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Queensway-Carleton Hospital
Overall Campus
Part 4 Expansion

Stormwater Management Report

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QUEENSWAY CARLETON HOSPITAL
PART 4 EXPANSION
STORMWATER MANAGEMENT REPORT

Prepared by:

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November 28, 2025

Ref: R-2025-085
Novatech File No. 123089

NOVATECH
Engineers, Planners & Landscape Architects

November 28, 2025

Parkin Architects Limited
200 Laurier Avenue West, 3rd floor
Ottawa, Ontario
K1P 6M7

Attention: Derek Judson

Re: Queensway Carleton Hospital: Part 4 Expansion
Stormwater Management Report
3045 Baseline Road, Ottawa, ON
Novatech File No.: 123089

Enclosed is a copy of the Stormwater Management Report prepared for the proposed Queensway Carleton Hospital: Part 4 Expansion located at 3045 Baseline Road. This report addresses the approach to on-site stormwater management and is submitted in support of the Site Plan Control application.

Please contact the undersigned, should you have any questions or require additional information.

NOVATECH

François Thauvette

François Thauvette, P. Eng.
Senior Project Manager

cc: Sue Sallaj Ginn (QCH)
Mohammed Fawzi (City of Ottawa)
Daniel Vancek (VR Eng.)
Linda Rutherford (VR Eng.)

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1.0 INTRODUCTION

The Queensway-Carleton Hospital (QCH) is undergoing another facility expansion to meet the growing demands of the Greater Ottawa community. The proposed Part 4 expansion will include new Hospital buildings, building expansions and renovations, the construction of a new multi-storey parking garage, the extension of the Ring Road along the west side of the campus, internal roadway re-alignments as well as parking lot modifications. The QCH has retained Novatech to complete the site servicing, grading, and stormwater management design for this proposed expansion phase. As part of the proposed works, the existing infrastructure systems (i.e., sewers, watermains and utilities) are being reviewed and upgraded to meet the needs of the Part 4 campus expansion, while also considering future Master Plan expansion phases. One of the central objectives is to upgrade the storm sewers and to ensure they will be relocated where they will not be impacted by future development phases. Another important goal is to ensure the overall sequencing of the work will minimize disruptions to Hospital operations during construction. This report addresses the approach to stormwater management (SWM) on the QCH campus and is being submitted in support of the Site Plan Control application.

1.1 Site Location, Description and General Campus History

The Queensway-Carleton Hospital is located at 3045 Baseline Road and situated on a 20.2-hectare property administered by the National Capital Commission (NCC). The site's north-western entrance off Richmond Road and south-eastern entrance off Baseline Road are connected by John Sutherland Drive. Residential properties and Highway 416 border the subject site to the north-east and south-west, respectively. The legal description of the property is designated as Part of Lot 16, Concession 2 (O.F.), Geographic Township of Nepean, City of Ottawa. Refer to **Figure 1** for an aerial view of the QCH campus.

Figure 1 - Aerial View of the Subject Site

Image Source: geoOttawa (City of Ottawa)

First constructed in the mid 1970s, the Hospital campus has undergone several facility expansions, including various building additions and parking lot modifications. A brief overview of the past QCH expansion projects is as follows:

- The 1998 expansion phase included a small Hospital addition and construction of the Ring Road on the west side of the campus as well as the construction of several parking lots. Portions of the existing storm sewer and watermain were also replaced to accommodate the Hospital expansion as well as anticipated future developments. The increased flow was mitigated using controlled flow roof drains and inlet control devices (ICDs) located within the storm sewer system in the parking lots. A Stormceptor STC 4000 was installed to provide water quality control prior to discharging the stormwater runoff into the existing ditch along the west property line.
- In 2003, the expansion phase included the construction of the Emergency building on the east side of the Hospital, a new parking lot in the northwest corner of the campus, and the reconfiguration of some existing parking lots. Similarly, the increased flow was mitigated using controlled flow roof drains and ICDs located within the storm sewer system in the various parking lots. Based on this report, the existing Stormceptor STC 4000 was determined to be at capacity for the campus.
- In 2005, the Operations Room (OR) addition was constructed as well as the removal of some of the existing storm sewers within the loading dock area. The increased flow was to be mitigated using controlled flow roof drains.
- In 2008, the expansion phase included construction of a Power Plan addition, Cancer Centre, multi-level parking structure, and surface parking lots on the north side of the campus. A new on-site sanitary pump station including twin forcemains was also constructed in response to capacity concerns within the Graham Creek Sanitary Sewer, with most campus sanitary flows being re-directed to the Lynwood Sanitary Collector south of Baseline Road. Portions of the existing storm sewer and watermain were also replaced to accommodate the Hospital expansion. Underground super-pipes were constructed within the new paved parking areas to provide storage for stormwater management purposes. Also included in the works was the construction of a new Stormceptor STC 9000 replacing the existing Stormceptor STC 4000.
- The 2012 expansion phase included construction of a Surgical Centre addition, MRI Centre, and Main Entry building, as well as modifications to the alignment of the Ring Road on the west side of the campus. Additionally, portions of the existing storm sewer and watermain were replaced to accommodate the proposed Hospital expansion.
- In 2023, the Mental Health Wing, located within the southwest portion of the campus, was expanded and includes control flow roof drains as part of the overall campus SWM strategy.

1.2 Pre-Consultation Information

A pre-consultation meeting was held with the City of Ottawa on May 23, 2024, at which time the client was advised of the general submission requirements. Subsequent meetings were held with the National Capital Commission (NCC) and City staff to further discuss the project and approach to site servicing, drainage, and stormwater management. Refer to **Appendix A** for a summary of the correspondence related to the proposed development.

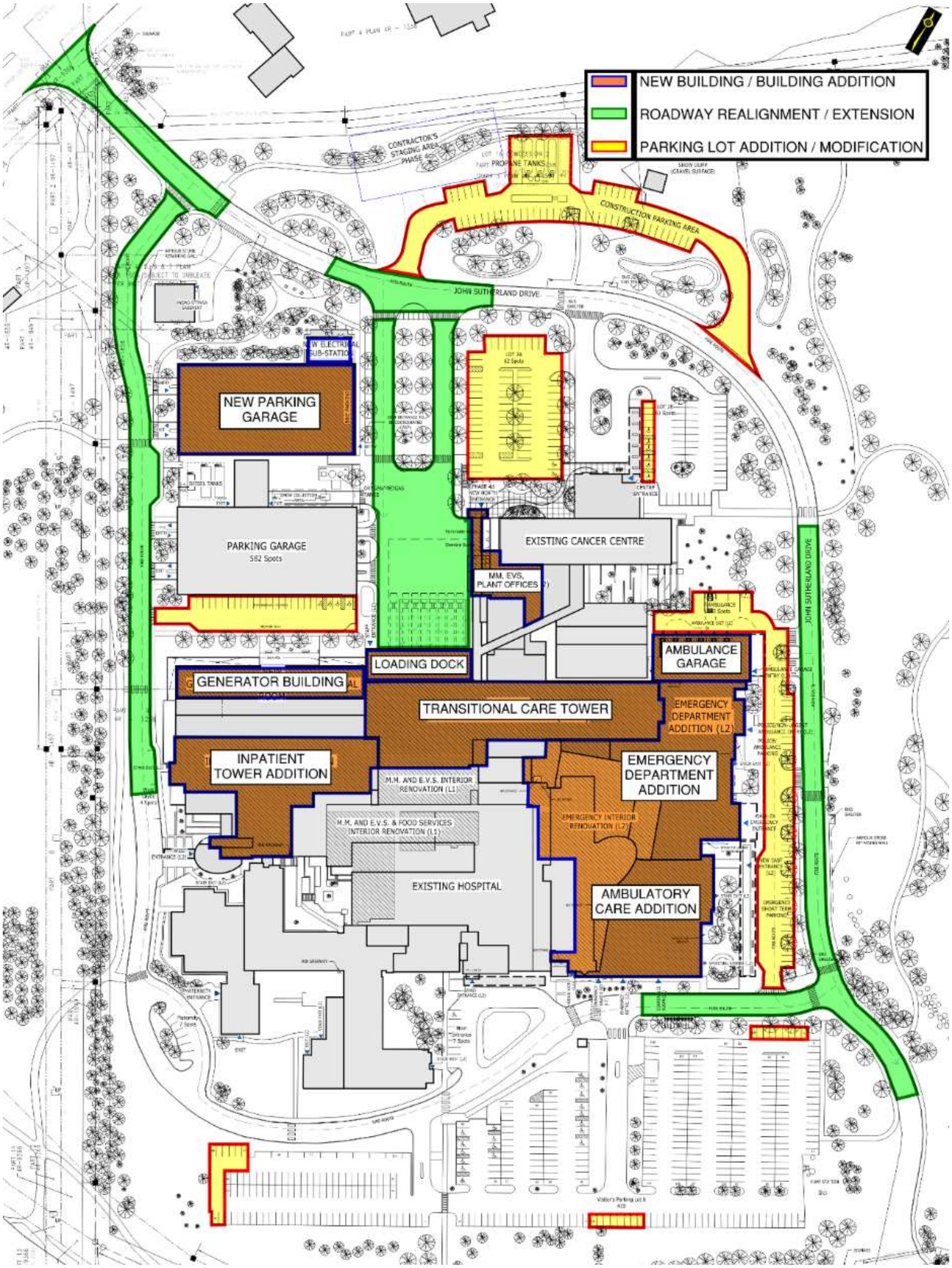
The subject site is located within the jurisdiction of the Rideau Valley Conservation Authority (RVCA). Based on feedback from the City of Ottawa, on-site stormwater management, including both quantity and quality control measures, will be required. The proposed development will be required to meet a *'Normal'* Level of treatment for stormwater quality treatment (i.e., 70% long-term TSS removal) prior to releasing flows from the developed portion of the campus. An amendment to the existing QCH stormwater management Certificate of Approval (C of A) No. 6601-8B8MMR is also anticipated to be required due to the proposed modifications to the on-site stormwater management system. Refer to **Appendix E** for a copy of the existing C of A.

1.3 Proposed Development

The proposed Part 4 expansion will include new medical facilities and ancillary buildings, including an Ambulance Garage, Generator building, Electrical Sub-Station, Materials Management & Environmental Services (MM & EVS) building, and Loading Dock adjacent to the Materials Management addition. The proposed works will also include building additions and renovations at the Emergency Department, Ambulatory Care, Inpatient Tower and Transitional Care Tower. The increased demand for on-site parking will be provided by the construction of a new Multi-Storey Parking Garage as well as modifications to the various surface parking lots on the QCH campus. Proposed roadwork includes the extension of the west Ring Road as well as the re-alignment of the central loading dock area and portions of John Sutherland Drive.

As part of the proposed storm drainage and stormwater management works, the existing infrastructure (i.e., storm sewers) are being reviewed and upgraded. Portions of the existing private sewer system will be removed and realigned, while new segments will be extended to accommodate the new buildings, roadways and parking lot modifications. New storm sewer works will be required along the west Ring Road extension, within the loading dock area, below the new Emergency building expansion, along the realigned portion of the John Sutherland Drive as well as within the northern portion of the campus. The proposed development will be phased appropriately to ensure minimal disruptions to the Hospital’s operations during construction. Refer to **Figure 2** for new building locations and proposed roadworks within the QCH campus.

Figure 2 - New Buildings and Roadway Locations



1.4 Reference Material

The following design guidelines have been used to establish the servicing and stormwater management requirements for the proposed development:

- Ottawa Sewer Design Guidelines (2012) and Technical Bulletins (2010-present).
- Ministry of the Environment Design Guidelines for Sewage Works (2008).
- Ministry of the Environment Design Guidelines for Drinking Water Systems (2008).

The following reports and studies were reviewed and/or prepared as part of the design process:

[1] Queensway-Carleton Hospital Stormwater Management Report, prepared by Novatech Engineering Consultants Ltd., dated October 1998.

[2] Queensway-Carleton Hospital Stormwater Management Report, prepared by Ainley Group, dated May 2003.

[3] Queensway-Carleton Hospital Stormwater Management Report, prepared by IBI Group, dated May 2005.

[4] Queensway-Carleton Hospital Overall Campus – Cancer Centre Addition Stormwater Management Report, prepared by Novatech Engineering Consultants Ltd., dated March 2008.

[5] Queensway-Carleton Hospital Overall Campus – Part 3 Expansion Stormwater Management Report, prepared by Novatech Engineering Consultants Ltd., dated July 2010.

[6] Queensway-Carleton Hospital Part 4 Expansion – Site Servicing Report, prepared by Novatech, dated November 28, 2025.

[7] Geotechnical Investigation – Queensway-Carleton Hospital Expansion, prepared by WSP, dated April 10, 2025.

The details of the proposed QCH Part 4 site servicing design, which will have an impact on the overall SWM design for the campus, are addressed in a separate report entitled: Queensway-Carleton Hospital Part 4 Expansion – Site Servicing Report[6].

2.0 STORM DRAINAGE AND STORMWATER MANAGEMENT

On-site stormwater management, including both water quantity and quality control measures, will be required for the proposed QCH campus expansion. The general approach to stormwater management will be consistent with previously approved QCH SWM Reports[1,2,3,4,5]. The objective of the storm drainage and stormwater management design is to provide proper sewer outlets for the QCH campus while meeting the design criteria established by the City of Ottawa. Refer to the enclosed plans and subsequent sections of the report for further details.

2.1 Existing Conditions

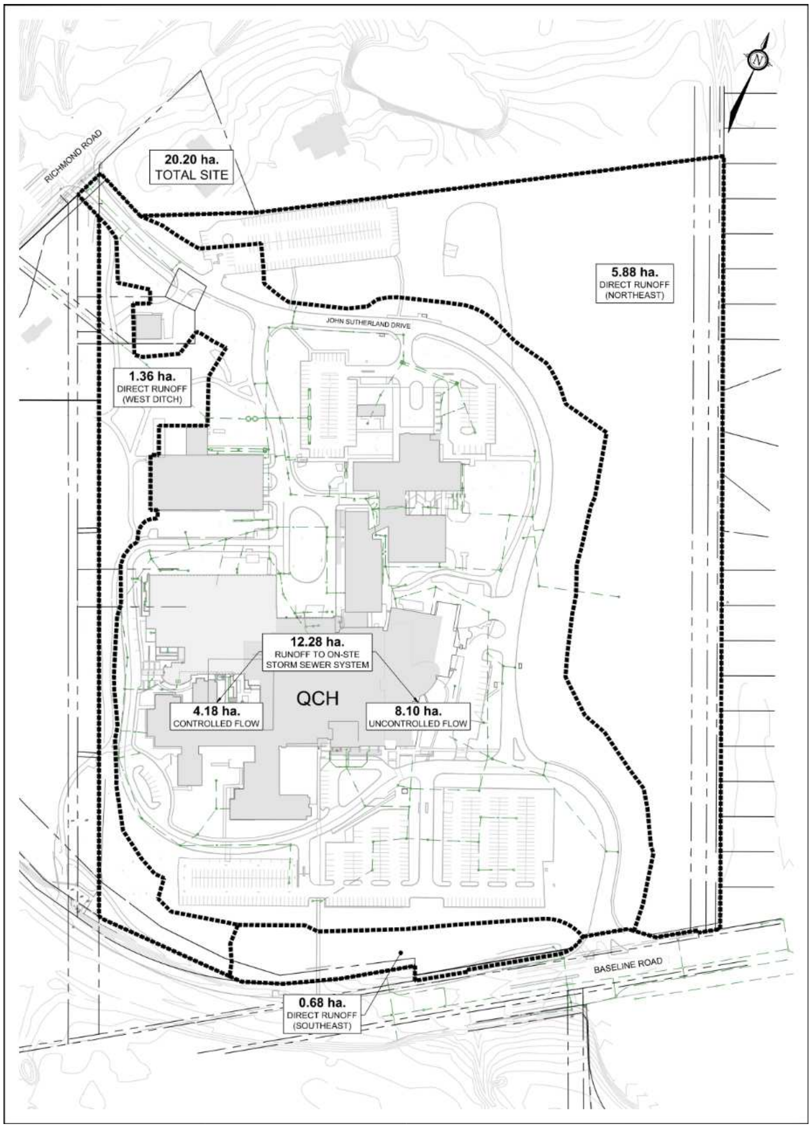
John Sutherland Drive essentially forms the boundary between the developed portion of the campus to the southwest and the largely undeveloped landscaped area to the northeast. The developed portion of the QCH campus, southwest of John Sutherland Drive, consists of existing Hospital buildings, surface parking lots, a multi-level parking structure, access roads and small landscaped areas. The remainder of the campus northeast of John Sutherland Drive, with the exception of the gravel snow dump area and ancillary surface parking lot (which is being removed as part of the proposed works), is comprised of grass fields, berms, and landscaped areas.

2.1.1 Existing Drainage Patterns

The previous SWM Report[5] divided existing drainage into two drainage areas, however after a detailed review of the existing topography and stormwater infrastructure, the existing drainage areas were slightly revised and are outlined as follows.

Under existing conditions, the 20.20 ha QCH campus generally consists of four drainage areas; A large undeveloped grass/vegetated area (5.88 ha) which currently drains uncontrolled towards the northeast corner of the property, a small grassed area (0.68 ha) along the southern boundary of the campus which currently drains to the storm sewers within Baseline Road, a grassed area with multi-use pathways (1.34 ha) along the western boundary of the campus which drains uncontrolled to the ditch adjacent to Richmond Road, and finally the main campus area (12.28 ha) which drains to the Richmond Road ditch through the on-site storm sewer system and downstream Stormceptor STC 9000 water quality treatment unit. Refer to **Figure 3**: Existing Storm Drainage Areas for details.

Figure 3 - Existing Storm Drainage Areas



A high-level breakdown of the various QCH campus drainage areas is provided in **Table 2.1** below.

Table 2.1: Existing Drainage Conditions

Total Site Area (20.20 ha)				
Area Draining to the NE Corner of the QCH campus (5.88 ha)	Area Draining to the Existing Ditch Along Richmond Road (13.64 ha)			Direct Runoff SE Outlet (0.68 ha)
	Flow to the Storm Sewer System (12.28 ha)		Direct Runoff to West Ditch (1.36 ha)	
	Controlled Flow (4.18 ha)	Uncontrolled Flow (8.10 ha)		

As described in the previous SWM Reports[1,2,3,4,5], the existing QCH campus stormwater management design includes both controlled and uncontrolled flows. The controlled flows include runoff from the building roofs, the existing parking structure and some of the surface parking lots around the campus; while the uncontrolled flows include direct runoff from the landscaped areas as well as uncontrolled flow directed to the on-site storm sewer system. Stormwater drainage from the campus ultimately discharges into Graham Creek, via the roadside ditch along Richmond Road or via the municipal storm sewer in Baseline Road.

2.1.2 Existing Release Rate

As the existing conditions drainage areas have been revised, existing conditions peak flows have been re-calculated using the rational method to be used as a basis for the allowable release rates from the site. Peak flows for the 5-year and 100-year storm events are outlined in **Table 2.2**. Refer to **Appendix D** for detailed calculations.

Table 2.2: Existing Stormwater Flow Rate

Total Site (L/s) 5-year = 1,303 100-year = 2,384				
Direct Runoff to the NE Corner of the QCH campus (L/s) 5-yr = 160 100-yr = 328	Drainage to the Existing Ditch Along Richmond Road (L/s) 5-year = 1,119 100-year = 2,007			Direct Runoff to SE Outlet (L/s) 5-yr = 24 100-yr = 49
	Flow to the Storm Sewer System (L/s) 5-year = 1,075 100-year = 1,917		Direct Runoff to West Ditch (L/s) 5-yr = 44 100-yr = 90	
	Controlled Flow (L/s)* 5-yr = 230 100-yr = 273	Uncontrolled Flow (L/s) 5-yr = 845 100-yr = 1,644		

*Information taken directly from previous SWM report[5] and design drawings.

2.1.3 Existing Quality Control Measures

Based on a review of the previous SWM Report[5], the Stormceptor STC 9000 currently provides a *'Normal'* level of protection (i.e. minimum 70% long-term removal of TSS) for the runoff from approximately 11.46 ha (of the 12.28 ha portion of the site) that is currently tributary to the existing storm sewer system which outlets to the west ditch. There is a small area along John Sutherland Drive (0.82 ha of the 12.28 ha portion of the site) at the northwest corner of the campus which is not routed through the water quality unit and outlets directly to the Richmond Road ditch.

Approximately 1.36 ha of undeveloped vegetated area of the total 13.64 ha tributary to the west ditch along Richmond Road, does not require any stormwater quality control measures. Similarly, no stormwater quality control measures are currently being provided for the mainly grass/vegetated areas sheet draining overland towards the northeast corner of the campus (5.88 ha) and towards the southeast outlet (0.68 ha).

2.2 Post-Development Conditions

As described above, the proposed Part 4 QCH Hospital expansion will consist of additional medical facilities, renovations to existing buildings, modifications to internal roadways, the construction of a new parking garage and modifications to existing surface parking lots. Significant upgrades to the on-site storm sewer system will be necessary to accommodate the proposed works and to divert flows, including the removal and realignment of existing sewer segments as well as the construction of new infrastructure. The hospital campus will continue to be serviced by a dual drainage system, including upgrading and expanding the existing storm sewer network (minor system) and by improving the surface storage capacity and major overland flow routes (major system), where possible.

Due to the extent of hard surface areas and limited release rate from the campus, runoff exceeding the existing conditions release rate will be stored on site. Where possible, this will be achieved using controlled flow roof drains on the proposed and existing buildings, by providing surface storage within parking areas with inflows to the storm sewer controlled by ICDs, and by providing storage within over-sized storm sewers and underground tanks. Stormwater runoff from the remainder of the campus, unaffected by the expansion, will generally remain unchanged.

Storm sewer outlets will remain the same, with runoff from most of the campus being routed to the existing storm sewer at the northwest corner of the campus, ultimately discharging to Graham Creek, via the drainage ditch along Richmond Road. The remainder of the campus, northeast of John Sutherland Drive will generally remain undeveloped, except for the new propane tank area parking lot, which will be offset by the removal of the large existing surface parking lot in this area. Stormwater runoff from the landscaped area northeast of John Sutherland Drive and south of the main parking lot along Baseline Road will generally continue to sheet drain towards their respective outlets per existing conditions.

Refer to **Figure 4** for a plan showing the existing storm sewers servicing the QCH Campus and the proposed storm sewer modifications for the Part 4 expansion.

