information and the recommended location for the proposed connections. Services should ideally be grouped in a common trench to minimize the number of road cuts.*
   ii. *Connections to trunk sewers and easement sewers are typically not permitted.*
   iii. *Provide information on the monitoring manhole requirements – should be located in an accessible location on private property near the property line (i.e. Not in a parking area).*
   iv. *Review provision of a high-level sewer.*
   v. *Provide information on the type of connection permitted*

Sewer connections to be made above the springline of the sewermain as per:

a. Std Dwg S11.1 for flexible main sewers – *connections made using approved tee or wye fittings.*
b. Std Dwg S11 (For rigid main sewers) – *lateral must be less that 50% the diameter of the sewermain,*
c. Std Dwg S11.2 (for rigid main sewers using bell end insert method) – *for larger diameter laterals where manufactured inserts are not available; lateral must be less that 50% the diameter of the sewermain,*
d. Connections to manholes permitted when the connection is to rigid main sewers where the lateral exceeds 50% the diameter of the sewermain. – Connect obvert to obvert with the outlet pipe unless pipes are a similar size.
e. *No submerged outlet connections.*

3. As per Section 4.3.1 of the Water Design Guidelines: “Service areas with a basic day demand greater than 50 m^3/day (about 50 homes) shall be connected with a minimum of two feedermains to avoid the creation of a vulnerable service area. Distribution mains shall be looped whenever possible to provide redundant supply and improved circulation and water quality.”

Based on the proposed sub-division the site requires two watermain feeds. Linking the existing watermain stubs on Klondike Road (from March Road) to Sandhill Road.
Note: one connection to the existing watermain stub on Klondike at the intersection of Sandhill will not be accepted.

4. Water Boundary condition requests must include the location of the service and the expected loads required by the proposed development. Please provide the following information:
    i. Location of service
    ii. Type of development and the amount of fire flow required (as per FUS, 1999).
    iii. Average daily demand: ___ l/s.
    iv. Maximum daily demand: ___l/s.
    v. Maximum hourly daily demand: ___ l/s.
5. The applicant will need to confirm with the City whether sufficient capacity is available in the local sanitary sewer on Sandhill or Klondike to accommodate flows generated from the subject site.

Please note that residual capacity at the Briaridge PS is a constraint. A study is currently underway to increase the rated capacity at the station from 55 l/s to 175 l/s. The project to increase capacity is likely a few years away (target date 2021-2022). Note that an EA is not required as part of scope of work for this upgrade.

6. MOECC ECA Requirements

An MOECC Environmental Compliance Approval will be required for the proposed development due to new services and roads. Please contact Ontario Ministry of the Environment and Climate Change, Ottawa District Office to arrange a pre-submission consultation:
For residential applications:
Charlie Primeau
(613) 521-3450, ext. 251
Charlie.Primeau@ontario.ca

Note that the typically the Public Consultation performed as part of the ESA process is submitted as part of the application for the ECA. Please confirm this with the MOECC Ottawa District Office as part of the pre-submission consultation.

7. Phase 1 ESAs and Phase 2 ESAs must conform to clause 4.8.4 of the Official Plan that requires that development applications conform to Ontario Regulation 153/04.

Please refer to the links to "Guide to preparing studies and plans" and fees for general information. Additional information is available related to building permits, development charges, and the Accessibility Design Standards. Be aware that other fees and permits may be required, outside of the development review process. You may obtain background drawings by contacting informationcentre@ottawa.ca.

These pre-con comments are valid for one year. If you submit a development application(s) after this time, you may be required to meet for another pre-consultation meeting and/or the submission requirements may change. You are as well encouraged to contact us for a follow-up meeting if the plan/concept will be further refined.
Please contact me at Lisa.Stern@ottawa.ca or at 613-580-2424 extension 21108 if you have any questions.

Appendix B

Sanitary Design Sheets

Klondike Road - Block 10: Sanitary Sewer Design Sheet

AREA			RESIDENTIAL											ICI							INFILTRATION				PIPE					
			Singles		Semi-Detached / Towns					TOTAL																				
ID	From	To	Units	Pop.	Units	Pop.	Future Block 10	Future 1075 Klondike Rd	Pop.	Pop.	Accum. Pop.	Peak Factor	Peak Flow (l/s)	Light Industrial Area (ha)	Accum. Area (ha)	Peak Factor	Commercial Area (ha)	Institutional Area (ha)	Accum. Area (ha)	Peak Flow (l/s)	Total Area (ha)	Accum. Area (ha)	Infilt. Flow (l/s)	**Total Flow (l/s)**	Size (mm)	Slope (%)	Length (m)	Capacity (l/s)	Full Flow Vel. (m/s)	Q/Q_{full} (%)
Block 10																														
A2-1	**MH01**	**MH09**	0	0.0	0	0.0	53		111.3	111.3	111.3	3.6	1.3				0.00	0.00	0.00	0.0	0.60	0.60	0.2	1.5	200	0.50	67.8	24.2	0.75	6.2%
Klondike Road																														
A2-2	**MH09**	**1**	0	0.0	0	0.0	0.00	10	17.6	17.6	128.9	3.6	1.5				0.00	0.00	0.00	0.0	0.28	0.88	0.3	1.8	200	1.40	47.6	40.5	1.25	4.4%
A1-1, A1-2, A1-3	**1**	**266**	0	0.0	58	156.6	0.00		0.0	156.6	285.5	3.5	3.2				0.00	0.00	0.00	0.0	1.85	2.73	0.9	4.1	200	0.65	117.0	27.6	0.85	14.9%
Off-site Drainage Areas (To Briar Ridge Pump Station)																														
A3-3	266	265	0	0.0	57	153.9	0.00		0.0	153.9	439.4	3.4	4.8				0.00	0.00	0.00	0.0	2.47	5.20	1.7	6.6	200	0.32	91.0	19.4	0.60	33.9%
A3-4	265	264	0	0.0	0	0.0	0.00		0.0	0.0	439.4	3.4	4.8				0.00	2.21	2.21	1.1	2.21	7.41	2.4	8.4	200	0.32	120.0	19.4	0.60	43.2%
A3-5	264	206	0	0.0	107	288.9	0.00		0.0	288.9	728.3	3.3	7.8				0.00	0.00	2.21	1.1	3.99	11.40	3.8	12.6	250	0.24	306.3	30.4	0.60	41.6%
A3-1, A3-2, A3-6	206	205	201	683.4	392	1058.4	0.00		0.0	1741.8	2470.1	3.0	24.1				9.02	0.00	11.23	5.5	37.33	48.73	16.1	45.6	450	0.20	52.5	133.0	0.81	34.3%
A3-7, A3-8	205	204	0	0.0	0	0.0	0.00		0.0	0.0	2470.1	3.0	24.1	5.4	5.4	4.7	0.00	0.00	11.23	15.7	5.40	54.13	17.9	57.7	450	0.20	79.7	133.0	0.81	43.4%
	204	203	0	0.0	0	0.0	0.00		0.0	0.0	2470.1	3.0	24.1		5.4	4.7	0.00	0.00	11.23	15.7	0.00	54.13	17.9	57.7	450	0.20	79.7	133.0	0.81	43.4%
	203	202	0	0.0	0	0.0	0.00		0.0	0.0	2470.1	3.0	24.1	7.9	13.3	3.9	0.00	0.00	11.23	26.5	7.90	62.03	20.5	71.0	450	0.26	90.0	151.7	0.92	46.8%
	202	201	0	0.0	0	0.0	0.00		0.0	0.0	2470.1	3.0	24.1		13.3	3.9	0.00	0.00	11.23	26.5	0.00	62.03	20.5	71.0	450	0.25	270.0	148.7	0.91	47.8%
	201	PS	0	0.0	0	0.0	0.00		0.0	0.0	2470.1	3.0	24.1		13.3	3.9	0.00	0.00	11.23	26.5	0.00	62.03	20.5	71.0	450	0.15	21.6	115.2	0.70	61.7%

Design Parameters:

Avg Flow/Person =	280	l/day
Comm./Inst. Flow =	28000	l/ha/day
Light Industrial Flow =	35000	l/ha/day
Infiltration =	0.33	l/s/ha
Pipe Friction n =	0.013	
Residential Peaking Factor =	Harmon Equation (max 4, min 2)	
Peaking Factor Comm./Inst. =	1.5	

Population Density:

	ppl/unit	units/ha
Block 10 Apartment Unit	2.1	
Future 1075 Klondike Road	1.8	35
Single	3.4	
Semi / Town	2.7	

Project: 1055 Klondike Road - Block 10 (117034-10)

Designed: LRW

Checked: MAB

Date: May 17, 2021

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Engineers, Planners & Landscape Architects

Appendix C

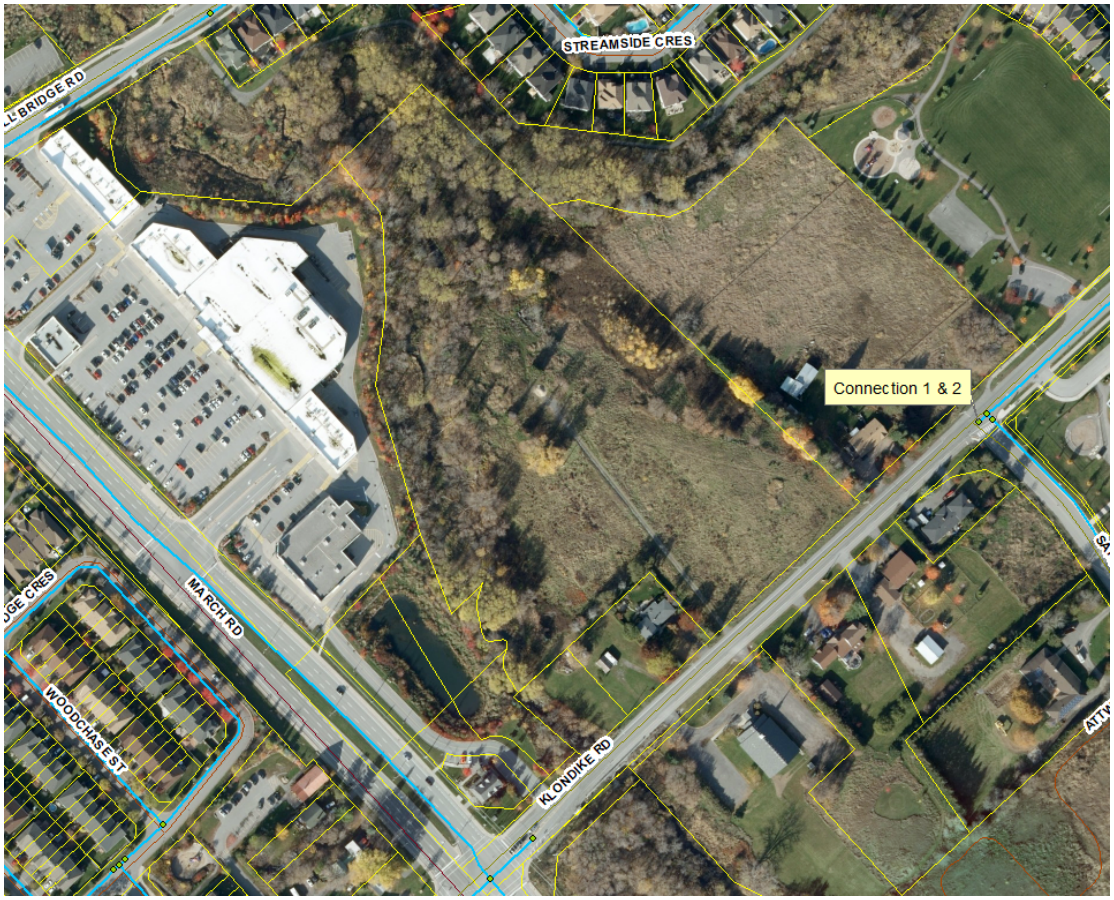
Watermain Boundary Conditions,
FUS Calculations, &
Modelling Results

Boundary Conditions
1055 Klondike Road

Provided Information

Scenario	Demand	
	L/min	L/s
Average Daily Demand	21	0.355
Maximum Daily Demand	53	0.887
Peak Hour	117	1.952
Fire Flow Demand #1	21,000	350.00

Location



Results

Connection 1 – Klondike Rd.

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	130.0	78.3
Peak Hour	126.3	73.1
Max Day plus Fire 1	113.3	54.6

Ground Elevation = 74.9 m

Connection 2 – Klondike Rd.

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	130.0	78.3
Peak Hour	126.3	73.1
Max Day plus Fire 1	113.3	54.6

Ground Elevation = 74.9 m

Notes

1. Two service connections with a separation valve in between.
2. Klondike 406mm watermain to be extended from East and West to provide redundancy

Disclaimer

The boundary condition information is based on current operation of the city water distribution system. The computer model simulation is based on the best information available at the time. The operation of the water distribution system can change on a regular basis, resulting in a variation in boundary conditions. The physical properties of watermains deteriorate over time, as such must be assumed in the absence of actual field test data. The variation in physical watermain properties can therefore alter the results of the computer model simulation. Fire Flow analysis is a reflection of available flow in the watermain; there may be additional restrictions that occur between the watermain and the hydrant that the model cannot take into account.

FUS - Fire Flow Calculations

As per 1999 Fire Underwriter's Survey Guidelines

NOVATECH
Engineers, Planners & Landscape Architects

Novatech Project #: 117034-10
Project Name: 1055 Klondike Block 10
Date: 5/10/2021
Input By: Designer
Reviewed By: Project Manager

Legend: Input by User; No Information or Input Required

Building Description: 4-Storey Apartment
Wood frame

Step			Input		Value Used	Total Fire Flow (L/min)
Base Fire Flow						
1	**Construction Material**			**Multiplier**		
	Coefficient related to type of construction **C**	Wood frame	Yes	1.5	1.5	
		Ordinary construction		1		
		Non-combustible construction		0.8		
		Modified Fire resistive construction (2 hrs)		0.6		
		Fire resistive construction (> 3 hrs)		0.6		
2	**Floor Area**					
	A	Building Footprint (m^2)	1462			
		Number of Floors/Storeys	4			
		Area of structure considered (m^2)			**5,848**	
	F	**Base fire flow without reductions**	20			**25,000**
		F = 220 C (A)$^{0.5}$				
b n						
3	**Occupancy hazard reduction or surcharge**			**Reduction/Surcharge**		
	(1)	Non-combustible		-25%	-15%	**21,250**
		Limited combustible	Yes	-15%		
		Combustible		0%		
		Free burning		15%		
		Rapid burning		25%		
4	**Sprinkler Reduction**			**Reduction**		
	(2)	Adequately Designed System (NFPA 13)	Yes	-30%	-30%	**-8,500**
		Standard Water Supply	Yes	-10%	-10%	
		Fully Supervised System		-10%		
				Cumulative Total	**-40%**	
5	**Exposure Surcharge (cumulative %)**				**Surcharge**	
	(3)	North Side	10.1 - 20 m		15%	**8,500**
		East Side	20.1 - 30 m		10%	
		South Side	10.1 - 20 m		15%	
		West Side	> 45.1m		0%	
				Cumulative Total	**40%**	
Results						
6	**(1) + (2) + (3)**	**Total Required Fire Flow, rounded to nearest 1000L/min**			**L/min**	**21,000**
		(2,000 L/min < Fire Flow < 45,000 L/min)		or	L/s	**350**
				or	USGPM	5,548
7	**Storage Volume**	Required Duration of Fire Flow (hours)			Hours	4.5
		Required Volume of Fire Flow (m^3)			m^3	5670

KLONDIKE ROAD - BLOCK 10
Water Demand

	Area (ha)	Units	Population	Average Day Demand (L/s)	Maximum Day Demand (L/s)	Peak Hour Demand (L/s)
Apartment Unit	N/A	53	111	0.361	0.902	1.984
Total	**0.00**	**53**	**111**	**0.361**	**0.902**	**1.984**

Water Demand Parameters

Apartment Unit	2.1	ppl/unit
Residential Demand	280	L/c/day
Residential Max Day	2.5	x Avg Day
Residential Peak Hour	2.2	x Max Day
Residential Fire Flow	350	L/s

Klondike Road - Block 10: Watermain Demand

Node	Semi-Detached	Towns	Block 10 Apartment Unit	Total Population	Average Day Demand (L/s)	Maximum Day Demand (L/s)	Peak Hour Demand (L/s)	Fire Flow (L/s)
B1			53	111	0.361	0.902	1.984	N/A
H1				0	0.000	0.000	0.000	95
H2				0	0.000	0.000	0.000	95
H3				0	0.000	0.000	0.000	95
HYD4				0	0.000	0.000	0.000	63
T4				0	0.000	0.000	0.000	N/A
Total	**0**	**0**	**53**	**111**	**0.361**	**0.902**	**1.984**	

Water Demand Parameters

Semi-Detached	2.7	ppl/unit	Residential Max Day	2.5	x Avg Day
Towns	2.7	ppl/unit	Residential Peak Hour	2.2	x Max Day
Block 10 Apartment Unit	2.1	ppl/unit	Apartment Fire Flow	350	L/s
Residential Demand	280	L/c/day			

Klondike Road - Block 10: Watermain Analysis

Network Table - Nodes - (Peak Hour)

Node ID	Elevation m	Demand LPS	Head m	Pressure m	Pressure kPa	Pressure psi
Junc B1	78.3	1.98	126.29	47.97	470.59	68.25
Junc H1	78.1	0	126.3	48.2	472.84	68.58
Junc H2	78.12	0	126.3	48.18	460.00	66.72
Junc H3	78.27	0	126.3	48.03	450.00	65.27
Junc HYD4	77.93	0	126.3	48.37	474.51	68.82
Junc T4	77.7	0	126.3	48.6	476.77	69.15
Resvr RES1	126.3	-4.78	126.3	0	0.00	0.00

Network Table - Links - (Peak Hour)

Link ID	Length m	Diameter mm	Roughness	Flow LPS	Velocity m/s	Headloss m/km	Friction Factor
Pipe P12	35	250	110	-1.98	0.04	0.02	0.045
Pipe P13	25	250	110	1.98	0.04	0.01	0.045
Pipe P14	11	250	110	-1.98	0.04	0.01	0.045
Pipe P15	25	155	100	-1.98	0.11	0.18	0.050

Klondike Road - Block 10: Watermain Analysis

Network Table - Nodes - (Max Pressure Check)

Node ID	Elevation m	Demand LPS	Head m	Pressure m	Pressure kPa	Pressure psi	Age Hours
Junc B1	78.32	0.36	130	51.68	506.98	73.53	12.94
Junc H1	78.1	0	130	51.9	509.14	73.84	11.21
Junc H2	78.12	0	130	51.88	508.94	73.82	12.15
Junc H3	78.27	0	130	51.73	507.47	73.60	12.57
Junc HYD4	77.93	0	130	52.07	510.81	74.09	13.88
Junc T4	77.7	0	130	52.3	513.06	74.41	9.89
Resvr RES1	130	-0.87	130	0	0.00	0.00	0

Network Table - Links - (Max Pressure Check)

Link ID	Length m	Diameter mm	Roughness	Flow LPS	Velocity m/s	Headloss m/km	Friction Factor
Pipe P12	35	250	110	-0.36	0.01	0.00	0.049
Pipe P13	25	250	110	0.36	0.01	0.00	0.068
Pipe P14	11	250	110	0.36	0.01	0.00	0.075
Pipe P15	25	155	100	0.36	0.02	0.01	0.065

Klondike Road - Block 10: Watermain Analysis

Network Table - Nodes (Max Day + FF)

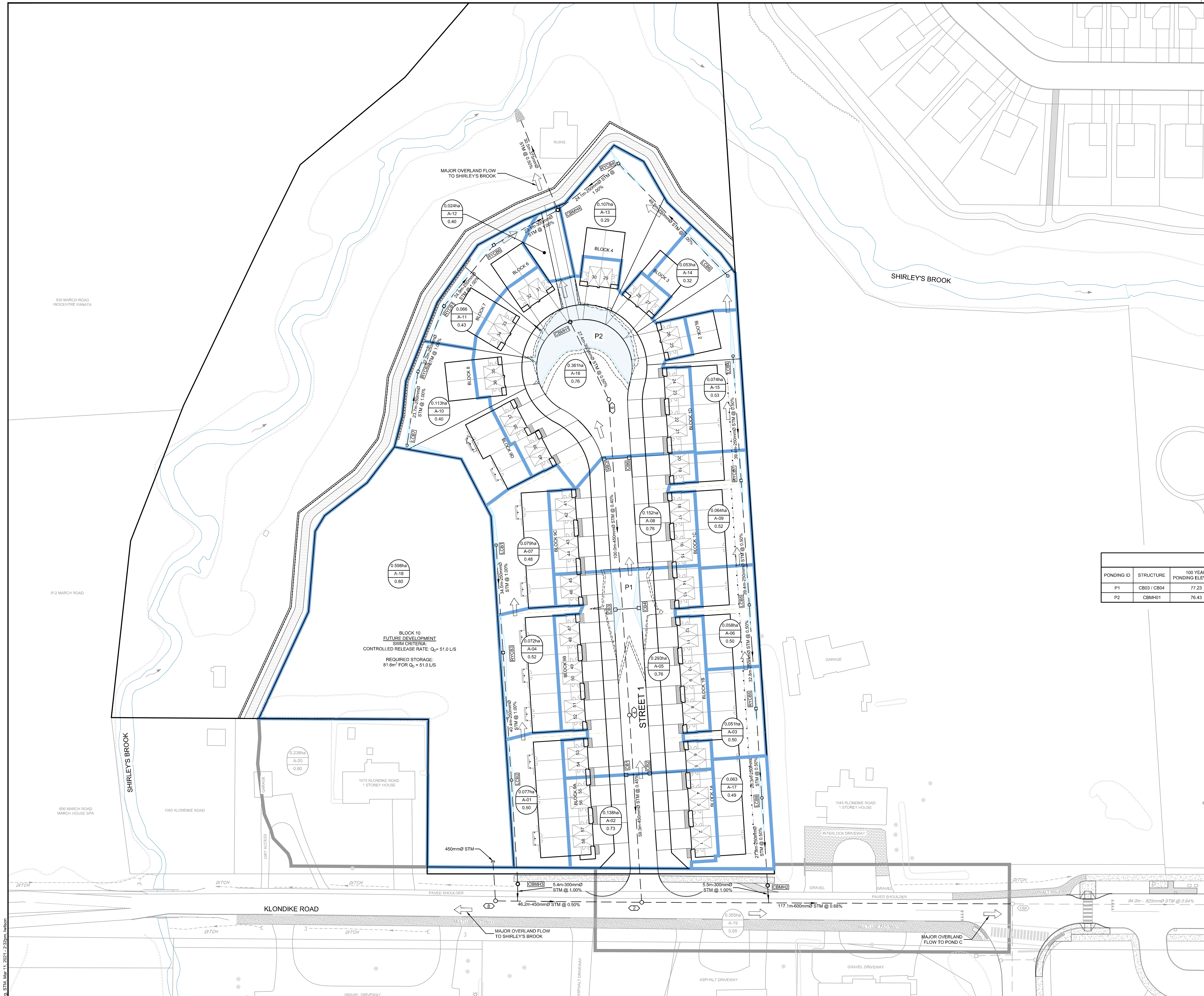
Node ID	Elevation m	Demand LPS	Head m	Pressure m	Pressure kPa	Pressure psi
Junc B1	78.32	0.87	102.91	24.59	241.23	34.99
Junc H1	78.1	95	104.89	26.79	262.81	38.12
Junc H2	78.12	95	103.13	25.01	245.35	35.58
Junc H3	78.27	95	102.91	24.64	241.72	35.06
Junc HYD4	77.93	65	110.14	32.21	315.98	45.83
Junc T4	77.7	0	110.06	32.36	317.45	46.04
Resvr RES1	113.3	-352.14	113.3	0	0.00	0.00

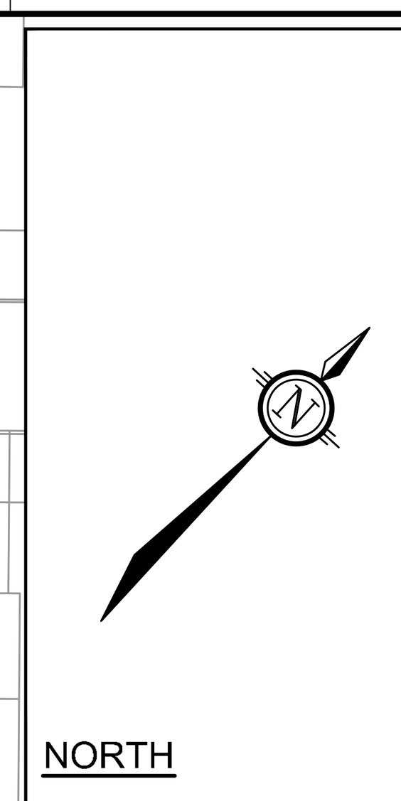
Network Table - Links (Max Day + FF)

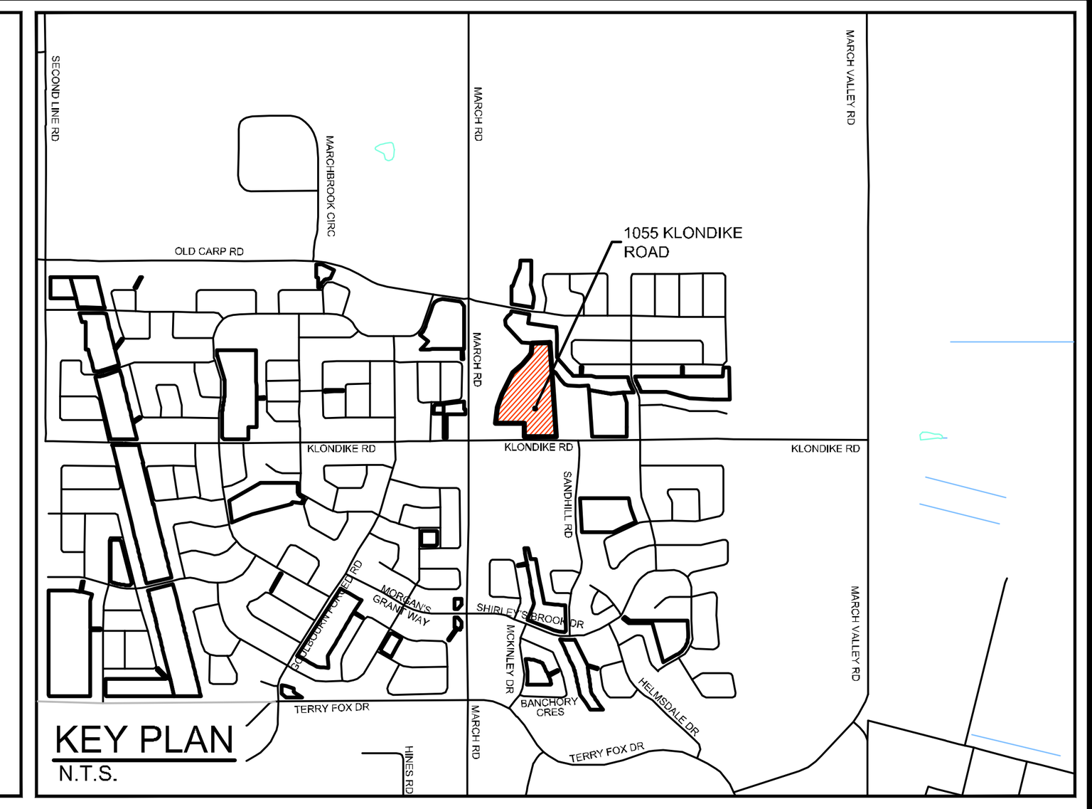
Link ID	Length m	Diameter mm	Roughness	Flow LPS	Velocity m/s	Headloss m/km	Friction Factor
Pipe P12	35	250	110	-285.87	5.82	148.88	0.022
Pipe P13	25	250	110	190.87	3.89	70.46	0.023
Pipe P14	11	250	110	-95.87	1.95	19.68	0.025
Pipe P15	25	155	100	-0.87	0.05	0.04	0.057

Appendix D

STM Design Sheets, SWM Excerpts &
PCSWMM Modelling Info







LEGEND

- 0.24 ha — AREA (hectares)
- A-01 — AREA ID
- 0.65 — RUN-OFF COEFFICIENT
- PROPOSED STORM DRAINAGE AREA BOUNDARY
- 100 — PROPOSED STORM MANHOLE / SEWER AND FLOW DIRECTION
- 95 — PROPOSED ROAD CATCHBASIN
- LCB1 — LANDSCAPE CATCH BASIN
- RYCB1 — REAR YARD CATCH BASIN
- CBMH1 — CATCH BASIN MANHOLE
- MAJOR SYSTEM FLOW ROUTE
- MAX STATIC PONDING LIMITS
- 100-YR PONDING LIMITS
- 100-YR +20% PONDING LIMITS

PONDING

PONDING ID	STRUCTURE	100 YEAR PONDING ELEVATION	100 YEAR PONDING DEPTH (m)	100 YEAR +20% PONDING ELEVATION	100 YEAR + 20% PONDING DEPTH (m)	MAX STATIC PONDING ELEVATION	MAX STATIC PONDING DEPTH (m)
P1	CB03 / CB04	77.23	0.21	77.25	0.23	77.09	0.07
P2	CBMH01	76.43	0.29	76.47	0.33	76.42	0.28

NOTE:
THE POSITION OF ALL POLE LINES, CONDUITS, WATERMAINS, SEWERS AND OTHER UNDERGROUND AND OVERGROUND UTILITIES AND STRUCTURES IS NOT NECESSARILY SHOWN ON THE CONTRACT DRAWINGS, AND WHERE SHOWN, THE ACCURACY OF THE POSITION OF SUCH UTILITIES AND STRUCTURES IS NOT GUARANTEED. BEFORE STARTING WORK, DETERMINE THE EXACT LOCATION OF ALL SUCH UTILITIES AND STRUCTURES AND ASSUME ALL LIABILITY FOR DAMAGE TO THEM.