Figure 4 - Storm Sewer Drainage Plan

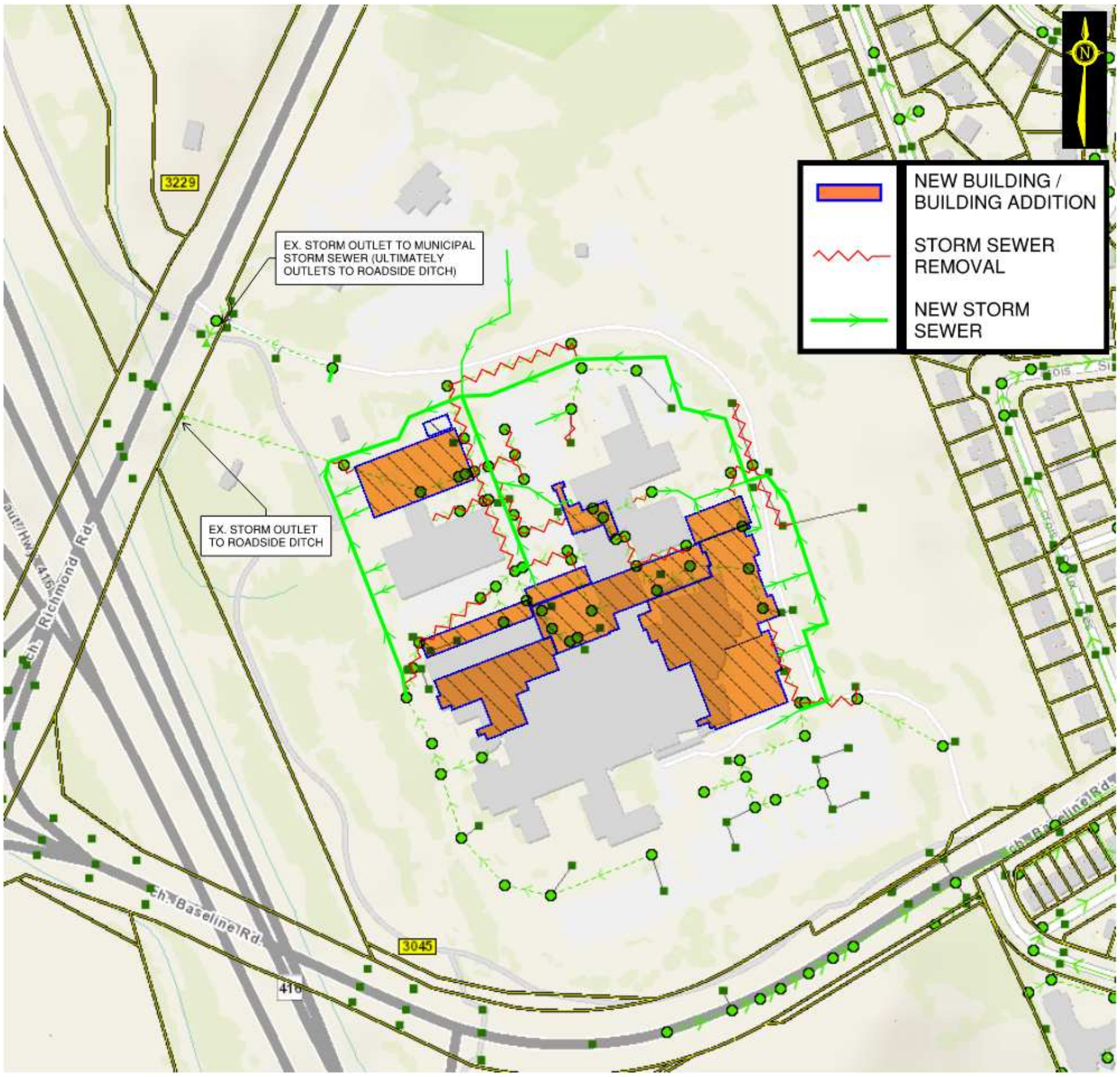


Image Source: geoOttawa (City of Ottawa)

2.2.1 Stormwater Management Criteria and Objectives

The stormwater management (SWM) criteria for the proposed QCH Part 4 expansion have been provided during pre-consultation meetings with the City of Ottawa and are intended to generally follow the approach of the previously approved QCH SWM Reports[1,2,3,4,5]. The SWM criteria and design objectives are as follows:

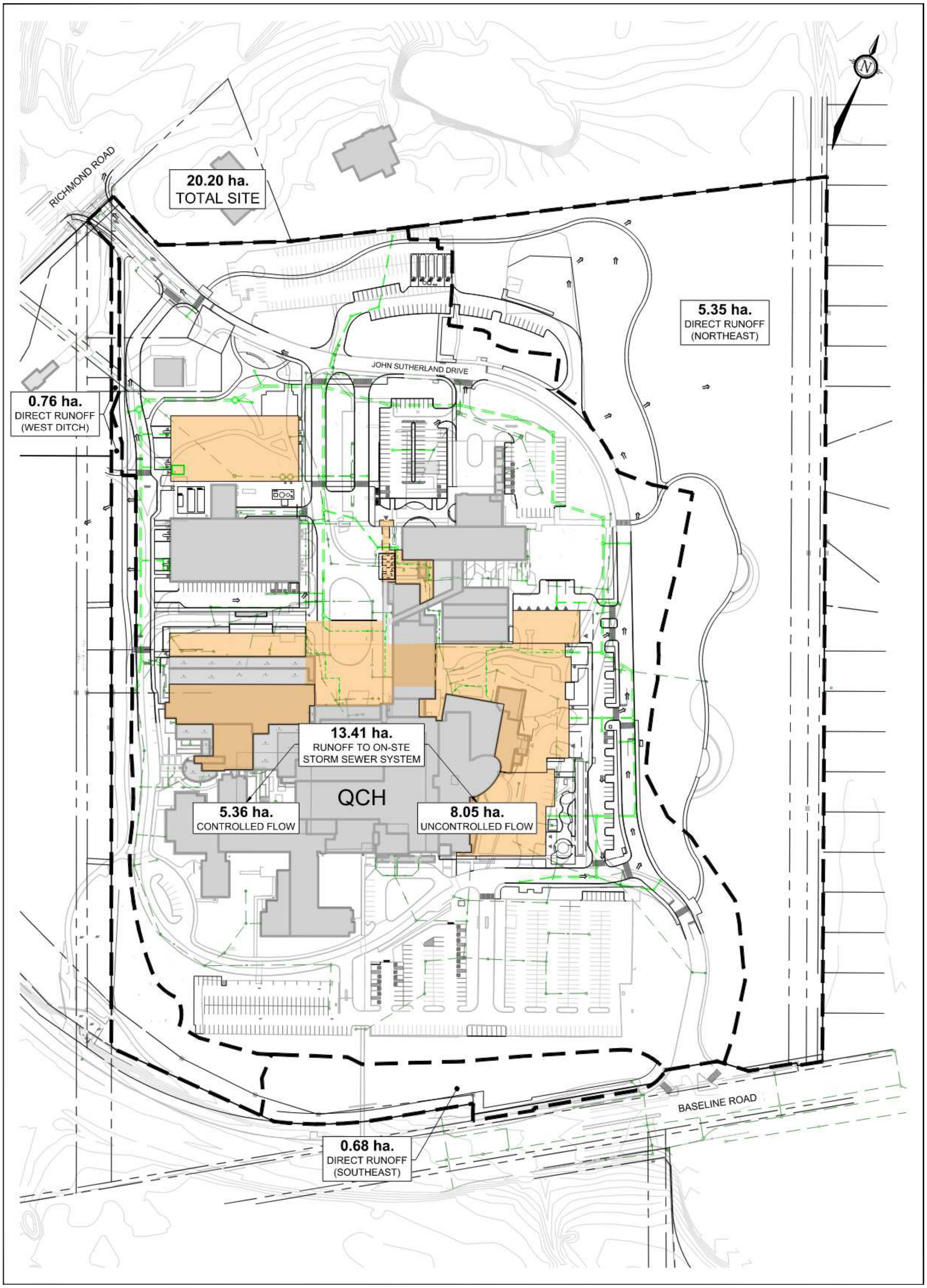
- Provide a dual drainage system (i.e., minor, and major system flows – where possible);
- Provide on-site stormwater quantity control measures, prior to releasing flows into the drainage ditch adjacent to Richmond Road, for all storms up to and including the 100-year design event;
- Ensure that no surface ponding will occur on the paved surfaces (parking lots and drive aisles) during the 2-year storm event;
    - Ensure that no surface ponding will occur on roadways to be used by emergency vehicles during any storm event.

- Provide on-site stormwater quality control equivalent to a *"Normal"* level of protection (minimum 70% long-term TSS removal) prior to releasing flows from the site;
    - Based on the previous SWM Reports, Graham Creek is a Type II Habitat requiring 70% TSS removal, as described in the MOE Stormwater Management Planning and Design Manual.
- Provide guidelines to ensure that site preparation and construction is in accordance with the current Best Management Practices for Erosion a Sediment Control.

2.2.2 Post-Development Flow

Under post-development conditions, the 20.20 ha QCH campus will still consist of four drainage areas. A large undeveloped grass/vegetated area, approximately 5.35 ha (reduced from 5.88 ha), will continue to drain uncontrolled towards the northeast corner of the property, a small grassed area (0.68 ha, unchanged) south of the main parking lot will continue to drain to the municipal storm sewer within Baseline Road, a grassed area of 0.76 ha (reduced from 1.34 ha) along the western boundary of the campus which drains uncontrolled to the ditch adjacent to Richmond Road, and finally the main campus area of 13.41 ha (increased from 12.28 ha), will continue to drain towards the existing ditch along Richmond Road. The latter area can be further divided into two smaller sub-catchment areas; the undeveloped vegetated area which drains uncontrolled to the ditch and the remainder of the campus, where flows are being directed to the ditch via the on-site storm sewer system and new water quality treatment units. Refer to **Figure 5**: Post-Development Storm Drainage Areas for details.

Figure 5 - Post-Development Storm Drainage Areas



A high-level breakdown of the various QCH campus post-development drainage areas is provided in **Table** 2..

Table 2.3: Proposed Drainage Conditions

<table>
<tr><th colspan="5">Total Site Area (20.20 ha)</th></tr>
<tr><th rowspan="3">Area Draining to the NE Corner (5.35 ha)</th><th colspan="3">Area Draining to the Existing Ditch Along the West Property Line (14.17 ha)</th><th rowspan="3">Direct Runoff to SE Outlet (0.68 ha)</th></tr>
<tr><th colspan="2">Flow to the Storm Sewer System (13.41 ha)</th><th rowspan="2">Direct Runoff to West Ditch (0.76 ha)</th></tr>
<tr><th>Controlled Flow (5.36 ha)</th><th>Uncontrolled Flow (8.05 ha)</th></tr>
</table>

The post-development flow from the QCH campus will include both controlled flow and uncontrolled runoff. The controlled portion will include flow from the various building roofs, the existing parking structure and various parking lots around the campus. The uncontrolled portion will include direct runoff from the landscaped areas as well as uncontrolled flow directed to the on-site storm sewer system.

3.0 Stormwater Management Modeling

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

The PCSWMM model schematics and model output data are provided in **Appendix D**. Digital copies of the modeling files and model output for all storm events are provided as part of the digital submission.

3.1 Design Storms

The hydrologic analysis was completed using the following synthetic design storms:

- 3-hour Chicago storm distribution
- 12-hour SCS Type II storm distribution

The return periods analyzed include the 2,5 & 100-year storm events. The IDF parameters used to generate the design storms were taken from the City of Ottawa Sewer Design Guidelines (October 2012). The 25mm water quality storm event was also run.

The 3-hour Chicago distribution generated the highest peak flows for both the minor and major systems and was determined to be the critical storm distribution for the design of the storm drainage system.

The proposed drainage system was also ‘stress tested’ using a 100-year (+20%) 3-hour Chicago design storm. This design storm has a 20% higher intensity and total volume compared to the 100-year event.

3.2 Model Development

The PCSWMM model represents both the minor and major system flows from the campus. The model further delineates the above-noted four drainage areas for the existing campus and proposed expansion areas. Existing and proposed stormwater management infrastructure including pipes, storage tanks, roof drains, and inlet control devices have been included to determine appropriate sizing to reduce peak flows from the increased impervious area. Model parameters are outlined as follows:

Infiltration

Infiltration losses for all catchment areas were modeled using Horton's infiltration equation, which defines the infiltration capacity of 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 as specified in the City of Ottawa Sewer Design Guidelines were used for all catchments.

Horton's Equation:	Initial infiltration rate:	$f_o = 76.2$ mm/hr
$f(t) = f_c + (f_o - f_c)e^{-k(t)}$	Final infiltration rate:	$f_c = 13.2$ mm/hr
	Decay Coefficient:	$k = 4.14$/hr

Depression Storage

The default values for depression storage in the City of Ottawa were used for all sub-catchments.

- Depression Storage (pervious areas): 4.67 mm
- Depression Storage (impervious areas): 1.57 mm

The rooftops assumed to provide no depression storage (zero-impervious parameter).

Equivalent Width

'Equivalent Width' refers to the width of the sub-catchment flow path. This parameter (Table 5.1) is calculated as described in Section 5.4.5.6 of the City of Ottawa Sewer Design Guidelines.

Impervious Values

Runoff coefficients for each sub-catchment area were determined based on the proposed site plan. Refer to the Stormwater Management Plan (123089-SWM) for details. Percent impervious values were calculated using:

$$\%imp = (C - 0.20) / 0.70$$

Storm Drainage Areas

For modeling purposes, the site has been divided into sub-catchments based on the drainage areas tributary to each inlet of the proposed storm sewer system. The sub-catchment areas are shown on the Stormwater Management Plan (123089-SWM). The hydrologic modeling parameters were developed based on the imperviousness of each sub-catchment. A summary of sub-catchment parameters is provided in **Table 3.1**. An expanded table has been provided in **Appendix D**.

Table 3.1: Sub-catchment Parameters

Area ID	Catchment Area (ha)	Runoff Coefficient (C)	Percent Impervious (%)	No Depression (%)	Flow Path Length (m)	Equivalent Width (m)	Average Slope (%)
A101	0.157	0.60	57%	0%	20.06	78.28	0.5%
A102	0.202	0.36	23%	0%	36.40	55.49	0.5%
A103	0.190	0.53	47%	0%	20.51	92.66	0.5%
A104	0.195	0.69	70%	0%	32.94	59.19	0.5%
A105	0.082	0.67	67%	0%	24.52	33.44	0.5%
A106	0.027	0.43	33%	0%	18.17	14.86	0.5%
A107	0.079	0.64	63%	0%	15.54	50.85	0.5%
A108	0.087	0.66	66%	0%	19.39	44.86	0.5%
A113	0.792	0.90	100%	0%	106.42	74.42	0.5%
A116a	0.038	0.90	100%	0%	22.08	17.21	0.5%
A116b	0.017	0.90	100%	0%	6.04	28.13	0.5%
A117	0.023	0.90	100%	0%	13.57	16.96	0.5%
A119	0.122	0.64	63%	0%	47.78	25.53	0.5%
A120	0.227	0.55	50%	0%	41.94	54.12	0.5%
A121	0.100	0.80	86%	0%	19.31	51.78	0.5%
A122	0.283	0.38	25%	0%	28.93	97.82	0.5%
A137	0.020	0.74	77%	0%	7.80	25.65	0.5%
B101	0.550	0.48	40%	0%	29.24	188.09	0.5%
B102	0.127	0.71	73%	0%	28.01	45.35	0.5%
B103	0.030	0.55	51%	0%	9.59	31.28	0.5%
B104	0.137	0.73	76%	0%	25.35	54.05	0.5%
B105	0.077	0.63	62%	0%	14.96	51.48	0.5%
B106	0.155	0.74	77%	0%	16.43	94.33	0.5%
B107	0.081	0.52	46%	0%	18.78	43.12	0.5%
B108	0.052	0.87	96%	0%	12.81	40.60	0.5%
B109	0.052	0.64	63%	0%	14.15	36.75	0.5%
B110	0.153	0.51	45%	0%	18.48	82.77	0.5%
B111	0.055	0.90	100%	0%	15.19	36.21	0.5%
B112	0.660	0.43	33%	0%	32.21	204.88	0.5%
B113	0.091	0.20	0%	0%	18.79	48.42	0.5%
B114	0.394	0.77	82%	0%	44.07	89.40	0.5%
B115	0.290	0.81	87%	0%	35.39	81.94	0.5%
B116	0.175	0.27	9%	0%	63.88	27.39	0.5%
B117	0.211	0.60	57%	0%	36.93	57.14	0.5%
B118	0.164	0.32	17%	0%	23.94	68.50	0.5%
B119	0.150	0.44	35%	0%	20.73	72.34	0.5%
B120	0.089	0.69	69%	0%	12.85	69.28	0.5%
B121	0.089	0.62	60%	0%	17.67	50.36	0.5%
B122a	0.179	0.79	85%	0%	37.41	47.85	0.5%
B122a	0.002	0.79	85%	0%	6.34	3.16	0.5%

Area ID	Catchment Area (ha)	Runoff Coefficient (C)	Percent Impervious (%)	No Depression (%)	Flow Path Length (m)	Equivalent Width (m)	Average Slope (%)
B122b	0.002	0.79	85%	0%	8.46	2.36	0.5%
B123	0.108	0.69	70%	0%	24.99	43.21	0.5%
B124	0.023	0.90	100%	0%	12.78	17.99	0.5%
B125	0.267	0.73	76%	0%	45.79	58.31	0.5%
B126	0.112	0.52	45%	0%	44.96	24.91	0.5%
B127	0.203	0.53	47%	0%	22.86	88.79	0.5%
B128	0.086	0.41	30%	0%	18.33	46.92	0.5%
B129	0.016	0.20	0%	0%	6.66	24.04	0.5%
B130	0.086	0.63	62%	0%	14.28	60.22	0.5%
B131	0.093	0.69	70%	0%	14.33	64.90	0.5%
B132	0.180	0.76	80%	0%	32.63	55.16	0.5%
B133	0.145	0.46	37%	0%	41.43	35.00	0.5%
B134	0.494	0.46	37%	0%	3.14	1575.26	0.5%
B135	0.325	0.60	57%	0%	12.86	252.64	0.5%
EX-A01a	0.423	0.67	66%	0%	29.62	142.80	0.5%
EX-A01b	0.336	0.76	80%	0%	21.12	159.11	0.5%
EX-A02-01	0.028	0.20	0%	0%	16.44	17.04	0.5%
EX-A02-02	0.039	0.20	0%	0%	24.20	16.12	0.5%
EX-A02A	0.400	0.71	73%	0%	30.70	130.29	0.5%
EX-A02B	0.518	0.65	64%	0%	34.34	150.86	0.5%
EX-A03-01	0.080	0.90	100%	0%	18.92	42.28	0.5%
EX-A03-02	0.158	0.90	100%	0%	13.87	113.93	0.5%
EX-A04	0.040	0.90	100%	0%	10.31	38.81	0.5%
EX-R01	0.072	0.90	100%	0%	19.92	36.14	0.5%
EX-R02	0.295	0.90	100%	0%	55.27	53.37	0.5%
EX-R03	0.044	0.90	100%	0%	28.31	15.54	0.5%
P3-01	0.486	0.90	100%	0%	58.73	82.76	0.5%
P3-02	0.017	0.90	100%	0%	11.23	15.14	0.5%
P3-03	0.038	0.90	100%	0%	11.65	32.62	0.5%
P4-01	0.200	0.90	100%	0%	22.83	87.60	0.5%
P4-02	0.294	0.90	100%	0%	28.29	103.93	0.5%
P4-03	0.084	0.90	100%	0%	30.48	27.56	0.5%
P4-04	0.128	0.90	100%	0%	37.20	34.41	0.5%
P4-05	0.341	0.90	100%	0%	50.84	67.08	0.5%
P4-06	0.059	0.90	100%	0%	11.61	50.84	0.5%
P4-07	0.046	0.90	100%	0%	19.42	23.68	0.5%
P4-08	0.288	0.90	100%	0%	67.84	42.45	0.5%
P4-09	0.272	0.90	100%	0%	69.47	39.15	0.5%
P4-	0.721	0.26	8%	0%	288.33	25.01	1.5%

Area ID	Catchment Area (ha)	Runoff Coefficient (C)	Percent Impervious (%)	No Depression (%)	Flow Path Length (m)	Equivalent Width (m)	Average Slope (%)
DR01a							
P4-DR01b	0.680	0.26	8%	0%	209.29	32.49	1.3%
P4-DR01c	0.038	0.26	8%	0%	76.00	5.00	0.5%
P4-DR02	5.351	0.25	7%	0%	510.00	104.92	2.0%
TOTAL:	**20.20**						

3.3 Model Results

The on-site storage and conveyance system requirements were refined using the PCSWMM model. The model was used to ensure that peak flows are controlled to the allowable release rates.

3.3.1 Storage Requirements

Roof Drains

The existing building roofs contain both uncontrolled and control flow roof drains. Flows from the new and renovated building roofs (excluding the new parking garage) will be attenuated using Watts adjustable 'Accutrol' control flow roof drains (model number RD-100-A-ADJ) prior to being directed to the downstream storm sewer system. Where possible, runoff from some existing roofs will be directed onto the new roofs to optimize on-site storage and reduce peak flows. Peak flows from new roofs are based on the number of control flow roof drains and their individual weir setting (i.e., fully closed, ¼ open, etc.). Storage provided on the new roofs has been estimated based on average end-area method calculations and a maximum ponding depth of 0.15m above the drains. Scuppers will be installed to provide an overflow for storms that exceed the maximum available storage (i.e. for storms greater than the 100-year design event). **Table 3.2** summarizes the roof drainage area ID, number of drains within the roof area, 100-year peak flows and maximum storage available.

Table 3.2: Roof Flows & Storage

Drainage Area ID	Number of Roof Drains	100-Year Peak Flow from Drains (L/s)	Maximum Storage Volume Available (m^3)
A113	-	371.5	-
A116	-	30.3	-
A117	-	11.4	-
P3-1	28	31.6	154.2
P3-2**	2	2.3	4.5
*P3-3**	-	12.1	-
P4-1	5	2.9	75.7
P4-2	7	5.7	92.7
P4-3	2	0.6	33.1

Drainage Area ID	Number of Roof Drains	100-Year Peak Flow from Drains (L/s)	Maximum Storage Volume Available (m^3)
P4-4	3	1.0	44.6
P4-5	12	5.1	146.9
P4-6	2	0.6	29
P4-7	3	1.6	23.8

**Denotes uncontrolled roof drainage*
***Information taken directly from the previous SWM Report[5].*

Refer to **Appendix C** for control flow roof drain information and **Appendix D** for detailed SWM calculations.

Surface Storage (Parking Lots)

Under existing conditions, the southern parking lots (areas EX-A01a, EX-A01b, EX-A02a, EX-A02b) provide some surface storage with flows being controlled by ICDs installed in the various catchbasins. These areas will provide approximately 309 m^3 of storage, per the previous SWM Report[5].

Tank Storage

Two storage tanks adjacent to the new and existing parking garages are to be installed to provide additional storage and peak flow control. Each tank provides approximately 65m^3 of storage. Refer to **Appendix C** for detailed storage tank information.

Oversized Storm Sewers

An existing oversized storm sewer (1500mm) provided within the parking area towards the northeast corner of the site, adjacent to the Cancer Centre provides some underground storage for runoff from the parking area. Flows from this storm sewer are controlled by an ICD located within the downstream manhole. ICD sizes are outlined in the following section.

3.3.2 Orifice Controls

Storm flows from some of the existing paved parking areas are attenuated using inlet control devices (ICDs) located within the outlet pipes of existing storm sewer structures. These ICDs allow for increased surface storage during large storm events (5-year and larger) and reduce the peak flow to the storm sewer system. As a part of the PCSWMM modelling exercise, existing ICDs were assessed to determine if they could be replaced to further reduce peak flows and maximize available surface storage. **Table 3.3** outlines the existing and proposed ICD specifications, peak design flow rates, and anticipated maximum ponding depths.

Table 3.3: Inlet Control Device Parameters

Drainage Area ID	Structure ID	ICD Size	ICD Type	5-Yr Peak Flow (L/s)	100-Yr Peak Flow (L/s)	Max Ponding Depth (m)
Existing						
EX. A1a	EX. CB132	84mm	Plug Type Orifice	20.00	20.99	0.35
EX. A1b	EX. CB	85mm	Plug Type Orifice	20.80	21.38	0.35
EX. A2A	EX. CB	91mm	Plug Type Orifice	23.85	23.87	0.35

Drainage Area ID	Structure ID	ICD Size	ICD Type	5-Yr Peak Flow (L/s)	100-Yr Peak Flow (L/s)	Max Ponding Depth (m)
EX. A2B	EX. CB129	81mm	Plug Type Orifice	20.43	20.95	0.35
Proposed						
B108	CB405	83mm	Slide-in plate	14.49	20.86	
B112	CBMH408	178mm	Slide-in plate	72.13	99.71	-
B114-B115	CBMH 10	178mm	Slide-in plate	68.94	103.30	-
B116,117,118	CBMH412	178mm	Slide-in plate	50.46	99.67	-
B120,127	CB410	178mm	Slide-in plate	51.79	106.59	-
B121	EX. CB01	83mm	Slide-in plate	16.31	22.10	0.35
B123	CBMH 1	83mm	Slide-in plate	16.31	22.10	0.35
B128	CB411	94mm	Slide-in plate	11.47	18.08	-
B129	CB412	83mm	Slide-in plate	0.99	4.66	-
B130	CB413	102mm	Slide-in plate	17.30	34.70	-
B131	CB402	108mm	Slide-in plate	20.38	41.58	-
B132	CB403	152mm	Slide-in plate	43.54	80.53	-
B133	CB404	108mm	Slide-in plate	16.89	35.10	-
B134_1*	CB414	94mm	Slide-in plate	5.77	17.03	-
B135_2*	EX-LD01	152mm	Slide-in plate	14.51	31.05	-
P4-08	Tank 01	225mm	Slide-in plate	55.08	83.31	N/A
P4-09	Tank 02	200mm	Slide-in plate	46.50	64.93	N/A

**Denotes a sub-area from a larger sub-catchment area*

Refer to **Appendix C** for ICD information and to **Appendix D** for detailed SWM calculations and modelling results.

3.3.3 Peak Flows

The following table summarizes the post-development flows for the QCH campus for both the 5-year and 100-year design events:

Table 3.4: Post-Development Flow Summary (L/s)

Design Event	Direct Runoff to Northeast	Direct Runoff to SE Outlet	Flows from Main Campus	Direct Runoff to West Ditch	Total Site Flow	Existing Conditions Peak Flow
5-year	105	19	1,440	20	1,584	*1,303*
100-year	247	48	2,062	50	2,408	*2,384*

**Based on PCSWMM Model Results for a 3-hour Chicago Storm; outfall results account for hydrograph timing.*

As shown in the above table, post-development peak flows are somewhat higher than the calculated existing conditions peak flows. Given the increase in impervious areas on-site and limitations with available on-site storage, some increase in peak flows to the ditch along Richmond Road is to be expected. Overall, the 100-year peak flow is approximately 1% higher. The 5-year peak flow has a larger increase; however, the receiving watercourses (Richmond Road ditch and Graham Creek) have sufficient capacity to convey the increase in peak flows. The main goal of the updated stormwater management strategy for the campus is to improve upon the existing hospital stormwater infrastructure, which has been achieved through providing an increase in areas with flow controls.

It should also be noted that there are limitations with comparing peak flows calculated using the Rational Method (previous SWM Reports) and those calculated using the PCSWMM model. The Rational Method calculation provides good approximation of peak flows, however the PCSWMM model is generally more accurate as it accounts for more variables (i.e. slopes, storage controls, hydrograph timing etc.) which can result in higher overall peak flows.

Furthermore, we anticipate that future QCH campus expansions phases will continue to improve the stormwater management controls as uncontrolled areas will be replaced with new buildings with control-flow roof drains.

3.3.4 Stormwater Quality Control Unit Sizing

As discussed previously, the existing water quality control unit (Stormceptor STC9000) currently provides a *'Normal'* level of protection (i.e. minimum 70% long-term removal of TSS). Stormwater flows from the developed portion of the campus flowing through the STC9000 are being discharged into the existing roadside ditch along Richmond Road, which is ultimately tributary to Graham Creek.

To accommodate the proposed Part 4 Expansion, the existing STC9000 water quality treatment unit will be removed. Under post-development conditions, the *'Normal'* level of water quality control will be maintained by two (2) new treatment units, which will be installed immediately upstream of the existing 900mm dia. QCH campus storm sewer outlet pipe. Stormwater runoff collected by the on-site storm sewer system (13.41 ha) can be subdivided into three smaller sub catchment areas. Flows from a portion of the existing storm sewer system near the northwest corner of the campus (0.82 ha) will continue to outlet directly into the existing ditch without treatment, while stormwater runoff from the western portion of the campus (2.56 ha) will be treated by the new water quality treatment unit ("OGS #1") and stormwater runoff from the remainder of the campus (10.03 ha) will be treated by second new water quality treatment unit ("OGS #2").

The "PCSWMM for Stormceptor" online tool has been used to size the two new water quality treatment units capable of meeting the TSS removal requirements (*'Normal'* or 70% long-term TSS removal). The model parameters for the TSS removal were based on historical rainfall data for Ottawa from the Ottawa CDA RCS rainfall station. It was determined that a Stormceptor model EF5 for the 2.56 ha drainage area (OGS #1) will exceed the target removal rate, providing a net annual 74% TSS removal. Similarly, it was determined that a Stormceptor Model EF10 for the 10.03 ha drainage area (OGS #2) will exceed the target removal rate, providing a net annual 74% TSS removal. Refer **Appendix C** for detailed sizing information.

Additional stormwater quality treatment will be provided by the on-site catchbasins and storm manhole structures, which will be equipped with sumps to promote additional settling of sediment. It is recommended that the client implement a maintenance and monitoring program for both the on-site storm sewer system and two new water quality treatment units. The storm drainage system should be inspected routinely (at least annually); the ICDs should be inspected to ensure they are free of debris; and the water quality units should be inspected at regular intervals and maintained when necessary to ensure optimal performance.

4.0 SITE GRADING

The existing QCH campus generally slopes in a north-westerly direction, with the approximate elevation dropping from 79.40m at the site entrance off Baseline Road down to approximately 74.20m at the Richmond Road entrance. The finished floor elevations (FFE) of the proposed Part 4 expansion buildings are based on the existing hospital floor elevations, site topography, and elevations of the new internal roadways. The new buildings additions generally match into the existing Level 1 (74.98m) and Level 2 (79.25m) floor elevations, while the new parking garage has been set at an elevation of 77.40m. Overland flow is generally directed outwards towards the West Ring Road extension and John Sutherland Drive, captured by downstream catchbasins. Some existing parking lots provide low-point surface storage above the catchbasins. The grading design will generally match into the existing elevations around the site.

Refer to the enclosed Grading and Erosion & Sediment Control Plans for details.

4.1 Major Overland Flow Route

As discussed above, the QCH campus generally slopes in a north-westerly direction, with the main storm sewer outlet discharging to the roadside ditch along Richmond Road, located near the northwest corner of the site. In the case of a major rainfall event exceeding the design storms provided for, the stormwater located within the parking and landscaped areas will cascade into lower drainage areas along the re-aligned portion of John Sutherland Drive and ultimately spill towards the northeast corner of the campus. Meanwhile, stormwater located within the northwest portion of John Sutherland Drive and west Ring Road will overflow toward the existing naturalized drainage ditch to the west and/or directly towards the roadside ditch along Richmond Road. The major system continues north from these ditches to Graham Creek, which ultimately outlets to the Ottawa River. The major overland flow route within the QCH campus is shown on the enclosed Grading and Erosion & Sediment Control Plans.

The modified loading dock area will continue to be a low point on the QCH campus, therefore there is no major overland flow route for stormwater draining towards this area. All runoff will be directed towards and drained through the new storm sewer system, which has been oversized (within the loading dock area) to account for this existing condition. Furthermore, as part of the proposed storm sewer upgrades, stormwater flows from other parts of the campus will be diverted away from the loading dock area to reduce potential flooding risks. It is recommended that the owner conduct routine inspections of the storm sewers (at least annually) to ensure that the stormwater drainage system is clean and operational.

5.0 EROSION AND SEDIMENT CONTROL

To mitigate erosion and to prevent sediment from entering the storm sewer system and downstream drainage ditch, temporary erosion and sediment control measures will be implemented on-site during construction in accordance with the Best Management Practices for Erosion and Sediment Control. This includes the following temporary measures:

- Filter bags / catch basin inserts (sediment sacks) will be placed under the grates of nearby catchbasins and manholes and will remain in place until vegetation has been established and construction is completed.
- Silt fencing will be placed per OPSS 577 and OPSD 219.110 along the surrounding construction limits.
- Mud mats will be installed at the site entrances.
- Street sweeping and cleaning will be performed, as required, to suppress dust and to provide safe and clean roadways adjacent to the construction site.

- On-site dewatering is to be directed to a sediment trap and/or gravel splash pad and discharged safely to an approved outlet as directed by the engineer.
- Any stockpiled material will be properly managed to prevent those materials from entering the sewer system and/or the downstream ditch or watercourse.

The temporary erosion and sediment control measures will be implemented prior to construction and will remain in place during all phases of construction. Regular inspection and maintenance of the erosion control measures will be undertaken.

In addition, the following measure will provide permanent erosion and sediment control on site:

- A Stormceptor EF5 water quality unit will be installed to provide water quality control for the western portion of the campus (2.56 ha).
- A Stormceptor EF10 water quality unit will be installed to provide water quality control for the remainder of the campus (10.03 ha).

6.0 GEOTECHNICAL INVESTIGATIONS

The Geotechnical Investigation – Queensway Carleton Hospital Expansion (CA0033714.1722, dated April 10, 2025) has been prepared by WSP for the QCH Campus Part 4 Expansion. Refer to the Geotechnical Report[7] for subsurface conditions, construction recommendations and geotechnical inspection requirements.

7.0 CONCLUSIONS

This report has been prepared in support of the site plan control application for the proposed Queensway Carleton Hospital Part 4 Expansion, located at 3045 Baseline Road, in Ottawa.

The conclusions are as follows:

- A dual drainage system consisting of storm sewers (minor system) and an overland flow path (major system) has been provided to control and convey peak flows from the hospital campus.
- On-site stormwater quantity control measures have been provided, where possible, using control flow roof drains and ICDs. The total 5-year release rate from the campus, including both controlled flows, uncontrolled flows, and direct runoff was calculated to be 1,584 L/s, while the total 100-year release rate was calculated to be 2,408 L/s.
- Campus flows will continue to be directed into the existing outlets including the drainage ditch adjacent to the Richmond Road entrance, near the northeast corner of the campus, and the southeast outlet to the municipal storm sewer in Baseline Road.
- No surface ponding will occur on the paved surfaces (parking lots and drive aisles) during the 2-year storm event.
    - No surface ponding will occur on roadways to be used by emergency vehicles during any storm event.
- On-site stormwater quality control equivalent to a *"Normal"* level of protection (minimum 70% long-term TSS removal) has been provided via two new water quality treatment units (Stormceptor EF5 and Stormceptor EF10) prior to releasing flows from the site.
- Guidelines have been provided to ensure that site preparation and construction is in accordance with the current Best Management Practices for Erosion a Sediment Control.

It is recommended that the proposed stormwater management design be approved for implementation.

NOVATECH

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APPENDIX A

Project Correspondence

File No.: PC2024-0148

June 6, 2024

Derek Judson
Parkin
Via email: judson@parkin.ca

Subject: **Pre-Consultation: Meeting Feedback**
Proposed Site Plan Control Application – 3045 Baseline Road

Please find below information regarding next steps as well as consolidated comments from the above-noted pre-consultation meeting held on May 23, 2024.

Pre-Consultation Preliminary Assessment

1 ☐	**2** ☐	**3** ☒	**4** ☐	**5** ☐

One (1) indicates that considerable major revisions are required while five (5) suggests that the proposal appears to meet the City's key land use policies and guidelines. This assessment is purely advisory and does not consider technical aspects of the proposal or in any way guarantee application approval.

Next Steps

1. A review of the proposal and materials submitted for the above-noted pre-consultation has been undertaken. Please proceed to complete a Phase 2 Pre-consultation Application Form and submit it together with the necessary studies and/or plans to planningcirculations@ottawa.ca.

2. In your subsequent pre-consultation submission, please ensure that all comments or issues detailed herein are addressed. A detailed cover letter stating how each issue has been addressed must be included with the submission materials. Please coordinate the numbering of your responses within the cover letter with the comment number(s) herein.

3. Please note, if your development proposal changes significantly in scope, design, or density before the Phase 3 pre-consultation, you may be required to complete or repeat the Phase 2 pre-consultation process.

Supporting Information and Material Requirements

1. The attached **Study and Plan Identification List** outlines the information and material that has been identified, during this phase of pre-consultation, as either required (R) or advised (A) as part of a future complete application submission.

a. The required plans and studies must meet the City's Terms of Reference (ToR) and/or Guidelines, as available on Ottawa.ca. These ToR and Guidelines outline the specific requirements that must be met for each plan or study to be deemed adequate.

Consultation with Technical Agencies

1. You are encouraged to consult with technical agencies early in the development process and throughout the development of your project concept. A list of technical agencies and their contact information is enclosed.

Planning

Comments:

1. Site is located in the Greenbelt Transect of the Official Plan
2. Current Zoning: RI[307r] H(20) (Rural Institutional Zone, Urban Exception 307r, height restriction 20) & O1[434r] (Parks and Open Space Zone, Urban Exception 434r)
    a. Additional height proposed will require a Zoning Bylaw Amendment application
3. Site Plan application required
4. Consultation is required with the Ministry of Transportation due to proximity to Highway 417.
    a. We recommend consultation with MTO prior to full application submission
5. There looks to be a residence located at the NW end of John Sutherland Drive that may be impacted by the proposed road connection
    a. Consulttaion with this homeowner will be required
    b. Is this a land lease agreement with the NCC? Not sure as propertie details are not available at this time.
6. Please reach out to the RVCA for consultation prior to application submission
7. The Active Transportation Network traverses the site. The new proposed road alignment causes a disruption to the current routes.
    a. Please consider the bike bath realigment
    b. Please consider pathway connections at the intersection of Richmond Road and John Sutherland Road

    c. Please consider pathway realignment at the intersection of Baseline Road and Cedarview Road.

Process Comments

8. Site Plan Control & Zoning By-Law Amendment applications can no longer run concurrently
    a. Pre-Consultation for both applications can be done together
    b. Applications to separate at time of full submission
9. Consultation/ Application process with the NCC
    a. The NCC has a separate and distinct review process for development applications
    b. Recommendation to coordinate submission requirements with the NCC – ideally creating one set of submission requirements to be shared between the City and the NCC
        i. City Staff will wait until further consultation has been done with the NCC before providing a Studies and Plans Identification List (SPIL) so no materials will be duplicated
        ii. Updated survey plan for proper lotting may be required
10. Please reach out to Ted Horton (ted.horton@ncc-ccn.ca) to begin pre-consultation process with the NCC

Urban Design

Comments:

11. Submission requirements:
    a. A Design Brief will be required but will be minimal in terms of requirements. A terms of reference will be provided in the follow-up.
    b. Site plan
    c. Landscape plan
    d. Elevations
12. For new buildings, please avoid blank facades. Incorporating windows, doors and architectural treatments to reduce blank facades from the public realm should be sought. For parking garages, please utilize plantings to hide and screen blank walls with all-season plantings.

13. Please ensure there are clear pedestrian linkages from new structures to entrances.

14. Please provide bicycle parking in close proximity to building entrances. Bicycle parking that is covered would be optimal.

Engineering

General Comments:

15. With the development being spread throughout different parts of the site, the applicant should first ensure that they have reviewed all previous studies and plans developed for the site.

16. Existing public services (main connections) have been listed in these comments. It is the responsibility of the applicant to confirm the existing infrastructure on site and to demonstrate adequate outlets/connections to City infrastructure.

17. During the pre-consultation meeting the applicant asked if an update to the previously developed servicing report report would be acceptable or if a new report would be required for this proposal. Please contact Ryan Brault to further discuss.

Water:

Existing Public Services:

1220mm, SE of site, Baseline Road, Backbone Infrastructure

Boundary Conditions:

18. Request Boundary Conditions prior to first submission. Contact assigned City Infrastructure Project Manager with the following information:
    a. Location of service(s)
    b. Type of development
    c. Fire flow (per FUS method – include FUS calculation sheet with boundary condition request – boundary conditions will not be requested without fire flow calculations)
    d. Average Daily Demand (l/s)
    e. Maximum Hourly Demand (l/s)
    f. Maximum Daily Demand (l/s)

General Comments:

19. Per WDG 4.3.1, where basic demand is greater than 50 m3 /day, there shall be a minimum of two water services, separated by an isolation valve, to avoid creation of vulnerable service area.

20. Per WDG 4.4.7.2, District Meter Area (DMA) Chamber is required for services greater than 150mm in diameter.

SANITARY

Existing Public Services:

525mm (conc.), E boundary of site

245mm (conc.), S of site, S of E-W rail corridor

Existing forcemain to collector sewer

General Comments:

21. Please submit anticipated sanitary demands.

22. Analysis and demonstration that there is sufficient/adequate residual capacity to accommodate any increase in wastewater flows in the receiving and downstream wastewater systems are required to be provided.

STORMWATER

Existing Infrastructure/Systems:

Ditch, NW of site, at Richmond Road

General Comments:

23. Quantity Control:
    a. Allowable runoff coefficient(c): Lesser of pre-development or c=0.5.
    b. Time of Concentration (Tc): pre-development or maximum=10min.
    c. Site should be controlled Post=Pre up to the the 100-year storm event

24. Quality Control:
    a. Normal level of treatment is required: minimum 70% TSS removal

GEOTECHNICAL INVESTIGATION

25. A geotechnical report is required for this development proposal.

GENERAL INFORMATION/OTHER

26. Topographic information and design grades to be tied to proper geodetic benchmark along with proper description of the Geodetic Benchmark used.

27. All submitted report and plan are to be provided in *.pdf documents (documents shall be flattened and unsecured)

REFERENCES AND RESOURCES

28. 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).

29. Servicing and site works shall be in accordance with the following documents:

    a. Previous studies/master plans developed for the site

    b. General City of Ottawa guidelines (including technical bulletins)

30. geoOttawa - https://maps.ottawa.ca/geoOttawa/

Feel free to contact Ryan Brault ((613) 580-2424 ext. 32540, ryan.brault@ottawa.ca), Project Manager, for follow-up questions.

Noise

Comments:

31. Noise Impact Studies required for the following:

    a. Road, as the site is within proximity to Highway 417, Richmond Road and Baseline Road.

    b. Rail

    c. Stationary, due to the proximity to neighboring exposed mechanical equipment and/or if there will be any exposed mechanical equipment due to the proximity to neighboring noise sensitive land uses.

Feel free to contact Josiane Gervais, TPM, for follow-up questions.

Transportation

Comments:

32. Follow Transportation Impact Assessment Guidelines:

a. Note that the TIA Guidelines have been updated to align with the new pre-application consultation process. The changes are available on the City’s website.

b. A Transportation Impact Assessment is required. Please submit the Scoping report to josiane.gervais@ottawa.ca at your earliest convenience or, at the latest, as part of the Phase 2 pre-con package. Should a Phase 2 pre-con be waived, the applicant is still responsible to submit the Scoping Report and must allow for a 14 day circulation period.

c. The Strategy Report must be submitted for review at the latest with the Phase 3 pre-con package. The applicant is still encouraged to submit the Strategy Repot to the TMP before submission of the Phase 3 pre-con package and allow for a 14 day circulation period.

d. Changes to the Baseline/Cedarview intersection will trigger an RMA. Since an RMA is required to support the proposed development, the functional plan and/or RMA plans must be submitted with the formal submission to deem complete. Request base mapping asap via Engineering Services

e. There are constraints with the existing structure over Hwy 417 that could impact the potential for adding an eastbound left-turn lane.

33. ROW Protection:

a. Ensure that the development proposal complies with the Right-of-Way protection requirements of the Official Plan's Schedule C16.

b. Any requests for exceptions to ROW protection requirements must be discussed with Transportation Planning and concurrence provided by Transportation Planning management.

c. If required, ROW must be unincumbered and conveyed at no cost to the City. Note that conveyance of the ROW/corner triangle will be required prior to registration of the SP agreement. Additional information on the conveyance process can be provided upon request.

34. Transportation Master Plan includes:

a. Transit Priority Corridor (Isolated Measures) (Affordable Network) along Baseline and Richmond Road

b. BRT (2031 Network Concept) along Baseline and Richmond Road

35. Nearby planned construction and infrastructure projects include:

a. road resurfacing along Baseline, planned in 3-5 years; and

   b. Transit Priority work planned in 1-2 years (for more information contact PM Chris Ogilvie)

36. There are numerous transit stops along the property frontage and throughout the site. An upgrade to stop #1391 may be required as part of the proposed intersection work. OC Transpo may also wish to adjust service along the new road for more direct access to the expanded inpatient building. Therefore new bus stops may be added onto the road which should be considered.