No.	REVISION	DATE	BY
2.	ISSUED FOR APPROVAL	MAR 12/21	MAB
1.	ISSUED FOR APPROVAL	SEPT 3/20	MAB

SCALE 1:500

DESIGN LRW | CHECKED MAB | DRAWN DTD | CHECKED MAB | APPROVED JGR

FOR REVIEW ONLY

LICENSED PROFESSIONAL ENGINEER L. R. WILSON 100160065 PROVINCE OF ONTARIO

LICENSED PROFESSIONAL ENGINEER M.A. BISSETT 2021.03.12 PROVINCE OF ONTARIO

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CITY OF OTTAWA
1055 KLONDIKE ROAD

POST-DEVELOPMENT STORM DRAINAGE AREA PLAN

PROJECT No. 117034-0
REV # 2
DRAWING No. 117034-STM2

1055 Klondike Road - Block 10 (117034-10)
PCSWMM Storage Curves (surface/underground storage)

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CB01-Storage		
Depth (m)	Area (m^2)	Volume (m^3)
0.00	0.00	0.00
1.59	0.00	0.00
1.64	0.00	0.00
1.69	115.00	2.88
1.74	255.00	12.13
1.79	415.00	28.88
1.84	495.00	51.63
1.89	515.00	76.88
1.90	0.00	79.45
2.59	0.00	79.45

CB02-Storage		
Depth (m)	Area (m^2)	Volume (m^3)
0.00	0.00	0.00
1.50	0.00	0.00
1.55	10.00	0.25
1.60	40.00	1.50
1.65	86.00	4.65
1.70	141.00	10.33
1.75	200.00	18.85
1.80	262.00	30.40
1.81	0.00	31.71
2.50	0.00	31.71

CB03-Storage		
Depth (m)	Area (m^2)	Volume (m^3)
0.00	0.00	0.00
1.06	0.00	0.00
1.07	0.00	0.00
1.70	0.00	0.00
1.75	8.00	0.20
1.80	31.00	1.18
1.85	70.00	3.70
1.90	125.00	8.57
1.95	185.00	16.33
2.00	240.00	26.95
2.01	0.00	28.15
2.70	0.00	28.15

LC01-Storage		
Depth (m)	Area (m^2)	Volume (m^3)
0.00	0.00	0.00
1.00	0.00	0.00
1.05	5.00	0.13
1.10	20.00	0.75
1.13	35.00	1.58
1.14	0.00	1.75
2.00	0.00	1.75

LC02-Storage		
Depth (m)	Area (m^2)	Volume (m^3)
0.00	0.00	0.00
0.95	0.00	0.00
1.00	7.00	0.18
1.05	30.00	1.10
1.10	60.00	3.35
1.15	105.00	7.47
1.16	0.00	8.00
1.95	0.00	8.00

LC03-Storage		
Depth (m)	Area (m^2)	Volume (m^3)
0.00	0.00	0.00
1.44	0.00	0.00
1.49	4.00	0.10
1.54	17.00	0.63
1.59	38.00	2.00
1.64	66.00	4.60
1.69	104.00	8.85
1.74	150.00	15.20
1.75	0.00	15.95
2.44	0.00	15.95

LC04-Storage		
Depth (m)	Area (m^2)	Volume (m^3)
0.00	0.00	0.00
1.31	0.00	0.00
1.36	12.00	0.30
1.41	46.00	1.75
1.46	103.00	5.48
1.51	183.00	12.63
1.56	286.00	24.35
1.61	412.00	41.80
1.62	0.00	43.86
2.31	0.00	43.86

RY03-Storage		
Depth (m)	Area (m2)	Volume (m3)
0.00	0.00	0.00
1.06	0.00	0.00
1.07	0.00	0.00
1.70	0.00	0.00
1.75	8.00	0.20
1.80	30.00	1.15
1.85	67.00	3.58
1.90	115.00	8.12
1.91	0.00	8.70
2.70	0.00	8.70

1055 Klondike Road - Block 10 (117034-10)
PCSWMM Model Results (Ponding)

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CB / CBMH ID	Invert Elev. (m)	Rim Elev. (m)	Spill Elev. (m)	Ponding Depth (m)	HGL Elev. (m)[1]				Ponding Depth (m)				Spill Depth (m)			
					2-yr	5-yr	100-yr	100-yr (+20%)	2-yr	5-yr	100-yr	100-yr (+20%)	2-yr	5-yr	100-yr	100-yr (+20%)
CB01	76.24	77.83	78.13	0.30	77.64	77.96	78.06	78.10	0.00	0.13	0.23	0.27	0.00	0.00	0.00	0.00
CB02	76.33	77.73	78.03	0.30	77.63	77.83	77.94	77.97	0.00	0.10	0.21	0.24	0.00	0.00	0.00	0.00
CB03	76.13	77.83	78.13	0.30	77.63	77.95	78.06	78.09	0.00	0.12	0.23	0.26	0.00	0.00	0.00	0.00
LC01	76.67	77.67	77.80	0.13	76.70	76.71	77.34	77.37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
LC02	76.20	77.15	77.35	0.20	76.31	76.45	77.34	77.37	0.00	0.00	0.19	0.22	0.00	0.00	0.00	0.02
LC03	76.56	78.00	78.30	0.30	77.64	78.01	78.14	78.18	0.00	0.01	0.14	0.18	0.00	0.00	0.00	0.00
LC04	76.42	77.73	78.03	0.30	77.63	77.83	77.95	77.97	0.00	0.10	0.22	0.24	0.00	0.00	0.00	0.00
RY03	75.45	77.15	77.35	0.20	76.17	76.45	77.34	77.36	0.00	0.00	0.19	0.21	0.00	0.00	0.00	0.01

[1] *3-hour Chicago Storm.*

1055 Klondike Road - Block 10 (117034-10)
Summary of Hydraulic Grade Line (HGL) Elevations

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MH ID	Obvert Elevation (m)	T/G Elevation (m)	HGL Elevation[1] (m)	Surcharge (m)	Clearance from T/G (m)	HGL in Stress Test[1] (m)
MH02	74.88	78.09	74.60	0.00	3.49	74.60
MH04	74.71	78.10	74.43	0.00	3.67	74.43
MH08	72.61	77.68	72.32	0.00	5.36	72.33
TD01	75.18	75.78	74.99	0.00	0.79	75.00

[1] *3-hour Chicago Storm*

Klondike Road - Block 10
Maple Leaf Homes
Project No.: 117034-10

STORM SEWER DESIGN SHEET
(Maple Leaf Homes)
FLOW RATES BASED ON RATIONAL METHOD

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Engineers, Planners & Landscape Architects

LOCATION				AREA (ha)			FLOW							TOTAL FLOW	SEWER DATA							
Street	Catchment ID	From Manhole	To Manhole	Area (ha)	C	AC (ha)	Indiv 2.78 AC	Accum 2.78 AC	Time of Concentration	Rainfall Intensity 2 Year (mm/hr)	Rainfall Intensity 5 Year (mm/hr)	Rainfall Intensity 10 Year (mm/hr)	Peak Flow (L/s)	Total Peak Flow, Q (L/s)	Dia. (m) Actual	Dia. (mm)	Type	Slope (%)	Length (m)	Capacity (L/s)	Velocity (m/s)	Flow Time (min)	Ratio Q/Q full
	B-05, B-06, B-07, B-10	MH2	MH4	0.240	0.75	0.18	0.500	0.500	10.00	76.81			38.4	38.4	0.381	375	PVC	0.50	34.5	129.2	1.13	0.51	30%
						0.00	0.000	0.000	10.00													
						0.00	0.000	0.000	10.00													
	B-11, B-12, B-13	RY2	MH4	0.190	0.54	0.10	0.285	0.285	10.00	76.81			21.9	21.9	0.305	300	PVC	1.00	49.5	100.8	1.38	0.60	22%
						0.00	0.000	0.000	10.00													
						0.00	0.000	0.000	10.00													
	B-01, B-02	MH4	MH8	0.114	0.43	0.05	0.136	0.922	10.60	74.59			68.8	68.8	0.457	450	Conc	0.50	58.4	210.2	1.28	0.76	33%
						0.00	0.000	0.000	10.60													
						0.00	0.000	0.000	10.60													

Q = 2.78 AIC, where
Q = Peak Flow in Litres per Second (L/s)
A = Area in hectares (ha)
I = Rainfall Intensity (mm/hr), 5 year storm
C = Runoff Coefficient

Consultant:	**Novatech**
Date:	May 17, 2021
Design By:	Lucas Wilson
Client:	**Dwg. Reference:** / **Checked By:**
Maple Leaf Homes	117034-10-STM / MAB

Legend:

*	Indicates 100 Year intensity for storm sewers
10.00	Storm sewers designed to the 2 year event (without ponding) for local roads
10.00	Storm sewers designed to the 5 year event (without ponding) for collector roads
10.00	Storm sewers designed to the 10 year event (without ponding) for arterial roads

StormTech SC-740 Chamber

Designed to meet the most stringent industry performance standards for superior structural integrity while providing designers with a cost-effective method to save valuable land and protect water resources. The StormTech system is designed primarily to be used under parking lots thus maximizing land usage for commercial and municipal applications.

StormTech®
Detention • Retention • Recharge

Subsurface Stormwater Management℠

StormTech SC-740 Chamber
(not to scale)

Nominal Chamber Specifications

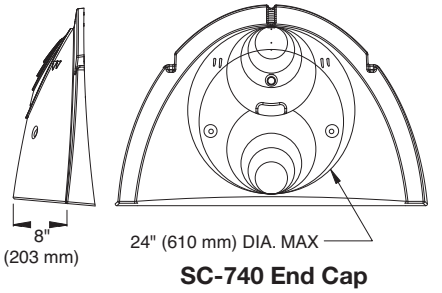
Size (L x W x H)
85.4" x 51.0" x 30.0"
(2170 x 1295 x 762 mm)

Chamber Storage
45.9 ft³ (1.30 m³)

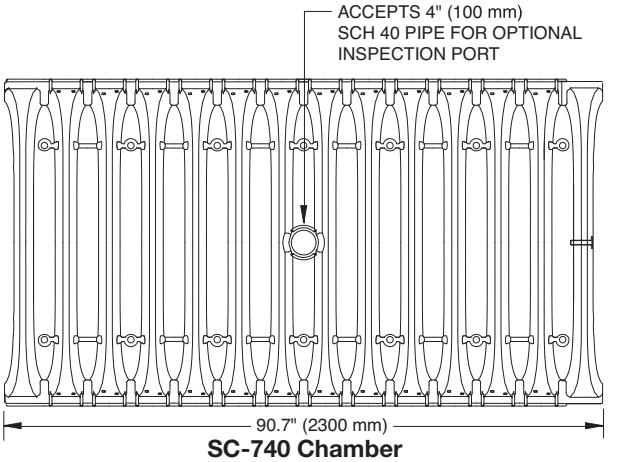
Minimum Installed Storage*
74.9 ft³ (2.12 m³)

Weight
74.0 lbs (33.6 kg)

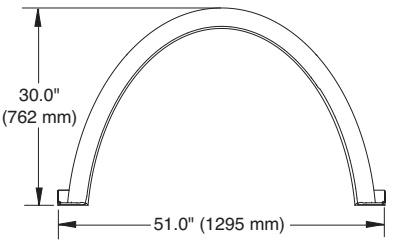
Shipping
30 chambers/pallet
60 end caps/pallet
12 pallets/truck

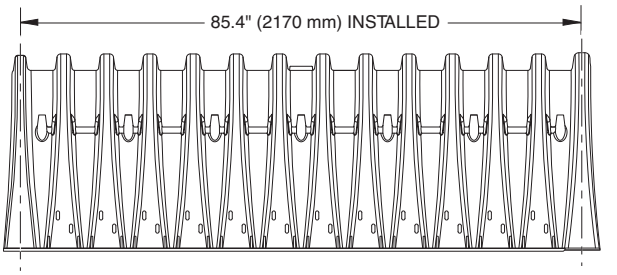


SC-740 End Cap

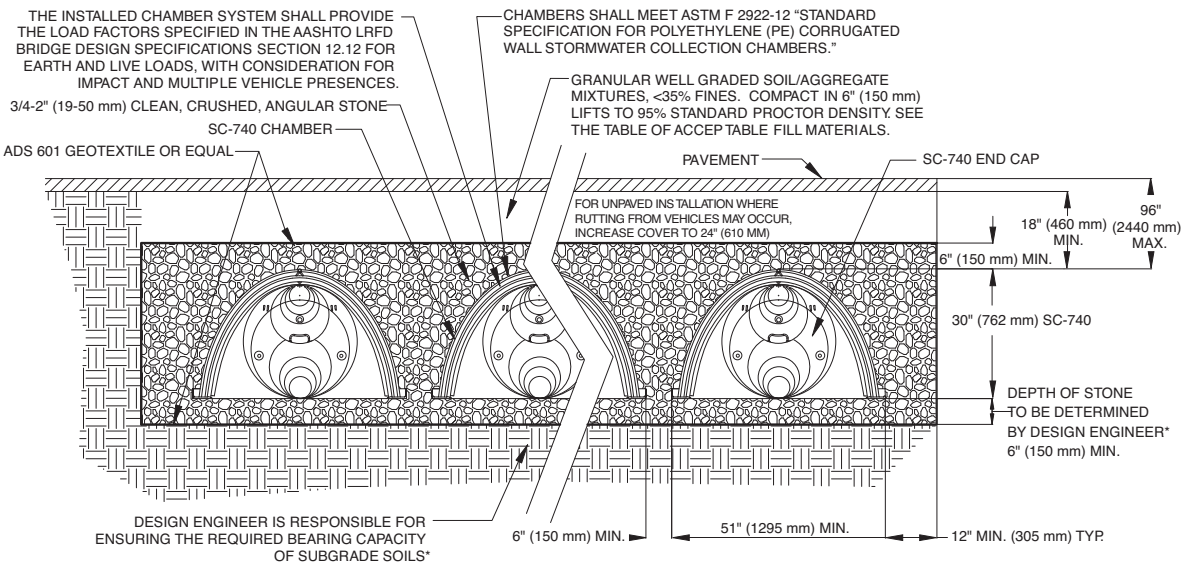


SC-740 Chamber





Typical Cross Section Detail
(not to scale)



THIS CROSS SECTION DETAILS THE REQUIREMENTS NECESSARY TO SATISFY THE LOAD FACTORS SPECIFIED IN THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS SECTION 12.12 FOR EARTH AND LIVE LOADS USING STORMTECH CHAMBERS

MADE IN THE U.S.A.

SC-740 Cumulative Storage Volumes Per Chamber

Assumes 40% Stone Porosity. Calculations are Based Upon a 6" (152 mm) Stone Base Under the Chambers.

Depth of Water in System Inches (mm)	Cumulative Chamber Storage Ft³ (m³)	Total System Cumulative Storage Ft³ (m³)
42 (1067)	45.90 (1.300)	74.90 (2.121)
41 (1041)	45.90 (1.300)	73.77 (2.089)
40 (1016)	Stone 45.90 (1.300)	72.64 (2.057)
39 (991)	Cover 45.90 (1.300)	71.52 (2.025)
38 (965)	45.90 (1.300)	70.39 (1.993)
37 (948)	45.90 (1.300)	69.26 (1.961)
36 (914)	45.90 (1.300)	68.14 (1.929)
35 (889)	45.85 (1.298)	66.98 (1.897)
34 (864)	45.69 (1.294)	65.75 (1.862)
33 (838)	45.41 (1.286)	64.46 (1.825)
32 (813)	44.81 (1.269)	62.97 (1.783)
31 (787)	44.01 (1.246)	61.36 (1.737)
30 (762)	43.06 (1.219)	59.66 (1.689)
29 (737)	41.98 (1.189)	57.89 (1.639)
28 (711)	40.80 (1.155)	56.05 (1.587)
27 (686)	39.54 (1.120)	54.17 (1.534)
26 (660)	38.18 (1.081)	52.23 (1.479)
25 (635)	36.74 (1.040)	50.23 (1.422)
24 (610)	35.22 (0.977)	48.19 (1.365)
23 (584)	33.64 (0.953)	46.11 (1.306)
22 (559)	31.99 (0.906)	44.00 (1.246)
21 (533)	30.29 (0.858)	41.85 (1.185)
20 (508)	28.54 (0.808)	39.67 (1.123)
19 (483)	26.74 (0.757)	37.47 (1.061)
18 (457)	24.89 (0.705)	35.23 (0.997)
17 (432)	23.00 (0.651)	32.96 (0.939)
16 (406)	21.06 (0.596)	30.68 (0.869)
15 (381)	19.09 (0.541)	28.36 (0.803)
14 (356)	17.08 (0.484)	26.03 (0.737)
13 (330)	15.04 (0.426)	23.68 (0.670)
12 (305)	12.97 (0.367)	21.31 (0.608)
11 (279)	10.87 (0.309)	18.92 (0.535)
10 (254)	8.74 (0.247)	16.51 (0.468)
9 (229)	6.58 (0.186)	14.09 (0.399)
8 (203)	4.41 (0.125)	11.66 (0.330)
7 (178)	2.21 (0.063)	9.21 (0.264)
6 (152)	0	6.76 (0.191)
5 (127)	0	5.63 (0.160)
4 (102)	Stone Foundation 0	4.51 (0.125)
3 (76)	0	3.38 (0.095)
2 (51)	0	2.25 (0.064)
1 (25)	0	1.13 (0.032)

Note: Add 1.13 cu. ft. (0.032 m³) of storage for each additional inch (25 mm) of stone foundation.

Storage Volume Per Chamber

	Bare Chamber Storage	Chamber and Stone Stone Foundation Depth in. (mm)		
	ft³ (m³)	6 (150)	12 (305)	18 (460)
StormTech SC-740	45.9 (1.3)	74.9 (2.1)	81.7 (2.3)	88.4 (2.5)

Note: Storage volumes are in cubic feet per chamber. Assumes 40% porosity for the stone plus the chamber volume.

Amount of Stone Per Chamber

	Stone Foundation Depth		
ENGLISH TONS (CUBIC YARDS)	6"	12"	18"
StormTech SC-740	3.8 (2.8 yd³)	4.6 (3.3 yd³)	5.5 (3.9 yd³)
METRIC KILOGRAMS (METER³)	**150 mm**	**305 mm**	**460 mm**
StormTech SC-740	3450 (2.1 m³)	4170 (2.5 m³)	4490 (3.0 m³)

Note: Assumes 6" (150 mm) of stone above, and between chambers.

Volume of Excavation Per Chamber

	Stone Foundation Depth		
	6" (150 mm)	12" (305 mm)	18" (460 mm)
StormTech SC-740	5.5 (4.2)	6.2 (4.7)	6.8 (5.2)

Note: Volumes are in cubic yards (cubic meters) per chamber. Assumes 6" (150 mm) of separation between chamber rows and 18" (460 mm) of cover. The volume of excavation will vary as the depth of the cover increases.

STANDARD LIMITED WARRANTY OF STORMTECH LLC ("STORMTECH"): PRODUCTS

(A) This Limited Warranty applies solely to the StormTech chambers and endplates manufactured by StormTech and sold to the original purchaser (the "Purchaser"). The chambers and endplates are collectively referred to as the "Products."

(B) The structural integrity of the Products, when installed strictly in accordance with StormTech's written installation instructions at the time of installation, are warranted to the Purchaser against defective materials and workmanship for one (1) year from the date of purchase. Should a defect appear in the Limited Warranty period, the Purchaser shall provide StormTech with written notice of the alleged defect at StormTech's corporate headquarters within ten (10) days of the discovery of the defect. The notice shall describe the alleged defect in reasonable detail. StormTech agrees to supply replacements for those Products determined by StormTech to be defective and covered by this Limited Warranty. The supply of replacement products is the sole remedy of the Purchaser for breaches of this Limited Warranty. StormTech's liability specifically excludes the cost of removal and/or installation of the Products.

(C) **THIS LIMITED WARRANTY IS EXCLUSIVE. THERE ARE NO OTHER WARRANTIES WITH RESPECT TO THE PRODUCTS, INCLUDING NO IMPLIED WARRANTIES OF MERCHANT-ABILITY OR OF FITNESS FOR A PARTICULAR PURPOSE.**

(D) This Limited Warranty only applies to the Products when the Products are installed in a single layer. **UNDER NO CIRCUMSTANCES, SHALL THE PRODUCTS BE INSTALLED IN A MULTI-LAYER CONFIGURATION.**

(E) No representative of StormTech has the authority to change this Limited Warranty in any manner or to extend this Limited Warranty. This Limited Warranty does not apply to any person other than to the Purchaser.

(F) Under no circumstances shall StormTech be liable to the Purchaser or to any third party for product liability claims; claims arising from the design, shipment, or installation of the Products, or the cost of other goods or services related to the purchase and installation of the Products. For this Limited Warranty to apply, the Products must be installed in accordance with all site conditions required by state and local codes; all other applicable laws; and StormTech's written installation instructions.

(G) **THE LIMITED WARRANTY DOES NOT EXTEND TO INCIDENTAL, CONSEQUENTIAL, SPECIAL OR INDIRECT DAMAGES. STORMTECH SHALL NOT BE LIABLE FOR PENALTIES OR LIQUIDATED DAMAGES, INCLUDING LOSS OF PRODUCTION AND PROFITS; LABOR AND MATERIALS; OVERHEAD COSTS; OR OTHER LOSS OR EXPENSE INCURRED BY THE PURCHASER OR ANY THIRD PARTY. SPECIFICALLY EXCLUDED FROM LIMITED WARRANTY COVERAGE ARE DAMAGE TO THE PRODUCTS ARISING FROM ORDINARY WEAR AND TEAR; ALTERATION, ACCIDENT, MISUSE, ABUSE OR NEGLECT; THE PRODUCTS BEING SUBJECTED TO VEHICLE TRAFFIC OR OTHER CONDITIONS WHICH ARE NOT PERMITTED BY STORMTECH'S WRITTEN SPECIFICATIONS OR INSTALLATION INSTRUCTIONS; FAILURE TO MAINTAIN THE MINIMUM GROUND COVERS SET FORTH IN THE INSTALLATION INSTRUCTIONS; THE PLACEMENT OF IMPROPER MATERIALS INTO THE PRODUCTS; FAILURE OF THE PRODUCTS DUE TO IMPROPER SITING OR IMPROPER SIZING; OR ANY OTHER EVENT NOT CAUSED BY STORMTECH. THIS LIMITED WARRANTY REPRESENTS STORMTECH'S SOLE LIABILITY TO THE PURCHASER FOR CLAIMS RELATED TO THE PRODUCTS, WHETHER THE CLAIM IS BASED UPON CONTRACT, TORT, OR OTHER LEGAL THEORY.**

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Printed on recycled paper

User Inputs

Chamber Model:	SC-740
Outlet Control Structure:	No
Project Name:	117034-10 (6 Chambers)
Engineer:	Lucas Wilson
Project Location:	
Measurement Type:	Metric
Required Storage Volume:	16.10 cubic meters.
Stone Porosity:	40%
Stone Foundation Depth:	152 mm.
Stone Above Chambers:	152 mm.
Average Cover Over Chambers:	457 mm.
Design Constraint Dimensions:	(2.00 m. x 14.20 m.)

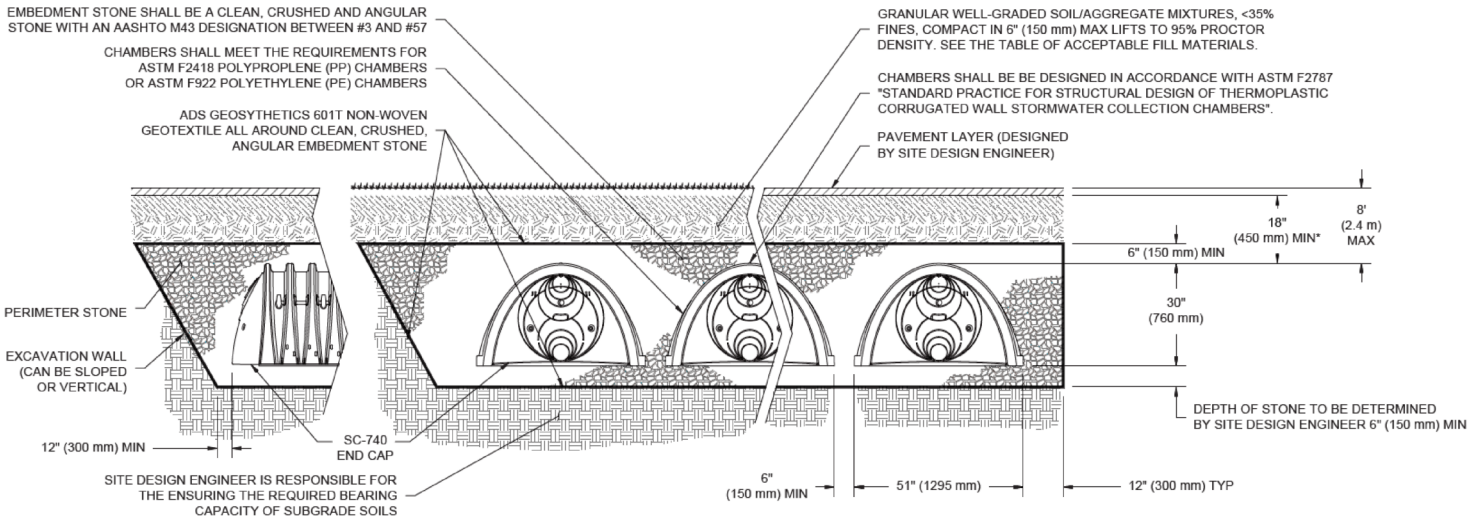
Results

System Volume and Bed Size

Installed Storage Volume:	16.15 cubic meters.
Storage Volume Per Chamber:	1.30 cubic meters.
Number Of Chambers Required:	6
Number Of End Caps Required:	2
Chamber Rows:	1
Maximum Length:	14.11 m.
Maximum Width:	1.91 m.
Approx. Bed Size Required:	26.88 square meters.

System Components

Amount Of Stone Required:	20.88 cubic meters
Volume Of Excavation (Not Including Fill):	28.68 cubic meters



*MINIMUM COVER TO BOTTOM OF FLEXIBLE PAVEMENT. FOR UNPAVED INSTALLATIONS WHERE RUTTING FROM VEHICLES MAY OCCUR, INCREASE COVER TO 24" (600 mm).