37. As the proposed site is institutional and for general public use, AODA legislation applies.

    a. Ensure all crosswalks located internally on the site provide a TWSI at the depressed curb, per requirements of the Integrated Accessibility Standards Regulation under the AODA.

    b. Clearly define accessible parking stalls and ensure they meet AODA standards (include an access aisle next to the parking stall and a pedestrian curb ramp at the end of the access aisle, as required).

    c. Please consider using the City's Accessibility Design Standards, which provide a summary of AODA requirements.

38. On site plan:

    a. Ensure site access meets the City's Private Approach Bylaw.

    b. Ensure drive aisle meets Part 4 – Parking, Queueing and Loading Privisions of the Zoning By-law.

    c. Show all details of the roads abutting the site; include such items as pavement markings, accesses and/or sidewalks.

    d. Turning movement diagrams required for all accesses showing the largest vehicle to access/egress the site.

    e. Turning movement diagrams required for internal movements (loading areas, garbage).

    f. Show all curb radii measurements; ensure that all curb radii are reduced as much as possible and fall within TAC guidelines (Figure 8.5.1).

    g. Show dimensions for site elements (i.e. lane/aisle widths, access width and throat length, parking stalls, sidewalks, pedestrian pathways, etc.)

    h. Sidewalk is to be continuous across accesses as per City Specification 7.1.

   i. Show details of parking stalls within proposed lots. Parking stalls at the end of dead-end parking aisles require adequate turning around space.

   j. Show slope of garage ramps on site plan. Note that underground ramps should be limited to a 12% grade and must contain a subsurface melting device when exceeding 6% if exposed to the elements. Ramp grades greater than 15% can be psychological barriers to some drivers. When parking ramp's break over slope exceeds 8%, a vertical-curve transition or a transition slope of half the ramp slope should be used. Without this transition, bottoming out of vehicles may occur.

   k. Note areas that will not be impacted by this application.

Feel free to contact Josiane Gervais, Transportation Project Manager, for follow-up questions.

<u>Environment</u>

Comments:

39. The access road is within an area designated as a Greenbelt Natural Linkage Area, which is a designation that triggers an Environmental Impact Study (EIS) for development. The EIS will need to address all NCC requirements and the City will accept a different format if that is what is required to meet NCC needs. If the road is removed from the area designated Greenbelt Natural Linkage Area, we could support waiving the EIS since there would be no development within that feature/area.

40. The EIS will need to address both Federally and Provincially listed species.

41. Bird-Safe Design Guidelines - Please review and incorporate bird safe design elements. Some of the risk factors include glass and related design traps such as corner glass and fly-through conditions, ventilation grates and open pipes, landscaping, light pollution. More guidance and solutions are available in the guidelines which can be found here: https://documents.ottawa.ca/sites/documents/files/birdsafedesign_guidelines_en.pdf

42. Urban Heat Island - Please add features that reduce the urban heat island effect (see OP 10.3.3) produced by the parking lot and a building footprint. For example, this impact can be reduced by adding large canopy trees, green roofs or vegetation walls, or constructing the parking lot or building differently.

Feel free to contact Matthew Hayley, Environmental Planner, for follow-up questions.

Forestry

Comments:

43. Priority should be given to the retention of trees and softscape areas that could accommodate future tree plantings. Consider altering the design of the connections to John Sutherland Dr. and Baseline Rd to make use of the existing road network on site, rather than converting greenspace to paved surfaces.

44. To mitigate the increase in paved areas, the Landscape Plan should include a tree planting plan that focuses on providing shade to the proposed parking lots, along pedestrian connections, and waiting/drop-off areas.

45. The following Tree Conservation Report (TCR) guidelines have been adapted from the Schedule E of the Tree Protection By-law – for more information on these requirements please contact julian.alvarez-barkham@ottawa.ca

    a. A Tree Conservation Report (TCR) must be supplied for review along with the suite of other plans/reports required by the City
        i. An approved TCR is a requirement of Site Plan approval.
    b. Any removal of privately-owned trees 10cm or larger in diameter within the urban area, or city-owned trees of any 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.
    c. The TCR must contain 2 separate plans:
        i. Plan/Map 1 - show existing conditions with tree cover information.
        ii. Plan/Map 2 - show proposed development with tree cover information.
    d. The TCR must list all trees on site, as well as off-site trees if the CRZ (critical root zone) extends into the developed area, by species, diameter, and health condition.
        i. For ease of review, the Planning Forester suggests that all trees be numbered and referenced in an inventory table.
    e. Please identify trees by ownership – private onsite, private on adjoining site, city owned, co-owned (trees on a property line)
    f. If trees are to be removed, the TCR must clearly show where they are, and document the reason they cannot be retained.
        i. Compensation may be required for the removal of city owned trees.
    g. The removal of trees on a property line will require the permission of both property owners.
    h. 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 on the Tree Protection Specification or by searching Ottawa.ca.
        i. The location of tree protection fencing must be shown on the plan.

    - ii. Show the critical root zone of the retained trees.
  - i. 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.

46. The following Landscape Plan (LP) guidelines have been adapted from Schedule E of the Tree Protection By-law – for more information on these requirements please contact julian.alvarez-barkham@ottawa.ca
  - a. Please ensure any retained trees are shown on the LP.
  - b. Minimum Setbacks
    - i. Maintain 1.5m from sidewalk or MUP/cycle track or water service laterals.
    - ii. Maintain 2.5m from curb.
    - iii. Coniferous species require a minimum 4.5m setback from curb, sidewalk, or MUP/cycle track/pathway.
    - iv. Maintain 7.5m between large growing trees, and 4m between small growing trees. Park or open space planting should consider 10m spacing, except where otherwise approved in naturalization / afforestation areas.
    - v. Adhere to Ottawa Hydro's planting guidelines (species and setbacks) when planting around overhead primary conductors.
  - b. Tree specifications
    - i. Minimum stock size: 50mm tree caliper for deciduous, 200cm height for coniferous.
    - ii. Maximize the use of large deciduous species wherever possible to maximize future canopy coverage.
  - c. Tree planting on city property shall be in accordance with the City of Ottawa's Tree Planting Specification; and if possible, include watering and warranty as described in the specification.
  - d. No root barriers, dead-man anchor systems, or planters are permitted.
  - e. No tree stakes unless necessary (and only 1 on the prevailing winds side of the tree)
  - f. Hard surface planting
    - i. If there are hard surface plantings, a planting detail must be provided.
    - ii. Curb style planter design is highly recommended.
    - iii. No grates are to be used and if guards are required, City of Ottawa standard (which can be provided) shall be used.
  - c. Trees are to be planted at grade.
  - d. Soil Volume - Please demonstrate as per the **Landscape Plan Terms of Reference** that the available soil volumes for new plantings will meet or exceed the following:

Tree Type/Size	Single Tree Soil Volume (m^3)	Multiple Tree Soil Volume (m^3/tree)
Ornamental	15	9
Columnar	15	9
Small	20	12
Medium	25	15
Large	30	18
Conifer	25	15

i. It is strongly suggested that the proposed species list include a column listing the available soil volume.

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

f. The City requests that consideration be given to planting native species wherever there is a high probability of survival to maturity.

g. Efforts shall be made to provide as much future canopy cover as possible at a site level, through tree planting and tree retention. The Landscape Plan shall show/document that the proposed tree planting and retention will contribute to the City's overall canopy cover over time. **Please provide a projection of the future canopy cover for the site to 40 years.**

Feel free to contact Julian Alvarez-Barkham, Forester, for follow-up questions.

<u>Parkland</u>

Comments: Parkland comments to be provided at a later date.

<u>Other</u>

47. The High Performance Development Standard (HPDS) is a collection of voluntary and required standards that raise the performance of new building projects to achieve sustainable and resilient design. The HPDS was passed by Council on April 13, 2022.

   a. At this time, the HPDS is not in effect and Council has referred the 2023 HPDS Update Report back to staff with direction to bring forward an updated report to Committee with recommendations for revised phasing timelines, resource requirements and associated amendments to the Site Plan Control By-law by no later than Q1 2024.

   b. Please refer to ottawa.ca/HPDS for more information.

Submission Requirements and Fees

1. The attached **Study and Plan Identification List** outlines the information and material that has been identified as either required (R) or advised (A) as part of a future complete application submission.
    a. The required plans and studies must meet the City's Terms of Reference (ToR) and/or Guidelines, as available on Ottawa.ca. These ToR and Guidelines outline the specific requirements that must be met for each plan or study to be deemed adequate.
2. All of the above comments or issues should be addressed to ensure the effectiveness of the application submission review.

Should there be any questions, please do not hesitate to contact myself or the contact identified for the above areas / disciplines.

Yours Truly,
Kieran Watson

Encl. List Applicable Information

c.c. Insert contacts to be cc'd

APPENDIX B

Development Servicing Study Checklist

Servicing study guidelines for development applications

4. Development Servicing Study Checklist

The following section describes the checklist of the required content of servicing studies. It is expected that the proponent will address each one of the following items for the study to be deemed complete and ready for review by City of Ottawa Infrastructure Approvals staff.

The level of required detail in the Servicing Study will increase depending on the type of application. For example, for Official Plan amendments and re-zoning applications, the main issues will be to determine the capacity requirements for the proposed change in land use and confirm this against the existing capacity constraint, and to define the solutions, phasing of works and the financing of works to address the capacity constraint. For subdivisions and site plans, the above will be required with additional detailed information supporting the servicing within the development boundary.

4.1 General Content

☐ Executive Summary (for larger reports only).

☒ Date and revision number of the report.

☒ Location map and plan showing municipal address, boundary, and layout of proposed development.

☒ Plan showing the site and location of all existing services.

☒ Development statistics, land use, density, adherence to zoning and official plan, and reference to applicable subwatershed and watershed plans that provide context to which individual developments must adhere.

☒ Summary of Pre-consultation Meetings with City and other approval agencies.

☒ Reference and confirm conformance to higher level studies and reports (Master Servicing Studies, Environmental Assessments, Community Design Plans), or in the case where it is not in conformance, the proponent must provide justification and develop a defendable design criteria.

☒ Statement of objectives and servicing criteria.

☒ Identification of existing and proposed infrastructure available in the immediate area.

☒ Identification of Environmentally Significant Areas, watercourses and Municipal Drains potentially impacted by the proposed development (Reference can be made to the Natural Heritage Studies, if available).

☒ Concept level master grading plan to confirm existing and proposed grades in the development. This is required to confirm the feasibility of proposed stormwater management and drainage, soil removal and fill constraints, and potential impacts to neighbouring properties. This is also required to confirm that the proposed grading will not impede existing major system flow paths.

☐ Identification of potential impacts of proposed piped services on private services (such as wells and septic fields on adjacent lands) and mitigation required to address potential impacts.

☒ Proposed phasing of the development, if applicable.

☒ Reference to geotechnical studies and recommendations concerning servicing.

☒ All preliminary and formal site plan submissions should have the following information:

- Metric scale
- North arrow (including construction North)
- Key plan
- Name and contact information of applicant and property owner
- Property limits including bearings and dimensions
- Existing and proposed structures and parking areas
- Easements, road widening and rights-of-way
- Adjacent street names

4.2 Development Servicing Report: Water

☐ Confirm consistency with Master Servicing Study, if available

☐ Availability of public infrastructure to service proposed development

☐ Identification of system constraints

☐ Identify boundary conditions

☐ Confirmation of adequate domestic supply and pressure

☐ Confirmation of adequate fire flow protection and confirmation that fire flow is calculated as per the Fire Underwriter’s Survey. Output should show available fire flow at locations throughout the development.

☐ Provide a check of high pressures. If pressure is found to be high, an assessment is required to confirm the application of pressure reducing valves.

☐ Definition of phasing constraints. Hydraulic modeling is required to confirm servicing for all defined phases of the project including the ultimate design

☐ Address reliability requirements such as appropriate location of shut-off valves

☐ Check on the necessity of a pressure zone boundary modification.

☐ Reference to water supply analysis to show that major infrastructure is capable of delivering sufficient water for the proposed land use. This includes data that shows that the expected demands under average day, peak hour and fire flow conditions provide water within the required pressure range

☐ Description of the proposed water distribution network, including locations of proposed connections to the existing system, provisions for necessary looping, and appurtenances (valves, pressure reducing valves, valve chambers, and fire hydrants) including special metering provisions.

☐ Description of off-site required feedermains, booster pumping stations, and other water infrastructure that will be ultimately required to service proposed development, including financing, interim facilities, and timing of implementation.

☐ Confirmation that water demands are calculated based on the City of Ottawa Design Guidelines.

☐ Provision of a model schematic showing the boundary conditions locations, streets, parcels, and building locations for reference.

4.3 Development Servicing Report: Wastewater

☐ Summary of proposed design criteria (Note: Wet-weather flow criteria should not deviate from the City of Ottawa Sewer Design Guidelines. Monitored flow data from relatively new infrastructure cannot be used to justify capacity requirements for proposed infrastructure).

☐ Confirm consistency with Master Servicing Study and/or justifications for deviations.

☐ Consideration of local conditions that may contribute to extraneous flows that are higher than the recommended flows in the guidelines. This includes groundwater and soil conditions, and age and condition of sewers.

☐ Description of existing sanitary sewer available for discharge of wastewater from proposed development.

☐ Verify available capacity in downstream sanitary sewer and/or identification of upgrades necessary to service the proposed development. (Reference can be made to previously completed Master Servicing Study if applicable)

☐ Calculations related to dry-weather and wet-weather flow rates from the development in standard MOE sanitary sewer design table (Appendix ‘C’) format.

☐ Description of proposed sewer network including sewers, pumping stations, and forcemains.

☐ Discussion of previously identified environmental constraints and impact on servicing (environmental constraints are related to limitations imposed on the development in order to preserve the physical condition of watercourses, vegetation, soil cover, as well as protecting against water quantity and quality).

☐ Pumping stations: impacts of proposed development on existing pumping stations or requirements for new pumping station to service development.

☐ Forcemain capacity in terms of operational redundancy, surge pressure and maximum flow velocity.

☐ Identification and implementation of the emergency overflow from sanitary pumping stations in relation to the hydraulic grade line to protect against basement flooding.

☐ Special considerations such as contamination, corrosive environment etc.

4.4 Development Servicing Report: Stormwater Checklist

☒ Description of drainage outlets and downstream constraints including legality of outlets (i.e. municipal drain, right-of-way, watercourse, or private property)

☐ Analysis of available capacity in existing public infrastructure.

☒ A drawing showing the subject lands, its surroundings, the receiving watercourse, existing drainage patterns, and proposed drainage pattern.

☒ Water quantity control objective (e.g. controlling post-development peak flows to pre-development level for storm events ranging from the 2 or 5 year event (dependent on the receiving sewer design) to 100 year return period); if other objectives are being applied, a rationale must be included with reference to hydrologic analyses of the potentially affected subwatersheds, taking into account long-term cumulative effects.

☒ Water Quality control objective (basic, normal or enhanced level of protection based on the sensitivities of the receiving watercourse) and storage requirements.

☒ Description of the stormwater management concept with facility locations and descriptions with references and supporting information.

☐ Set-back from private sewage disposal systems.

☐ Watercourse and hazard lands setbacks.

☐ Record of pre-consultation with the Ontario Ministry of Environment and the Conservation Authority that has jurisdiction on the affected watershed.

☒ Confirm consistency with sub-watershed and Master Servicing Study, if applicable study exists.

☒ Storage requirements (complete with calculations) and conveyance capacity for minor events (1:5 year return period) and major events (1:100 year return period).

☐ Identification of watercourses within the proposed development and how watercourses will be protected, or, if necessary, altered by the proposed development with applicable approvals.

☒ Calculate pre and post development peak flow rates including a description of existing site conditions and proposed impervious areas and drainage catchments in comparison to existing conditions.

☐ Any proposed diversion of drainage catchment areas from one outlet to another.

☒ Proposed minor and major systems including locations and sizes of stormwater trunk sewers, and stormwater management facilities.

☒ If quantity control is not proposed, demonstration that downstream system has adequate capacity for the post-development flows up to and including the 100 year return period storm event.

☒ Identification of potential impacts to receiving watercourses

☐ Identification of municipal drains and related approval requirements.

☒ Descriptions of how the conveyance and storage capacity will be achieved for the development.

☐ 100 year flood levels and major flow routing to protect proposed development from flooding for establishing minimum building elevations (MBE) and overall grading.

☐ Inclusion of hydraulic analysis including hydraulic grade line elevations.

☒ Description of approach to erosion and sediment control during construction for the protection of receiving watercourse or drainage corridors.

☐ Identification of floodplains – proponent to obtain relevant floodplain information from the appropriate Conservation Authority. The proponent may be required to delineate floodplain elevations to the satisfaction of the Conservation Authority if such information is not available or if information does not match current conditions.

☐ Identification of fill constraints related to floodplain and geotechnical investigation.

4.5 Approval and Permit Requirements: Checklist

The Servicing Study shall provide a list of applicable permits and regulatory approvals necessary for the proposed development as well as the relevant issues affecting each approval. The approval and permitting shall include but not be limited to the following:

☐ Conservation Authority as the designated approval agency for modification of floodplain, potential impact on fish habitat, proposed works in or adjacent to a watercourse, cut/fill permits and Approval under Lakes and Rivers Improvement Act. The Conservation Authority is not the approval authority for the Lakes and Rivers Improvement Act. Where there are Conservation Authority regulations in place, approval under the Lakes and Rivers Improvement Act is not required, except in cases of dams as defined in the Act.

☐ Application for Certificate of Approval (CofA) under the Ontario Water Resources Act.

☐ Changes to Municipal Drains.

☐ Other permits (National Capital Commission, Parks Canada, Public Works and Government Services Canada, Ministry of Transportation etc.)

4.6 Conclusion Checklist

☒ Clearly stated conclusions and recommendations

☐ Comments received from review agencies including the City of Ottawa and information on how the comments were addressed. Final sign-off from the responsible reviewing agency.

☒ All draft and final reports shall be signed and stamped by a professional Engineer registered in Ontario

APPENDIX C

Storm Servicing Background Information

WATTS®

Adjustable Accutrol Weir

Tag: ____________________

Adjustable Flow Control for Roof Drains

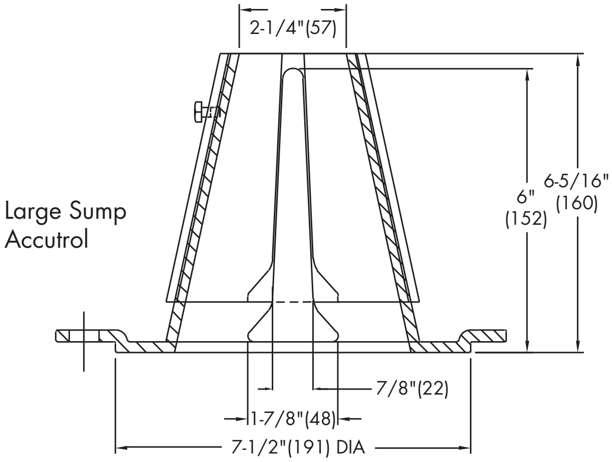
ADJUSTABLE ACCUTROL (for Large Sump Roof Drains only)

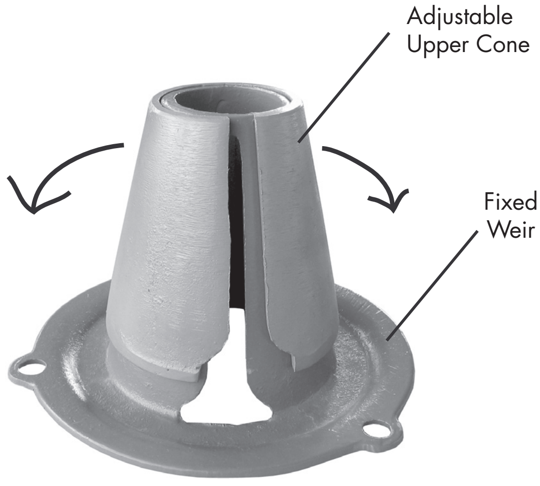
For more flexibility in controlling flow with heads deeper than 2", Watts Drainage offers the Adjustable Accutrol. The Adjustable Accutrol Weir is designed with a single parabolic opening that can be covered to restrict flow above 2" of head to less than 5 gpm per inch, up to 6" of head. To adjust the flow rate for depths over 2" of head, set the slot in the adjustable upper cone according to the flow rate required. Refer to Table 1 below.
Note: Flow rates are directly proportional to the amount of weir opening that is exposed.

EXAMPLE:

For example, if the adjustable upper cone is set to cover 1/2 of the weir opening, flow rates above 2"of head will be restricted to 2-1/2 gpm per inch of head.

Therefore, at 3"of head, the flow rate through the Accutrol Weir that has 1/2 the slot exposed will be:
[5 gpm (per inch of head) x 2 inches of head] + 2-1/2 gpm (for the third inch of head) = 12-1/2 gpm.





1/2 Weir Opening Exposed Shown Above

TABLE 1. Adjustable Accutrol Flow Rate Settings

Weir Opening Exposed	1"	2"	3"	4"	5"	6"
	Flow Rate (gallons per minute)					
Fully Exposed	5	10	15	20	25	30
3/4	5	10	13.75	17.5	21.25	25
1/2	5	10	12.5	15	17.5	20
1/4	5	10	11.25	12.5	13.75	15
Closed	5	5	5	5	5	5

Job Name ____________________

Job Location ____________________

Engineer ____________________

Contractor ____________________

Contractor's P.O. No. ____________________

Representative ____________________

Watts product specifications in U.S. customary units and metric are approximate and are provided for reference only. For precise measurements, please contact Watts Technical Service. Watts reserves the right to change or modify product design, construction, specifications, or materials without prior notice and without incurring any obligation to make such changes and modifications on Watts products previously or subsequently sold.