User Inputs

Chamber Model:	SC-740
Outlet Control Structure:	Yes
Project Name:	117034-10 (9 Chambers)
Engineer:	Lucas Wilson
Project Location:	
Measurement Type:	Metric
Required Storage Volume:	25.70 cubic meters.
Stone Porosity:	40%
Stone Foundation Depth:	152 mm.
Stone Above Chambers:	152 mm.
Average Cover Over Chambers:	457 mm.
Design Constraint Dimensions:	(5.00 m. x 8.85 m.)

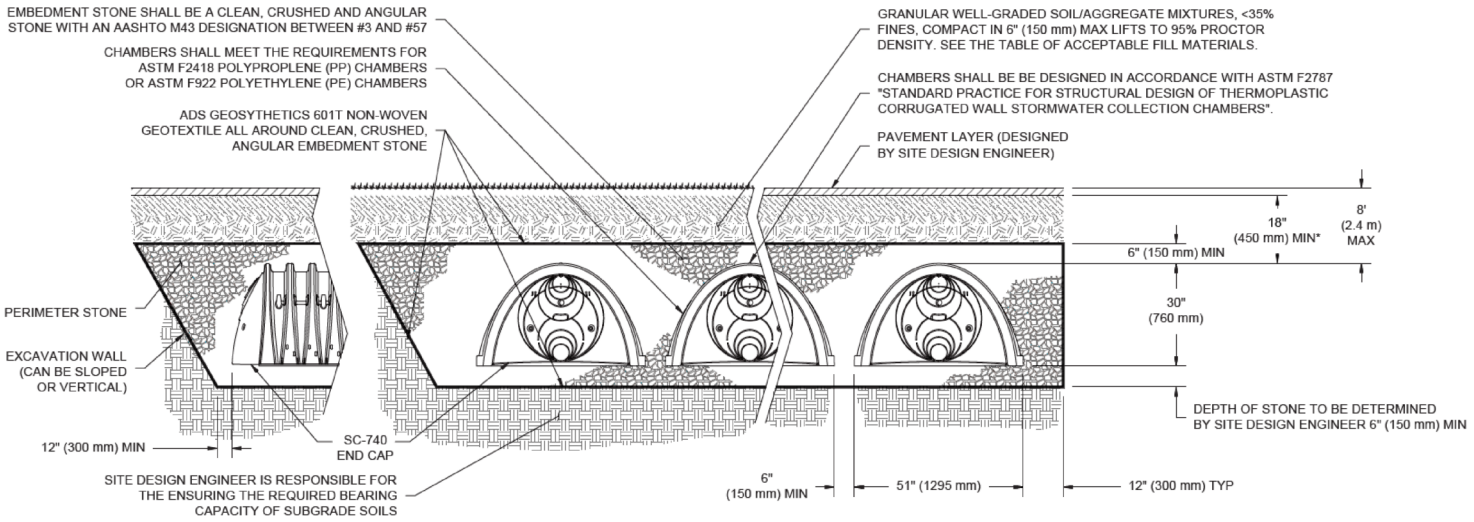
Results

System Volume and Bed Size

Installed Storage Volume:	25.74 cubic meters.
Storage Volume Per Chamber:	1.30 cubic meters.
Number Of Chambers Required:	9
Number Of End Caps Required:	6
Chamber Rows:	3
Maximum Length:	8.80 m.
Maximum Width:	4.98 m.
Approx. Bed Size Required:	43.87 square meters.

System Components

Amount Of Stone Required:	35.10 cubic meters
Volume Of Excavation (Not Including Fill):	46.80 cubic meters

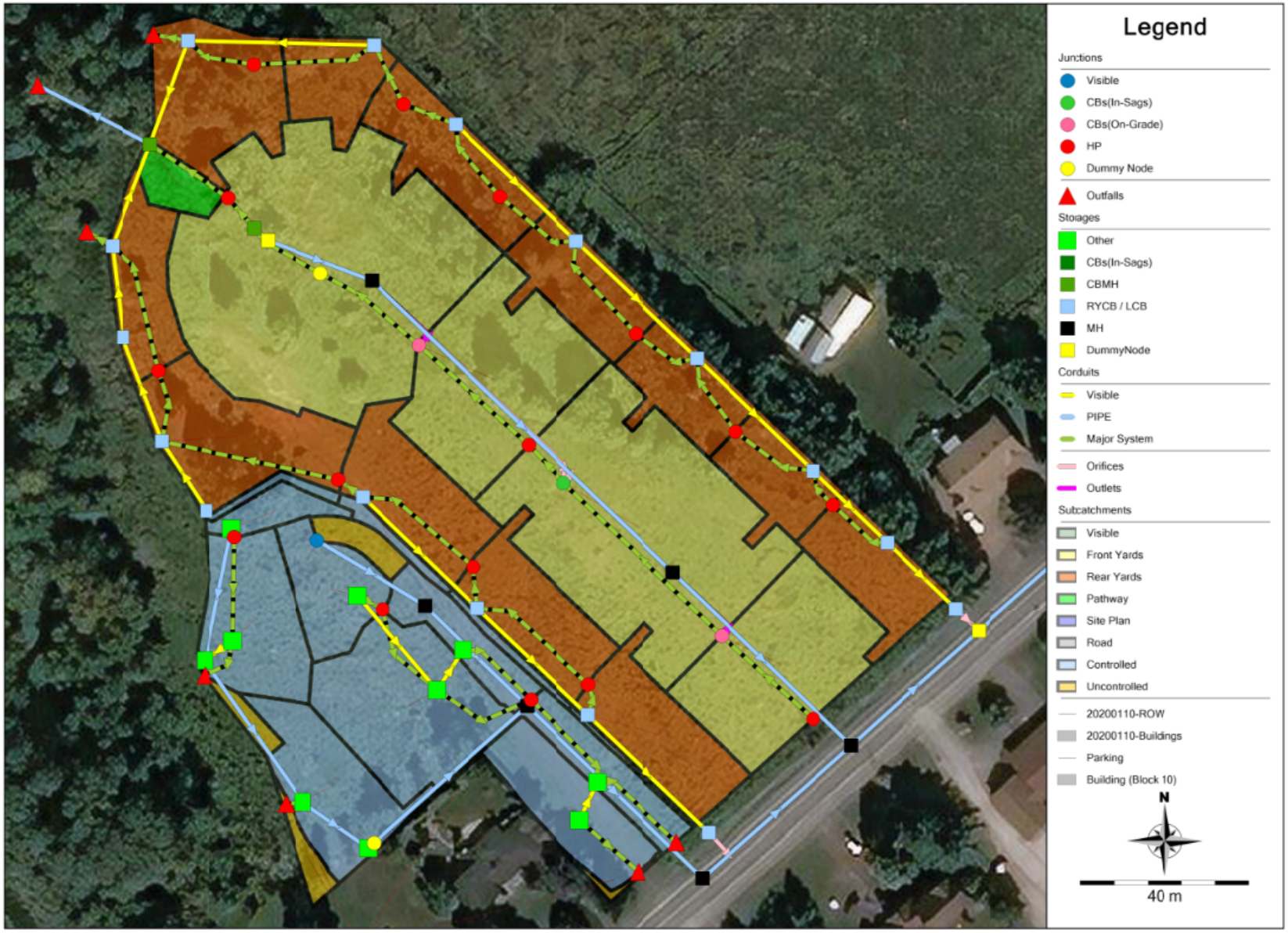


*MINIMUM COVER TO BOTTOM OF FLEXIBLE PAVEMENT. FOR UNPAVED INSTALLATIONS WHERE RUTTING FROM VEHICLES MAY OCCUR, INCREASE COVER TO 24" (600 mm).

1055 Klondike – Maple Leaf Homes (117034)
PCSWMM Model Schematic

NOVATECH
Engineers, Planners & Landscape Architects

Overall Model Schematic



Date: 2021-05-10
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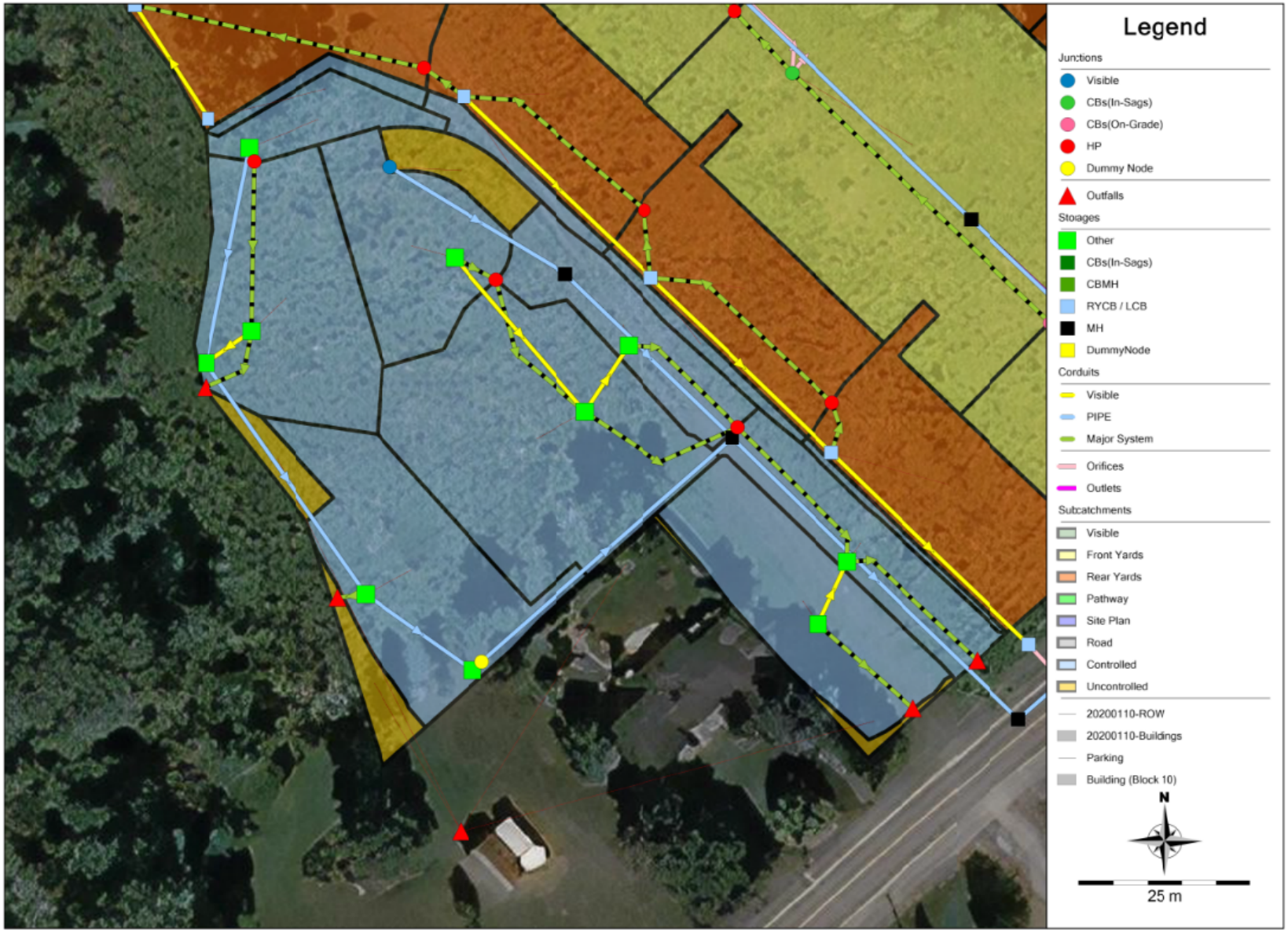
1055 Klondike – Maple Leaf Homes (117034)
PCSWMM Model Schematic

NOVATECH
Engineers, Planners & Landscape Architects

Overall (Block 10)



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1055 Klondike – Maple Leaf Homes (117034)
PCSWMM Model Schematic

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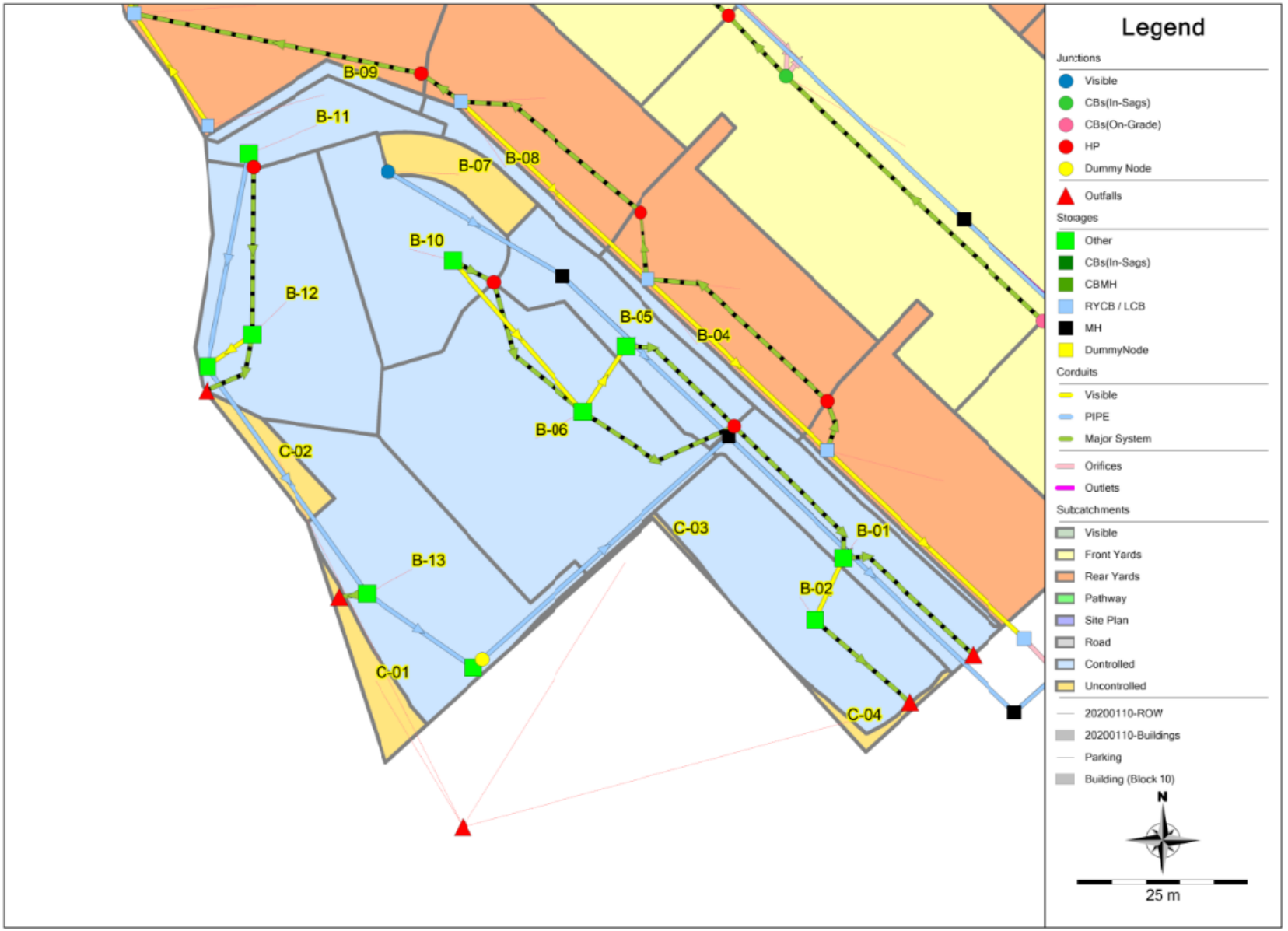
Engineers, Planners & Landscape Architects

Subcatchments (ID's)



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1055 Klondike – Maple Leaf Homes (117034)
PCSWMM Model Schematic

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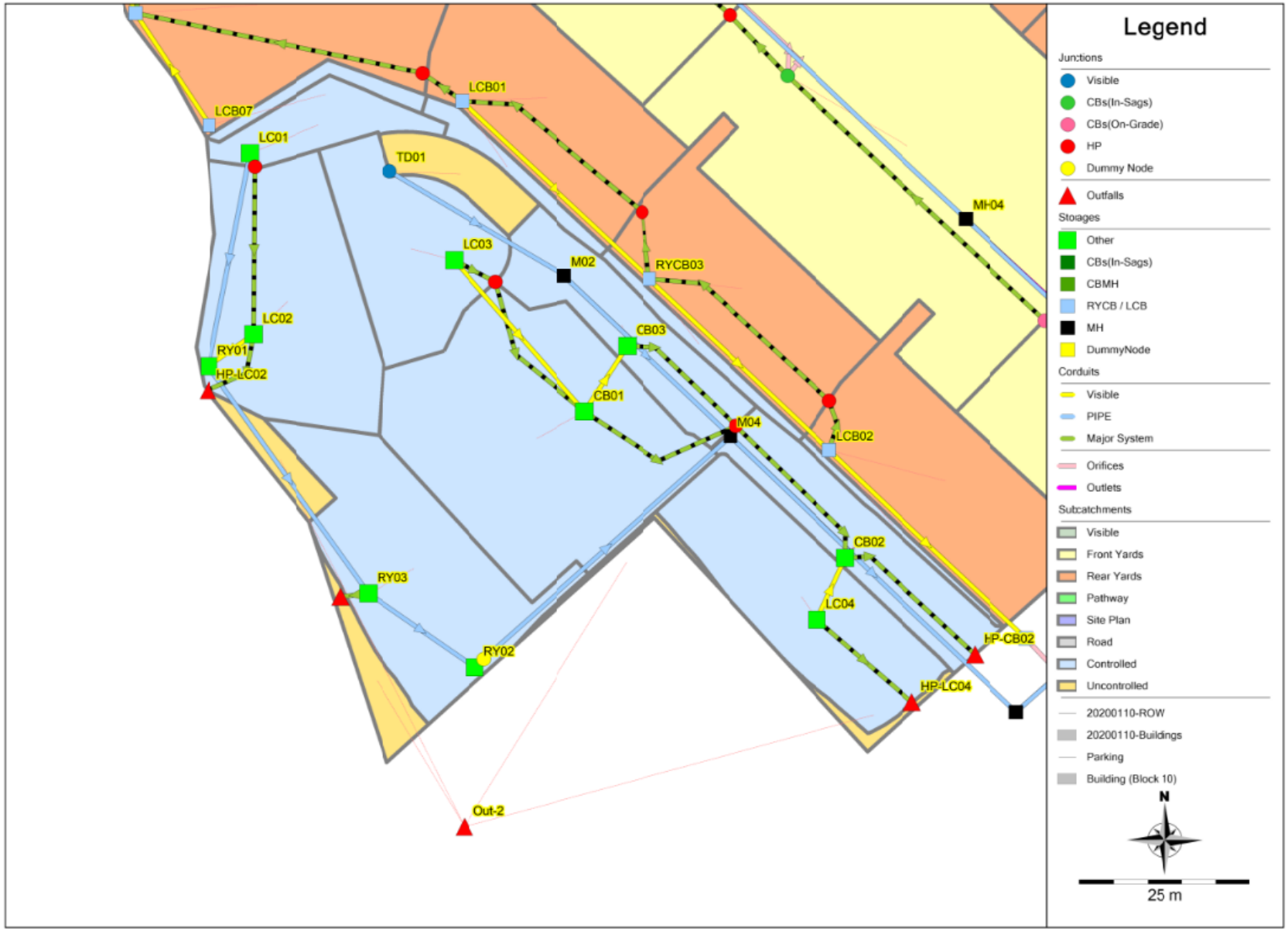
Nodes ID's



Date: 2021-05-10
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MAPLE LEAF HOMES

1055 KLONDIKE ROAD – ORR RIDGE

SITE SERVICING AND STORMWATER MANAGEMENT REPORT

Prepared for:

Maple Leaf Homes

Prepared By:

NOVATECH
Suite 200, 240 Michael Cowpland Drive
Ottawa, Ontario
K2M 1P6

Issued: September 3, 2020
Revised: March 12, 2021

Novatech File: 117034
Report Ref: R-2020-013

5.4.3 Rear Yard Perforated Pipes

Drainage from the rear yards / rooftops will be collected with rear yard catchbasins connected to a perforated pipe system. The perforated pipe system will consist of 250mm perforated pipe surrounded by 50mm dia. clearstone. The proposed perforated pipes in the rear yards will promote infiltration. This will mitigate the reduction in groundwater infiltration / recharge resulting from the proposed increase in impervious areas. Infiltration has not been accounted for in the model.

5.4.4 Stormwater Management Requirements for Site Plan Block

The Site Plan Block (0.60 ha) is to adhere to the following stormwater management criteria:

- Minor system inlet rate = 51 L/s
- Major system storage = 81.6 m^3
- *No major system overland flow to Shirley's Brook during the 100-year storm event.*

The development of the Site Plan Block is to not include major system overland flow to Shirley's Brook during the 100-year storm event. The allowable 100-year flow rate to Shirley's Brook for the Subject Site is being used by the proposed subdivision.

6.0 ROADWAYS

6.1 Proposed Road Infrastructure

The proposed development will consist of a local roadway with an 18.0m right of way (ROW) to provide access to the townhome and semi-detached units. The access to the medium density block will consist of a private roadway. The proposed cross sections will conform to City of Ottawa Standards.

1055 Klondike Road – Orr Ridge (117034)
PCSWMM Model Output
100yr 3-hour Chicago Storm

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EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.015)
  ---------------------------------------------------------------

  M:\2017\117034\CAD\Design\117034-GP.dwg


  *************
  Element Count
  *************
  Number of rain gages ...... 1
  Number of subcatchments ... 34
  Number of nodes ........... 67
  Number of links ........... 83
  Number of pollutants ...... 0
  Number of land uses ....... 0


  ****************
  Raingage Summary
  ****************
                                                 Data       Recording
  Name                 Data Source               Type       Interval
  ------------------------------------------------------------------
  Raingage             C3hr-100yr                INTENSITY   10 min.


  *********************
  Subcatchment Summary
  *********************
  Name                        Area     Width   %Imperv    %Slope Rain Gage            Outlet
  ------------------------------------------------------------------------------------------
---
  A-01                        0.08     38.50     42.90    3.5000 Raingage             LCB02
  A-02                        0.14     55.20     75.40    4.0000 Raingage             CB01/02
  A-03                        0.05     25.50     43.10    5.0000 Raingage             RYCB05
  A-04                        0.07     36.00     45.80    4.0000 Raingage             RYCB03
  A-05                        0.29    117.20     79.90    4.0000 Raingage             CB03/04
  A-06                        0.06     29.00     43.10    5.0000 Raingage             LCB05
  A-07                        0.08     39.50     40.50    3.0000 Raingage             LCB01
  A-08                        0.15     60.80     79.60    4.0000 Raingage             CB05/06
  A-09                        0.06     32.00     45.30    5.0000 Raingage             RYCB07
  A-10                        0.11     45.20     29.20    2.5000 Raingage             RYCB02
  A-11                        0.07     44.00     33.30    5.0000 Raingage             RYCB01
  A-12                        0.02      9.60     29.20    3.5000 Raingage             CBMH04
  A-13                        0.11     30.57     12.10    3.5000 Raingage             RYCB04
  A-14                        0.05     21.20     17.00    4.0000 Raingage             LCB06
  A-15                        0.07     37.00     47.30    5.5000 Raingage             LCB04
  A-16                        0.36     90.25     79.50    3.0000 Raingage             CBMH01
  A-17                        0.06     31.50     41.30    5.0000 Raingage             LCB08
  B-01                        0.04     17.60     85.70    1.5000 Raingage             CB02
  B-02                        0.07     35.00      0.00    2.5000 Raingage             LC04
  B-03                        0.00     40.00      0.00   33.3300 Raingage             LCB02
  B-04                        0.01     35.00      0.00   33.3300 Raingage             RYCB03
  B-05                        0.04     20.50     82.90    1.5000 Raingage             CB03
  B-06                        0.13     52.00     82.90    1.5000 Raingage             CB01
  B-07                        0.01      7.50     82.90   10.5000 Raingage             TD01
  B-08                        0.01     45.00     44.30   33.3300 Raingage             LCB01
  B-09                        0.01     40.00      0.00   33.3300 Raingage             LCB07
  B-10                        0.05     36.00     57.10    4.5000 Raingage             LC03
  B-11                        0.02     14.67     18.60    2.0000 Raingage             LC01
  B-12                        0.09     43.00     54.30    3.0000 Raingage             LC02
  B-13                        0.08     41.00     50.00    3.0000 Raingage             RY03
  C-01                        0.01     22.00      0.00   33.3300 Raingage             Out-2
  C-02                        0.01     18.00     62.90    2.5000 Raingage             Out-2
  C-03                        0.00     20.00      0.00   33.3300 Raingage             Out-2
  C-04                        0.00     30.00      0.00   33.3300 Raingage             Out-2


  ************
  Node Summary
  ************
                                          Invert      Max.    Ponded    External
  Name                 Type                Elev.     Depth      Area    Inflow
  ------------------------------------------------------------------------------
  CB01/02              JUNCTION           77.52      1.00       0.0
  CB03/04              JUNCTION           75.62      2.40       0.0
  CB05/06              JUNCTION           76.73      1.00       0.0
  D01                  JUNCTION           76.70      1.00       0.0
  HP01                 JUNCTION           77.79      1.00       0.0
  HP02                 JUNCTION           77.09      1.00       0.0
  HP-03                JUNCTION           76.42      1.00       0.0
  HP-CB01-CB03         JUNCTION           78.13      1.00       0.0
  HP-LC01              JUNCTION           77.80      1.00       0.0
  HP-LC03              JUNCTION           78.30      1.00       0.0
  HP-LCB01             JUNCTION           77.03      1.00       0.0
  HP-LCB02             JUNCTION           77.53      1.00       0.0
  HP-LCB04             JUNCTION           74.00      1.00       0.0
  HP-LCB05             JUNCTION           74.70      1.00       0.0
  HP-LCB06             JUNCTION           73.77      1.00       0.0
  HP-LCB08             JUNCTION           75.56      1.00       0.0
  HP-RYCB02            JUNCTION           76.71      1.00       0.0
  HP-RYCB03            JUNCTION           77.44      1.00       0.0
  HP-RYCB05            JUNCTION           75.00      1.00       0.0
  HP-RYCB07            JUNCTION           74.33      1.00       0.0
  RY02-Dummy           JUNCTION           75.24      2.72       0.0
  TD01                 JUNCTION           72.93      2.85       0.0
  EX-MH159             OUTFALL            70.98      0.60       0.0
  HP-CB02              OUTFALL            78.03      1.00       0.0
  HP-LC02              OUTFALL            77.35      1.00       0.0
  HP-LC04              OUTFALL            78.03      1.00       0.0
  HP-RY03              OUTFALL            77.35      1.00       0.0
  HW1_(STM)            OUTFALL            70.79      0.38       0.0
  Out-1                OUTFALL            76.56      1.00       0.0
  Out-2                OUTFALL             0.00      0.00       0.0
  Out-3                OUTFALL            73.47      1.00       0.0
  CB01                 STORAGE            76.24      2.59       0.0
  CB02                 STORAGE            76.33      2.40       0.0
  CB03                 STORAGE            76.13      2.70       0.0
  CBMH01               STORAGE            72.89      4.25       0.0
  CBMH01-Dummy         STORAGE            72.89      3.25       0.0
  CBMH02               STORAGE            71.86      5.10       0.0
  CBMH02-Dummy         STORAGE            71.49      5.41       0.0
  CBMH03               STORAGE            74.31      3.49       0.0
  CBMH04               STORAGE            70.94      5.40       0.0
  LC01                 STORAGE            76.67      2.00       0.0
  LC02                 STORAGE            76.20      1.95       0.0
  LC03                 STORAGE            76.56      2.44       0.0
  LC04                 STORAGE            76.42      2.31       0.0
  LCB01                STORAGE            75.43      2.40       0.0
  LCB02                STORAGE            74.69      3.64       0.0
  LCB04                STORAGE            72.75      2.00       0.0
  LCB05                STORAGE            72.35      3.15       0.0
  LCB06                STORAGE            71.90      2.58       0.0
  LCB07                STORAGE            75.18      2.40       0.0
  LCB08                STORAGE            72.05      4.31       0.0
  M02                  STORAGE            74.50      3.59       0.0
  M04                  STORAGE            74.26      3.84       0.0
  MH02                 STORAGE            71.77      5.99       0.0
  MH04                 STORAGE            72.19      5.23       0.0
  MH06                 STORAGE            72.60      4.04       0.0
  MH08                 STORAGE            72.16      5.52       0.0
  RY01                 STORAGE            75.91      1.53       0.0
  RY02                 STORAGE            75.24      2.72       0.0
  RY03                 STORAGE            75.45      2.70       0.0
  RYCB01               STORAGE            74.72      2.73       0.0
  RYCB02               STORAGE            74.94      2.59       0.0
  RYCB03               STORAGE            75.09      3.03       0.0
  RYCB04               STORAGE            71.34      2.94       0.0
  RYCB05               STORAGE            72.19      3.61       0.0
  RYCB06               STORAGE            74.42      2.96       0.0
  RYCB07               STORAGE            72.55      2.58       0.0


  ************
  Link Summary
  ************
  Name                 From Node          To Node            Type           Length    %Slope Roughness
  ---------------------------------------------------------------------------------------------------
  1_(104)_(1)_(STM) CBMH02-Dummy      EX-MH159           CONDUIT          76.3    0.6684    0.0130
  1_(104)_(STM)      MH02             CBMH02-Dummy       CONDUIT          40.8    0.6863    0.0130
  1_(11)_(STM)       MH04             MH02               CONDUIT          59.3    0.4555    0.0130
  1_(131)_(STM)      CBMH01-Dummy     MH06               CONDUIT          27.4    0.5115    0.0130
  1_(135)_(STM)      HP-03            CBMH04             CONDUIT           3.0   38.5872    0.0150
  1_(87)_(STM)       CBMH04           HW1_(STM)          CONDUIT          30.5    0.4918    0.0130
  1_(9)_(STM)        MH06             MH04               CONDUIT         100.0    0.4000    0.0130
  19                 LC04             HP-LC04            CONDUIT           3.0  -10.0504    0.0350
  2                  LCB08            HP-LCB08           CONDUIT           3.0   -6.6815    0.0350
  3                  CBMH01           HP-03              CONDUIT           3.0   -9.3743    0.0150
  4                  HP-LCB08         RYCB05             CONDUIT           3.0   26.1876    0.0350
  4_1                CB05/06          D01                CONDUIT           3.0    1.0001    0.2500
  4_2                D01              CBMH01             CONDUIT           3.0   19.0006    0.2500
  5                  HP02             CB05/06            CONDUIT          35.3    1.0199    0.2500
  6                  CB03/04          HP02               CONDUIT          12.4   -0.5645    0.2500
  7                  CB01/02          CB03/04            CONDUIT          52.4    0.9542    0.2500
```

8	HP01	CB01/02	CONDUIT	29.5	0.9153	0.2500	
CB01-CB03	CB01	CB03	CONDUIT	10.6	1.0378	0.0130	
CB01-HP	CB01	HP-CB01-CB03	CONDUIT	3.0	-10.0504	0.0150	
CB02-HP	CB02	HP-CB02	CONDUIT	3.0	-10.0504	0.0150	
CB03-HP	CB03	HP-CB01-CB03	CONDUIT	3.0	-10.0504	0.0150	
HP-CB01-CB02	HP-CB01-CB03	CB02	CONDUIT	3.0	13.4535	0.0150	
HP-LC01-LC02	HP-LC01	LC02	CONDUIT	3.0	20.4124	0.0350	
HP-LC03-CB01	HP-LC03	CB01	CONDUIT	3.0	15.8625	0.0150	
HP-LCB01-RYCB02	HP-LCB01	RYCB02	CONDUIT	3.0	16.9031	0.0350	
HP-LCB02-RYCB03	HP-LCB02	RYCB03	CONDUIT	3.0	13.7961	0.0350	
HP-LCB04-LCB06	HP-LCB04	LCB06	CONDUIT	3.0	17.5997	0.0350	
HP-LCB05-RYCB07	HP-LCB05	RYCB07	CONDUIT	3.0	19.3525	0.0350	
HP-LCB06-RYCB04	HP-LCB06	RYCB04	CONDUIT	3.0	16.5557	0.0350	
HP-RYCB02-RYCB06	HP-RYCB02	RYCB06	CONDUIT	3.0	11.0672	0.0350	
HP-RYCB03-LCB01	HP-RYCB03	LCB01	CONDUIT	3.0	20.7672	0.0350	
HP-RYCB05-LCB05	HP-RYCB05	LCB05	CONDUIT	3.0	16.9031	0.0350	
HP-RYCB07-LCB04	HP-RYCB07	LCB04	CONDUIT	3.0	19.7051	0.0350	
LC01-HP	LC01	HP-LC01	CONDUIT	3.0	-4.3374	0.0350	
LC01-RY01	LC01	RY01	CONDUIT	32.7	2.2330	0.0130	
LC02-HP	LC02	HP-LC02	CONDUIT	3.0	-6.6815	0.0350	
LC02-RY01	LC02	RY01	CONDUIT	8.1	1.0015	0.0100	
LC03-CB01	LC03	CB01	CONDUIT	26.2	0.9924	0.0130	
LC03-HP	LC03	HP-LC03	CONDUIT	3.0	-10.0504	0.0150	
LC04-CB02	LC04	CB02	CONDUIT	9.3	0.9678	0.0130	
LCB01-HP	LCB01	HP-LCB01	CONDUIT	3.0	-6.6815	0.0350	
LCB01-LCB02	LCB01	RYCB03	CONDUIT	34.0	1.0001	0.0130	
LCB02-HP	LCB02	HP-LCB02	CONDUIT	3.0	-6.6815	0.0350	
LCB02-RYCB03	RYCB03	LCB02	CONDUIT	40.4	0.9901	0.0130	
LCB04-HP	LCB04	HP-LCB04	CONDUIT	3.0	-8.3624	0.0350	
LCB04-LCB08	LCB04	RYCB07	CONDUIT	39.4	0.5076	0.0130	
LCB05-HP	LCB05	HP-LCB05	CONDUIT	3.0	-6.6815	0.0350	
LCB05-RYCB05	LCB05	RYCB05	CONDUIT	32.8	0.4878	0.0130	
LCB06-HP	LCB06	HP-LCB06	CONDUIT	3.0	-9.7122	0.0350	
LCB06-RYCB04	LCB06	RYCB04	CONDUIT	49.5	1.0102	0.0130	
LCB07-RYCB02	LCB07	RYCB02	CONDUIT	23.7	1.0127	0.0130	
LCB08-CBMH02	LCB08	CBMH02	CONDUIT	27.8	0.5036	0.0150	
LCB08-LCB05	RYCB07	LCB05	CONDUIT	39.4	0.5076	0.0130	
M02-M04	M02	M04	CONDUIT	34.5	0.4928	0.0130	
M04-MH08	M04	MH08	CONDUIT	58.4	0.4966	0.0130	
MH08-MH02	MH08	MH02	CONDUIT	47.6	0.5042	0.0130	
RY01-RY03	RY01	RY03	CONDUIT	42.9	1.0024	0.0130	
RY02-MH04	RY02-Dummy	M04	CONDUIT	49.5	1.0102	0.0130	
RY03-HP	RY03	HP-RY03	CONDUIT	3.0	-6.6815	0.0350	
RY03-RY02	RY03	RY02	CONDUIT	18.1	0.9929	0.0130	
RYCB01-RYCB06	RYCB01	RYCB06	CONDUIT	24.9	1.0041	0.0130	
RYCB02-HP	RYCB02	HP-RYCB02	CONDUIT	3.0	-6.0108	0.0350	
RYCB02-RYCB01	RYCB02	RYCB01	CONDUIT	22.2	0.9910	0.0130	
RYCB03-CBMH03	LCB02	CBMH03	CONDUIT	32.9	1.0031	0.0150	
RYCB03-HP	RYCB03	HP-RYCB03	CONDUIT	3.0	-10.7279	0.0350	
RYCB04-CBMH04	RYCB04	CBMH04	CONDUIT	24.1	0.9959	0.0130	
RYCB04-Out-3	RYCB04	Out-3	CONDUIT	3.0	-6.3461	0.0350	
RYCB05-HP	RYCB05	HP-RYCB05	CONDUIT	3.0	-6.6815	0.0350	
RYCB05-LCB08	RYCB05	LCB08	CONDUIT	28.3	0.4947	0.0150	
RYCB06-CBMH04	RYCB06	CBMH04	CONDUIT	23.1	0.9957	0.0130	
RYCB06-Out-1	RYCB06	Out-1	CONDUIT	3.0	-6.0108	0.0350	
RYCB07-HP	RYCB07	HP-RYCB07	CONDUIT	3.0	-6.6815	0.0350	
TD01-M02	TD01	M02	CONDUIT	29.6	1.0136	0.0130	
CB02-O	CB02	M04	ORIFICE				
CB03-O	CB03	M02	ORIFICE				
CB04-O	CB03/04	MH06	ORIFICE				
CB3-O	CB03/04	MH06	ORIFICE				
CBmh02-ICD	CBMH02	CBMH02-Dummy	ORIFICE				
CBMH03-ICD	CBMH03	MH08	ORIFICE				
CBMH1-O(1)	CBMH01	CBMH01-Dummy	ORIFICE				
RY02-O	RY02	RY02-Dummy	ORIFICE				
CB01/02-O	CB01/02	MH04	OUTLET				
CB05/06-O	CB05/06	MH06	OUTLET				

****
Cross Section Summary
****

Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow
1_(104)_(1)_(STM)	CIRCULAR	0.60	0.28	0.15	0.60	1	502.03
1_(104)_(STM)	CIRCULAR	0.60	0.28	0.15	0.60	1	508.69
1_(11)_(STM)	CIRCULAR	0.45	0.16	0.11	0.45	1	192.43
1_(131)_(STM)	CIRCULAR	0.30	0.07	0.07	0.30	1	69.16
1_(135)_(STM)	RECT_OPEN	1.00	3.00	0.60	3.00	1	88384.99
1_(87)_(STM)	CIRCULAR	0.38	0.11	0.09	0.38	1	122.96
1_(9)_(STM)	CIRCULAR	0.45	0.16	0.11	0.45	1	180.33

19	RECT_OPEN	1.00	3.00	0.75	3.00	1	22432.52
2	TRAPEZOIDAL	1.00	3.30	0.50	6.30	1	15316.10
3	RECT_OPEN	1.00	3.00	0.60	3.00	1	43563.76
4	TRAPEZOIDAL	1.00	3.30	0.50	6.30	1	30322.01
4_1	18mROW	1.00	15.42	7.47	18.00	1	23562.63
4_2	18mROW	1.00	15.42	7.47	18.00	1	102706.27
5	18mROW	1.00	15.42	7.47	18.00	1	23795.13
6	18mROW	1.00	15.42	7.47	18.00	1	17703.31
7	18mROW	1.00	15.42	7.47	18.00	1	23016.65
8	18mROW	1.00	15.42	7.47	18.00	1	22542.02
CB01-CB03	CIRCULAR	0.20	0.03	0.05	0.20	1	33.41
CB01-HP	RECT_OPEN	1.00	3.00	0.75	3.00	1	52342.55
CB02-HP	RECT_OPEN	1.00	3.00	0.75	3.00	1	52342.55
CB03-HP	RECT_OPEN	1.00	3.00	0.75	3.00	1	52342.55
HP-CB01-CB02	RECT_OPEN	1.00	3.00	0.75	3.00	1	60559.26
HP-LC01-LC02	RECT_OPEN	1.00	3.00	0.75	3.00	1	31969.37
HP-LC03-CB01	RECT_OPEN	1.00	3.00	0.75	3.00	1	65758.23
HP-LCB01-RYCB02	TRAPEZOIDAL	1.00	3.30	0.50	6.30	1	24360.89
HP-LCB02-RYCB03	TRAPEZOIDAL	1.00	3.30	0.50	6.30	1	22008.41
HP-LCB04-LCB06	TRAPEZOIDAL	1.00	3.30	0.50	6.30	1	24857.83
HP-LCB05-RYCB07	TRAPEZOIDAL	1.00	3.30	0.50	6.30	1	26066.28
HP-LCB06-RYCB04	TRAPEZOIDAL	1.00	3.30	0.50	6.30	1	24109.24
HP-RYCB02-RYCB06	TRAPEZOIDAL	1.00	3.30	0.50	6.30	1	19711.89
HP-RYCB03-LCB01	TRAPEZOIDAL	1.00	3.30	0.50	6.30	1	27002.18
HP-RYCB05-LCB05	TRAPEZOIDAL	1.00	3.30	0.50	6.30	1	24360.89
HP-RYCB07-LCB04	TRAPEZOIDAL	1.00	3.30	0.50	6.30	1	26302.65
LC01-HP	RECT_OPEN	1.00	3.00	0.75	3.00	1	14736.76
LC01-RY01	CIRCULAR	0.30	0.07	0.07	0.30	1	144.51
LC02-HP	RECT_OPEN	1.00	3.00	0.75	3.00	1	18290.47
LC02-RY01	CIRCULAR	0.25	0.05	0.06	0.25	1	77.37
LC03-CB01	CIRCULAR	0.20	0.03	0.05	0.20	1	32.68
LC03-HP	RECT_OPEN	1.00	3.00	0.75	3.00	1	52342.55
LC04-CB02	CIRCULAR	0.25	0.05	0.06	0.25	1	58.51
LCB01-HP	TRAPEZOIDAL	1.00	3.30	0.50	6.30	1	15316.10
LCB01-LCB02	CIRCULAR	0.25	0.05	0.06	0.25	1	59.47
LCB02-HP	TRAPEZOIDAL	1.00	3.30	0.50	6.30	1	15316.10
LCB02-RYCB03	CIRCULAR	0.25	0.05	0.06	0.25	1	59.18
LCB04-HP	TRAPEZOIDAL	1.00	3.30	0.50	6.30	1	17134.69
LCB04-LCB08	CIRCULAR	0.25	0.05	0.06	0.25	1	42.37
LCB05-HP	TRAPEZOIDAL	1.00	3.30	0.50	6.30	1	15316.10
LCB05-RYCB05	CIRCULAR	0.25	0.05	0.06	0.25	1	41.54
LCB06-HP	TRAPEZOIDAL	1.00	3.30	0.50	6.30	1	18465.79
LCB06-RYCB04	CIRCULAR	0.25	0.05	0.06	0.25	1	59.77
LCB07-RYCB02	CIRCULAR	0.25	0.05	0.06	0.25	1	59.85
LCB08-CBMH02	CIRCULAR	0.25	0.05	0.06	0.25	1	36.58
LCB08-LCB05	CIRCULAR	0.25	0.05	0.06	0.25	1	42.37
M02-M04	CIRCULAR	0.38	0.11	0.09	0.38	1	123.08
M04-MH08	CIRCULAR	0.45	0.16	0.11	0.45	1	200.92
MH08-MH02	CIRCULAR	0.45	0.16	0.11	0.45	1	202.46
RY01-RY03	CIRCULAR	0.30	0.07	0.07	0.30	1	96.82
RY02-MH04	CIRCULAR	0.30	0.07	0.07	0.30	1	97.20
RY03-HP	RECT_OPEN	1.00	3.00	0.75	3.00	1	18290.47
RY03-RY02	CIRCULAR	0.30	0.07	0.07	0.30	1	96.36
RYCB01-RYCB06	CIRCULAR	0.25	0.05	0.06	0.25	1	59.59
RYCB02-HP	TRAPEZOIDAL	1.00	3.30	0.50	6.30	1	14527.05
RYCB02-RYCB01	CIRCULAR	0.25	0.05	0.06	0.25	1	59.20
RYCB03-CBMH03	CIRCULAR	0.25	0.05	0.06	0.25	1	51.62
RYCB03-HP	TRAPEZOIDAL	1.00	3.30	0.50	6.30	1	19407.38
RYCB04-CBMH04	CIRCULAR	0.25	0.05	0.06	0.25	1	59.35
RYCB04-Out-3	TRAPEZOIDAL	1.00	3.30	0.50	6.30	1	14926.66
RYCB05-HP	TRAPEZOIDAL	1.00	3.30	0.50	6.30	1	15316.10
RYCB05-LCB08	CIRCULAR	0.25	0.05	0.06	0.25	1	36.25
RYCB06-CBMH04	CIRCULAR	0.30	0.07	0.07	0.30	1	96.50
RYCB06-Out-1	TRAPEZOIDAL	1.00	3.30	0.50	6.30	1	14527.05
RYCB07-HP	TRAPEZOIDAL	1.00	3.30	0.50	6.30	1	15316.10
TD01-M02	CIRCULAR	0.25	0.05	0.06	0.25	1	59.87

****
Transect Summary
****

Transect 18mROW
Area:

0.0008	0.0034	0.0076	0.0136	0.0219
0.0328	0.0461	0.0605	0.0758	0.0919
0.1090	0.1269	0.1458	0.1655	0.1862
0.2077	0.2301	0.2533	0.2767	0.3000
0.3233	0.3466	0.3699	0.3933	0.4166
0.4399	0.4632	0.4866	0.5099	0.5332
0.5566	0.5799	0.6032	0.6266	0.6499

```
            0.6732     0.6966     0.7199     0.7432     0.7666
            0.7899     0.8133     0.8366     0.8599     0.8833
            0.9066     0.9300     0.9533     0.9767     1.0000
Hrad:
            0.0013     0.0026     0.0039     0.0051     0.0072
            0.0108     0.0163     0.0239     0.0327     0.0427
            0.0539     0.0662     0.0795     0.0938     0.1091
            0.1252     0.1421     0.1639     0.1905     0.2174
            0.2445     0.2718     0.2991     0.3265     0.3538
            0.3812     0.4084     0.4356     0.4627     0.4896
            0.5165     0.5432     0.5698     0.5963     0.6226
            0.6488     0.6749     0.7008     0.7265     0.7521
            0.7776     0.8029     0.8281     0.8531     0.8779
            0.9026     0.9272     0.9516     0.9759     1.0000
Width:
            0.0728     0.1455     0.2183     0.3006     0.4114
            0.5222     0.5967     0.6350     0.6733     0.7116
            0.7499     0.7882     0.8265     0.8648     0.9031
            0.9414     0.9797     0.9989     0.9989     0.9990
            0.9990     0.9990     0.9991     0.9991     0.9991
            0.9992     0.9992     0.9992     0.9993     0.9993
            0.9994     0.9994     0.9994     0.9995     0.9995
            0.9995     0.9996     0.9996     0.9996     0.9997
            0.9997     0.9997     0.9998     0.9998     0.9998
            0.9999     0.9999     0.9999     1.0000     1.0000


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

***************
Analysis Options
***************
Flow Units ..... LPS
Process Models:
  Rainfall/Runoff ..... YES
  RDII ..... NO
  Snowmelt ..... NO
  Groundwater ..... NO
  Flow Routing ..... YES
  Ponding Allowed ..... YES
  Water Quality ..... NO
Infiltration Method ..... HORTON
Flow Routing Method ..... DYNWAVE
Surcharge Method ..... EXTRAN
Starting Date ..... 07/22/2019 00:00:00
Ending Date ..... 07/23/2019 00:00:00
Antecedent Dry Days ..... 0.0
Report Time Step ..... 00:01:00
Wet Time Step ..... 00:01:00
Dry Time Step ..... 00:05:00
Routing Time Step ..... 2.00 sec
Variable Time Step ..... YES
Maximum Trials ..... 8
Number of Threads ..... 4
Head Tolerance ..... 0.001500 m


*********************
Control Actions Taken
*********************


**************************        Volume         Depth
Runoff Quantity Continuity     hectare-m            mm
**************************     ---------       -------
Total Precipitation .....          0.175        71.667
Evaporation Loss .....             0.000         0.000
Infiltration Loss .....            0.036        14.642
Surface Runoff .....               0.138        56.678
Final Storage .....                0.001         0.428
Continuity Error (%) .....       -0.114


**************************        Volume        Volume
Flow Routing Continuity        hectare-m      10^6 ltr
**************************     ---------      ---------
Dry Weather Inflow .....           0.000         0.000
Wet Weather Inflow .....           0.138         1.383
Groundwater Inflow .....           0.000         0.000
RDII Inflow .....                  0.000         0.000
External Inflow .....             0.000         0.001
External Outflow .....            0.138         1.382
Flooding Loss .....                0.000         0.000
Evaporation Loss .....             0.000         0.000
Exfiltration Loss .....            0.000         0.000
Initial Stored Volume ....         0.000         0.003
Final Stored Volume .....          0.000         0.003
Continuity Error (%) .....        0.171


*************************
Highest Continuity Errors
*************************
Node CB05/06 (-2.55%)
Node CB01/02 (-2.54%)


***************************
Time-Step Critical Elements
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Link HP-LCB04-LCB06 (2.97%)


*******************************
Highest Flow Instability Indexes
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Link RY02-O (3)
Link CBMH1-O(1) (2)


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Routing Time Step Summary
*************************
Minimum Time Step           :     0.50 sec
Average Time Step           :     1.97 sec
Maximum Time Step           :     2.00 sec
Percent in Steady State     :    -0.00
Average Iterations per Step :     2.00
Percent Not Converging      :     0.01
Time Step Frequencies       :
    2.000 -  1.516 sec      :    96.76 %
    1.516 -  1.149 sec      :     1.17 %
    1.149 -  0.871 sec      :     1.93 %
    0.871 -  0.660 sec      :     0.13 %
    0.660 -  0.500 sec      :     0.00 %


***************************
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      LPS
  ---------------------------------------------------------------------------------------------------------------
  A-01                            71.67       0.00       0.00      25.43      30.76      15.52      46.29
0.04     32.21   0.646
  A-02                            71.67       0.00       0.00      10.85      53.40       6.80      60.20
0.08     65.48   0.840
  A-03                            71.67       0.00       0.00       4.21      30.90      36.60      67.50
0.03     25.24   0.942
  A-04                            71.67       0.00       0.00      24.09      32.84      14.79      47.63
0.03     30.85   0.665
  A-05                            71.67       0.00       0.00       8.85      56.59       5.57      62.16
0.18    140.58   0.867
  A-06                            71.67       0.00       0.00      25.26      30.90      15.55      46.46
0.03     24.84   0.648
  A-07                            71.67       0.00       0.00      26.56      29.04      16.11      45.15
0.04     32.20   0.630
  A-08                            71.67       0.00       0.00       8.99      56.38       5.65      62.03
0.09     72.88   0.866
  A-09                            71.67       0.00       0.00      24.27      32.48      14.97      47.45
0.03     27.69   0.662
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A-10		71.67	0.00	0.00	32.01	20.94	18.76	39.70
0.04	39.24	0.554						
A-11		71.67	0.00	0.00	29.56	23.87	18.29	42.16
0.03	27.94	0.588						
A-12		71.67	0.00	0.00	31.85	20.50	18.92	39.42
0.01	8.72	0.550						
A-13		71.67	0.00	0.00	40.30	8.67	22.72	31.39
0.03	28.27	0.438						
A-14		71.67	0.00	0.00	37.43	12.19	22.08	34.27
0.02	17.50	0.478						
A-15		71.67	0.00	0.00	23.36	33.92	14.45	48.37
0.04	32.44	0.675						
A-16		71.67	0.00	0.00	9.09	56.23	5.61	61.84
0.22	170.67	0.863						
A-17		71.67	0.00	0.00	26.07	29.61	16.03	45.64
0.03	26.74	0.637						
B-01		71.67	0.00	0.00	1.02	60.14	9.23	69.38
0.03	21.80	0.968						
B-02		71.67	0.00	0.00	7.65	0.00	64.05	64.05
0.04	29.82	0.894						
B-03		71.67	0.00	0.00	6.86	0.00	64.92	64.92
0.00	1.98	0.906						
B-04		71.67	0.00	0.00	6.89	0.00	64.90	64.90
0.00	3.46	0.906						
B-05		71.67	0.00	0.00	1.22	58.19	11.04	69.23
0.03	20.31	0.966						
B-06		71.67	0.00	0.00	1.23	58.63	11.04	69.67
0.09	64.36	0.972						
B-07		71.67	0.00	0.00	1.19	58.21	11.08	69.28
0.01	7.44	0.967						
B-08		71.67	0.00	0.00	3.82	31.09	36.16	67.25
0.01	4.46	0.938						
B-09		71.67	0.00	0.00	6.89	0.00	64.90	64.90
0.01	3.96	0.906						
B-10		71.67	0.00	0.00	3.07	40.94	27.70	68.64
0.04	26.70	0.958						
B-11		71.67	0.00	0.00	6.08	13.05	52.28	65.34
0.01	10.25	0.912						
B-12		71.67	0.00	0.00	3.33	38.86	29.44	68.30
0.06	42.13	0.953						
B-13		71.67	0.00	0.00	3.66	35.81	32.19	68.01
0.06	40.00	0.949						
C-01		71.67	0.00	0.00	6.96	0.00	64.80	64.80
0.01	5.44	0.904						
C-02		71.67	0.00	0.00	2.60	44.15	24.02	68.17
0.01	4.46	0.951						
C-03		71.67	0.00	0.00	6.86	0.00	64.92	64.92
0.00	0.99	0.906						
C-04		71.67	0.00	0.00	6.86	0.00	64.92	64.92
0.00	1.48	0.906						

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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 hr:min	Reported Max Depth Meters
CB01/02	JUNCTION	0.00	0.10	77.62	0 01:10	0.10
CB03/04	JUNCTION	0.07	1.61	77.23	0 01:10	1.61
CB05/06	JUNCTION	0.00	0.14	76.87	0 01:10	0.14
D01	JUNCTION	0.00	0.08	76.78	0 01:10	0.08
HP01	JUNCTION	0.00	0.00	77.79	0 00:00	0.00
HP02	JUNCTION	0.01	0.10	77.19	0 01:16	0.10
HP-03	JUNCTION	0.00	0.01	76.43	0 01:14	0.01
HP-CB01-CB03	JUNCTION	0.00	0.00	78.13	0 00:00	0.00
HP-LC01	JUNCTION	0.00	0.00	77.80	0 00:00	0.00
HP-LC03	JUNCTION	0.00	0.00	78.30	0 00:00	0.00
HP-LCB01	JUNCTION	0.00	0.09	77.12	0 01:10	0.09
HP-LCB02	JUNCTION	0.00	0.00	77.53	0 00:00	0.00
HP-LCB04	JUNCTION	0.00	0.10	74.10	0 01:10	0.10
HP-LCB05	JUNCTION	0.00	0.02	74.72	0 01:10	0.02
HP-LCB06	JUNCTION	0.00	0.08	73.85	0 01:10	0.07
HP-LCB08	JUNCTION	0.00	0.00	75.56	0 00:00	0.00
HP-RYCB02	JUNCTION	0.00	0.01	76.72	0 01:10	0.01
HP-RYCB03	JUNCTION	0.00	0.00	77.44	0 00:00	0.00
HP-RYCB05	JUNCTION	0.00	0.00	75.00	0 00:00	0.00
HP-RYCB07	JUNCTION	0.00	0.05	74.38	0 01:10	0.05
RY02-Dummy	JUNCTION	0.01	0.09	75.33	0 01:23	0.09
TD01	JUNCTION	1.93	2.06	74.99	0 01:10	2.06
EX-MH159	OUTFALL	0.03	0.28	71.26	0 01:12	0.28
HP-CB02	OUTFALL	0.00	0.00	78.03	0 00:00	0.00
HP-LC02	OUTFALL	0.00	0.00	77.35	0 00:00	0.00
HP-LC04	OUTFALL	0.00	0.00	78.03	0 00:00	0.00
HP-RY03	OUTFALL	0.00	0.00	77.35	0 00:00	0.00
HW1_(STM)	OUTFALL	0.36	0.36	71.15	0 00:00	0.36
Out-1	OUTFALL	0.00	0.00	76.56	0 00:00	0.00
Out-2	OUTFALL	0.00	0.00	0.00	0 00:00	0.00
Out-3	OUTFALL	0.00	0.00	73.47	0 00:00	0.00
CB01	STORAGE	0.29	1.82	78.06	0 01:41	1.82
CB02	STORAGE	0.10	1.61	77.94	0 01:22	1.61
CB03	STORAGE	0.31	1.93	78.06	0 01:41	1.93
CBMH01	STORAGE	0.19	3.54	76.43	0 01:14	3.54
CBMH01-Dummy	STORAGE	0.02	0.23	73.12	0 01:14	0.23
CBMH02	STORAGE	0.31	3.03	74.89	0 01:10	3.01
CBMH02-Dummy	STORAGE	0.03	0.28	71.77	0 01:11	0.28
CBMH03	STORAGE	0.30	3.19	77.50	0 01:10	3.17
CBMH04	STORAGE	0.22	1.09	72.03	0 01:13	1.09
LC01	STORAGE	0.03	0.67	77.34	0 01:22	0.67
LC02	STORAGE	0.07	1.14	77.34	0 01:22	1.14
LC03	STORAGE	0.23	1.58	78.14	0 01:10	1.58
LC04	STORAGE	0.09	1.53	77.95	0 01:22	1.53
LCB01	STORAGE	0.14	1.74	77.17	0 01:10	1.74
LCB02	STORAGE	0.24	2.81	77.50	0 01:10	2.80
LCB04	STORAGE	0.14	1.40	74.15	0 01:10	1.40
LCB05	STORAGE	0.21	2.37	74.72	0 01:10	2.37
LCB06	STORAGE	0.03	1.97	73.87	0 01:10	1.96
LCB07	STORAGE	0.01	1.55	76.73	0 01:10	1.54
LCB08	STORAGE	0.27	2.84	74.89	0 01:10	2.83
M02	STORAGE	0.02	0.10	74.60	0 01:10	0.10
M04	STORAGE	0.02	0.17	74.43	0 01:10	0.17
MH02	STORAGE	0.03	0.28	72.05	0 01:11	0.28
MH04	STORAGE	0.03	0.39	72.58	0 01:14	0.39
MH06	STORAGE	0.02	0.30	72.90	0 01:12	0.30
MH08	STORAGE	0.02	0.16	72.32	0 01:11	0.16
RY01	STORAGE	0.09	1.43	77.34	0 01:22	1.43
RY02	STORAGE	0.16	2.08	77.32	0 01:23	2.08
RY03	STORAGE	0.13	1.89	77.34	0 01:23	1.89
RYCB01	STORAGE	0.02	1.28	76.00	0 01:10	1.27
RYCB02	STORAGE	0.02	1.78	76.72	0 01:10	1.78
RYCB03	STORAGE	0.18	2.35	77.44	0 01:10	2.34
RYCB04	STORAGE	0.03	2.12	73.46	0 01:11	2.11
RYCB05	STORAGE	0.24	2.67	74.86	0 01:10	2.66
RYCB06	STORAGE	0.01	0.43	74.85	0 01:11	0.43
RYCB07	STORAGE	0.17	1.86	74.41	0 01:10	1.85