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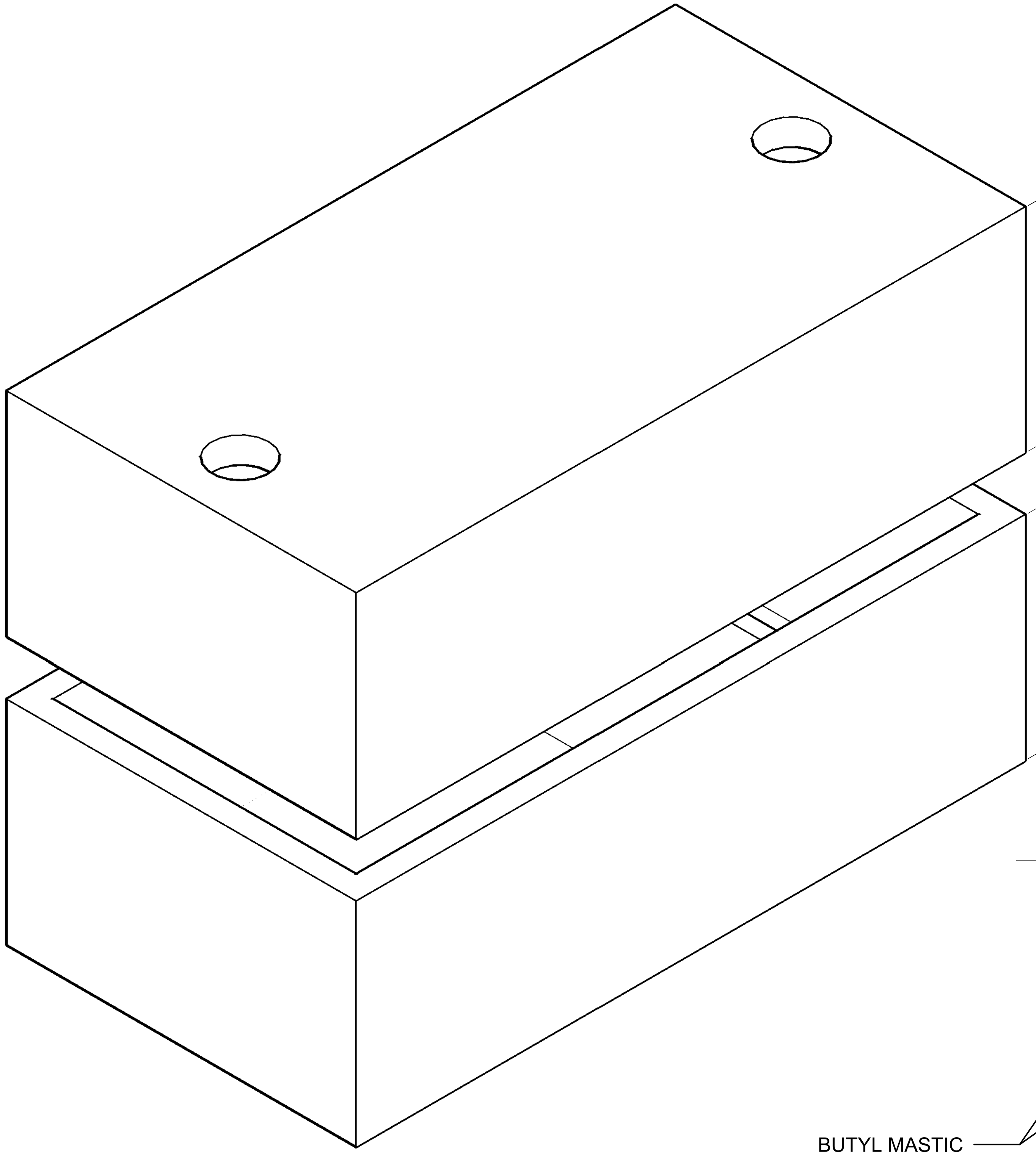


ISOMETRIC VIEW

CAPACITY		H1		H2		H	
LITRE	GALLON	OUTSIDE	INSIDE	OUTSIDE	INSIDE	OUTSIDE	INSIDE
35000	7700	2100	1850	600	350	2700	2200
40000	8800	2100	1850	900	650	3000	2500
45000	9900	2100	1850	1150	900	3250	2750
50000	11000	2100	1850	1350	1100	3450	2950
55000	12100	2100	1850	1650	1400	3750	3250
60000	13200	2100	1850	1850	1600	3950	3450
65000	14300	2100	1850	2100	1850	4200	3700

CAPACITY		WEIGHT (tonne)		
LITRE	GALLON	BASE	TOP	ALL
35000	7700	36	18.3	54.3
40000	8800	36	21.6	57.6
45000	9900	36	24.3	60.3
50000	11000	36	26.4	62.4
55000	12100	36	29.6	65.6
60000	13200	36	31.8	67.8
65000	14300	36	34	70

NOTES:

ALL DIMENSIONS IN MILLIMETERS UNLESS OTHERWISE STATED.

NOT TO SCALE

NON TRAFFIC RATED, TRAFFIC RATED DESIGNS AVAILABLE UPON REQUEST

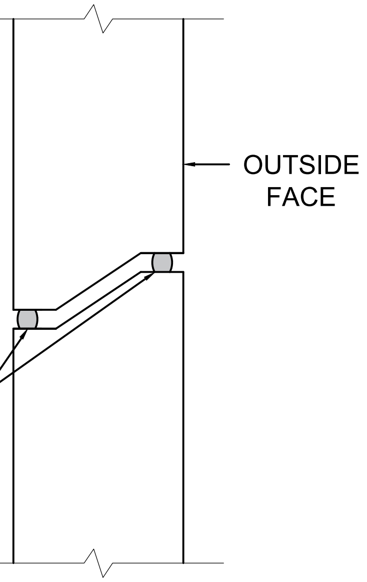
CUSTOM ACCESS OPENINGS, RISERS, AND HATCHES AVAILABLE UPON REQUEST

MAX DEPTH OF COVER = 1500mm

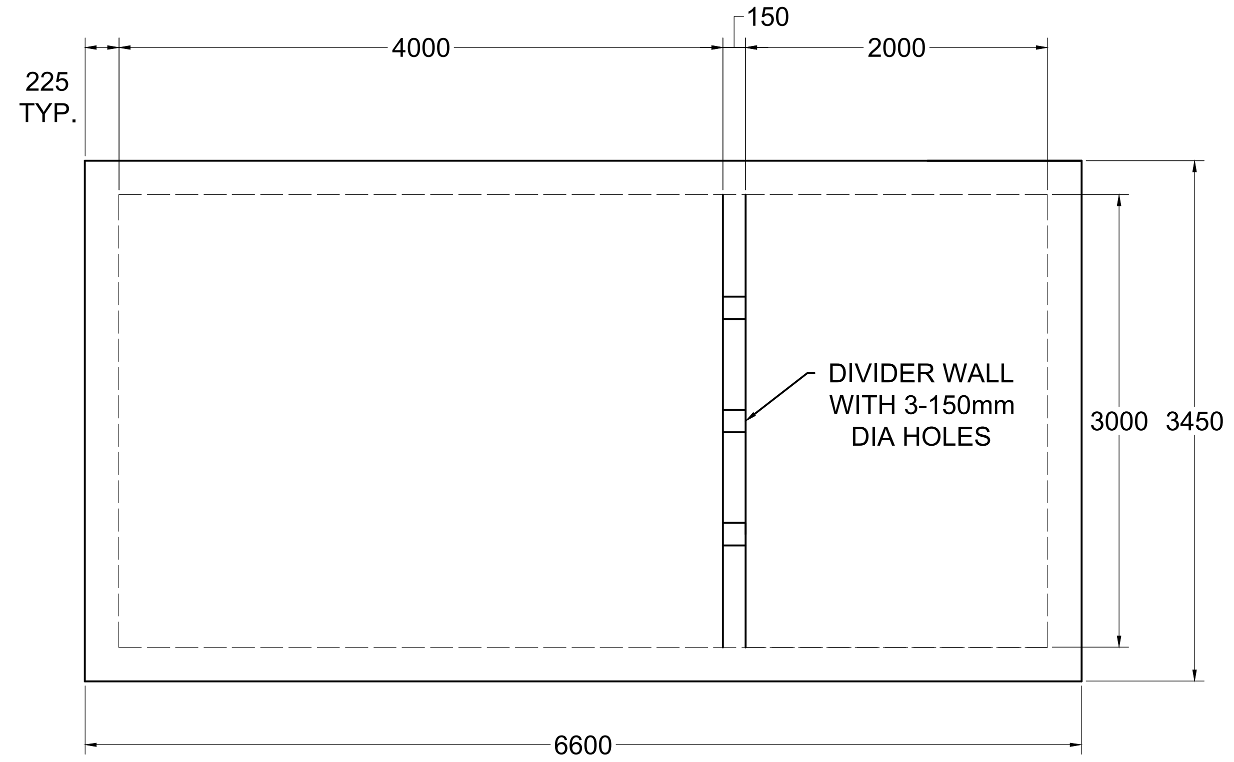
TYP. SLAB THICKNESS = 250mm

TANK DELIVERED IN TWO PIECES, TO BE ASSEMBLED ON SITE BY OTHERS

ALL LIFTING ANCHORS ARE TO BE DAYTON SUPERIOR OR APPROVED ALTERNATIVE. ALL RIGGING, HOISTING, AND LIFTING TO BE IN STRICT ACCORDANCE WITH DAYTON SUPERIOR MANUAL.



JOINT DETAIL



PLAN VIEW

SPECIFICATIONS:
PRODUCT DESIGNED IN ACCORDANCE WITH CSA A23.3

PRODUCTION:
IN ACCORDANCE WITH CSA A23.4

CONCRETE:
IN ACCORDANCE WITH CSA A23.1

REINFORCING:
IN ACCORDANCE WITH WITH CSA G30.18
GRADE 400W

SEPTIC TANK
(35,000L - 65,000L)

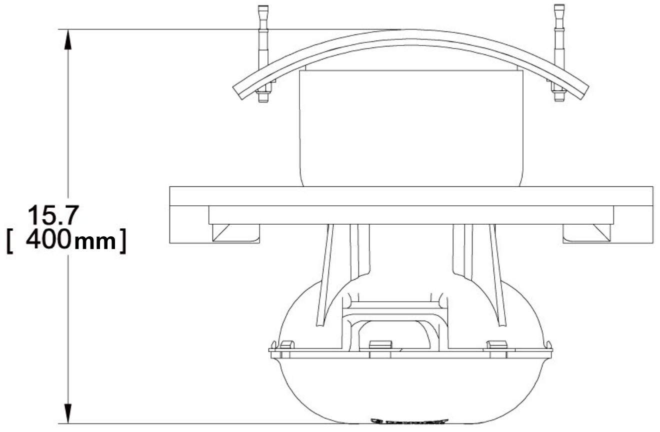
DRAWN BY:
JS

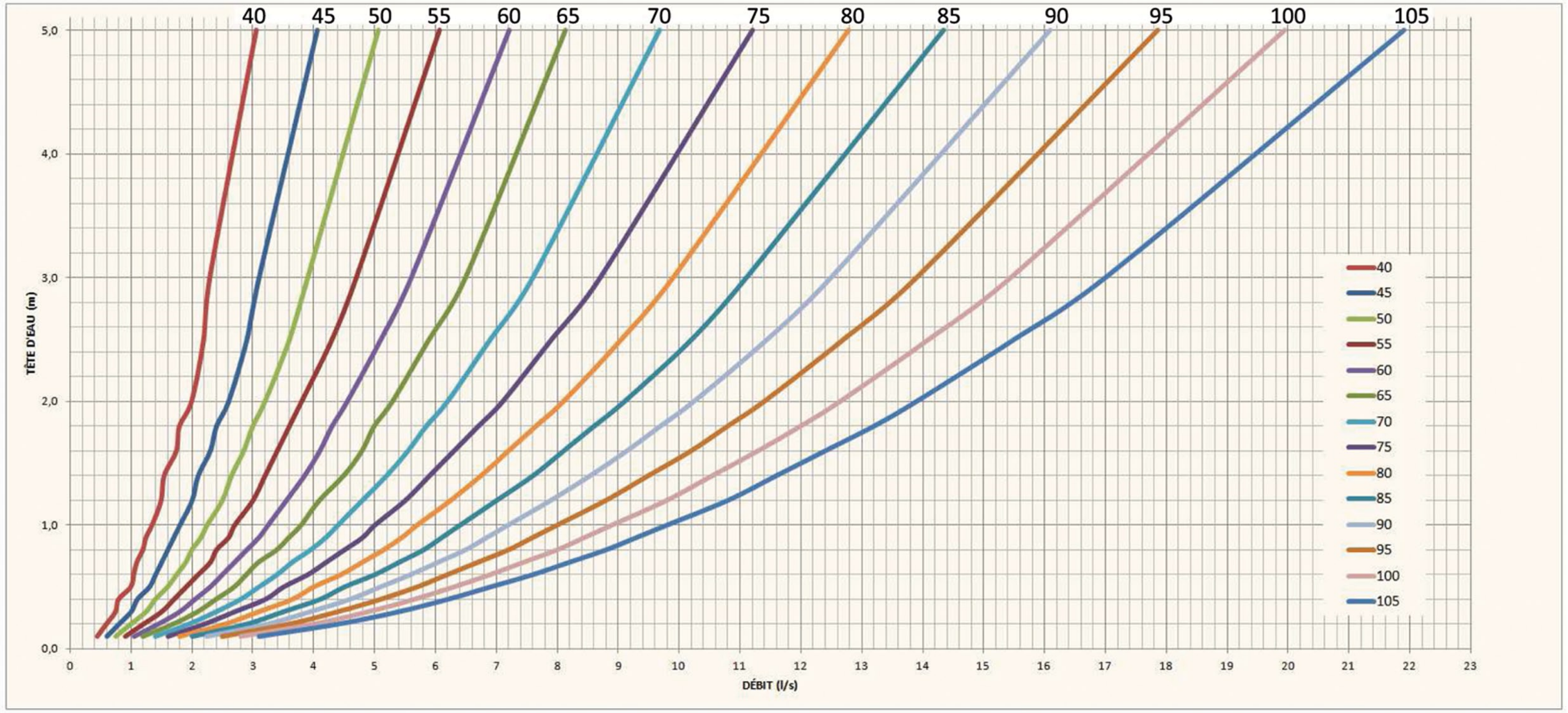
DATE:
AUG 2023

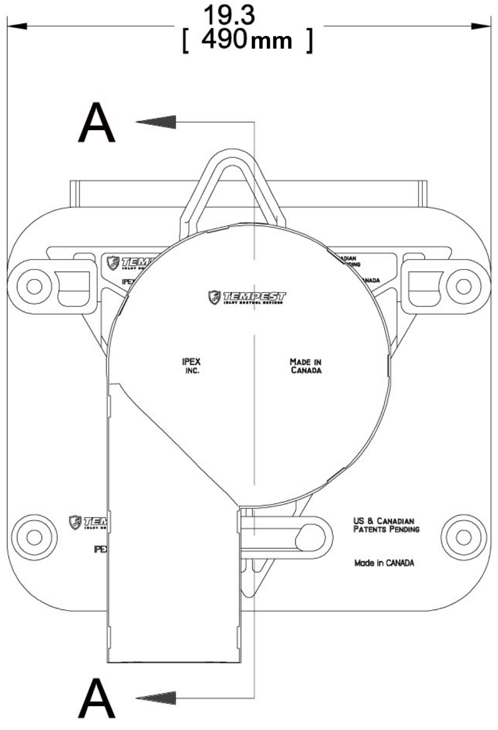
1645 SYDENHAM RD.
KINGSTON, ON

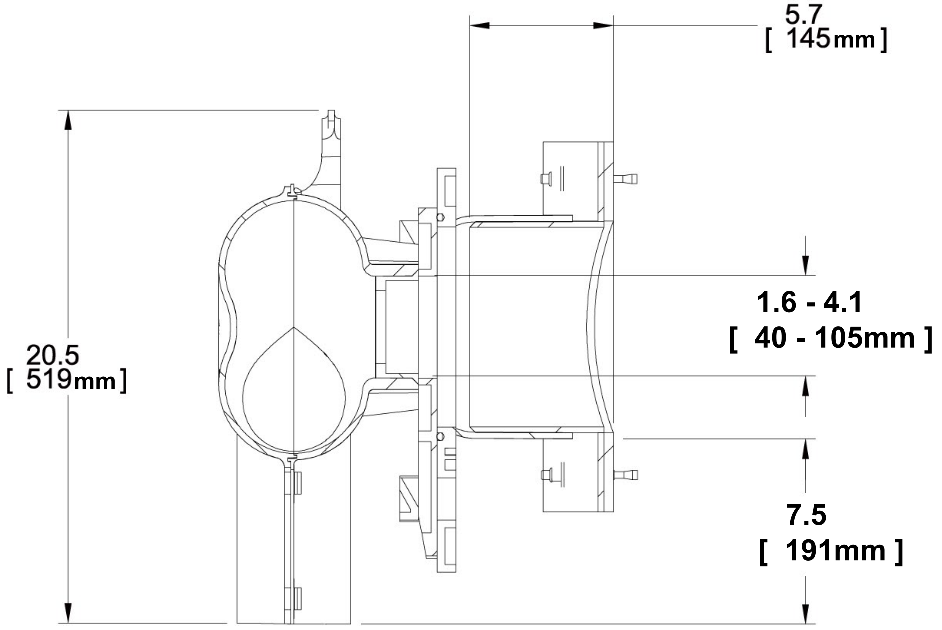
PHONE:
(800) 223-0012
1-613-546-6683

WWW.ANCHORCONCRETE.COM

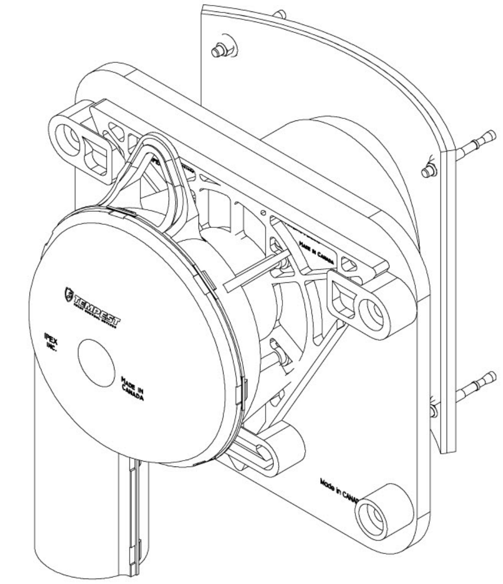








SECTION A-A



IPEX

Product development engineering
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Canada Tel 514 769 2200
www.ipexna.com

PROJECTION	UNITS	TITLE
	in [mm]	Tempest LMF round CB assembly [VORTEX]

SIZE	SCALE(S)	
B	1/8	1-2014

IPEX Tempest™
Inlet Control Devices

Municipal Technical Manual Series

Vol. I, 2nd Edition

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PRODUCT 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. 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 shall 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.

PRODUCT INFORMATION: TEMPEST HF & MHF ICD

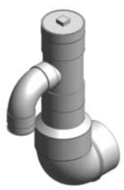
Product Description

Our HF, HF Sump and MHF ICD's are designed to accommodate catch basins or manholes with sewer outlet pipes 6" in diameter or larger. Any storm sewer larger than 12" may require custom modification. However, IPEX can custom build a TEMPEST device to accommodate virtually any storm sewer size.

Available in 5 preset flow curves, these ICDs have the ability to provide constant flow rates: 9lps (143 gpm) and greater

Product Function

TEMPEST HF (High Flow): designed to manage moderate to higher flows 15 L/s (240 gpm) or greater and prevent the propagation of odour and floatables. With this device, the cross-sectional area of the device is larger than the orifice diameter and has been designed to limit head losses. The HF ICD can also be ordered without flow control when only odour and floatable control is required.



TEMPEST HF (High Flow) Sump: The height of a sewer outlet pipe in a catch basin is not always conveniently located. At times it may be located very close to the catch basin floor, not providing enough sump for one of the other TEMPEST ICDs with universal back plate to be installed. In these applications, the HF Sump is offered. The HF Sump offers the same features and benefits as the HF ICD; however, is designed to raise the outlet in a square or round catch basin structure. When installed, the HF sump is fixed in place and not easily removed. Any required service to the device is performed through a clean-out located in the top of the device which can be often accessed from ground level.

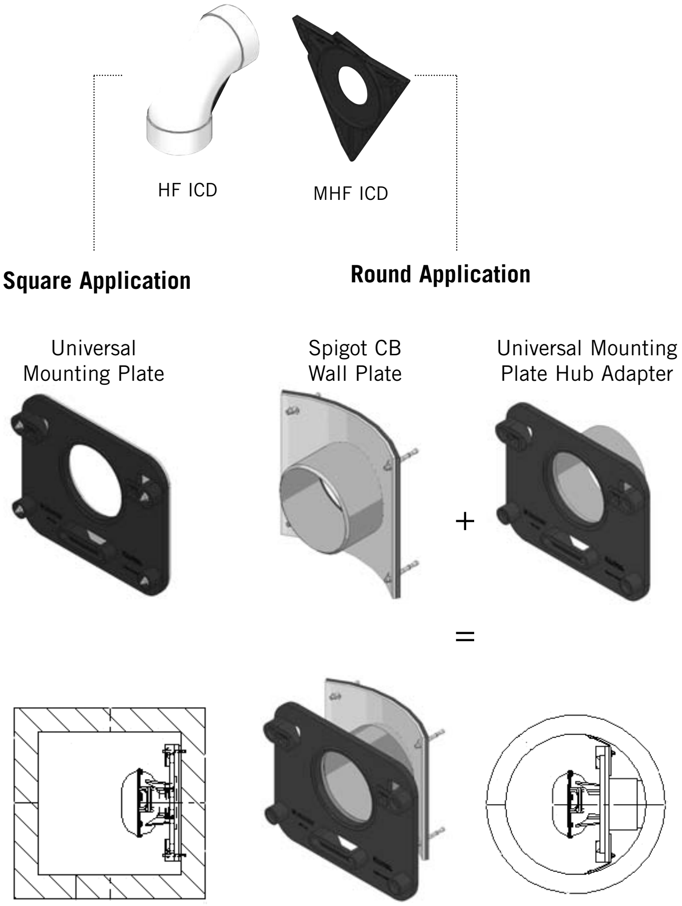
TEMPEST MHF (Medium to High Flow):
The MHF plate or plug is designed to control flow rates 9 L/s (143 gpm) or greater. It is not designed to prevent the propagation of odour and floatables.

Product Construction

The HF, HF Sump and MHF ICDs are built to be light weight at a maximum weight of 6.8 Kg (14.6 lbs).