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Node Inflow Summary
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Node	Type	Maximum Lateral Inflow LPS	Maximum Total Inflow LPS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 ltr	Total Inflow Volume 10^6 ltr	Flow Balance Error Percent	
CB01/02	JUNCTION	65.48	65.48	0 01:10	0.083	0.083	-2.479	
CB03/04	JUNCTION	140.58	162.17	0 01:10	0.182	0.201	0.673	
CB05/06	JUNCTION	72.88	75.66	0 01:10	0.0942	0.112	-2.489	
D01	JUNCTION	0.00	45.77	0 01:10	0	0.034	-0.793	
HP01	JUNCTION	0.00	0.00	0 00:00	0	0	0.000	ltr
HP02	JUNCTION	0.00	48.14	0 01:11	0	0.0241	18.932	
HP-03	JUNCTION	0.00	19.74	0 01:14	0	0.0078	0.002	
HP-CB01-CB03	JUNCTION	0.00	0.00	0 00:00	0	0	0.000	ltr
HP-LC01	JUNCTION	0.00	0.00	0 00:00	0	0	0.000	ltr
HP-LC03	JUNCTION	0.00	0.00	0 00:00	0	0	0.000	ltr
HP-LCB01	JUNCTION	0.00	88.01	0 01:10	0	0.0554	0.028	
HP-LCB02	JUNCTION	0.00	0.00	0 00:00	0	0	0.000	ltr
HP-LCB04	JUNCTION	0.00	114.17	0 01:10	0	0.0831	0.022	
HP-LCB05	JUNCTION	0.00	6.17	0 01:10	0	0.000394	0.277	
HP-LCB06	JUNCTION	0.00	62.93	0 01:10	0	0.012	0.202	
HP-LCB08	JUNCTION	0.00	0.00	0 00:00	0	0	0.000	ltr
HP-RYCB02	JUNCTION	0.00	3.61	0 01:10	0	7.1e-05	0.728	
HP-RYCB03	JUNCTION	0.00	0.00	0 00:00	0	0	0.000	ltr
HP-RYCB05	JUNCTION	0.00	0.00	0 00:00	0	0	0.000	ltr
HP-RYCB07	JUNCTION	0.00	36.13	0 01:10	0	0.00857	0.024	
RY02-Dummy	JUNCTION	0.00	19.16	0 01:23	0	0.129	-0.014	
TD01	JUNCTION	7.44	7.44	0 01:10	0.0104	0.0104	28.972	
EX-MH159	OUTFALL	0.00	227.90	0 01:12	0	1.08	0.000	
HP-CB02	OUTFALL	0.00	0.00	0 00:00	0	0	0.000	ltr

HP-LC02	OUTFALL	0.00	0.00	0	00:00	0	0	0.000 ltr
HP-LC04	OUTFALL	0.00	0.00	0	00:00	0	0	0.000 ltr
HP-RY03	OUTFALL	0.00	0.00	0	00:00	0	0	0.000 ltr
HW1_(STM)	OUTFALL	0.00	254.33	0	01:13	0	0.287	0.000
Out-1	OUTFALL	0.00	0.00	0	00:00	0	0	0.000 ltr
Out-2	OUTFALL	12.37	12.37	0	01:10	0.0165	0.0165	0.000
Out-3	OUTFALL	0.00	0.00	0	00:00	0	0	0.000 ltr
CB01	STORAGE	64.36	84.09	0	01:09	0.0905	0.128	0.027
CB02	STORAGE	21.80	26.81	0	01:03	0.0305	0.0759	0.008
CB03	STORAGE	20.31	97.13	0	01:04	0.0284	0.156	-0.054
CBMH01	STORAGE	170.67	215.81	0	01:10	0.223	0.257	0.150
CBMH01-Dummy	STORAGE	0.00	62.28	0	01:14	0	0.249	0.002
CBMH02	STORAGE	0.00	13.95	0	01:04	0	0.0731	0.001
CBMH02-Dummy	STORAGE	0.00	227.90	0	01:11	0	1.08	0.002
CBMH03	STORAGE	0.00	17.58	0	01:05	0	0.0633	0.007
CBMH04	STORAGE	8.72	254.95	0	01:12	0.00946	0.287	0.102
LC01	STORAGE	10.25	42.96	0	01:08	0.0144	0.0154	-0.137
LC02	STORAGE	42.13	46.12	0	01:09	0.0587	0.0587	0.255
LC03	STORAGE	26.70	26.70	0	01:10	0.037	0.0373	0.007
LC04	STORAGE	29.82	29.82	0	01:10	0.0448	0.0454	0.007
LCB01	STORAGE	36.66	88.41	0	01:10	0.0417	0.0729	-0.050
LCB02	STORAGE	34.19	42.26	0	01:05	0.0382	0.0748	0.052
LCB04	STORAGE	32.44	114.78	0	01:10	0.0358	0.096	-0.050
LCB05	STORAGE	24.84	61.17	0	01:10	0.0269	0.076	0.018
LCB06	STORAGE	17.50	131.02	0	01:10	0.0182	0.101	0.416
LCB07	STORAGE	3.96	26.16	0	01:07	0.00519	0.00646	-0.099
LCB08	STORAGE	26.74	30.13	0	01:04	0.0287	0.0816	0.069
M02	STORAGE	0.00	17.81	0	01:10	0	0.164	0.068
M04	STORAGE	0.00	51.19	0	01:10	0	0.368	-0.031
MH02	STORAGE	0.00	221.49	0	01:11	0	1.01	0.003
MH04	STORAGE	0.00	165.02	0	01:12	0	0.573	-0.215
MH06	STORAGE	0.00	143.24	0	01:12	0	0.506	0.212
MH08	STORAGE	0.00	57.32	0	01:10	0	0.432	-0.001
RY01	STORAGE	0.00	48.52	0	01:08	0	0.0743	0.051
RY02	STORAGE	0.00	36.30	0	01:07	0	0.129	0.012
RY03	STORAGE	40.00	75.09	0	01:06	0.0557	0.129	-0.146
RYCB01	STORAGE	27.94	133.75	0	01:10	0.0278	0.133	0.220
RYCB02	STORAGE	39.24	127.12	0	01:10	0.0448	0.107	0.038
RYCB03	STORAGE	34.31	56.86	0	01:10	0.0388	0.0678	0.011
RYCB04	STORAGE	28.27	151.57	0	01:10	0.0336	0.134	-0.961
RYCB05	STORAGE	25.24	40.81	0	01:10	0.0344	0.0776	0.010
RYCB06	STORAGE	0.00	128.59	0	01:10	0	0.133	-0.001
RYCB07	STORAGE	27.69	85.19	0	01:10	0.0304	0.0845	-0.022

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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 LPS
CB01	0.004	5	0	0	0.046	56	0 01:41	77.33
CB02	0.000	0	0	0	0.003	8	0 01:22	17.90
CB03	0.006	10	0	0	0.039	71	0 01:41	10.52
CBMH01	0.003	3	0	0	0.076	97	0 01:14	82.03
CBMH01-Dummy	0.000	1	0	0	0.000	7	0 01:14	62.28
CBMH02	0.000	6	0	0	0.000	59	0 01:10	6.49
CBMH02-Dummy	0.000	1	0	0	0.000	5	0 01:11	227.90
CBMH03	0.000	9	0	0	0.000	91	0 01:10	6.66
CBMH04	0.000	4	0	0	0.000	20	0 01:13	254.33
LC01	0.000	1	0	0	0.000	11	0 01:22	18.29
LC02	0.000	3	0	0	0.007	87	0 01:22	40.30
LC03	0.000	1	0	0	0.002	13	0 01:10	20.74
LC04	0.001	1	0	0	0.016	36	0 01:22	11.74
LCB01	0.000	6	0	0	0.000	72	0 01:10	88.01
LCB02	0.000	7	0	0	0.000	77	0 01:10	30.60
LCB04	0.000	7	0	0	0.000	70	0 01:10	114.17
LCB05	0.000	7	0	0	0.000	75	0 01:10	59.36
LCB06	0.000	1	0	0	0.000	76	0 01:10	126.09
LCB07	0.000	1	0	0	0.000	65	0 01:10	8.33
LCB08	0.000	6	0	0	0.000	66	0 01:10	23.80
M02	0.000	0	0	0	0.000	3	0 01:10	17.81
M04	0.000	1	0	0	0.000	4	0 01:10	50.68
MH02	0.000	0	0	0	0.000	5	0 01:11	221.53
MH04	0.000	1	0	0	0.000	8	0 01:14	164.90
MH06	0.000	1	0	0	0.000	7	0 01:12	143.22
MH08	0.000	0	0	0	0.000	3	0 01:11	57.21
RY01	0.000	6	0	0	0.001	94	0 01:22	36.40
RY02	0.000	6	0	0	0.001	77	0 01:23	19.16
RY03	0.001	6	0	0	0.023	92	0 01:23	36.30
RYCB01	0.000	1	0	0	0.000	47	0 01:10	126.73
RYCB02	0.000	1	0	0	0.000	69	0 01:10	111.11
RYCB03	0.000	6	0	0	0.000	77	0 01:10	52.90
RYCB04	0.000	1	0	0	0.000	72	0 01:11	122.07
RYCB05	0.000	7	0	0	0.000	74	0 01:10	37.88
RYCB06	0.000	0	0	0	0.000	14	0 01:11	127.12
RYCB07	0.000	7	0	0	0.000	72	0 01:10	84.16

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Outfall Loading Summary
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Outfall Node	Flow Freq Pcnt	Avg Flow LPS	Max Flow LPS	Total Volume 10^6 ltr
EX-MH159	26.65	58.46	227.90	1.079
HP-CB02	0.00	0.00	0.00	0.000
HP-LC02	0.00	0.00	0.00	0.000
HP-LC04	0.00	0.00	0.00	0.000
HP-RY03	0.00	0.00	0.00	0.000
HW1_(STM)	53.87	10.30	254.33	0.287
Out-1	0.00	0.00	0.00	0.000
Out-2	13.33	2.04	12.37	0.016
Out-3	0.00	0.00	0.00	0.000
System	10.43	70.80	485.97	1.383

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Link Flow Summary
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Link	Type	Maximum |Flow| LPS	Time of Max Occurrence days hr:min	Maximum |Veloc| m/sec	Max/ Full Flow	Max/ Full Depth
1_(104)_(1)_(STM)	CONDUIT	227.90	0 01:12	1.73	0.45	0.47
1_(104)_(STM)	CONDUIT	221.53	0 01:11	1.71	0.44	0.47
1_(11)_(STM)	CONDUIT	164.90	0 01:15	1.28	0.86	0.75
1_(131)_(STM)	CONDUIT	62.28	0 01:14	1.18	0.90	0.70
1_(135)_(STM)	CONDUIT	19.74	0 01:14	1.23	0.00	0.01
1_(87)_(STM)	CONDUIT	254.33	0 01:13	2.31	2.07	0.98
1_(9)_(STM)	CONDUIT	143.22	0 01:12	1.20	0.79	0.76
19	CONDUIT	0.00	0 00:00	0.00	0.00	0.11
2	CONDUIT	0.00	0 00:00	0.00	0.00	0.00
3	CONDUIT	19.74	0 01:14	0.05	0.00	0.15
4	CONDUIT	0.00	0 00:00	0.00	0.00	0.03
4_1	CHANNEL	45.77	0 01:10	0.11	0.00	0.11
4_2	CHANNEL	45.61	0 01:10	0.12	0.00	0.18
5	CHANNEL	23.24	0 01:16	0.06	0.00	0.11
6	CHANNEL	48.14	0 01:11	0.07	0.00	0.15
7	CHANNEL	22.79	0 01:10	0.03	0.00	0.16
8	CHANNEL	0.00	0 00:00	0.00	0.00	0.05
CB01-CB03	CONDUIT	77.33	0 01:04	2.46	2.31	1.00
CB01-HP	CONDUIT	0.00	0 00:00	0.00	0.00	0.12
CB02-HP	CONDUIT	0.00	0 00:00	0.00	0.00	0.11
CB03-HP	CONDUIT	0.00	0 00:00	0.00	0.00	0.11
HP-CB01-CB02	CONDUIT	0.00	0 00:00	0.00	0.00	0.11
HP-LC01-LC02	CONDUIT	0.00	0 00:00	0.00	0.00	0.07
HP-LC03-CB01	CONDUIT	0.00	0 00:00	0.00	0.00	0.12
HP-LCB01-RYCB02	CONDUIT	88.49	0 01:10	1.76	0.00	0.14
HP-LCB02-RYCB03	CONDUIT	0.00	0 00:00	0.00	0.00	0.16
HP-LCB04-LCB06	CONDUIT	114.17	0 01:10	1.85	0.00	0.24

HP-LCB05-RYCB07	CONDUIT	6.13	0	01:10	0.06	0.00	0.15
HP-LCB06-RYCB04	CONDUIT	63.18	0	01:10	1.59	0.00	0.12
HP-RYCB02-RYCB06	CONDUIT	2.14	0	01:10	0.48	0.00	0.01
HP-RYCB03-LCB01	CONDUIT	0.00	0	00:00	0.00	0.00	0.17
HP-RYCB05-LCB05	CONDUIT	0.00	0	00:00	0.00	0.00	0.11
HP-RYCB07-LCB04	CONDUIT	36.11	0	01:10	0.16	0.00	0.23
LC01-HP	CONDUIT	0.00	0	00:00	0.00	0.00	0.00
LC01-RY01	CONDUIT	33.14	0	01:08	0.53	0.23	1.00
LC02-HP	CONDUIT	0.00	0	00:00	0.00	0.00	0.10
LC02-RY01	CONDUIT	40.30	0	01:08	1.21	0.52	1.00
LC03-CB01	CONDUIT	20.74	0	01:04	0.66	0.63	1.00
LC03-HP	CONDUIT	0.00	0	00:00	0.00	0.00	0.07
LC04-CB02	CONDUIT	11.74	0	01:53	0.24	0.20	1.00
LCB01-HP	CONDUIT	88.01	0	01:10	0.44	0.01	0.21
LCB01-LCB02	CONDUIT	52.90	0	01:10	1.08	0.89	1.00
LCB02-HP	CONDUIT	0.00	0	00:00	0.00	0.00	0.08
LCB02-RYCB03	CONDUIT	22.95	0	01:10	0.52	0.39	1.00
LCB04-HP	CONDUIT	114.17	0	01:10	0.44	0.01	0.25
LCB04-LCB08	CONDUIT	48.16	0	01:10	0.98	1.14	1.00
LCB05-HP	CONDUIT	6.17	0	01:10	0.08	0.00	0.12
LCB05-RYCB05	CONDUIT	37.88	0	01:10	0.77	0.91	1.00
LCB06-HP	CONDUIT	62.93	0	01:10	0.27	0.00	0.23
LCB06-RYCB04	CONDUIT	86.64	0	01:08	1.77	1.45	1.00
LCB07-RYCB02	CONDUIT	22.21	0	01:07	0.48	0.37	1.00
LCB08-CBMH02	CONDUIT	13.95	0	01:04	0.38	0.38	1.00
LCB08-LCB05	CONDUIT	53.35	0	01:10	1.09	1.26	1.00
M02-M04	CONDUIT	17.81	0	01:10	0.80	0.14	0.26
M04-MH08	CONDUIT	50.68	0	01:10	1.00	0.25	0.36
MH08-MH02	CONDUIT	57.21	0	01:11	1.09	0.28	0.36
RY01-RY03	CONDUIT	36.40	0	01:06	0.77	0.38	1.00
RY02-MH04	CONDUIT	19.16	0	01:23	1.03	0.20	0.31
RY03-HP	CONDUIT	0.00	0	00:00	0.00	0.00	0.09
RY03-RY02	CONDUIT	36.30	0	01:07	0.51	0.38	1.00
RYCB01-RYCB06	CONDUIT	126.73	0	01:10	2.58	2.13	1.00
RYCB02-HP	CONDUIT	3.61	0	01:10	0.06	0.00	0.10
RYCB02-RYCB01	CONDUIT	107.81	0	01:11	2.20	1.82	1.00
RYCB03-CBMH03	CONDUIT	17.58	0	01:05	0.44	0.34	1.00
RYCB03-HP	CONDUIT	0.00	0	00:00	0.00	0.00	0.16
RYCB04-CBMH04	CONDUIT	122.07	0	01:11	2.49	2.06	1.00
RYCB04-Out-3	CONDUIT	0.00	0	00:00	0.00	0.00	0.09
RYCB05-HP	CONDUIT	0.00	0	00:00	0.00	0.00	0.03
RYCB05-LCB08	CONDUIT	16.59	0	01:10	0.38	0.46	1.00
RYCB06-CBMH04	CONDUIT	127.12	0	01:11	1.84	1.32	0.95
RYCB06-Out-1	CONDUIT	0.00	0	00:00	0.00	0.00	0.00
RYCB07-HP	CONDUIT	36.13	0	01:10	0.27	0.00	0.17
TD01-M02	CONDUIT	7.44	0	01:10	0.83	0.12	0.24
CB02-O	ORIFICE	14.98	0	01:22			1.00
CB03-O	ORIFICE	10.52	0	01:41			1.00
CB04-O	ORIFICE	27.54	0	01:10			1.00
CB3-O	ORIFICE	27.54	0	01:10			1.00
CBmh02-ICD	ORIFICE	6.49	0	01:10			1.00
CBMH03-ICD	ORIFICE	6.66	0	01:10			1.00
CBMH1-O(1)	ORIFICE	62.28	0	01:14			1.00
RY02-O	ORIFICE	19.16	0	01:23			1.00
CB01/02-O	DUMMY	21.80	0	01:01			
CB05/06-O	DUMMY	26.00	0	01:01			

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Flow Classification Summary
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Conduit	Adjusted /Actual Length	Dry	Up Dry	Down Dry	Sub Crit	Sup Crit	Up Crit	Down Crit	Norm Ltd	Inlet Ctrl
		Fraction of Time in Flow Class								
1_(104)_(1)_(STM)	1.00	0.01	0.00	0.00	0.76	0.24	0.00	0.00	0.85	0.00
1_(104)_(STM)	1.00	0.01	0.00	0.00	0.81	0.18	0.00	0.00	0.93	0.00
1_(11)_(STM)	1.00	0.01	0.00	0.00	0.00	0.00	0.00	0.99	0.00	0.00
1_(131)_(STM)	1.00	0.01	0.00	0.00	0.00	0.00	0.00	0.99	0.00	0.00
1_(135)_(STM)	1.00	0.98	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00
1_(87)_(STM)	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
1_(9)_(STM)	1.00	0.01	0.00	0.00	0.13	0.00	0.00	0.86	0.06	0.00
19	1.00	0.94	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	1.00	0.95	0.03	0.00	0.02	0.00	0.00	0.00	0.94	0.00
4	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4_1	1.00	0.01	0.50	0.00	0.49	0.00	0.00	0.00	0.87	0.00
4_2	1.00	0.01	0.00	0.00	0.05	0.00	0.00	0.94	0.03	0.00
5	1.00	0.01	0.04	0.00	0.96	0.00	0.00	0.00	0.02	0.00
6	1.00	0.04	0.00	0.00	0.04	0.00	0.00	0.92	0.00	0.00
7	1.00	0.76	0.00	0.00	0.04	0.00	0.00	0.20	0.02	0.00
8	1.00	0.76	0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CB01-CB03	1.00	0.01	0.00	0.00	0.99	0.00	0.00	0.00	0.04	0.00
CB01-HP	1.00	0.86	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CB02-HP	1.00	0.94	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CB03-HP	1.00	0.86	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HP-CB01-CB02	1.00	0.94	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HP-LC01-LC02	1.00	0.96	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HP-LC03-CB01	1.00	0.86	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HP-LCB01-RYCB02	1.00	0.96	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.00
HP-LCB02-RYCB03	1.00	0.98	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HP-LCB04-LCB06	1.00	0.95	0.00	0.00	0.01	0.00	0.00	0.04	0.01	0.00
HP-LCB05-RYCB07	1.00	0.98	0.01	0.00	0.01	0.00	0.00	0.00	0.95	0.00
HP-LCB06-RYCB04	1.00	0.99	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00
HP-RYCB02-RYCB06	1.00	0.99	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00
HP-RYCB03-LCB01	1.00	0.94	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HP-RYCB05-LCB05	1.00	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HP-RYCB07-LCB04	1.00	0.92	0.06	0.00	0.02	0.00	0.00	0.00	0.95	0.00
LC01-HP	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
LC01-RY01	1.00	0.02	0.00	0.00	0.09	0.01	0.00	0.89	0.04	0.00
LC02-HP	1.00	0.95	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00
LC02-RY01	1.00	0.01	0.00	0.00	0.08	0.00	0.00	0.91	0.00	0.00
LC03-CB01	1.00	0.01	0.00	0.00	0.22	0.00	0.00	0.78	0.02	0.00
LC03-HP	1.00	0.89	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00
LC04-CB02	1.00	0.02	0.01	0.00	0.97	0.00	0.00	0.00	0.91	0.00
LCB01-HP	1.00	0.94	0.01	0.00	0.04	0.00	0.00	0.00	0.93	0.00
LCB01-LCB02	1.00	0.01	0.00	0.00	0.99	0.00	0.00	0.00	0.12	0.00
LCB02-HP	1.00	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
LCB02-RYCB03	1.00	0.01	0.00	0.00	0.99	0.00	0.00	0.00	0.87	0.00
LCB04-HP	1.00	0.92	0.03	0.00	0.05	0.00	0.00	0.00	0.92	0.00
LCB04-LCB08	1.00	0.01	0.00	0.00	0.99	0.00	0.00	0.00	0.86	0.00
LCB05-HP	1.00	0.99	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00
LCB05-RYCB05	1.00	0.01	0.00	0.00	0.99	0.00	0.00	0.00	0.13	0.00
LCB06-HP	1.00	0.99	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00
LCB06-RYCB04	1.00	0.01	0.00	0.00	0.02	0.00	0.00	0.97	0.00	0.00
LCB07-RYCB02	1.00	0.01	0.02	0.00	0.97	0.00	0.00	0.00	0.96	0.00
LCB08-CBMH02	1.00	0.01	0.00	0.00	0.22	0.00	0.00	0.77	0.01	0.00
LCB08-LCB05	1.00	0.01	0.00	0.00	0.99	0.00	0.00	0.00	0.84	0.00
M02-M04	1.00	0.01	0.00	0.00	0.05	0.00	0.00	0.94	0.04	0.00
M04-MH08	1.00	0.01	0.00	0.00	0.00	0.00	0.00	0.99	0.00	0.00
MH08-MH02	1.00	0.01	0.00	0.00	0.00	0.00	0.00	0.99	0.00	0.00
RY01-RY03	1.00	0.01	0.00	0.00	0.11	0.00	0.00	0.88	0.02	0.00
RY02-MH04	1.00	0.01	0.00	0.00	0.00	0.00	0.00	0.99	0.00	0.00
RY03-HP	1.00	0.95	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RY03-RY02	1.00	0.01	0.00	0.00	0.13	0.00	0.00	0.86	0.02	0.00
RYCB01-RYCB06	1.00	0.01	0.00	0.00	0.01	0.00	0.00	0.99	0.00	0.00
RYCB02-HP	1.00	0.99	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RYCB02-RYCB01	1.00	0.01	0.00	0.00	0.95	0.04	0.00	0.00	0.98	0.00
RYCB03-CBMH03	1.00	0.01	0.00	0.00	0.18	0.00	0.00	0.81	0.03	0.00
RYCB03-HP	1.00	0.98	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RYCB04-CBMH04	1.00	0.00	0.73	0.00	0.24	0.01	0.00	0.02	0.96	0.00
RYCB04-Out-3	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RYCB05-HP	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RYCB05-LCB08	1.00	0.01	0.02	0.00	0.98	0.00	0.00	0.00	0.81	0.00
RYCB06-CBMH04	1.00	0.01	0.00	0.00	0.00	0.00	0.00	0.99	0.00	0.00
RYCB06-Out-1	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RYCB07-HP	1.00	0.98	0.00	0.00	0.02	0.00	0.00	0.00	0.01	0.00
TD01-M02	1.00	0.04	0.00	0.00	0.00	0.00	0.00	0.96	0.00	0.00

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Conduit Surcharge Summary
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Conduit	Hours Full: Both Ends	Hours Full: Upstream	Hours Full: Dnstream	Hours Above Full Normal Flow	Hours Capacity Limited
1_(87)_(STM)	0.01	0.26	0.01	0.25	0.01
CB01-CB03	4.59	4.59	4.87	0.06	0.06
LC01-RY01	0.90	0.90	1.46	0.01	0.01
LC02-RY01	1.20	1.20	1.30	0.01	0.01
LC03-CB01	3.98	3.98	4.46	0.01	0.01
LC04-CB02	1.23	1.23	1.29	0.01	0.01
LCB01-LCB02	2.21	2.21	2.53	0.01	0.01
LCB02-RYCB03	2.53	2.53	3.02	0.01	0.01
LCB04-LCB08	2.74	2.74	3.07	0.15	0.01
LCB05-RYCB05	3.49	3.49	3.80	0.01	0.01
LCB06-RYCB04	0.26	0.26	0.28	0.16	0.19
LCB07-RYCB02	0.15	0.15	0.19	0.01	0.01
LCB08-CBMH02	4.13	4.13	4.52	0.01	0.01

LCB08-LCB05	3.07	3.07	3.49	0.09	0.01
RY01-RY03	1.50	1.50	1.96	0.01	0.01
RY03-RY02	1.99	1.99	2.23	0.01	0.01
RYCB01-RYCB06	0.09	0.20	0.09	0.21	0.09
RYCB02-RYCB01	0.19	0.19	0.20	0.18	0.17
RYCB03-CBMH03	3.02	3.02	3.56	0.01	0.01
RYCB04-CBMH04	0.25	0.29	0.25	0.28	0.25
RYCB05-LCB08	3.80	3.80	4.13	0.01	0.01
RYCB06-CBMH04	0.01	0.08	0.01	0.11	0.01

Analysis begun on: Mon May 10 13:14:16 2021
Analysis ended on: Mon May 10 13:14:21 2021
Total elapsed time: 00:00:05

STORM SEWER: HYDRAULIC GRADE LINE ANALYSIS (100-YEAR EVENT - ULTIMATE CONDITION)

This spreadsheet uses the Darcy-Weisbach equation to calculate hydraulic losses through a pipe network with a specified flow rate. Minor losses are accounted for including both pipe bend losses and structure losses.
The spreadsheet returns the upstream hydraulic grade line if surcharged, or the pipe obvert if free flow conditions exist. The slope of the HGL is calculated and the minimum USF elevations can be established +0.30m above the HGL.
The theoretical 100-year event storm sewer peak flows will be controlled to the actual 5-year flow rates using various roadway inlet controls within CBs. Additional flows will be directed using overland flow routes.
The Ultimate Condition accounts for the entire drainage areas flowing through the completed storm sewer network.