Product Applications

The HF and MHF ICD's are available to accommodate both square and round applications:



The HF Sump is available to accommodate low to no sump applications in both square and round catch basins:

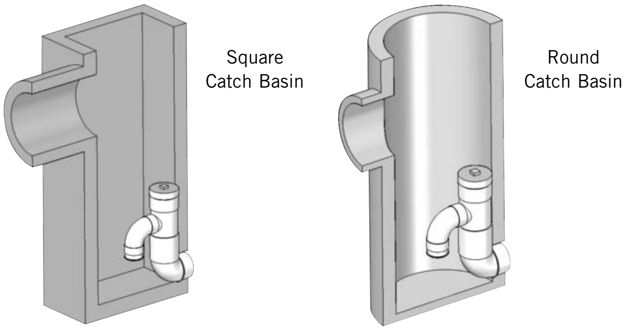
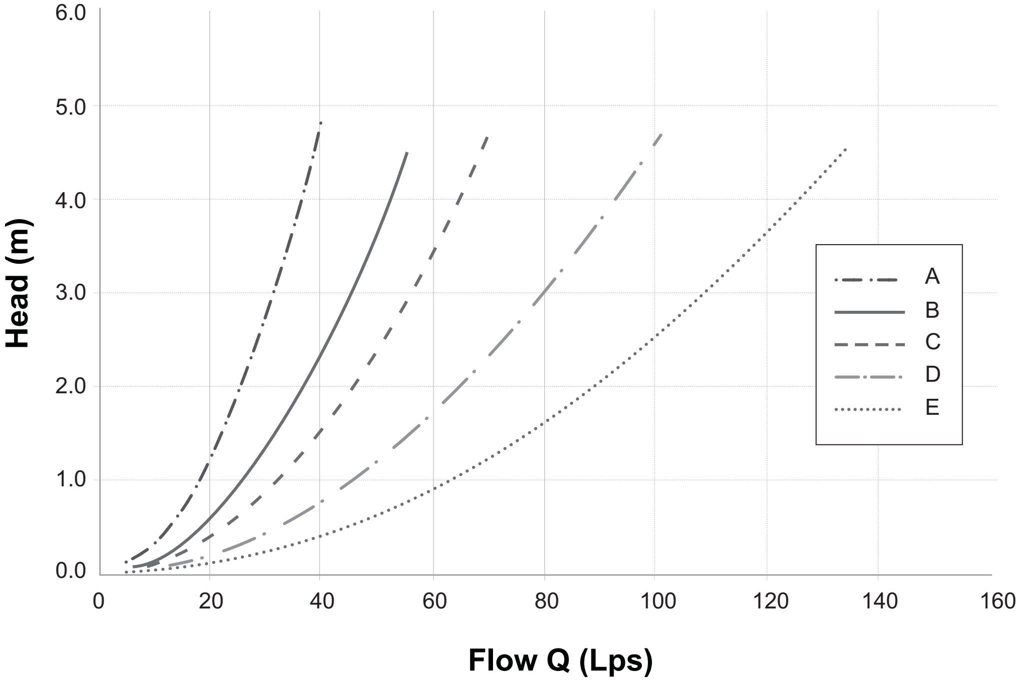


Chart 3: HF & MHF Preset Flow Curves



PRODUCT INSTALLATION

Instructions to assemble a TEMPEST HF or MHF ICD into a Square Catch Basin:

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 3/8 x 3-1/2, (4) washers, (4) nuts, universal mounting plate, ICD device
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. Thread the nuts on the top of the anchors to protect the threads when you hit the anchors with the hammer. Remove the nuts from the ends of the anchors.
5. Install the universal wall mounting plate on the anchors and screw the 4 nuts 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 the ground above using a reach bar, lower the 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 in to the universal wall mounting plate and has created a seal.

⚠ WARNING

- Verify that the outlet pipe doesn’t protrude into the catch basin. If it does, cut down the pipe flush to the catch basin wall.
- Call your IPEX representative for more information or if you have any questions about our products.

Instructions to assemble a TEMPEST HF or MHF ICD into a Round Catch Basin:

STEPS:

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 3/8 x 3-1/2, (4) washers and (4) nuts, spigot CB wall plate, universal mounting plate hub adapter, ICD device.
2. Use the round catch basin spigot adaptor 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 depth between 1-1/2" to 2-1/2". Clean the concrete dust from the holes.
4. Install the anchors (4) in the holes by using a hammer. Thread the nuts on the top of the anchors to protect the threads when you hit the anchors with the hammer. Remove the nuts from the ends of the anchors.
5. Install the spigot CB wall plate on the anchors and screw the 4 nuts in place with a maximum torque of 40 N.m (30 lbf-ft). There should be no gap between the spigot CB wall plate and the catch basin wall.
6. Put solvent cement on the hub of the universal mounting plate, hub adapter and the spigot of the CB wall plate, then 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 hub adapter should touch the catch basin wall.
7. From ground above using a reach bar, lower the 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 in to the wall mounting plate and has created a seal.

⚠ WARNING

- Verify that the outlet pipe doesn’t protrude into the catch basin. If it does, cut down the pipe flush to the catch basin wall.
- The solvent cement which is used in this installation is to be approved for PVC.
- The solvent cement should not be used below 0°C (32°F) or in a high humidity environment. Refer to the IPEX solvent cement guide to confirm the required curing time or visit the IPEX Online Solvent Cement Training Course available at www.ipexinc.com.
- Call your IPEX representative for more information or if you have any questions about our products.

Instructions to assemble a TEMPEST HF Sump into a Square or Round Catch Basin:

STEPS:

1. Materials and tooling verification:
   - Tooling: impact drill, 3/8" concrete bit, torque wrench for 9/16" nut, hand hammer, level, mastic tape and metal strapping
   - Material: (2) concrete anchor 3/8 x 3-1/2, (2) washers, (2) nuts, HF Sump pieces (2).
2. Apply solvent cement to the spigot end of the top half of the sump. Apply solvent cement to the hub of the bottom half of the sump. Insert the spigot of the top half of the sump into the hub of the bottom half of the sump.
3. Install the 8" spigot of the device into the outlet pipe. Use the mastic tape to seal the device spigot into the outlet pipe. You should use a level to be sure that the fitting is standing at the vertical.
4. Use an impact drill with a 3/8" concrete bit to make a series of 2 holes along each side of the body throat. The depth of the hole should be between 1-1/2" to 2-1/2". Clean the concrete dust from the 2 holes.
5. Install the anchors (2) in the holes by using a hammer. Put the nuts on the top of the anchors to protect the threads when you hit the anchors. Remove the nuts from the ends of the anchors.
6. Cut the metal strapping to length and connect each end of the strapping to the anchors. Screw the nuts in place with a maximum torque of 40 N.m (30 lbf-ft). The device should be completely flush with the catch basin wall.

⚠ WARNING

- Verify that the outlet pipe doesn't protrude into the catch basin. If it does, cut down the pipe flush to the catch basin wall.
- The solvent cement which is used in this installation is to be approved for PVC.
- The solvent cement should not be used below 0°C (32°F) or in a high humidity environment. Refer to the IPEX solvent cement guide to confirm the required curing time or visit the IPEX Online Solvent Cement Training Course available at www.ipexinc.com.
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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.

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High Flow (HF) Sump devices shall 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 shall have no moving parts.

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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.

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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.

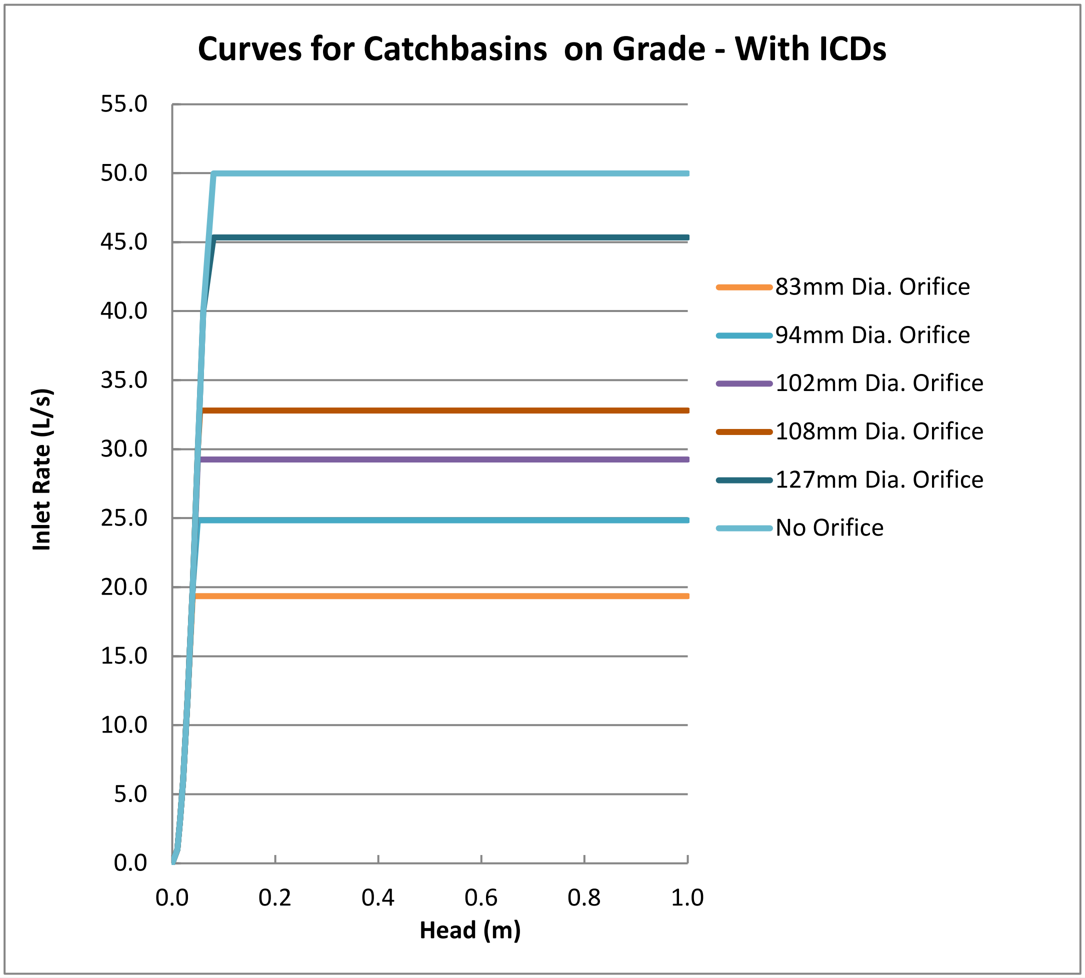
Dimensioning

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.

NOTE: Do not use or test the products in this manual with compressed air or other gases including air-over-water-boosters



Curb Inlet Catchbasins on Continuous Grade

Depth vs. Captured Flow Curve

A standard depth vs. captured flow curve for catch basins on a continuous grade was provided to Novatech by City staff for use in a dual-drainage model of an existing residential neighbourhood. This standard curve was derived using the inlet curves in Appendix 7A of the Ottawa Sewer Design Guidelines.

Novatech reviewed the methodology used to create this standard curve (described below) and determined that it was suitable for general use in other dual-drainage models.

- MTO Design Chart 4.04 provides the relationship between the gutter flow rate (Q_t) and flow spread (T) for Barrier Curb.
- MTO Design Chart 4.12 provides the relationship between flow spread (T) and flow depth (D).
- The relationship between the gutter flow rate (Q_t) and flow depth (D) was determined for different road slopes using the above charts and Manning's equation (refer to pages 58-60 of the MTO Drainage Management Manual – Part 2);
- The relationship between approach flow (Q_t) and captured flow (Q_c) was determined for different road slopes using the design chart for Barrier Curb with Gutter (Appendix 7-A.2).
- Using the above information, a family of curves was developed to characterize the relationship between flow depth and captured flow for curb inlet catchbasins on different road slopes. The results of this exercise can be summarized as follows:
  - For a given flow depth, the gutter flow rate (Q_t) increases as the road slope increases.
  - The capture efficiency (Q_c) of curb inlet catchbasins decrease as the road slope increases.
  - The net result is that the relationship between flow depth and capture rate is largely independent of road slope: While approach flow vs. captured flow (Q_t vs. Q_c) varies significantly with road grade, flow depth vs. captured flow (D vs. Q_c) does not.

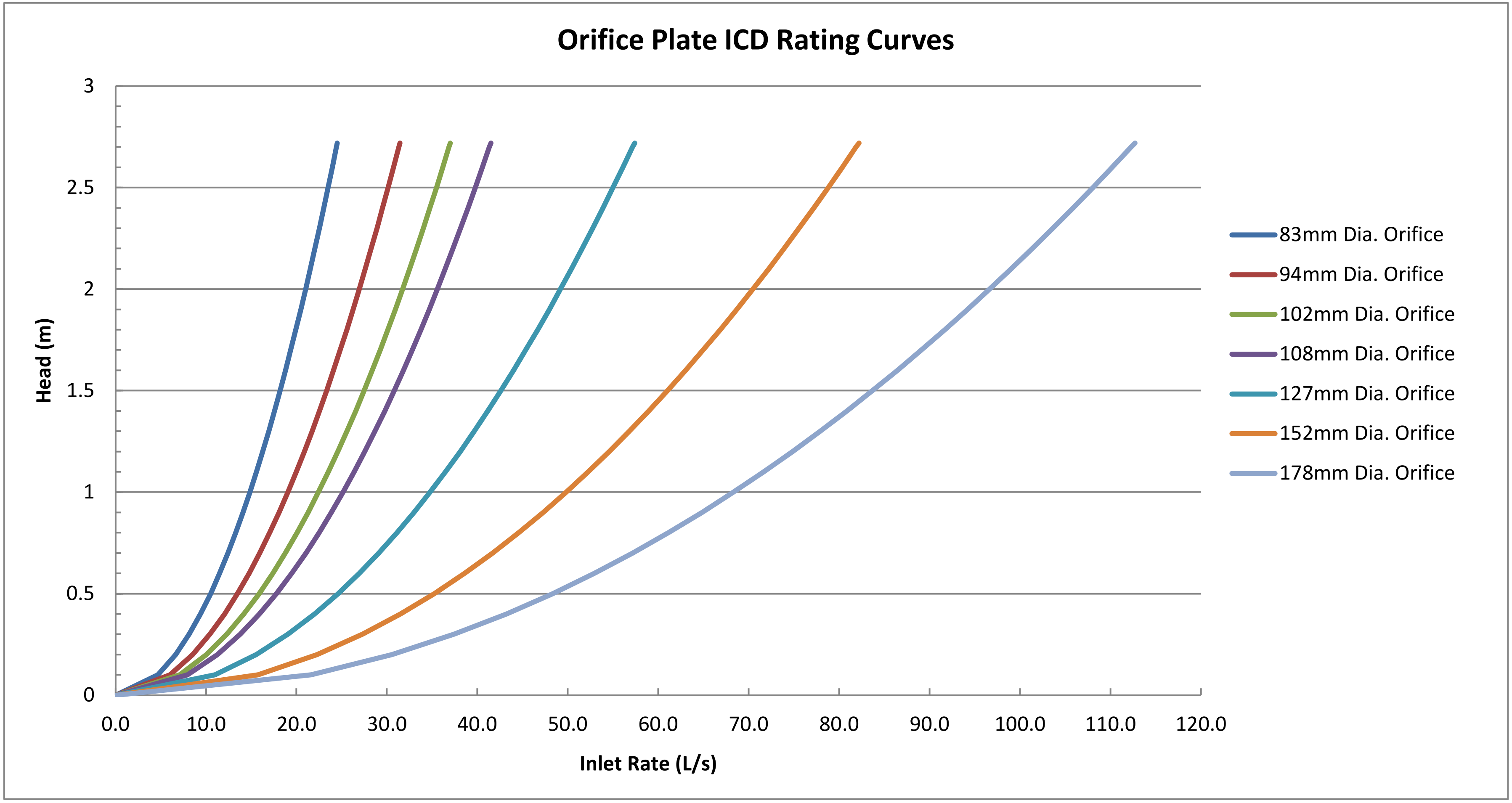
Since there was very little difference in the flow depth vs. captured flow curves for different road slopes, this family of curves was averaged to create a single standard curve for use in dual-drainage models.

Inlet Control Devices

The standard depth vs. capture flow curve was modified to account for the installation of ICDs in curb inlet catchbasins on continuous grade. Separate inlet curves were created for each standard ICD orifice size by capping the inlet rate on the depth vs. capture flow curve at the maximum flow rate through the ICD at a head of 1.2m (depth from centerline of CB lead to top of CICB frame).

Queensway-Carleton Hospital Part 4 Expansion

ICD Rating Curves



Prepared By: Novatech Engineering Consultants
Date: 11/28/2025

M:\2023\123089\DATA\Calculations\SWM\123089-ModelParams.xlsx

Imbrium® Systems

ESTIMATED NET ANNUAL SEDIMENT (TSS) LOAD REDUCTION

11/28/2025

Province:	Ontario
City:	Ottawa
Nearest Rainfall Station:	OTTAWA CDA RCS
Climate Station Id:	6105978
Years of Rainfall Data:	20

Project Name:	QCH Part 4 Expansion - OGS1
Project Number:	123089
Designer Name:	Kallie Auld
Designer Company:	Novatech
Designer Email:	k.auld@novatech-eng.com
Designer Phone:	613-254-9643
EOR Name:	
EOR Company:	
EOR Email:	
EOR Phone:	

Site Name:	OGS 1

Drainage Area (ha):	2.56
% Imperviousness:	70.00

Runoff Coefficient 'c': 0.72

Particle Size Distribution:	Fine
Target TSS Removal (%):	70.0
Required Water Quality Runoff Volume Capture (%):	90.00
Estimated Water Quality Flow Rate (L/s):	59.49
Oil / Fuel Spill Risk Site?	No
Upstream Flow Control?	No
Peak Conveyance (maximum) Flow Rate (L/s):	520.00
Influent TSS Concentration (mg/L):	200
Estimated Average Annual Sediment Load (kg/yr):	1805
Estimated Average Annual Sediment Volume (L/yr):	1467

Net Annual Sediment (TSS) Load Reduction Sizing Summary

Stormceptor Model	TSS Removal Provided (%)
EF4	67
EF5	74
EF6	79
EF8	86
EF10	90
EF12	93

Recommended Stormceptor EF Model: **EF5**

Estimated Net Annual Sediment (TSS) Load Reduction (%): **74**

Water Quality Runoff Volume Capture (%): **> 90**

THIRD-PARTY TESTING AND VERIFICATION

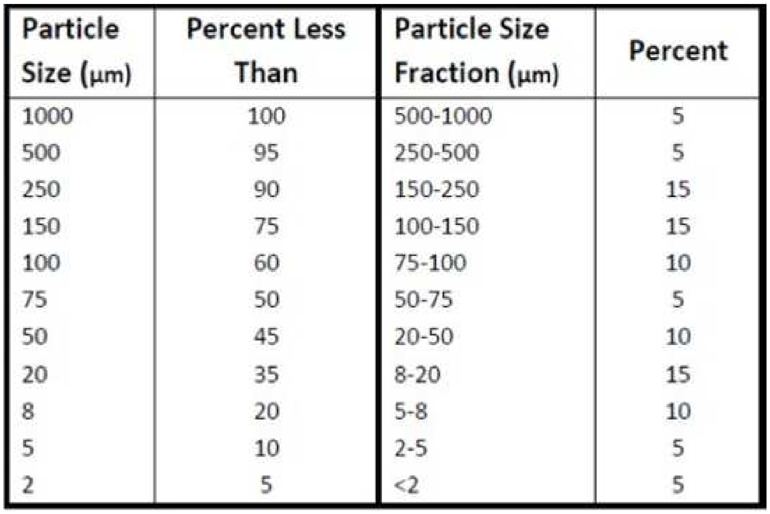
►**Stormceptor® EF and Stormceptor® EFO** are the latest evolutions in the Stormceptor® oil-grit separator (OGS) technology series, and are designed to remove a wide variety of pollutants from stormwater and snowmelt runoff. These technologies have been third-party tested in accordance with the Canadian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

PERFORMANCE

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

PARTICLE SIZE DISTRIBUTION (PSD)

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

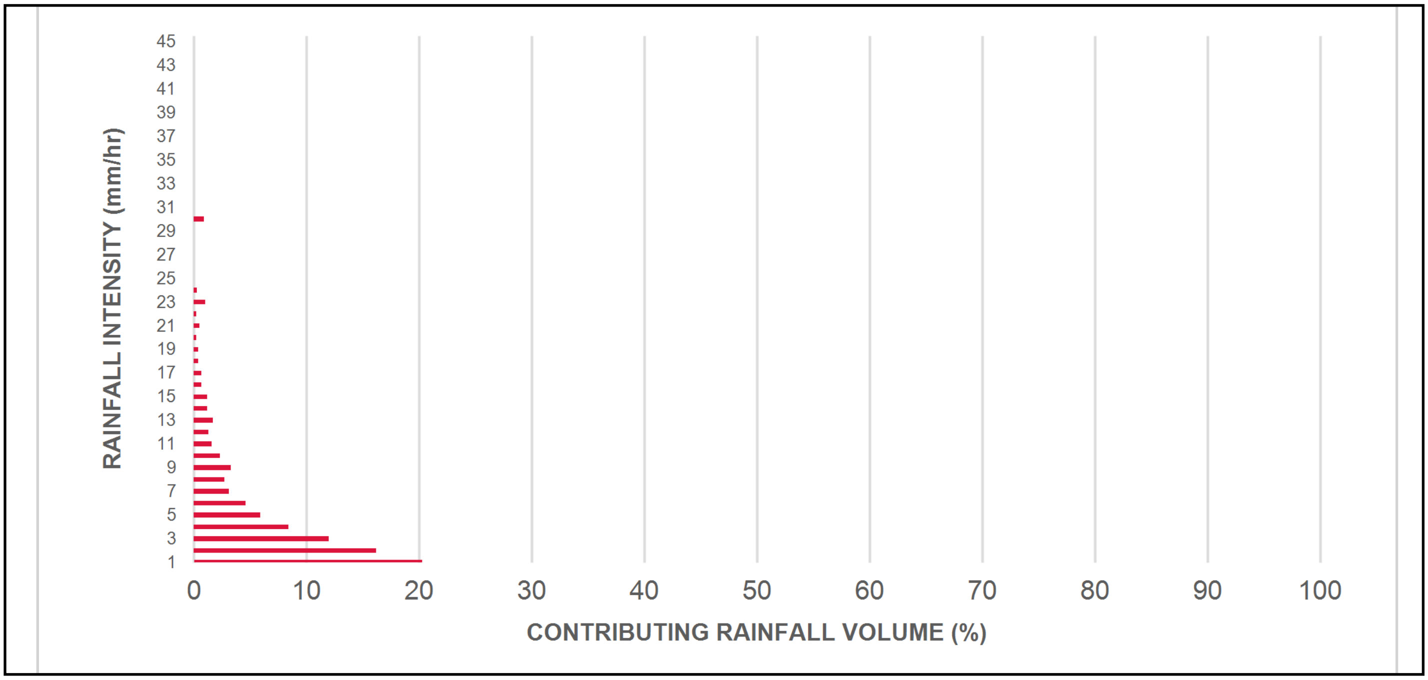


Particle Size (µm)	Percent Less Than	Particle Size Fraction (µm)	Percent
1000	100	500-1000	5
500	95	250-500	5
250	90	150-250	15
150	75	100-150	15
100	60	75-100	10
75	50	50-75	5
50	45	20-50	10
20	35	8-20	15
8	20	5-8	10
5	10	2-5	5
2	5	<2	5