LOCATION	MANHOLE		INVERT ELEVATION		GROUND ELEVATION	COVER	PIPE PARAMETERS			TOTAL FLOW	Q_{cap}	Q_{in}/Q_{cap}	COMPUTATIONAL COLUMNS					HEAD LOSS	SURCHARGE	HGL			PIPE SLOPE	MIN. USF ELEVATION
	Upstream	Downstream	U/S (m)	D/S (m)	Upstream (m)	Upstream (m)	Dia (mm)	Length (m)	'n'	(m^3/s)	(m^3/s)		Pipe Area (m^2)	L/D	Friction Factor (f)	Velocity V (m/s)	$V^2/2g$	HL (m)	Upstream (m)	U/S (m)	D/S (m)	SLOPE (%)	(%)	Upstream (m)
KLONDIKE ROAD																				67.57	<- OUTLET TO POND			
	FUT.MH C	OUTLET	65.93	65.90	67.95	0.670	1350	13.80	0.013	1.714	2.596	0.66	1.478	10	0.01905	1.16	0.07	0.05	0.34	67.62	67.57	0.35	0.14	67.92
	FUT.MH B	FUT.MH C	66.02	65.93	68.55	1.180	1350	51.00	0.013	1.738	2.339	0.74	1.478	38	0.01905	1.18	0.07	0.09	0.34	67.71	67.62	0.17	0.13	68.01
	FUT.MH A	FUT.MH B	66.24	66.05	68.87	1.280	1350	117.00	0.013	1.797	2.244	0.80	1.478	87	0.01905	1.22	0.08	0.14	0.26	67.85	67.71	0.12	0.13	68.15
	MH 153	FUT.MH A	66.40	66.24	70.01	2.260	1350	108.50	0.013	1.447	2.138	0.68	1.478	80	0.01905	0.98	0.05	0.09	0.19	67.94	67.85	0.08	0.13	68.24
	MH 154	MH 153	66.63	66.55	70.18	2.350	1200	39.90	0.013	1.441	1.821	0.79	1.167	33	0.01981	1.23	0.08	0.07	0.17	68.00	67.94	0.17	0.20	68.30
PHASE2																								
	MH 163	MH 154	66.97	66.90	70.25	2.380	900	65.0	0.013	0.180	0.620	0.29	0.657	72	0.02181	0.27	0.00	0.01	0.14	68.01	68.00	0.01	0.11	68.31
	MH 164	MH 163	67.33	67.27	69.82	1.890	600	41.5	0.013	0.159	0.244	0.65	0.292	69	0.02496	0.54	0.02	0.04	0.12	68.05	68.01	0.09	0.14	68.35
	MH 165	MH 164	67.59	67.41	70.15	2.035	525	110.0	0.013	0.161	0.181	0.89	0.223	210	0.02610	0.72	0.03	0.15	0.09	68.20	68.05	0.14	0.16	68.50
	MH 166	MH 165	67.87	67.67	70.50	2.180	450	90.3	0.013	0.126	0.140	0.90	0.164	201	0.02747	0.77	0.03	0.19	0.08	68.40	68.20	0.21	0.22	68.70
	MH 167	MH 166	68.25	68.02	70.50	1.950	300	66.4	0.013	0.045	0.059	0.75	0.073	221	0.03145	0.61	0.02	0.13	0.00	68.55	68.40	0.23	0.35	68.85
KLONDIKE ROAD																								
	MH 155	MH 154	66.78	66.63	70.12	2.140	1200	117.00	0.013	1.335	1.456	0.92	1.167	98	0.01981	1.14	0.07	0.14	0.17	68.15	68.00	0.11	0.13	68.45
	MH 156	MH 155	66.90	66.78	70.39	2.290	1200	91.30	0.013	1.279	1.475	0.87	1.167	76	0.01981	1.10	0.06	0.10	0.15	68.25	68.15	0.11	0.13	68.55
	MH 157	MH 156	67.03	66.90	70.29	2.060	1200	97.00	0.013	1.214	1.489	0.82	1.167	81	0.01981	1.04	0.06	0.10	0.12	68.35	68.25	0.10	0.13	68.65
MARCONI AVENUE																								
	MH 160	MH 157	68.08	67.78	70.64	2.110	450	120.00	0.013	0.129	0.149	0.87	0.164	267	0.02747	0.79	0.03	0.28	0.10	68.63	68.35	0.23	0.25	68.93
	MH 161	MH 160	68.35	68.23	70.87	2.220	300	23.90	0.013	0.023	0.071	0.32	0.073	80	0.03145	0.32	0.01	0.01	0.00	68.65	68.63	0.10	0.50	68.95
	MH 162	MH 161	68.50	68.38	71.50	2.700	300	24.60	0.013	0.000	0.070	0.00	0.073	82	0.03145	0.00	0.00	0.00	0.00	68.80	68.68	0.49	0.49	69.10
KLONDIKE ROAD																								
	MH 158	MH 157	68.30	67.40	71.78	2.655	825	120.00	0.013	1.064	1.297	0.82	0.552	145	0.02245	1.93	0.19	0.66	0.00	69.13	68.35	0.65	0.75	69.43
	MH 159	MH 158	68.90	68.30	74.79	5.065	825	94.00	0.013	0.932	1.196	0.78	0.552	114	0.02245	1.69	0.15	0.40	0.00	69.73	69.13	0.64	0.64	70.03
TER LEVEL at Outlet = 67.57m																								

TEMPEST Product Submittal Package

Date: May 12, 2021

Customer: Novatech

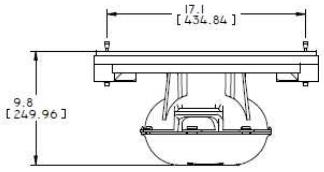
Contact: Lucas Wilson

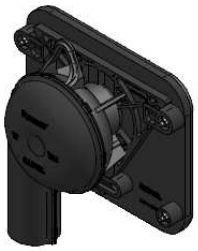
Location:

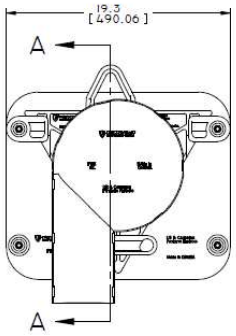
Project Name: Klondike Road

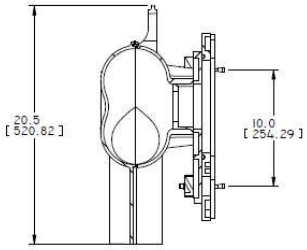
IPEX

Tempest LMF ICD Sq Shop Drawing

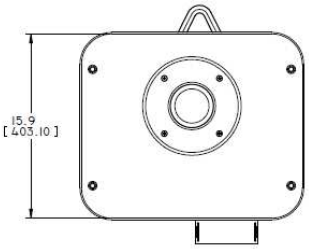








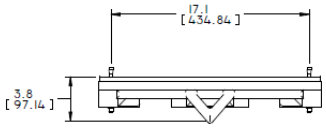
SECTION A-A

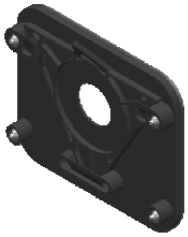


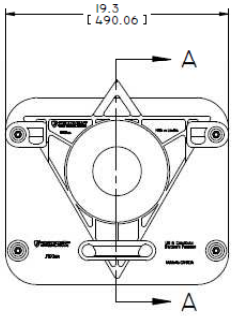
TOLERANCES	IPEX TECHNOLOGIES INC.				
PROJECTION	UNITS	TITLE	LMF SQUARE CB ASSEMBLY		
	in (mm)				
DRAWN BY	DATE	SIZE	SCALE(S)	SHEET	
H. M-MARTIN	2011-07-27	B	1/8	1 OF 1	
VERIFIED BY	DATE	DRAWING NUMBER		REV	
	2011-07-27	SGM74_FA00IR03		3	

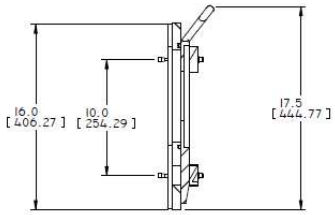
IPEX

Tempest MHF ICD Sq Shop Drawing









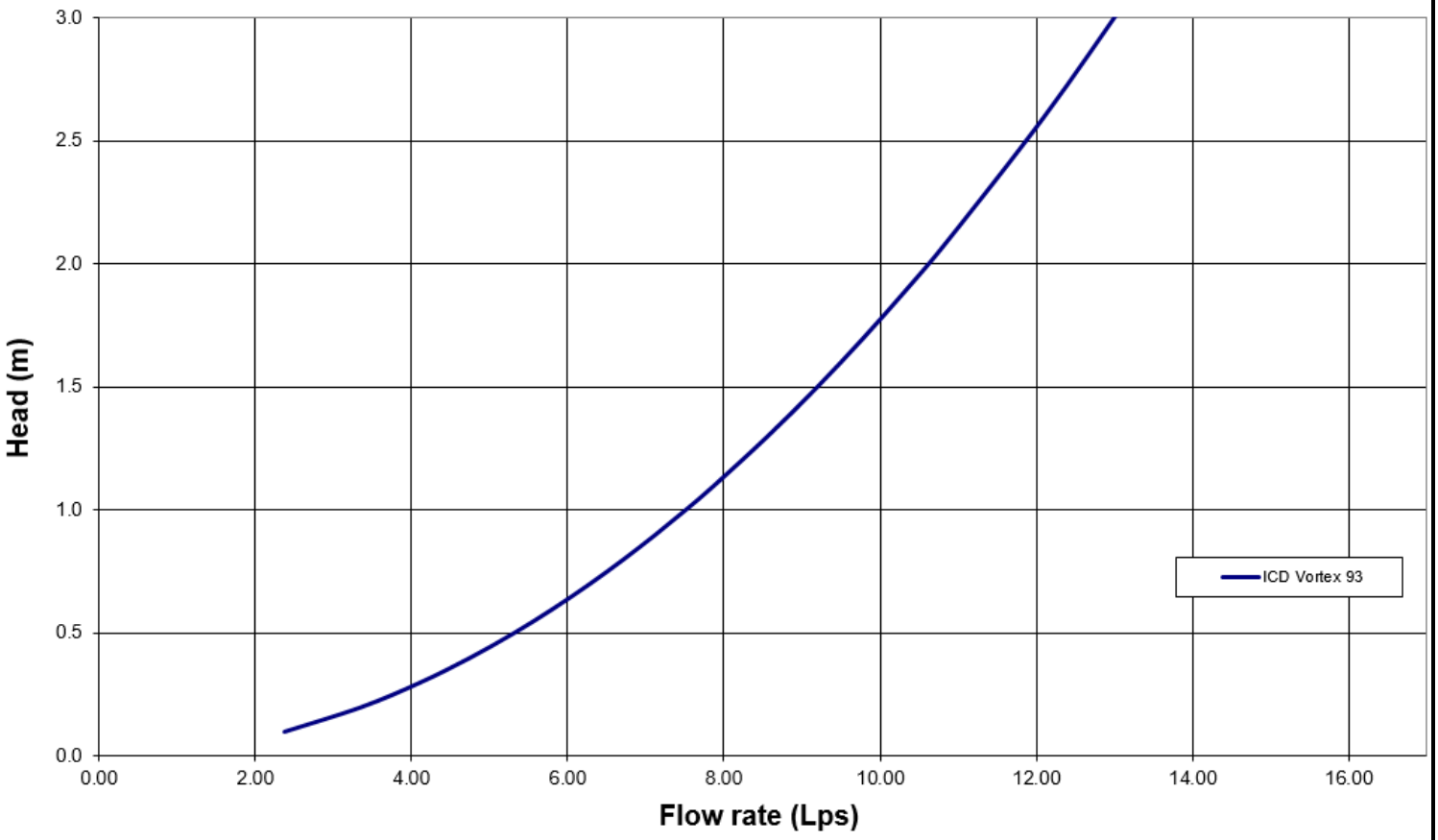
SECTION A-A

TOLERANCES:	IPEX TECHNOLOGIES INC.			
	PROJECTION	UNITS: in (mm)	TITLE: MHF SQUARE CB ASSEMBLY	
	DRAWN BY: H. M-MARTIN	DATE: 2011-07-25	SIZE: B	SCALE(S): 1/8
	VERIFIED BY	DATE: 2011-07-25	DRAWING NUMBER: SQH74_FA007R01	REV: 1

IPEX

Tempest LMF ICD Flow Curve

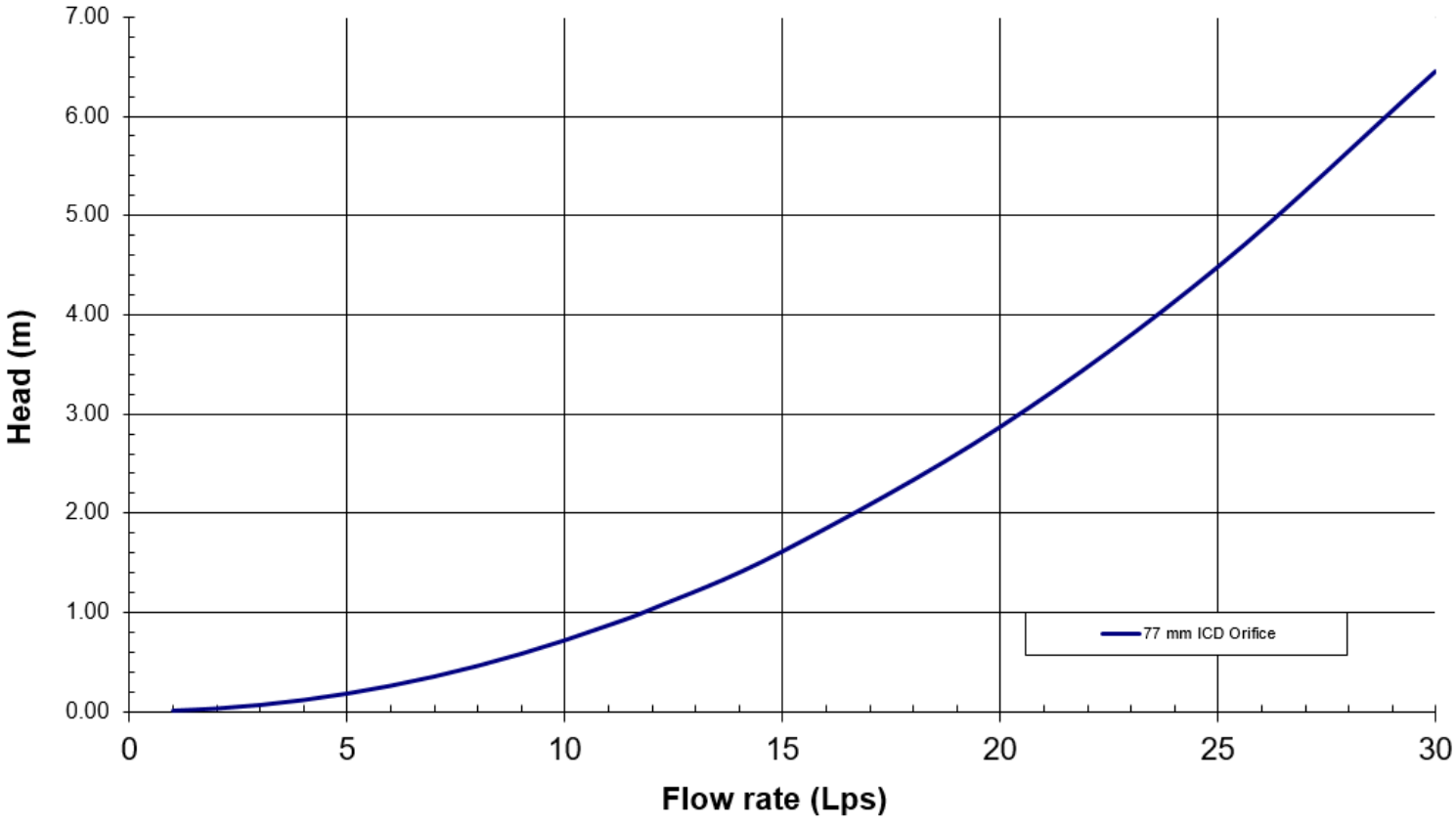
Flow: 10.5 L/s
Head: 1.93 m
CB03



IPEX

Tempest MHF ICD Flow Curve

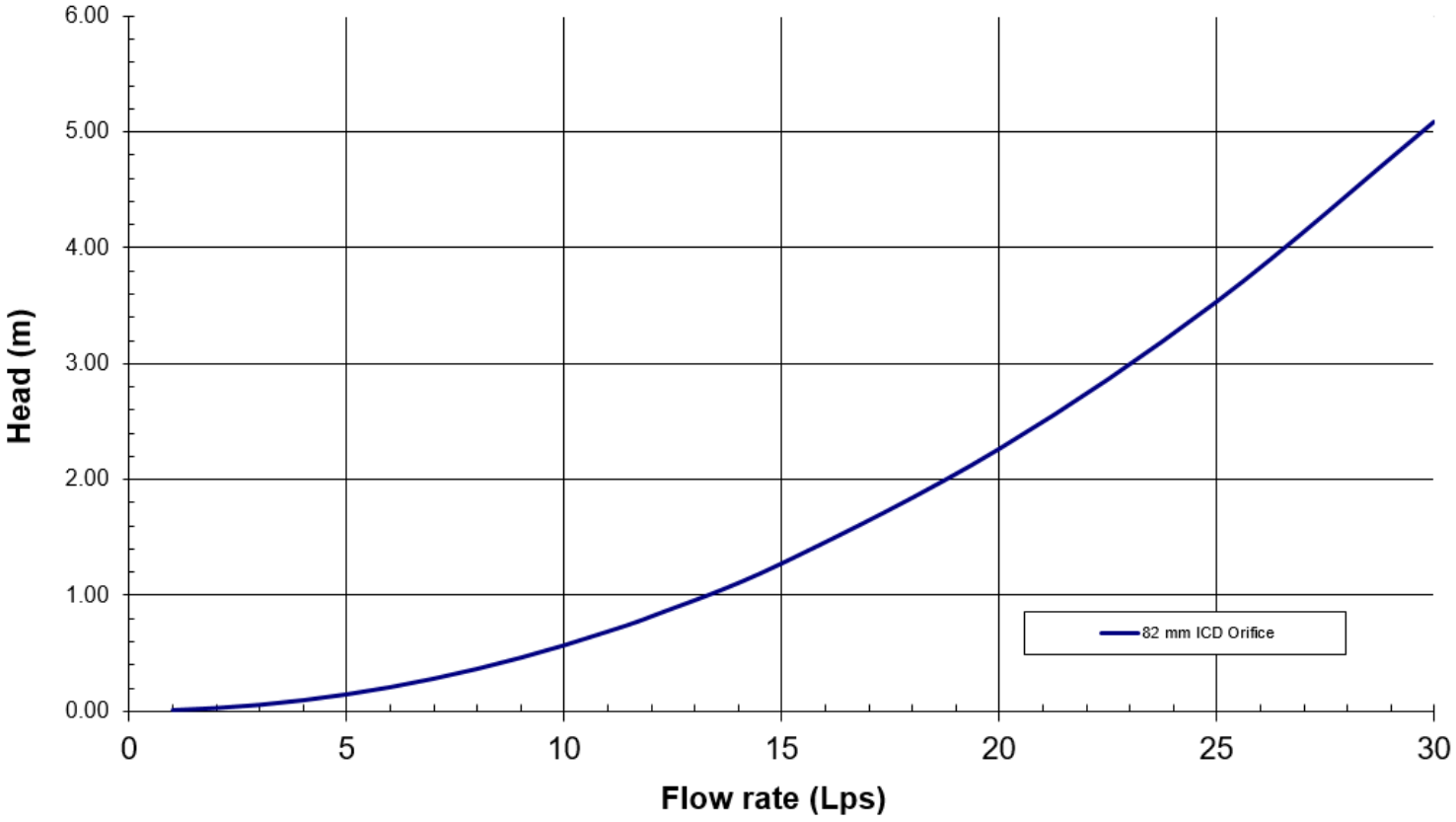
Flow: 15 L/s
Head: 1.61 m
CB02



IPEX

Tempest MHF ICD Flow Curve

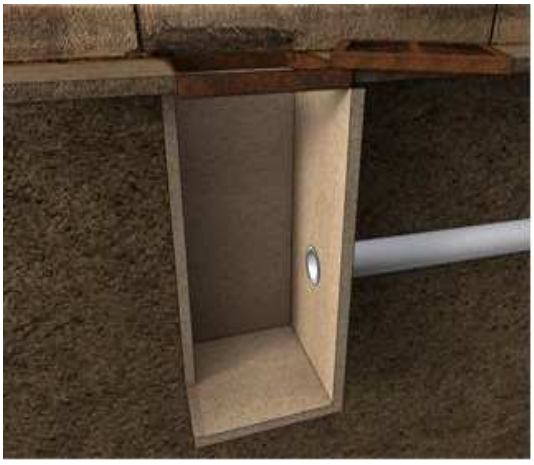
Flow: 19.2 L/s
Head: 2.08 m
RY02

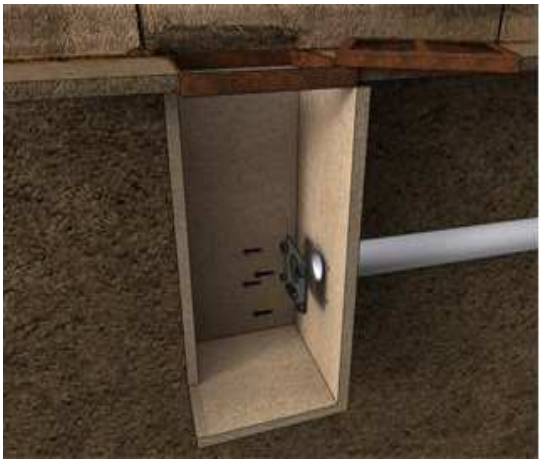


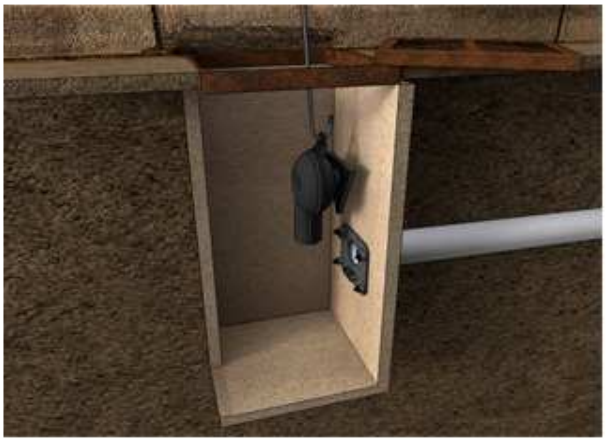
IPEX

Square CB Installation Notes:

1. Materials and tooling verification:
   - Tooling: impact drill, 3/8'' concrete bit, torque wrench for 9/16''nut, hand hammer, level, and marker.
   - Material: (4) concrete anchor 3/8x3-1/2, (4) washers, (4) nuts
2. Use the mounting wall plate to locate and mark the hole (4) pattern on the catch basin wall. You should use a level to ensure that the plate is at the horizontal.
3. Use an impact drill with a 3/8'' concrete bit to make the four holes at a minimum of 1-1/2'' depth up to 2-1/2''. Clean the concrete dust from the holes.
4. Install the anchors (4) in the holes by using a hammer. Put the nuts on the top of the anchors to protect the threads when you will hit the anchors with the hammer. Remove the nuts on the ends of the anchors
5. Install the wall mounting plate on the anchors and screw the nut in place with a maximum torque of 40 N.m (30 lbf-ft). There should be no gap between the wall mounting plate and the catch basin wall.
6. From ground above using a reach bar, lower the device by hooking the end of the reach bar to the handle of the LMF device. Align the triangular plate portion into the mounting wall plate. Push down the device to be sure it has centered in to the wall mounting plate and has created a seal.





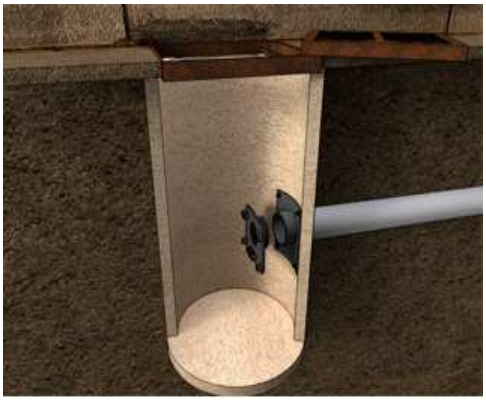


IPEX

Round CB Installation Notes: (Refer to square install notes above for steps 1 , 3, & 4)

2. Use spigot catch basin wall plate to locate and mark the hole (4) pattern on the catch basin wall. You should use a level to ensure that the plate is at the horizontal.
5. Install the CB spigot wall plate on the anchors and screw the 4 nuts in place with a maximum torque of 40 N.m (30 lb-ft). There should be no gap between the CB spigot wall plate and the catch basin wall.
6. Apply solvent cement on the hub of the universal mounting plate and the spigot of the spigot CB wall plate. Slide the hub over the spigot. Make sure the universal mounting plate is at the horizontal and its hub is completely inserted onto the spigot. Normally, the corners of the universal mounting plate hub adapter should touch the catch basin wall.
7. From ground above using a reach bar, lower the ICD device by hooking the end of the reach bar to the handle of the ICD device. Align the triangular plate portion into the mounting wall plate. Push down the device to be sure it has centered into the mounting plate and has created a seal.






CAUTION/WARNING/DISCLAIM:

- Verify that the inlet(s) pipe(s) is not protruding into the catch basin. If it is, cut it back so that the inlet pipe is flush with the catch basin wall.
- Any required cement in the installation must be approved for PVC.
- The solvent cement should not be used below 0°C (32°F) or in a high humidity environment. Please refer to the IPEX solvent cement guide to confirm required curing times or attend the IPEX **Online Solvent Cement Training Course**.
- Call your IPEX representative for more information or if you have any questions about our products.

IPEX

IPEX TEMPEST Inlet Control Devices Technical Specification

General

Inlet control devices (ICD's) are designed to provide flow control at a specified rate for a given water head level and also provide odour and floatable control where specified. All ICD's will be IPEX Tempest or approved equal.

All devices shall be removable from a universal mounting plate. An operator from street level using only a T-bar with a hook will be able to retrieve the device while leaving the universal mounting plate secured to the catch basin wall face. The removal of the TEMPEST devices listed above must not require any unbolting or special manipulation or any special tools.

High Flow (HF) Sump devices will consist of a removable threaded cap which can be accessible from street level with out entry into the catchbasin (CB). The removal of the threaded cap shall not require any special tools other than the operator's hand.

ICD's must have no moving parts.

Materials

ICD's are to be manufactured from Polyvinyl Chloride (PVC) or Polyurethane material, designed to be durable enough to withstand multiple freeze-thaw cycles and exposure to harsh elements.

The inner ring seal will be manufactured using a Buna or Nitrile material with hardness between Duro 50 and Duro 70.

The wall seal is to be comprised of a 3/8" thick Neoprene Closed Cell Sponge gasket which is attached to the back of the wall plate.

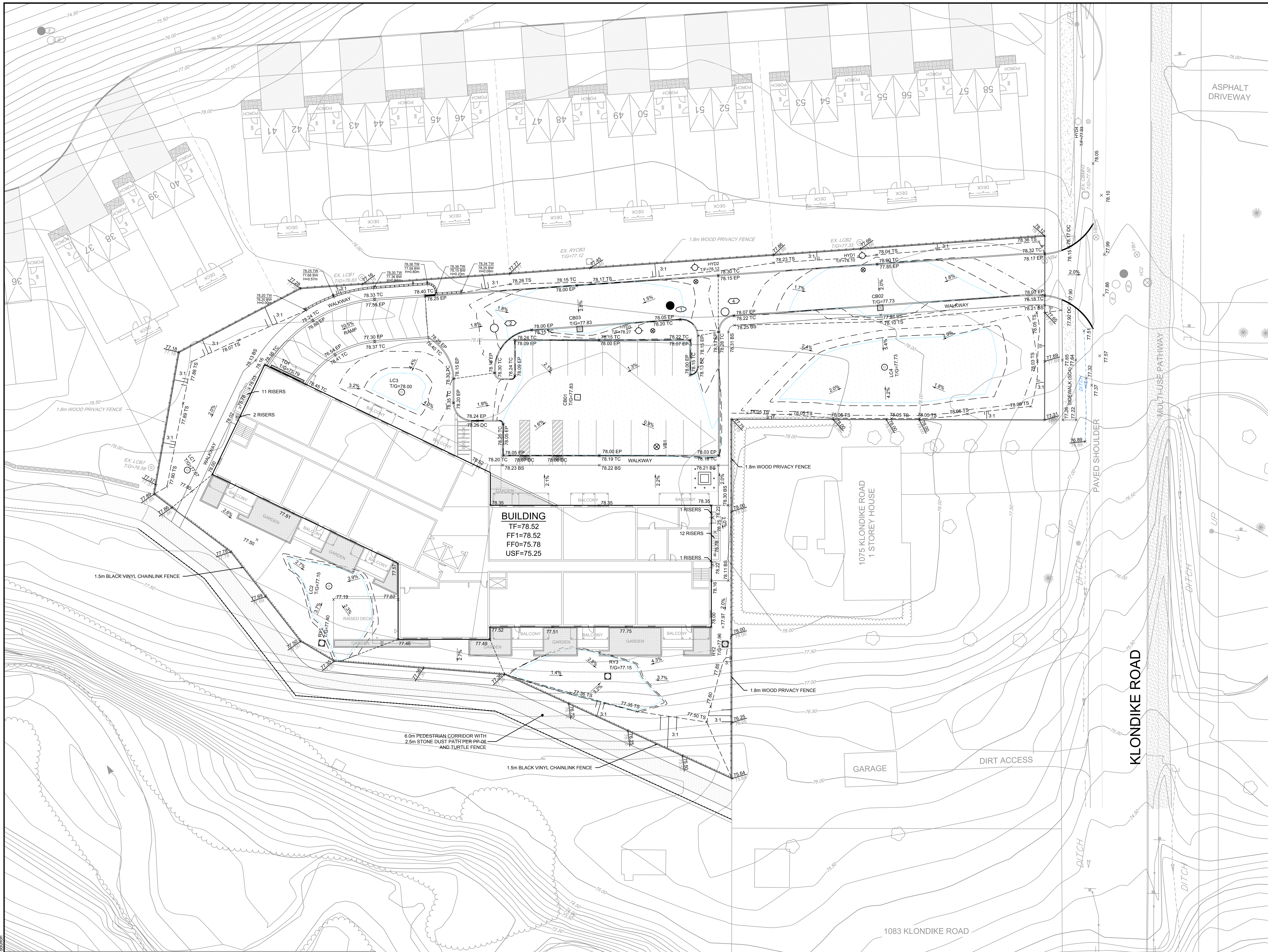
All hardware will be made from 304 stainless steel.

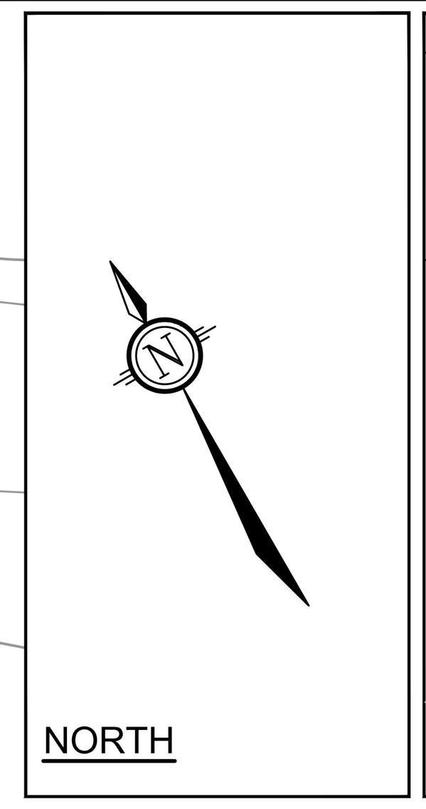
Dimensioning

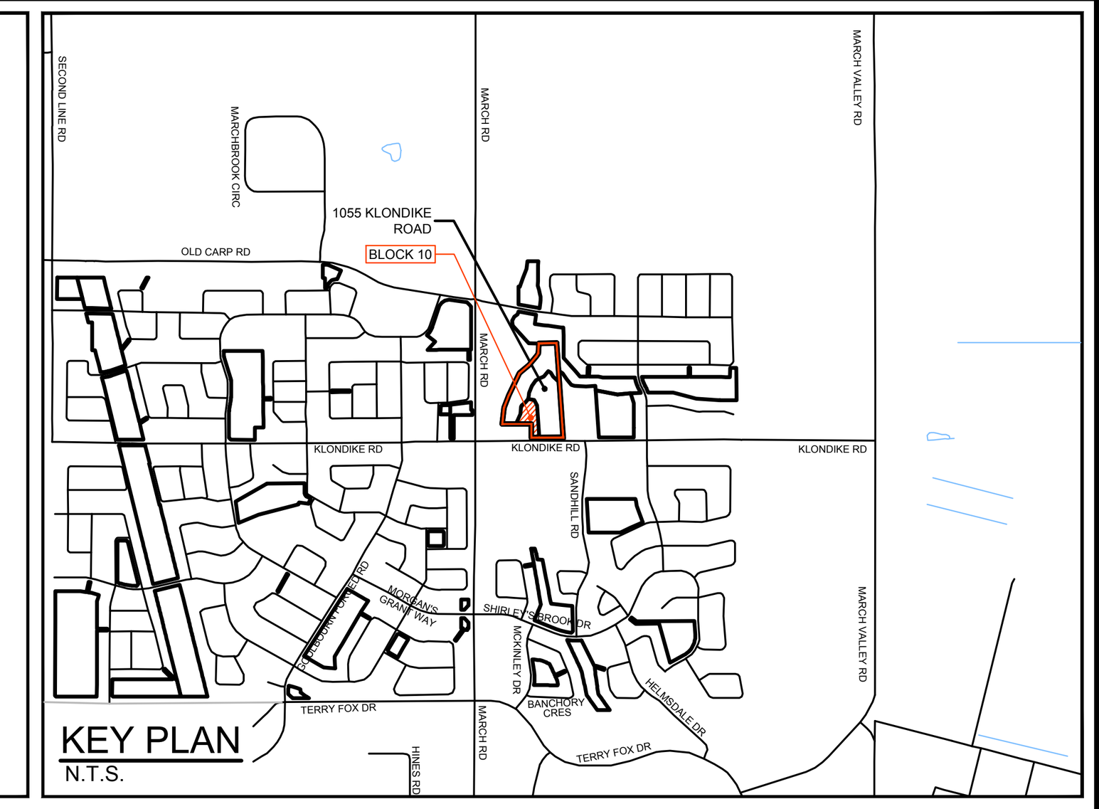
The Low Medium Flow (LMF), High Flow (HF) and the High Flow (HF) Sump shall allow for a minimum outlet pipe diameter of 200mm with a 600mm deep Catch Basin sump.

Installation

Contractor shall be responsible for securing, supporting and connecting the ICD's to the existing influent pipe and catchbasin/manhole structure as specified and designed by the Engineer.







LEGEND

2.5%	PROPOSED GRADE AND DIRECTION OF FLOW	TF	TOP OF FOUNDATION
76.90 ×	PROPOSED ELEVATION	FF1	FINISHED FLOOR ELEVATION - 1st FLOOR
105.53 / 105.53	PROPOSED ELEVATION / EXISTING ELEVATION	FF0	FINISHED FLOOR ELEVATION - BASEMENT
105.53 TW / 105.53 BW	PROPOSED TOP OF WALL ELEVATION / PROPOSED BOTTOM OF WALL ELEVATION	EP	EDGE OF PAVEMENT
77.50 ×	EXISTING ELEVATION	TC	TOP OF CURB
3:1	TERRACING (3:1 MAX)	BS	BACK OF SIDEWALK
	PROPOSED RETAINING WALL	TS	TOP OF SLOPE
	MAJOR OVERLAND FLOW DIRECTION	DC	TOP OF SLOPE
101.00	EXISTING CONTOUR AND ELEVATION		MAX STATIC PONDING LIMITS
			100-YR PONDING LIMITS
			100-YR +20% PONDING LIMITS

GENERAL NOTES:

1. DIMENSIONS AND LAYOUT INFORMATION SHALL BE CONFIRMED PRIOR TO COMMENCEMENT OF CONSTRUCTION.
2. THE ORIGINAL TOPOGRAPHY AND GROUND ELEVATIONS, SERVICING AND SURVEY INFORMATION SHOWN ON THIS PLAN ARE SUPPLIED FOR INFORMATION PURPOSES ONLY. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO VERIFY THE ACCURACY OF ALL INFORMATION OBTAINED FROM THIS PLAN.
3. CO-ORDINATE AND SCHEDULE ALL WORK WITH OTHER TRADES AND CONTRACTORS.
4. BEFORE COMMENCING CONSTRUCTION, PROVIDE PROOF OF COMPREHENSIVE ALL RISK AND OPERATIONAL LIABILITY INSURANCE INCLUDING BLASTING. INSURANCE POLICY TO NAME THE OWNER, ENGINEER AND THE CITY AS CO-INSURED. AMOUNT OF INSURANCE TO BE SPECIFIED BY OWNER'S AGENT.
5. CONNECT TO EXISTING SYSTEMS AS DETAILED, INCLUDING ALL RESTORATION WORK NECESSARY TO REINSTATE SURFACES TO EXISTING CONDITIONS OR BETTER.
6. DETERMINE THE EXACT LOCATION, SIZE, MATERIAL AND ELEVATION OF ALL EXISTING UTILITIES PRIOR TO COMMENCING CONSTRUCTION. PROTECT AND ASSUME ALL RESPONSIBILITY FOR ALL EXISTING UTILITIES WHETHER OR NOT SHOWN ON THESE DRAWINGS.
7. OBTAIN AND PAY FOR ALL NECESSARY PERMITS AND APPROVALS BEFORE COMMENCING CONSTRUCTION.
8. RESTORE ALL TRENCHES AND SURFACE FEATURES TO EXISTING CONDITIONS OR BETTER AND TO THE SATISFACTION OF CITY OF OTTAWA AUTHORITIES.

- ASPHALT RESTORATION SHALL BE IN ACCORDANCE WITH CITY OF OTTAWA DETAIL R-10.
- THICKNESS OF GRANULAR MATERIAL AND ASPHALT LAYERS TO MATCH EXISTING.
- BOULEVARDS SHALL BE REINSTATED WITH 100mm OF TOPSOIL, SEED AND MULCH.

9. REMOVE FROM SITE ALL EXCESS EXCAVATED MATERIAL UNLESS OTHERWISE INSTRUCTED BY ENGINEER.
10. ALL ELEVATIONS ARE GEODETIC AND UTILIZE METRIC UNITS.
11. ASPHALT WALKWAY TO BE CONSTRUCTED PER CITY STANDARD SC.20
12. REFER TO GEOTECHNICAL INVESTIGATION (DATED APRIL 4, 2018), PREPARED BY GEMTEC FOR SUBSURFACE CONDITIONS AND CONSTRUCTION RECOMMENDATIONS.
13. PERFORATED PIPE SUB-DRAINS TO BE PROVIDED AT SUBGRADE LEVEL EXTENDING FROM THE ROADSIDE CATCHBASIN FOR A DISTANCE OF 3.0m, PARALLEL TO THE CURB IN TWO DIRECTIONS.
14. DECOMMISSIONING OF ALL MONITORING WELLS AND DRINKING WATER WELLS SHALL BE CARRIED OUT AND IN ACCORDANCE WITH O.REG. 903. ANY SEPTIC SYSTEM OR AGRICULTURAL TILES DRAINS SHALL BE DECOMMISSIONED PRIOR TO ISSUANCE OF COMMENCE WORK NOTIFICATION.

GRADING AND PAVEMENT NOTES:

1. ALL TOPSOIL, ORGANIC OR DELETERIOUS MATERIAL MUST BE ENTIRELY REMOVED FROM BENEATH THE PROPOSED HARD SURFACE (ie. PAVEMENT, CURB, SIDEWALK, ETC.) AREAS AS DIRECTED BY THE SITE ENGINEER OR GEOTECHNICAL ENGINEER.
2. EXPOSED SUBGRADES IN PROPOSED PAVED AREAS SHOULD BE HEAVILY PROOF ROLLED WITH A LARGE (10 TON) VIBRATORY STEEL DRUM ROLLER UNDER DRY CONDITIONS AND INSPECTED BY THE GEOTECHNICAL ENGINEER PRIOR TO THE PLACEMENT OF GRANULARS.
3. ANY SOFT AREAS EVIDENT FROM THE PROOF ROLLING SHOULD BE SUB-EXCAVATED AND REPLACED WITH SUITABLE MATERIAL THAT IS FROST COMPATIBLE WITH THE EXISTING SOILS AS RECOMMENDED BY THE GEOTECHNICAL ENGINEER.
4. THE GRANULAR BASE SHOULD BE PLACED IN MAXIMUM 300mm LIFTS AND COMPACTED TO AT LEAST 98% OF THE STANDARD PROCTOR MAXIMUM DRY DENSITY VALUE. ANY ADDITIONAL GRANULAR FILL USED BELOW THE PROPOSED PAVEMENT SHOULD BE PLACED IN MAXIMUM 300mm LIFTS AND COMPACTED TO AT LEAST 95% OF THE STANDARD PROCTOR MAXIMUM DRY DENSITY VALUE.
5. ROADWAY SUBGRADE TO BE INSPECTED BY THE GEOTECHNICAL ENGINEER AT THE TIME OF CONSTRUCTION TO REVIEW IF A WOVEN GEOTEXTILE IS REQUIRED BELOW THE GRANULAR MATERIALS; AND TO CONFIRM THE DEPTH AND COMPACTION OF GRANULAR 'B'
6. PRIOR TO PLACEMENT OF TOPLIFT, THE CONTRACTOR SHALL ADJUST ALL STRUCTURES TO FINAL GRADE PER CITY OF OTTAWA STANDARDS.
7. MINIMUM OF 2% GRADE FOR ALL GRASS AREAS UNLESS OTHERWISE NOTED.
8. MAXIMUM TERRACING GRADE TO BE 3:1 UNLESS OTHERWISE NOTED.
9. ALL GRADES BY CURBS ARE EDGE OF PAVEMENT GRADES UNLESS OTHERWISE INDICATED.
10. ALL CURBS SHALL BE BARRIER CURB UNLESS OTHERWISE NOTED AND CONSTRUCTED PER CITY OF OTTAWA STANDARD (SC1.1).
11. REFER TO LANDSCAPE PLAN FOR PLANTING AND OTHER LANDSCAPE FEATURE DETAILS.

PAVEMENT STRUCTURE:

PRIVATE ACCESS
AND PARKING AREAS

40mm	ASPHALT SP12.5
60mm	ASPHALT SP19.0
150mm	GRAN "A"
450mm	GRAN "B" TYPE II
700mm	TOTAL DEPTH

PONDING

PONDING ID	STRUCTURE	100 YEAR PONDING ELEVATION	100 YEAR PONDING DEPTH (m)	100 YEAR +20% PONDING ELEVATION	100 YEAR + 20% PONDING DEPTH (m)	MAX STATIC PONDING ELEVATION	MAX STATIC PONDING DEPTH (m)
P1	CB01	78.06	0.23	78.10	0.27	78.13	0.30
P2	CB02	77.94	0.21	77.97	0.24	78.03	0.30
P3	CB03	78.06	0.23	78.09	0.26	78.13	0.30
P4	LC01	77.34	0.00	77.37	0.00	77.80	0.13
P5	LC02	77.34	0.19	77.37	0.22	77.35	0.20
P6	LC03	78.14	0.14	78.18	0.18	78.30	0.30
P7	LC04	77.95	0.22	77.97	0.24	78.03	0.30
P8	RY03	77.34	0.19	77.36	0.21	77.35	0.20

NOTE:
THE POSITION OF ALL POLE LINES, CONDUITS, WATERMAINS, SEWERS AND OTHER UNDERGROUND AND OVERGROUND UTILITIES AND STRUCTURES IS NOT NECESSARILY SHOWN ON THE CONTRACT DRAWINGS, AND WHERE SHOWN, THE ACCURACY OF THE POSITION OF SUCH UTILITIES AND STRUCTURES IS NOT GUARANTEED. BEFORE STARTING WORK, DETERMINE THE EXACT LOCATION OF ALL SUCH UTILITIES AND STRUCTURES AND ASSUME ALL LIABILITY FOR DAMAGE TO THEM.

No.	REVISION	DATE	BY
1.	ISSUED FOR APPROVAL	MAY 17/21	MAB

SCALE 1:250

DESIGN	DTD
CHECKED	LRW
DRAWN	DTD
CHECKED	LRW
APPROVED	MAB

FOR REVIEW ONLY

LICENSED PROFESSIONAL ENGINEER L. R. WILSON 100160065 PROVINCE OF ONTARIO

LICENSED PROFESSIONAL ENGINEER M.A. BISSETT 2021.05.17 PROVINCE OF ONTARIO

NOVATECH
Engineers, Planners & Landscape Architects
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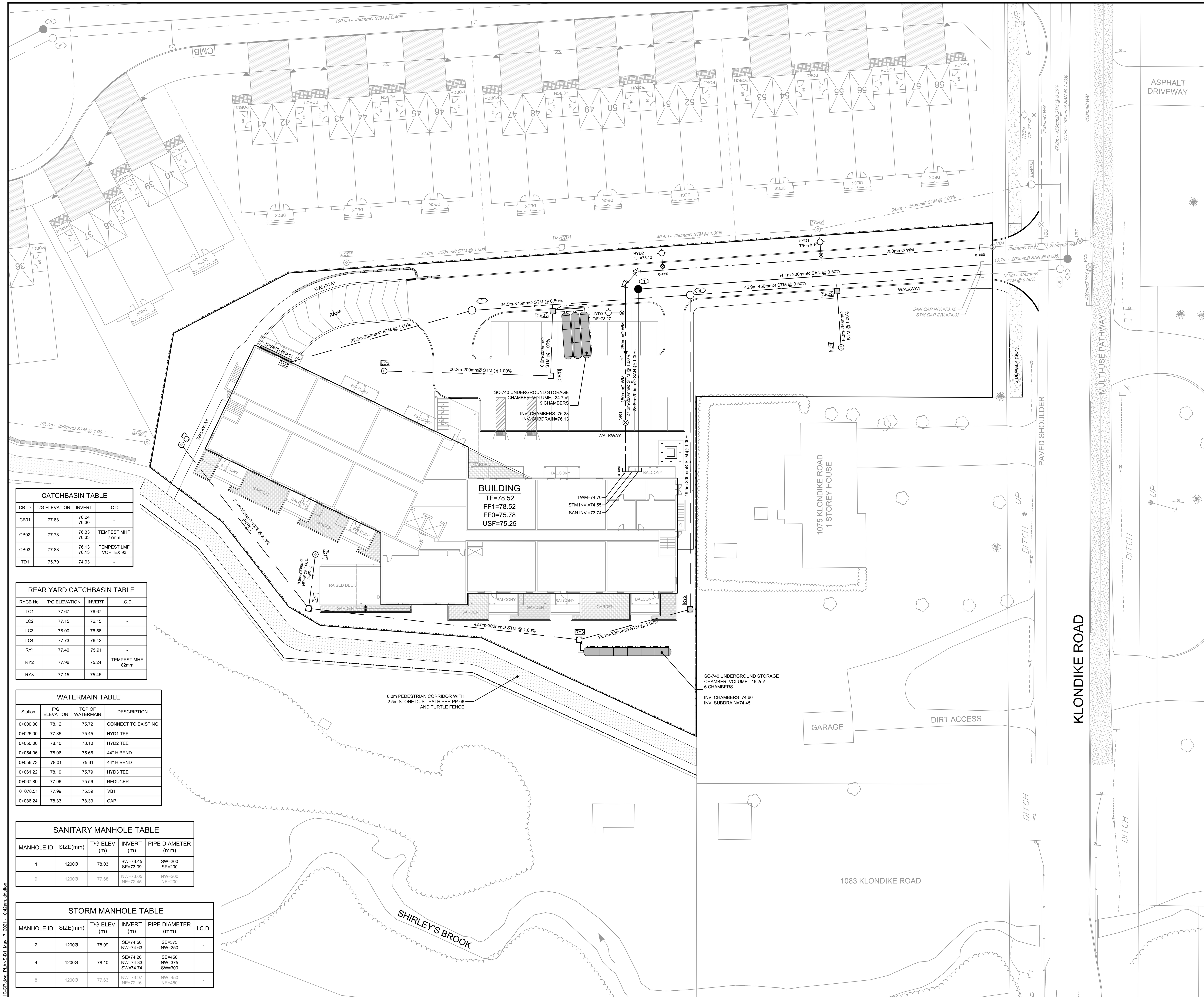
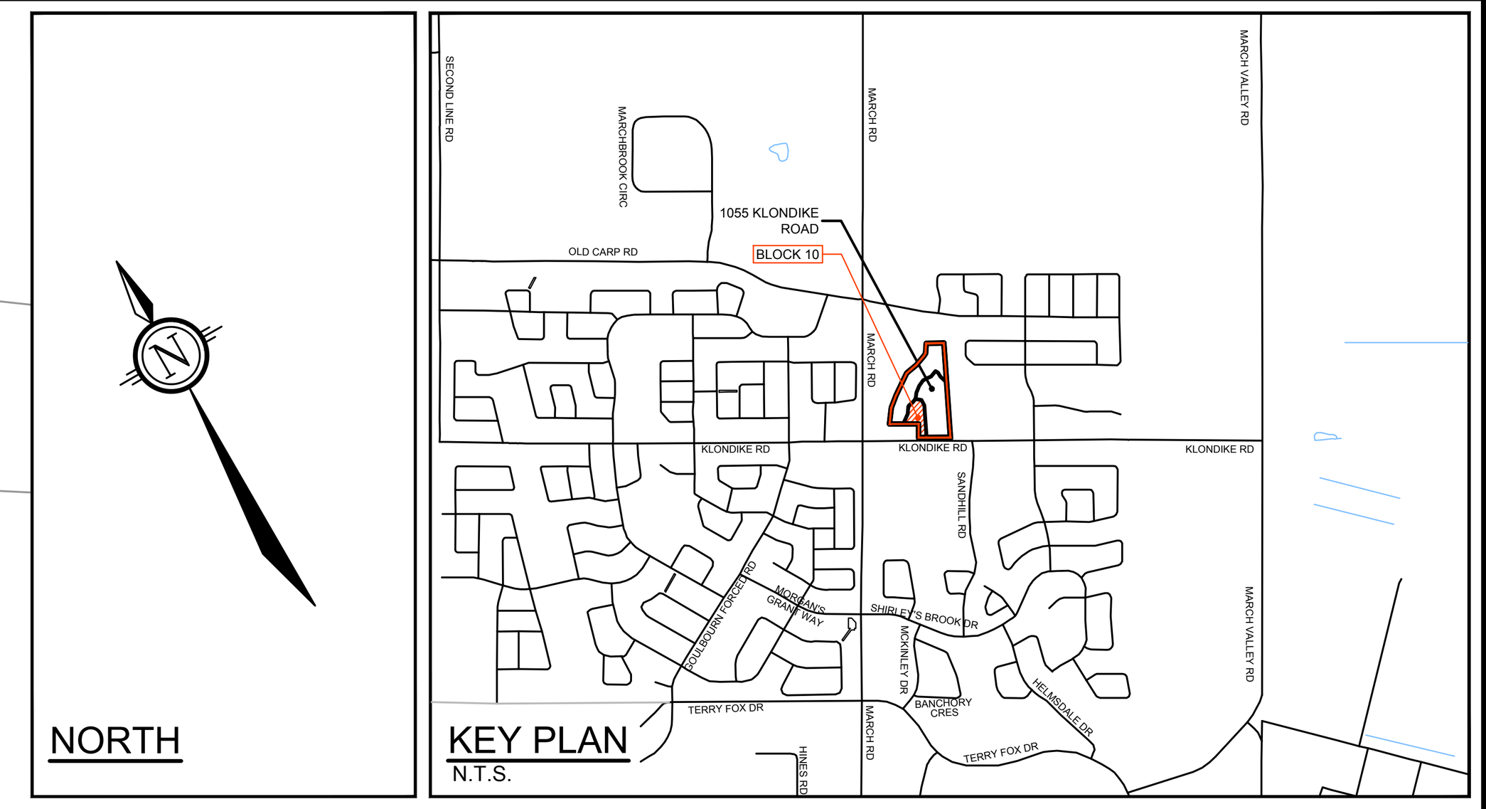
Ottawa, Ontario, Canada K2M 1P6
Telephone (613) 254-9643
Facsimile (613) 254-5867
Website www.novatech-eng.com

CITY OF OTTAWA
KLONDIKE RIDGE - BLOCK 10

GRADING PLAN

PROJECT No. 117034-10
REV REV # 1
DRAWING No. 117034-10-GR





LEGEND

Symbol	Description
101	SANITARY MANHOLE, SEWER & DIRECTION OF FLOW
100	STORM MANHOLE, SEWER & DIRECTION OF FLOW
300mmØ	WATERMAIN AND DIAMETER
VB	VALVE & VALVE BOX
VC	VALVE & VALVE CHAMBER
	BEND AND THRUST BLOCK
HYD	HYDRANT C/W VALVE & LEAD
	CAP
	REDUCER
95	ROAD CATCH BASIN
95	ROAD CATCH BASIN WITH ICD
LCB1	LANDSCAPE CATCH BASIN
RY1	REAR YARD CATCH BASIN
RY2	REAR YARD CATCH BASIN WITH ICD

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1. DIMENSIONS AND LAYOUT INFORMATION SHALL BE CONFIRMED PRIOR TO COMMENCEMENT OF CONSTRUCTION.
2. THE ORIGINAL TOPOGRAPHY AND GROUND ELEVATIONS, SERVICING AND SURVEY INFORMATION SHOWN ON THIS PLAN ARE SUPPLIED FOR INFORMATION PURPOSES ONLY. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO VERIFY THE ACCURACY OF ALL INFORMATION OBTAINED FROM THIS PLAN.
3. CO-ORDINATE AND SCHEDULE ALL WORK WITH OTHER TRADES AND CONTRACTORS.
4. BEFORE COMMENCING CONSTRUCTION, PROVIDE PROOF OF COMPREHENSIVE ALL RISK AND OPERATIONAL LIABILITY INSURANCE INCLUDING BLASTING. INSURANCE POLICY TO NAME THE OWNER, ENGINEER AND THE CITY AS CO-INSURED.
5. CONNECT TO EXISTING SYSTEMS AS DETAILED, INCLUDING ALL RESTORATION WORK NECESSARY TO REINSTATE SURFACES TO EXISTING CONDITIONS OR BETTER.
6. DETERMINE THE EXACT LOCATION, SIZE, MATERIAL AND ELEVATION OF ALL EXISTING UTILITIES PRIOR TO COMMENCING CONSTRUCTION. PROTECT AND ASSUME RESPONSIBILITY FOR ALL EXISTING UTILITIES WHETHER OR NOT SHOWN ON THESE DRAWINGS.
7. OBTAIN AND PAY FOR ALL NECESSARY PERMITS AND APPROVALS BEFORE COMMENCING CONSTRUCTION.
8. RESTORE ALL TRENCHES AND SURFACE FEATURES TO EXISTING CONDITIONS OR BETTER AND TO THE SATISFACTION OF MUNICIPAL AUTHORITIES.
9. REMOVE FROM SITE ALL EXCESS EXCAVATED MATERIAL UNLESS OTHERWISE INSTRUCTED BY THE ENGINEER.
10. ALL ELEVATIONS ARE GEODETIC AND UTILIZE METRIC UNITS.
11. REFER TO GEOTECHNICAL INVESTIGATION PROJECT: 64153.85 (DATED APRIL 4, 2018), PREPARED BY GEMTEC FOR SUBSURFACE CONDITIONS AND CONSTRUCTION RECOMMENDATIONS.
12. PERFORATED PIPE SUB-DRAINS TO BE PROVIDED AT SUBGRADE LEVEL EXTENDING FROM THE ROADSIDE CATCH BASIN FOR A DISTANCE OF 3.0m, PARALLEL TO THE CURB IN TWO DIRECTIONS.