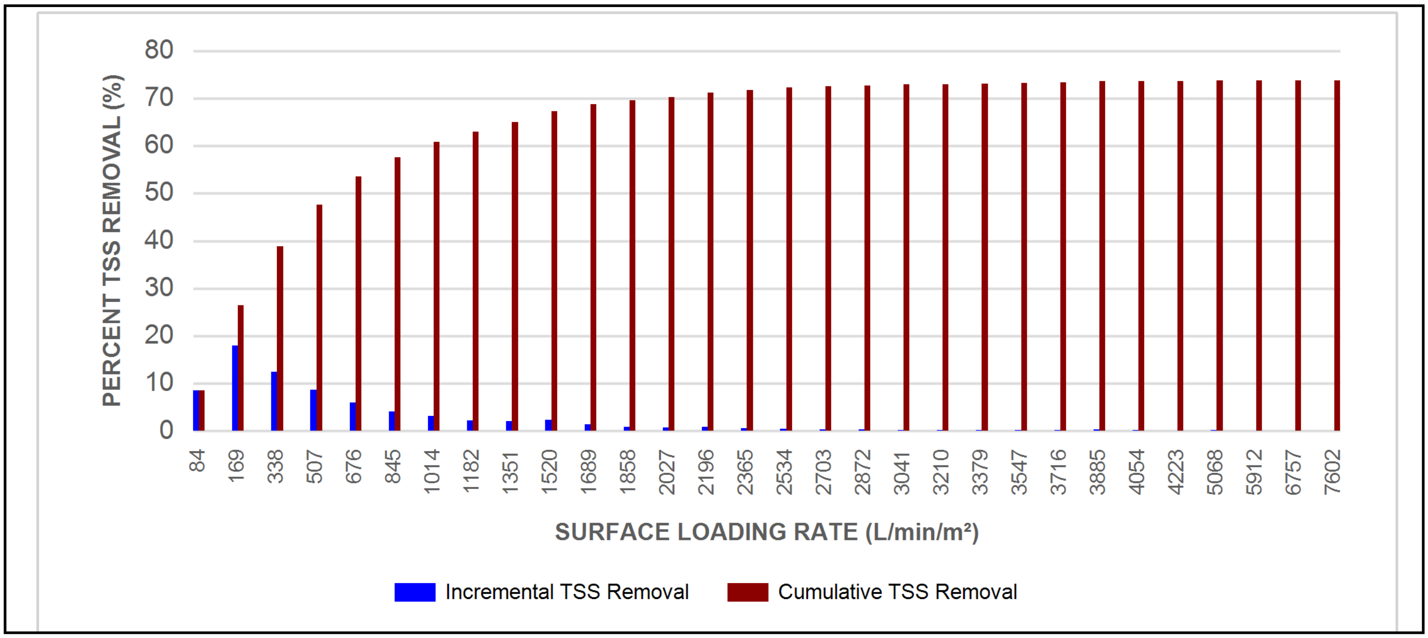
Rainfall Intensity (mm / hr)	Percent Rainfall Volume (%)	Cumulative Rainfall Volume (%)	Flow Rate (L/s)	Flow Rate (L/min)	Surface Loading Rate (L/min/m²)	Removal Efficiency (%)	Incremental Removal (%)	Cumulative Removal (%)
0.50	8.6	8.6	2.56	154.0	84.0	98	8.5	8.5
1.00	20.3	29.0	5.12	307.0	169.0	88	17.9	26.4
2.00	16.2	45.2	10.25	615.0	338.0	77	12.5	38.9
3.00	12.0	57.2	15.37	922.0	507.0	72	8.7	47.6
4.00	8.4	65.6	20.50	1230.0	676.0	70	5.9	53.5
5.00	5.9	71.6	25.62	1537.0	845.0	69	4.1	57.6
6.00	4.6	76.2	30.74	1845.0	1014.0	68	3.1	60.8
7.00	3.1	79.3	35.87	2152.0	1182.0	71	2.2	63.0
8.00	2.7	82.0	40.99	2460.0	1351.0	74	2.0	65.0
9.00	3.3	85.3	46.12	2767.0	1520.0	69	2.3	67.3
10.00	2.3	87.6	51.24	3074.0	1689.0	62	1.4	68.7
11.00	1.6	89.2	56.37	3382.0	1858.0	57	0.9	69.6
12.00	1.3	90.5	61.49	3689.0	2027.0	52	0.7	70.3
13.00	1.7	92.2	66.61	3997.0	2196.0	48	0.8	71.2
14.00	1.2	93.5	71.74	4304.0	2365.0	45	0.5	71.7
15.00	1.2	94.6	76.86	4612.0	2534.0	42	0.5	72.2
16.00	0.7	95.3	81.99	4919.0	2703.0	39	0.3	72.5
17.00	0.7	96.1	87.11	5227.0	2872.0	38	0.3	72.7
18.00	0.4	96.5	92.23	5534.0	3041.0	35	0.1	72.9
19.00	0.4	96.9	97.36	5841.0	3210.0	33	0.1	73.0
20.00	0.2	97.1	102.48	6149.0	3379.0	32	0.1	73.1
21.00	0.5	97.5	107.61	6456.0	3547.0	30	0.1	73.2
22.00	0.2	97.8	112.73	6764.0	3716.0	29	0.1	73.3
23.00	1.0	98.8	117.85	7071.0	3885.0	28	0.3	73.6
24.00	0.3	99.1	122.98	7379.0	4054.0	26	0.1	73.6
25.00	0.0	99.1	128.10	7686.0	4223.0	25	0.0	73.6
30.00	0.9	100.0	153.72	9223.0	5068.0	21	0.2	73.8
35.00	0.0	100.0	179.34	10761.0	5912.0	18	0.0	73.8
40.00	0.0	100.0	204.96	12298.0	6757.0	16	0.0	73.8
45.00	0.0	100.0	230.58	13835.0	7602.0	14	0.0	73.8
Estimated Net Annual Sediment (TSS) Load Reduction =								**74 %**

Climate Station ID: 6105978 *Years of Rainfall Data*: 20

RAINFALL DATA FROM OTTAWA CDA RCS RAINFALL STATION



INCREMENTAL AND CUMULATIVE TSS REMOVAL FOR THE RECOMMENDED STORMCEPTOR® MODEL



Maximum Pipe Diameter / Peak Conveyance

Stormceptor EF / EFO	Model Diameter (m)	Model Diameter (ft)	Min Angle Inlet / Outlet Pipes	Max Inlet Pipe Diameter (mm)	Max Inlet Pipe Diameter (in)	Max Outlet Pipe Diameter (mm)	Max Outlet Pipe Diameter (in)	Peak Conveyance Flow Rate (L/s)	Peak Conveyance Flow Rate (cfs)
EF4 / EFO4	1.2	4	90	609	24	609	24	425	15
EF5 / EFO5	1.5	5	90	762	30	762	30	710	25
EF6 / EFO6	1.8	6	90	914	36	914	36	990	35
EF8 / EFO8	2.4	8	90	1219	48	1219	48	1700	60
EF10 / EFO10	3.0	10	90	1828	72	1828	72	2830	100
EF12 / EFO12	3.6	12	90	1828	72	1828	72	2830	100

SCOUR PREVENTION AND ONLINE CONFIGURATION

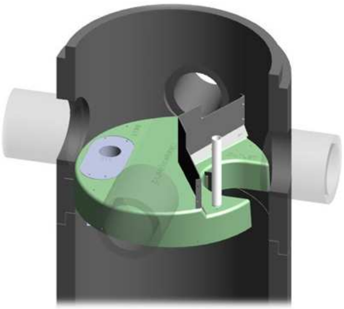
►**Stormceptor® EF and EFO** feature an internal bypass and superior scour prevention technology that have been demonstrated in third-party testing according to the scour testing provisions of the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators**, and the exceptional scour test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

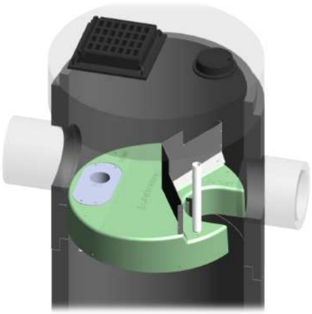
DESIGN FLEXIBILITY

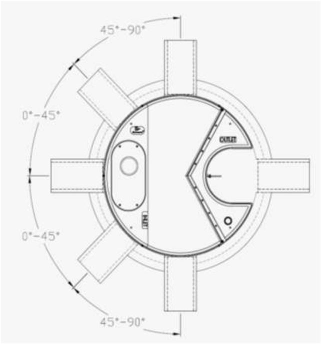
►**Stormceptor® EF** and **EFO** offers design flexibility in one simplified platform, accepting stormwater flow from a single inlet pipe or multiple inlet pipes, and/or surface runoff through an inlet grate. The device can also serve as a junction structure, accommodate a 90-degree inlet-to-outlet bend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

OIL CAPTURE AND RETENTION

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







INLET-TO-OUTLET DROP

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

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

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

HEAD LOSS

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

Pollutant Capacity

Stormceptor EF / EFO	Model Diameter		Depth (Outlet Pipe Invert to Sump Floor)		Oil Volume		Recommended Sediment Maintenance Depth *		Maximum Sediment Volume *		Maximum Sediment Mass **	
	(m)	(ft)	(m)	(ft)	(L)	(Gal)	(mm)	(in)	(L)	(ft³)	(kg)	(lb)
EF4 / EFO4	1.2	4	1.52	5.0	265	70	203	8	1190	42	1904	5250
EF5 / EFO5	1.5	5	1.62	5.3	420	111	305	10	2124	75	2612	5758
EF6 / EFO6	1.8	6	1.93	6.3	610	160	305	12	3470	123	5552	15375
EF8 / EFO8	2.4	8	2.59	8.5	1070	280	610	24	8780	310	14048	38750
EF10 / EFO10	3.0	10	3.25	10.7	1670	440	610	24	17790	628	28464	78500
EF12 / EFO12	3.6	12	3.89	12.8	2475	655	610	24	31220	1103	49952	137875

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

** Average density of wet packed sediment in sump = 1.6 kg/L (100 lb/ft³)

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

STANDARD STORMCEPTOR EF/EFO DRAWINGS

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

STANDARD STORMCEPTOR EF/EFO SPECIFICATION

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

STANDARD PERFORMANCE SPECIFICATION FOR “OIL GRIT SEPARATOR” (OGS) STORMWATER QUALITY TREAMENT DEVICE

PART 1 – GENERAL

1.1 WORK INCLUDED

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

1.2 REFERENCE STANDARDS & PROCEDURES

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

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

1.3 SUBMITTALS

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

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

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

PART 2 – PRODUCTS

2.1 OGS POLLUTANT STORAGE

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

2.1.1	4 ft (1219 mm) Diameter OGS Units:	1.19 m^3 sediment / 265 L oil
	5 ft (1524 mm) Diameter OGS Units:	1.95 m^3 sediment / 420L oil
	6 ft (1829 mm) Diameter OGS Units:	3.48 m^3 sediment / 609 L oil
	8 ft (2438 mm) Diameter OGS Units:	8.78 m^3 sediment / 1,071 L oil
	10 ft (3048 mm) Diameter OGS Units:	17.78 m^3 sediment / 1,673 L oil
	12 ft (3657 mm) Diameter OGS Units:	31.23 m^3 sediment / 2,476 L oil

PART 3 – PERFORMANCE & DESIGN

3.1 GENERAL

The OGS stormwater quality treatment device shall be verified in accordance with ISO 14034:2016 Environmental management – Environmental technology verification (ETV). The OGS stormwater quality treatment device shall remove oil, sediment and gross pollutants from stormwater runoff during frequent wet weather events, and retain these pollutants during less frequent high flow wet weather events below the insert within the OGS for later removal during maintenance. The Manufacturer shall have at least ten (10) years of local experience, history and success in engineering design, manufacturing and production and supply of OGS stormwater quality treatment device systems, acceptable to the Engineer of Record.

3.2 SIZING METHODOLOGY

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

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

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

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

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

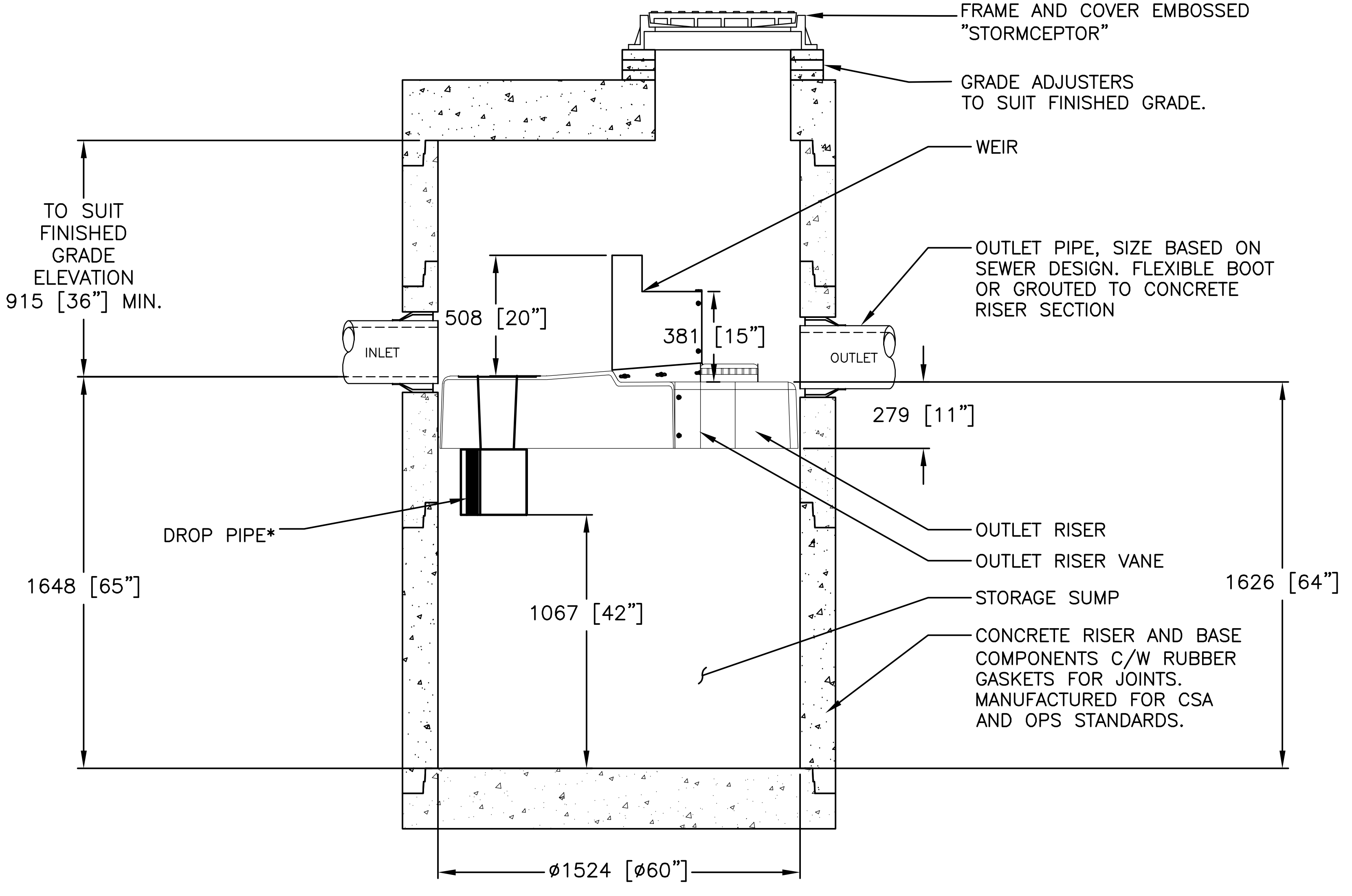
The OGS device shall also have sufficient annual sediment storage capacity as specified and calculated in Section 2.1.

3.3 CANADIAN ETV or ISO 14034 ETV VERIFICATION OF SCOUR TESTING

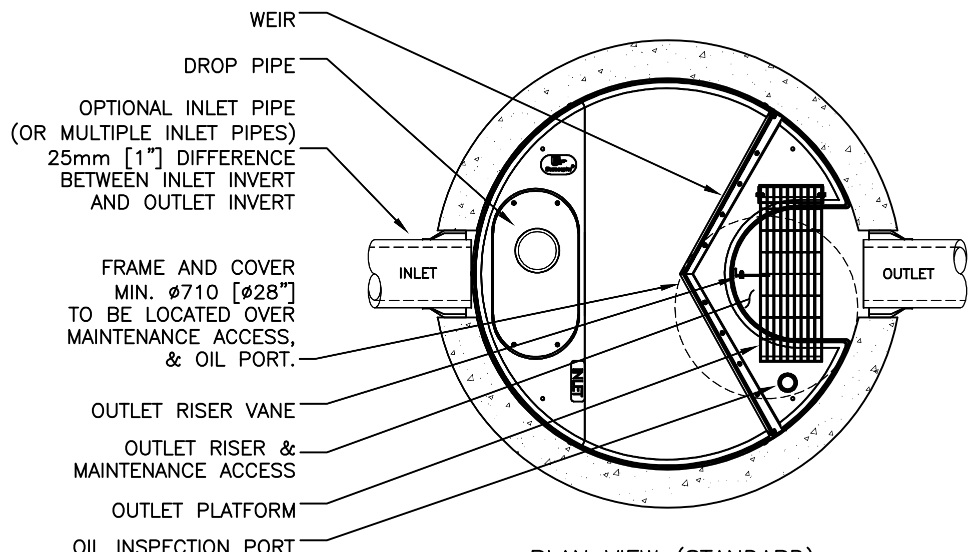
The OGS device shall have Canadian ETV or ISO 14034 ETV Verification of third-party scour testing conducted in accordance with the Canadian ETV Program's **Procedure for Laboratory Testing of Oil-Grit Separators.**

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

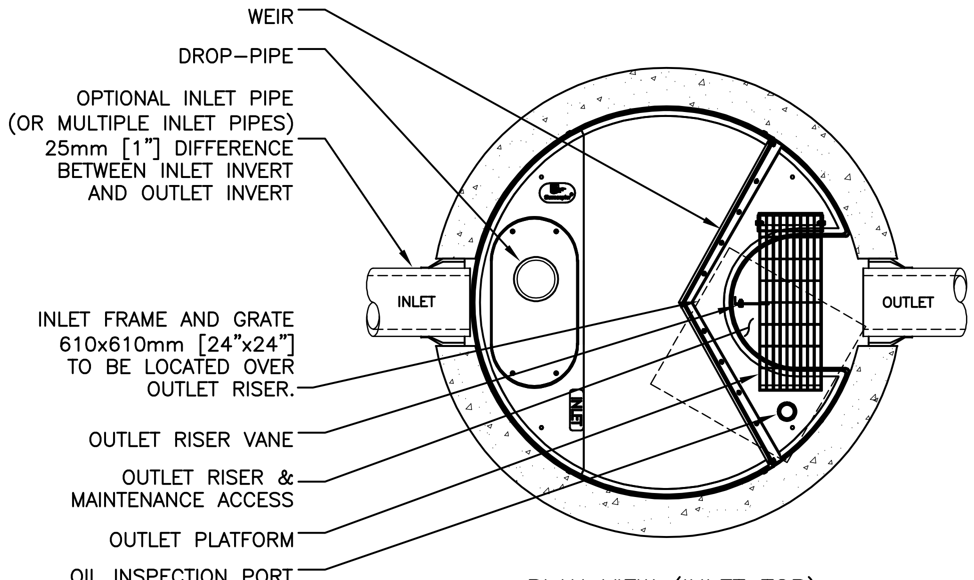
DRAWING NOT TO BE USED FOR CONSTRUCTION



SECTION VIEW



PLAN VIEW (STANDARD)



PLAN VIEW (INLET TOP)

GENERAL NOTES:

- * MAXIMUM SURFACE LOADING RATE (SLR) INTO LOWER CHAMBER THROUGH DROP PIPE IS 1135 L/min/m^2 (27.9 gpm/ft^2) FOR STORMCEPTOR EF5 AND 535 L/min/m^2 (13.1 gpm/ft^2) FOR STORMCEPTOR EFO5 (OIL CAPTURE CONFIGURATION).

1. ALL DIMENSIONS INDICATED ARE IN MILLIMETERS (INCHES) UNLESS OTHERWISE SPECIFIED.
2. STORMCEPTOR STRUCTURE INLET AND OUTLET PIPE SIZE AND ORIENTATION SHOWN FOR INFORMATIONAL PURPOSES ONLY.
3. UNLESS OTHERWISE NOTED, BYPASS INFRASTRUCTURE, SUCH AS ALL UPSTREAM DIVERSION STRUCTURES, CONNECTING STRUCTURES, OR PIPE CONDUITS CONNECTING TO COMPLETE THE STORMCEPTOR SYSTEM SHALL BE PROVIDED AND ADDRESSED SEPARATELY.
4. DRAWING FOR INFORMATION PURPOSES ONLY. REFER TO ENGINEER'S SITE/UTILITY PLAN FOR STRUCTURE ORIENTATION.
5. NO PRODUCT SUBSTITUTIONS SHALL BE ACCEPTED UNLESS SUBMITTED 10 DAYS PRIOR TO PROJECT BID DATE, OR AS DIRECTED BY THE ENGINEER OF RECORD.

INSTALLATION NOTES

A. ANY SUB-BASE, BACKFILL DEPTH, AND/OR ANTI-FLOTATION PROVISIONS ARE SITE-SPECIFIC DESIGN CONSIDERATIONS AND SHALL BE SPECIFIED BY ENGINEER OF RECORD.
B. CONTRACTOR TO PROVIDE EQUIPMENT WITH SUFFICIENT LIFTING AND REACH CAPACITY TO LIFT AND SET THE STRUCTURE (LIFTING CLUTCHES PROVIDED)
C. CONTRACTOR WILL INSTALL AND LEVEL THE STRUCTURE, SEALING THE JOINTS, LINE ENTRY AND EXIT POINTS (NON-SHRINK GROUT WITH APPROVED WATERSTOP OR FLEXIBLE BOOT)
D. CONTRACTOR TO TAKE APPROPRIATE MEASURES TO PROTECT THE DEVICE FROM CONSTRUCTION-RELATED EROSION RUNOFF.
E. DEVICE ACTIVATION, BY CONTRACTOR, SHALL OCCUR ONLY AFTER SITE HAS BEEN STABILIZED AND THE STORMCEPTOR UNIT IS CLEAN AND FREE OF DEBRIS.