SEWER NOTES:

1. SPECIFICATIONS:

ITEM	SPEC. No.	REFERENCE
CATCHBASIN (600x600mm)	705.010	OPSD
CATCHBASIN MANHOLE (1200Ø)	701.010	OPSD
STORM / SANITARY MANHOLE (1200Ø)	701.010	OPSD
ROADSIDE CB, FRAME & COVER	S2 & S19	CITY of OTTAWA
CURB INLET CB, FRAME & COVER	S3, S22 & S23	CITY of OTTAWA
CBMH FRAME & COVER	S25 & S24.1	CITY of OTTAWA
STORM / SANITARY MH FRAME & COVER	S24.1 / S24 & S25	CITY of OTTAWA
STORM SEWER	PVC DR 35 OR CONC.	(CLASS SPECIFIED ON PROFILE DRAWINGS)
SANITARY SEWER	PVC DR 35	
CATCHBASIN LEAD	PVC DR 35	

2. INSULATE ALL PIPES (SAN/STM) THAT HAVE LESS THAN 1.5m COVER WITH 50mmX1200mm HI-40 INSULATION. PROVIDE 150mm CLEARANCE BETWEEN PIPE AND INSULATION.
3. PIPE BEDDING, COVER AND BACKFILL ARE TO BE COMPACTED TO AT LEAST 95% OF THE STANDARD PROCTOR MAXIMUM DRY DENSITY. THE USE OF CLEAR CRUSHED STONE AS A BEDDING LAYER SHALL NOT BE PERMITTED.
4. SEWER SERVICE CONNECTIONS PER CITY OF OTTAWA DETAILS S11 AND S11.1.
5. THE SITE SERVICING CONTRACTOR SHALL PERFORM FIELD TESTS FOR QUALITY CONTROL OF ALL SANITARY SEWERS. LEAKAGE TESTING SHALL BE COMPLETED IN ACCORDANCE WITH OPSS 410.07.16 AND 407.07.24. DYE TESTING IS TO BE COMPLETED ON ALL SANITARY SERVICES TO CONFIRM PROPER CONNECTION TO THE SANITARY SEWER MAIN. THE FIELD TESTS SHALL BE PERFORMED IN THE PRESENCE OF THE ENGINEER.
6. STORM MANHOLES AND CBMHS SHALL HAVE 300mm SUMPS UNLESS OTHERWISE INDICATED.
7. CONTRACTOR TO TELEVISE (CCTV) ALL PROPOSED SEWERS, 200mmØ OR GREATER PRIOR TO BASE COURSE ASPHALT. UPON COMPLETION OF CONTRACT, THE CONTRACTOR IS RESPONSIBLE TO FLUSH AND CLEAN ALL SEWERS & APPURTENANCES.
8. SAFETY LANDING PER OPSD 404.020 REQUIRED IF MANHOLE DEPTH IS GREATER THAN 5.0m.

WATERMAIN NOTES:

1. GENERAL:

ITEM	DETAIL. No.	REFERENCE
WATERMAIN TRENCHING	W17	CITY OF OTTAWA
THERMAL INSULATION IN SHALLOW TRENCHES	W22	CITY OF OTTAWA
WATERMAIN CROSSING BELOW SEWER / OVER SEWER	W25 / W25.2	CITY OF OTTAWA

2. THE WATERMAIN SHALL BE PVC DR 18 IN ACCORDANCE WITH MATERIAL SPECIFICATION MW-18.1, UNLESS OTHERWISE INDICATED.
3. SUPPLY AND CONSTRUCT ALL WATERMAINS AND APPURTENANCES IN ACCORDANCE WITH THE CITY OF OTTAWA STANDARDS AND SPECIFICATIONS. EXCAVATION, INSTALLATION, BACKFILL AND RESTORATION OF ALL WATERMAINS BY THE CONTRACTOR. CONNECTIONS AND SHUT-OFFS AT THE MAIN AND CHLORINATION OF THE WATER SYSTEM SHALL BE PERFORMED BY CITY OFFICIALS.
4. WATERMAIN SHALL BE MINIMUM 2.4m DEPTH BELOW GRADE UNLESS OTHERWISE INDICATED.
5. PROVIDE MINIMUM 0.50m CLEARANCE BETWEEN OUTSIDE OF PIPES AT ALL CROSSINGS.

CATCHBASIN TABLE

CB ID	T/G ELEVATION	INVERT	I.C.D.
CB01	77.83	76.24 76.30	-
CB02	77.73	76.33 76.33	TEMPEST MHF 77mm
CB03	77.83	76.13 76.13	TEMPEST LMF VORTEX 93
TD1	75.79	74.93	-

REAR YARD CATCHBASIN TABLE

RYCB No.	T/G ELEVATION	INVERT	I.C.D.
LC1	77.67	76.67	-
LC2	77.15	76.15	-
LC3	78.00	76.56	-
LC4	77.73	76.42	-
RY1	77.40	75.91	-
RY2	77.96	75.24	TEMPEST MHF 82mm
RY3	77.15	75.45	-

WATERMAIN TABLE

Station	F/G ELEVATION	TOP OF WATERMAIN	DESCRIPTION
0+000.00	78.12	75.72	CONNECT TO EXISTING
0+025.00	77.85	75.45	HYD1 TEE
0+050.00	78.10	78.10	HYD2 TEE
0+054.06	78.06	75.66	44° H.BEND
0+056.73	78.01	75.61	44° H.BEND
0+061.22	78.19	75.79	HYD3 TEE
0+067.89	77.96	75.56	REDUCER
0+078.51	77.99	75.59	VB1
0+086.24	78.33	78.33	CAP

SANITARY MANHOLE TABLE

MANHOLE ID	SIZE(mm)	T/G ELEV (m)	INVERT (m)	PIPE DIAMETER (mm)
1	1200Ø	78.03	SW=73.45 SE=73.39	SW=200 SE=200
9	1200Ø	77.68	NW=73.05 NE=72.45	NW=200 NE=200

STORM MANHOLE TABLE

MANHOLE ID	SIZE(mm)	T/G ELEV (m)	INVERT (m)	PIPE DIAMETER (mm)	I.C.D.
2	1200Ø	78.09	SE=74.50 NW=74.63	SE=375 NW=250	-
4	1200Ø	78.10	SE=74.26 NW=74.33 SW=74.74	SE=450 NW=375 SW=300	-
8	1200Ø	77.63	NW=73.97 NE=72.16	NW=450 NE=450	-

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No.	REVISION	DATE	BY
1.	ISSUED FOR APPROVAL	MAY 17/21	MAB

SCALE 1:250

DESIGN DTD
CHECKED LRW
DRAWN DTD
CHECKED LRW
APPROVED MAB

FOR REVIEW ONLY

LICENSED PROFESSIONAL ENGINEER L. R. WILSON 100160065 PROVINCE OF ONTARIO

LICENSED PROFESSIONAL ENGINEER M.A. BISSETT 2021.05.17 PROVINCE OF ONTARIO

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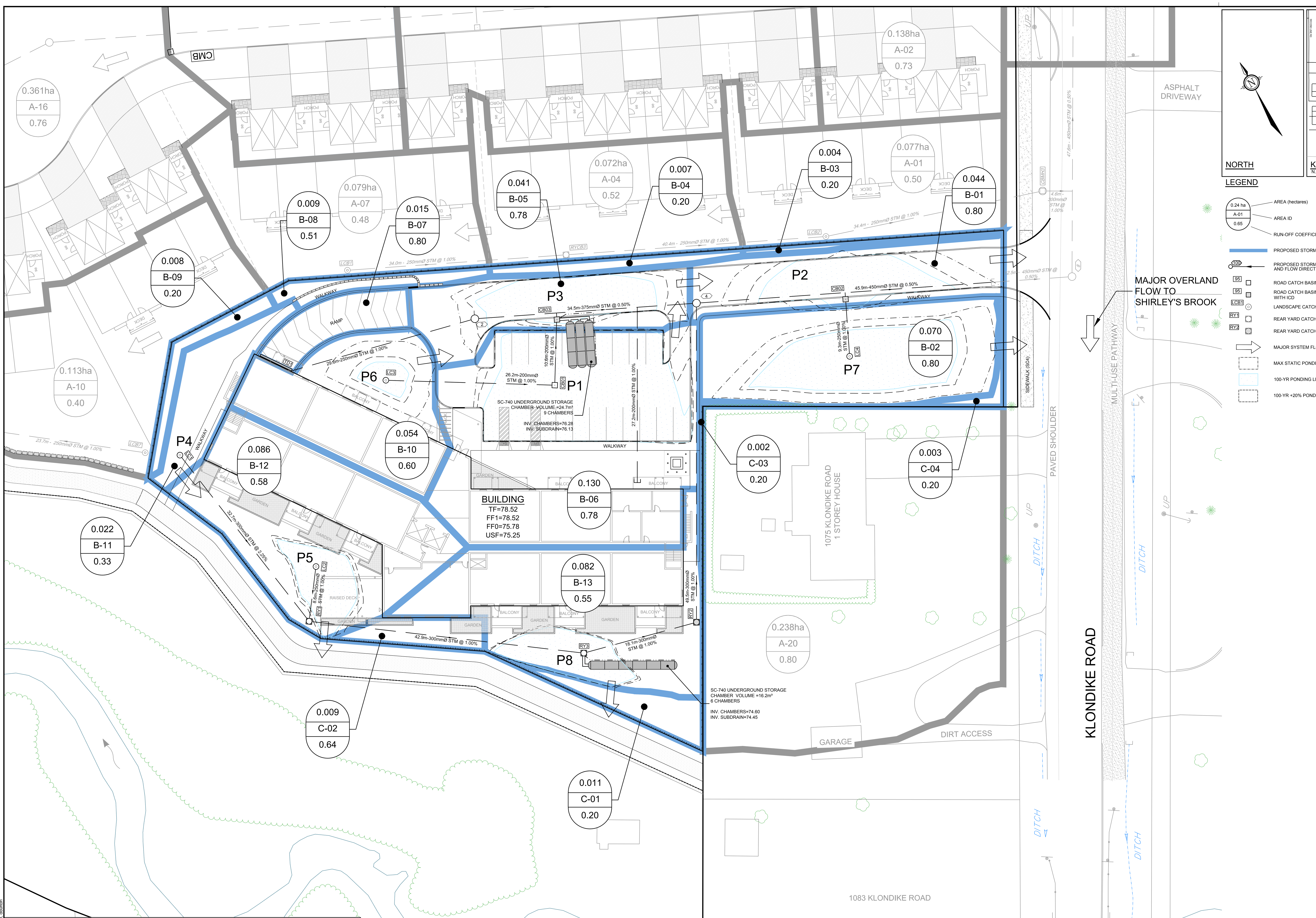
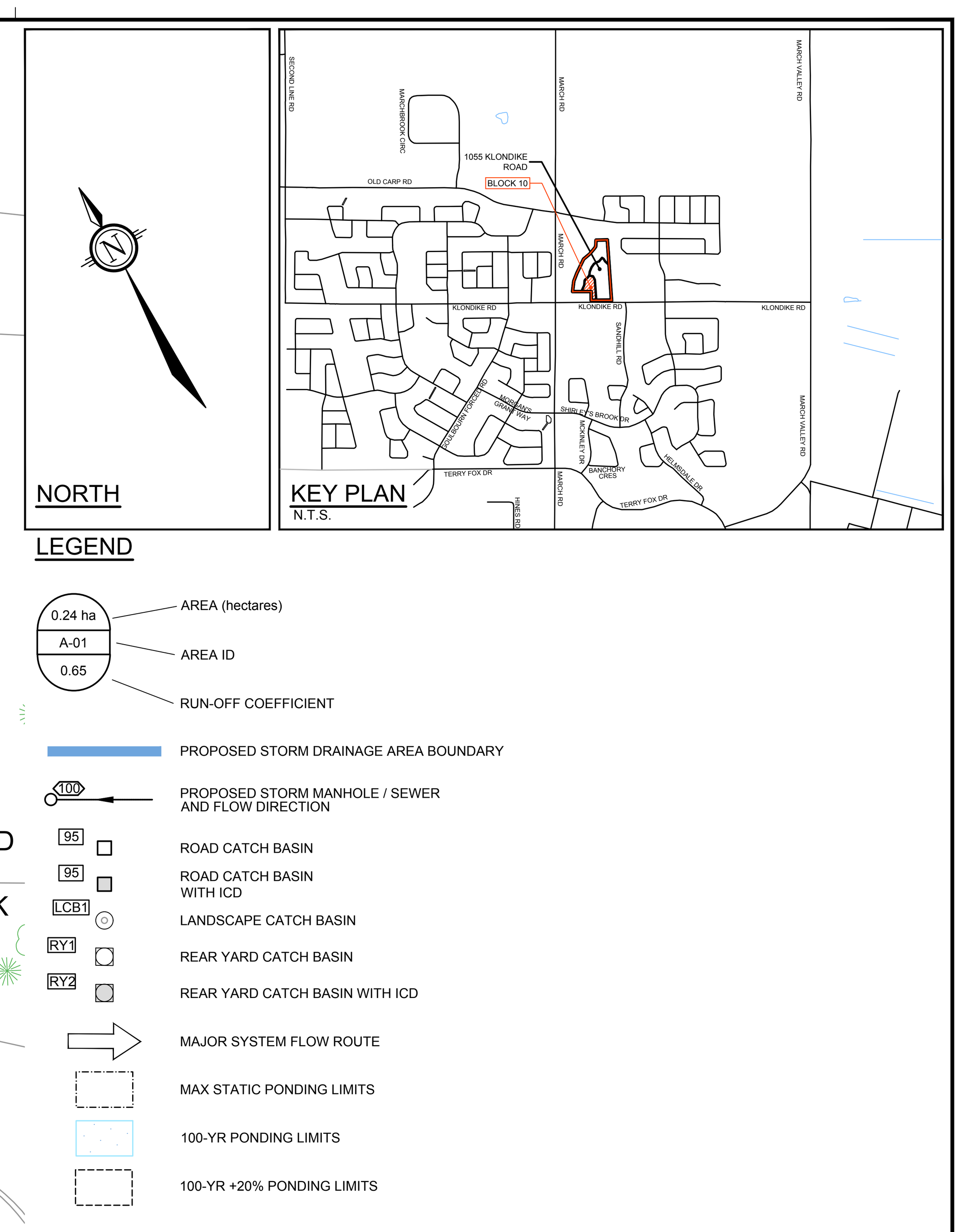
CITY OF OTTAWA
KLONDIKE RIDGE - BLOCK 10

SERVICING PLAN

PROJECT No. 117034-10
REV REV # 1
DRAWING No. 117034-10-GP

PLANB1.DWG - 1000mmx707mm





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RY2	77.96	75.24	TEMPEST MHF 82mm
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8	1200Ø	77.63	NW=73.97 NE=72.16	NW=450 NE=450	-

PONDING

PONDING ID	STRUCTURE	100 YEAR PONDING ELEVATION	100 YEAR PONDING DEPTH (m)	100 YEAR +20% PONDING ELEVATION	100 YEAR + 20% PONDING DEPTH (m)	MAX STATIC PONDING ELEVATION	MAX STATIC PONDING DEPTH (m)
P1	CB01	78.06	0.23	78.10	0.27	78.13	0.30
P2	CB02	77.94	0.21	77.97	0.24	78.03	0.30
P3	CB03	78.06	0.23	78.09	0.26	78.13	0.30
P4	LC01	77.34	0.00	77.37	0.00	77.80	0.13
P5	LC02	77.34	0.19	77.37	0.22	77.35	0.20
P6	LC03	78.14	0.14	78.18	0.18	78.30	0.30
P7	LC04	77.95	0.22	77.97	0.24	78.03	0.30
P8	RY03	77.34	0.19	77.36	0.21	77.35	0.20

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No.	REVISION	DATE	BY
1.	ISSUED FOR APPROVAL	MAY 17/21	MAB

SCALE 1:250

DESIGN DTD · CHECKED LRW · DRAWN DTD · CHECKED LRW · APPROVED MAB

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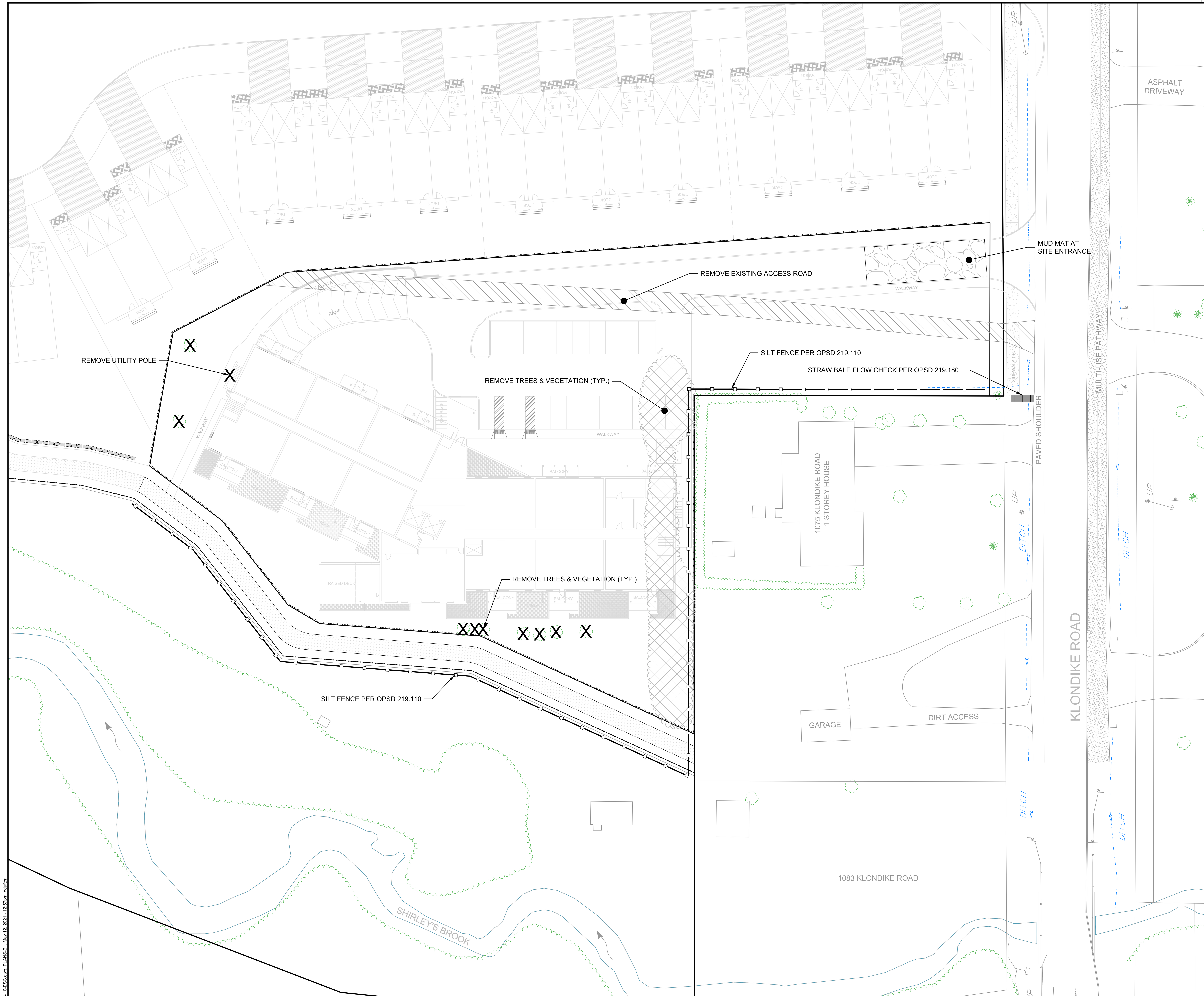
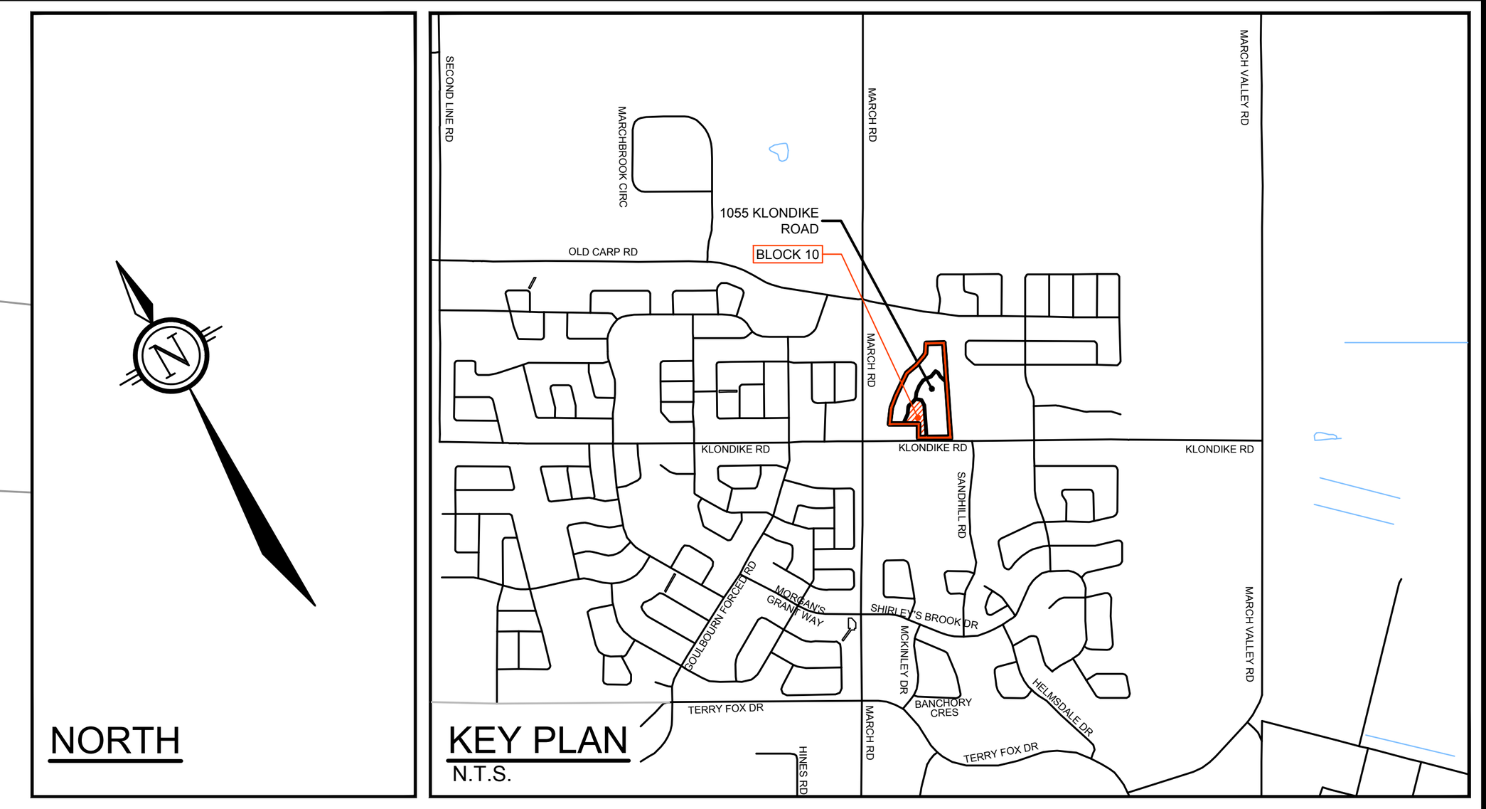
CITY OF OTTAWA
KLONDIKE RIDGE - BLOCK 10

STORM DRAINAGE AREA PLAN

PROJECT No. 117034-10
REV REV # 1
DRAWING No. 117034-10-STM

PLANB1.DWG - 1000mmx707mm





LEGEND

- GRAVEL SHOULDER & DRIVEWAY REMOVAL
- CLEARING, GRUBBING & TOPSOIL STRIPPING
- MUD MATS (50mm - 100mm GRANULAR B. TYPE II)
- X REMOVALS
- SILT FENCE PER OPSD 219.110
- STRAW BALE FLOW CHECK PER OPSD 219.180
- 101.00 EXISTING CONTOUR AND ELEVATION

EROSION AND SEDIMENT CONTROL NOTES :

1. ALL EROSION AND SEDIMENT CONTROLS SHALL BE INSTALLED TO THE SATISFACTION OF THE ENGINEER, THE MUNICIPALITY AND THE CONSERVATION AUTHORITY. THEY SHALL BE APPROPRIATE TO THE SITE CONDITIONS, PRIOR TO UNDERTAKING ANY SITE ALTERATIONS (FILLING, GRADING, REMOVAL OF VEGETATION, ETC.) AND DURING ALL PHASES OF SITE PREPARATION AND CONSTRUCTION. THESE PRACTICES SHALL BE IMPLEMENTED IN ACCORDANCE WITH THE CURRENT BEST MANAGEMENT PRACTICES FOR EROSION AND SEDIMENT CONTROL AND SHOULD INCLUDE AS A MINIMUM THOSE MEASURES INDICATED ON THE PLAN.
2. TO PREVENT SURFACE EROSION FROM ENTERING THE DITCH OR STORM SYSTEM DURING CONSTRUCTION, A LIGHT DUTY SILT FENCE BARRIER WILL ALSO BE INSTALLED IN SELECTED LOCATIONS SHOWN ON THIS PLAN. TERRAFIX SILT SOXX ARE TO BE INSTALLED ON ALL PROPOSED CATCHBASINS. THESE CONTROL MEASURES WILL REMAIN IN PLACE UNTIL VEGETATION HAS BEEN ESTABLISHED AND CONSTRUCTION COMPLETE.
3. THE SEDIMENT CONTROL MEASURES SHALL ONLY BE REMOVED WHEN, IN THE OPINION OF THE ENGINEER, THE MEASURES ARE NO LONGER REQUIRED. NO CONTROL MEASURES MAY BE PERMANENTLY REMOVED WITHOUT PRIOR AUTHORIZATION FROM THE ENGINEER.
4. THE CONTRACTOR SHALL IMMEDIATELY REPORT TO THE ENGINEER ANY ACCIDENTAL DISCHARGES OF SEDIMENT MATERIAL INTO ANY DITCH OR STORM SEWER SYSTEM. APPROPRIATE RESPONSE MEASURES, INCLUDING ANY REPAIRS TO EXISTING CONTROL MEASURES OR THE IMPLEMENTATION OF ADDITIONAL CONTROL MEASURES, SHALL BE CARRIED OUT BY THE CONTRACTOR WITHOUT DELAY.
5. THE CONTRACTOR ACKNOWLEDGES THAT FAILURE TO IMPLEMENT EROSION AND SEDIMENT CONTROL MEASURES MAY BE SUBJECT TO PENALTIES IMPOSED BY ANY APPLICABLE REGULATORY AGENCY.
6. THE CONTRACTOR SHALL PROVIDE DUST CONTROL WITH THE APPLICATION OF WATER AND/OR CALCIUM CHLORIDE AS REQUIRED.
7. THE CONTRACTOR SHALL PROTECT ALL SURVEY MONUMENTS.

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DESIGN	DTD
CHECKED	LRW
DRAWN	DTD
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APPROVED	MAB

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CITY OF OTTAWA
KLONDIKE RIDGE - BLOCK 10

EROSION AND SEDIMENT CONTROL PLAN

PROJECT No. 117034-10
REV REV # 1
DRAWING No. 117034-10-ESC

PLANB1.DWG - 1000mmx707mm