FOR SITE SPECIFIC DRAWINGS PLEASE CONTACT YOUR LOCAL STORMCEPTOR REPRESENTATIVE. SITE SPECIFIC DRAWINGS ARE BASED ON THE BEST AVAILABLE INFORMATION AT THE TIME. SOME FIELD REVISIONS TO THE SYSTEM LOCATION OR CONNECTION PIPING MAY BE NECESSARY BASED ON AVAILABLE SPACE OR SITE CONFIGURATION REVISIONS. ELEVATIONS SHOULD BE MAINTAINED EXCEPT WHERE NOTED ON BYPASS STRUCTURE (IF REQUIRED).

STANDARD DETAIL
NOT FOR CONSTRUCTION

SITE SPECIFIC DATA REQUIREMENTS

STORMCEPTOR MODEL	EF5				
STRUCTURE ID					*
WATER QUALITY FLOW RATE (L/s)					*
PEAK FLOW RATE (L/s)					*
RETURN PERIOD OF PEAK FLOW (yrs)					*
DRAINAGE AREA (HA)					*
DRAINAGE AREA IMPERVIOUSNESS (%)					*
PIPE DATA:	I.E.	MAT'L	DIA	SLOPE %	HGL
INLET #1	*	*	*	*	*
INLET #2	*	*	*	*	*
OUTLET	*	*	*	*	*

* PER ENGINEER OF RECORD

Stormceptor® EF

SCALE = NTS

imbrium®

407 FAIRVIEW DRIVE, WHITBY, ON L1N 3A9
TF 800-565-4801 CA 416-960-9900 INTL +1-416-960-9900

THE STORMCEPTOR SYSTEM IS PROTECTED BY ONE OR MORE OF THE FOLLOWING PATENTS
Australia Patent No. 693,164 • 707,133 • 729,096 • 779401 | Austrian Patent No. 289,647
| Canadian Patent No. 2,009,280 • 2,137,942 • 2,175,277 • 2,180,305 • 2,180,383 • 2,206,338 • 2,327,768
| China Patent No. 1,168,439 | Denmark DK 711,879 | German DE 69,534,021 | Indonesian Patent No 16,58
| Japan Patent No. 9-11476 (Pending) | Korea Patent No. 10-2000-0026101 (Pending)
| Malaysia Patent No. PI9701737 (Pending) | New Zealand Patent No. 314646
| United States Patent No. 4,985,148 • 5,498,331 • 5,725,760; 5,753,115 • 5,849,181 • 6,068,765 • 6,371,690

DATE: 8/22/2024	
DESIGNED: JSK	DRAWN: EC
CHECKED: BSF	APPROVED:
PROJECT No.: EF5	SEQUENCE No.: *
SHEET: 1 OF 1	

MARK	DATE	REVISION DESCRIPTION	BY
####	####	####	
####	####	####	####
####	####	####	####
####	####	####	####
0	08/22/24	INITIAL RELEASE	EC

The design and information shown on this drawing is provided as a service to the project owner, engineer and contractor by Imbrium Systems ("Imbrium"). Neither this drawing, nor any part thereof, may be used, reproduced or modified in any manner without the prior written consent of Imbrium. Failure to comply is done at the user's own risk and Imbrium expressly disclaims any liability or responsibility for such use.

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Imbrium® Systems
ESTIMATED NET ANNUAL SEDIMENT (TSS) LOAD REDUCTION

11/28/2025

Province:	Ontario
City:	Ottawa
Nearest Rainfall Station:	OTTAWA CDA RCS
Climate Station Id:	6105978
Years of Rainfall Data:	20

Project Name:	QCH Part 4 Expansion - OGS2
Project Number:	123089
Designer Name:	Kallie Auld
Designer Company:	Novatech
Designer Email:	k.auld@novatech-eng.com
Designer Phone:	613-254-9643
EOR Name:	
EOR Company:	
EOR Email:	
EOR Phone:	

Site Name:	OGS 2

Drainage Area (ha):	10.03
% Imperviousness:	70.00

Runoff Coefficient 'c': 0.72

Particle Size Distribution:	Fine
Target TSS Removal (%):	70.0
Required Water Quality Runoff Volume Capture (%):	90.00
Estimated Water Quality Flow Rate (L/s):	233.08
Oil / Fuel Spill Risk Site?	No
Upstream Flow Control?	No
Peak Conveyance (maximum) Flow Rate (L/s):	1300.00
Influent TSS Concentration (mg/L):	200
Estimated Average Annual Sediment Load (kg/yr):	7070
Estimated Average Annual Sediment Volume (L/yr):	5748

Net Annual Sediment (TSS) Load Reduction Sizing Summary

Stormceptor Model	TSS Removal Provided (%)
EF4	40
EF5	50
EF6	57
EF8	67
EF10	74
EF12	79

Recommended Stormceptor EF Model: EF10

Estimated Net Annual Sediment (TSS) Load Reduction (%): 74

Water Quality Runoff Volume Capture (%): > 90

THIRD-PARTY TESTING AND VERIFICATION

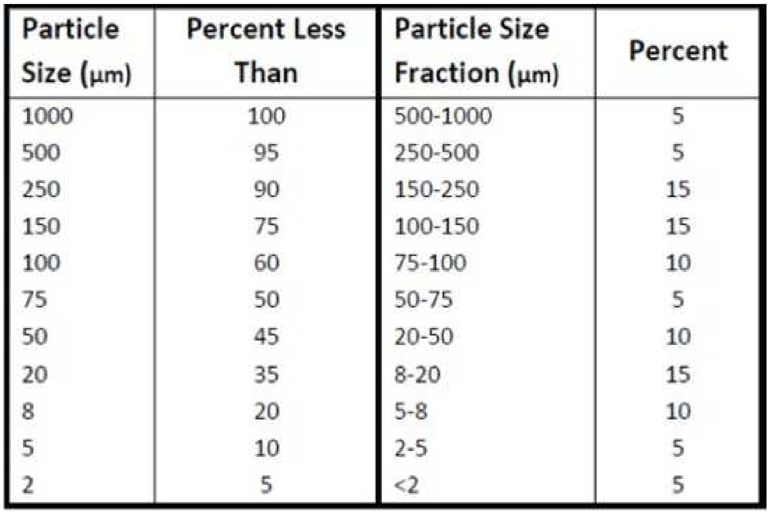
►**Stormceptor® EF and Stormceptor® EFO** are the latest evolutions in the Stormceptor® oil-grit separator (OGS) technology series, and are designed to remove a wide variety of pollutants from stormwater and snowmelt runoff. These technologies have been third-party tested in accordance with the Canadian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

PERFORMANCE

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

PARTICLE SIZE DISTRIBUTION (PSD)

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

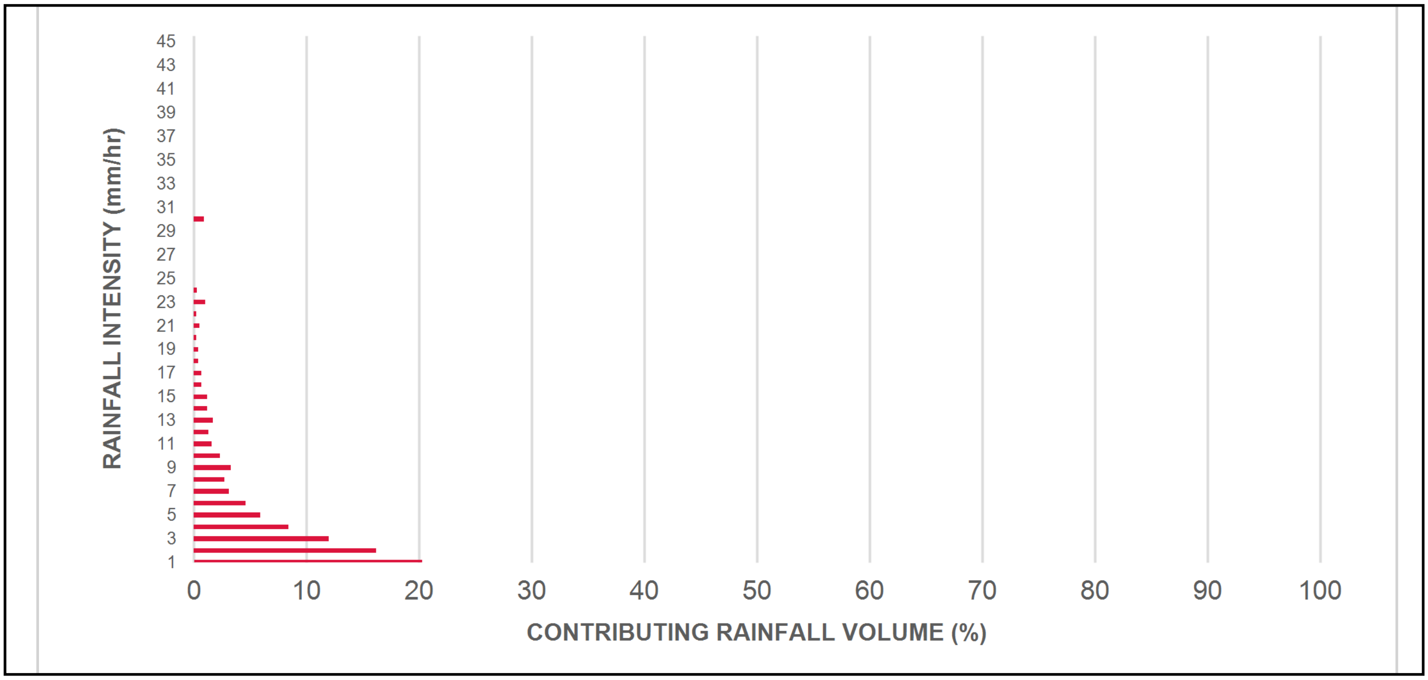


Particle Size (μm)	Percent Less Than	Particle Size Fraction (μm)	Percent
1000	100	500-1000	5
500	95	250-500	5
250	90	150-250	15
150	75	100-150	15
100	60	75-100	10
75	50	50-75	5
50	45	20-50	10
20	35	8-20	15
8	20	5-8	10
5	10	2-5	5
2	5	<2	5

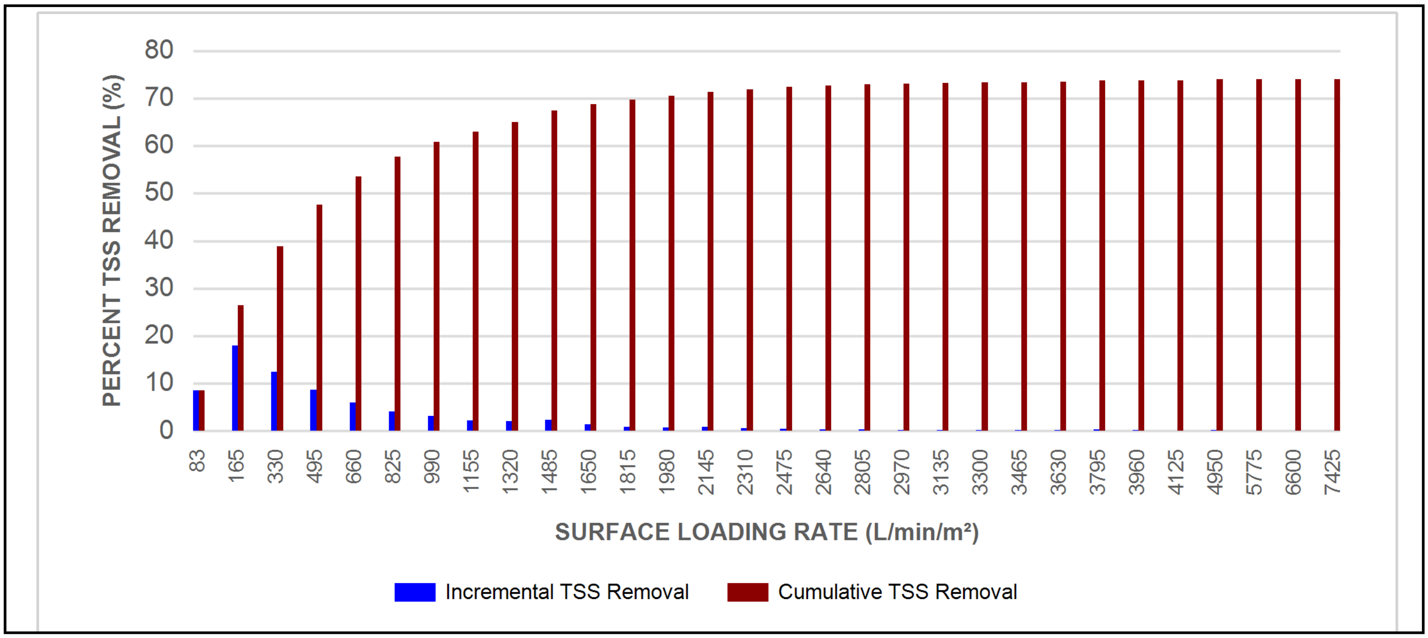
Rainfall Intensity (mm / hr)	Percent Rainfall Volume (%)	Cumulative Rainfall Volume (%)	Flow Rate (L/s)	Flow Rate (L/min)	Surface Loading Rate (L/min/m²)	Removal Efficiency (%)	Incremental Removal (%)	Cumulative Removal (%)
0.50	8.6	8.6	10.04	602.0	83.0	98	8.5	8.5
1.00	20.3	29.0	20.08	1205.0	165.0	88	17.9	26.4
2.00	16.2	45.2	40.15	2409.0	330.0	77	12.5	38.9
3.00	12.0	57.2	60.23	3614.0	495.0	72	8.7	47.6
4.00	8.4	65.6	80.30	4818.0	660.0	70	5.9	53.6
5.00	5.9	71.6	100.38	6023.0	825.0	69	4.1	57.7
6.00	4.6	76.2	120.46	7227.0	990.0	68	3.1	60.8
7.00	3.1	79.3	140.53	8432.0	1155.0	71	2.2	63.0
8.00	2.7	82.0	160.61	9637.0	1320.0	74	2.0	65.0
9.00	3.3	85.3	180.68	10841.0	1485.0	71	2.4	67.4
10.00	2.3	87.6	200.76	12046.0	1650.0	64	1.5	68.8
11.00	1.6	89.2	220.84	13250.0	1815.0	58	0.9	69.7
12.00	1.3	90.5	240.91	14455.0	1980.0	53	0.7	70.5
13.00	1.7	92.2	260.99	15659.0	2145.0	49	0.9	71.3
14.00	1.2	93.5	281.06	16864.0	2310.0	46	0.6	71.9
15.00	1.2	94.6	301.14	18068.0	2475.0	43	0.5	72.4
16.00	0.7	95.3	321.22	19273.0	2640.0	41	0.3	72.6
17.00	0.7	96.1	341.29	20478.0	2805.0	38	0.3	72.9
18.00	0.4	96.5	361.37	21682.0	2970.0	36	0.1	73.1
19.00	0.4	96.9	381.44	22887.0	3135.0	34	0.1	73.2
20.00	0.2	97.1	401.52	24091.0	3300.0	32	0.1	73.3
21.00	0.5	97.5	421.60	25296.0	3465.0	31	0.1	73.4
22.00	0.2	97.8	441.67	26500.0	3630.0	29	0.1	73.5
23.00	1.0	98.8	461.75	27705.0	3795.0	29	0.3	73.8
24.00	0.3	99.1	481.83	28910.0	3960.0	27	0.1	73.8
25.00	0.0	99.1	501.90	30114.0	4125.0	26	0.0	73.8
30.00	0.9	100.0	602.28	36137.0	4950.0	22	0.2	74.0
35.00	0.0	100.0	702.66	42160.0	5775.0	19	0.0	74.0
40.00	0.0	100.0	803.04	48183.0	6600.0	16	0.0	74.0
45.00	0.0	100.0	903.42	54205.0	7425.0	14	0.0	74.0
							Estimated Net Annual Sediment (TSS) Load Reduction =	**74 %**

Climate Station ID: 6105978 *Years of Rainfall Data*: 20

RAINFALL DATA FROM OTTAWA CDA RCS RAINFALL STATION



INCREMENTAL AND CUMULATIVE TSS REMOVAL FOR THE RECOMMENDED STORMCEPTOR® MODEL



Maximum Pipe Diameter / Peak Conveyance

Stormceptor EF / EFO	Model Diameter (m)	(ft)	Min Angle Inlet / Outlet Pipes	Max Inlet Pipe Diameter (mm)	(in)	Max Outlet Pipe Diameter (mm)	(in)	Peak Conveyance Flow Rate (L/s)	(cfs)
EF4 / EFO4	1.2	4	90	609	24	609	24	425	15
EF5 / EFO5	1.5	5	90	762	30	762	30	710	25
EF6 / EFO6	1.8	6	90	914	36	914	36	990	35
EF8 / EFO8	2.4	8	90	1219	48	1219	48	1700	60
EF10 / EFO10	3.0	10	90	1828	72	1828	72	2830	100
EF12 / EFO12	3.6	12	90	1828	72	1828	72	2830	100

SCOUR PREVENTION AND ONLINE CONFIGURATION

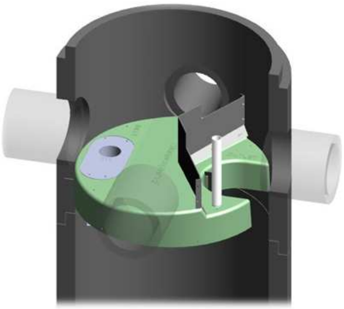
►**Stormceptor® EF and EFO** feature an internal bypass and superior scour prevention technology that have been demonstrated in third-party testing according to the scour testing provisions of the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators**, and the exceptional scour test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

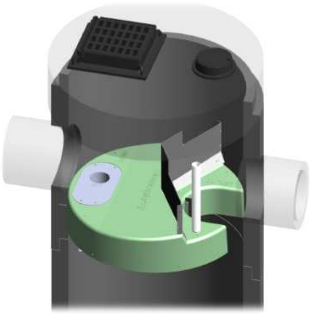
DESIGN FLEXIBILITY

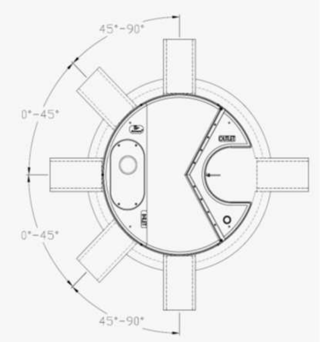
►**Stormceptor® EF** and **EFO** offers design flexibility in one simplified platform, accepting stormwater flow from a single inlet pipe or multiple inlet pipes, and/or surface runoff through an inlet grate. The device can also serve as a junction structure, accommodate a 90-degree inlet-to-outlet bend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

OIL CAPTURE AND RETENTION

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







INLET-TO-OUTLET DROP

Elevation differential between inlet and outlet pipe inverts is dictated by the angle at which the inlet pipe(s) enters the unit.
0° - 45° : The inlet pipe is 1-inch (25mm) higher than the outlet pipe.
45° - 90° : The inlet pipe is 2-inches (50mm) higher than the outlet pipe.

HEAD LOSS

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

Pollutant Capacity

Stormceptor EF / EFO	Model Diameter		Depth (Outlet Pipe Invert to Sump Floor)		Oil Volume		Recommended Sediment Maintenance Depth *		Maximum Sediment Volume *		Maximum Sediment Mass **	
	(m)	(ft)	(m)	(ft)	(L)	(Gal)	(mm)	(in)	(L)	(ft³)	(kg)	(lb)
EF4 / EFO4	1.2	4	1.52	5.0	265	70	203	8	1190	42	1904	5250
EF5 / EFO5	1.5	5	1.62	5.3	420	111	305	10	2124	75	2612	5758
EF6 / EFO6	1.8	6	1.93	6.3	610	160	305	12	3470	123	5552	15375
EF8 / EFO8	2.4	8	2.59	8.5	1070	280	610	24	8780	310	14048	38750
EF10 / EFO10	3.0	10	3.25	10.7	1670	440	610	24	17790	628	28464	78500
EF12 / EFO12	3.6	12	3.89	12.8	2475	655	610	24	31220	1103	49952	137875

*Increased sump depth may be added to increase sediment storage capacity
** Average density of wet packed sediment in sump = 1.6 kg/L (100 lb/ft³)

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

STANDARD STORMCEPTOR EF/EFO DRAWINGS

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

STANDARD STORMCEPTOR EF/EFO SPECIFICATION

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

STANDARD PERFORMANCE SPECIFICATION FOR “OIL GRIT SEPARATOR” (OGS) STORMWATER QUALITY TREAMENT DEVICE

PART 1 – GENERAL

1.1 WORK INCLUDED

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

1.2 REFERENCE STANDARDS & PROCEDURES

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

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

1.3 SUBMITTALS

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

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

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

PART 2 – PRODUCTS

2.1 OGS POLLUTANT STORAGE

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

2.1.1	4 ft (1219 mm) Diameter OGS Units:	1.19 m^3 sediment / 265 L oil
	5 ft (1524 mm) Diameter OGS Units:	1.95 m^3 sediment / 420L oil
	6 ft (1829 mm) Diameter OGS Units:	3.48 m^3 sediment / 609 L oil
	8 ft (2438 mm) Diameter OGS Units:	8.78 m^3 sediment / 1,071 L oil
	10 ft (3048 mm) Diameter OGS Units:	17.78 m^3 sediment / 1,673 L oil
	12 ft (3657 mm) Diameter OGS Units:	31.23 m^3 sediment / 2,476 L oil

PART 3 – PERFORMANCE & DESIGN

3.1 GENERAL

The OGS stormwater quality treatment device shall be verified in accordance with ISO 14034:2016 Environmental management – Environmental technology verification (ETV). The OGS stormwater quality treatment device shall remove oil, sediment and gross pollutants from stormwater runoff during frequent wet weather events, and retain these pollutants during less frequent high flow wet weather events below the insert within the OGS for later removal during maintenance. The Manufacturer shall have at least ten (10) years of local experience, history and success in engineering design, manufacturing and production and supply of OGS stormwater quality treatment device systems, acceptable to the Engineer of Record.

3.2 SIZING METHODOLOGY

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

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

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

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

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

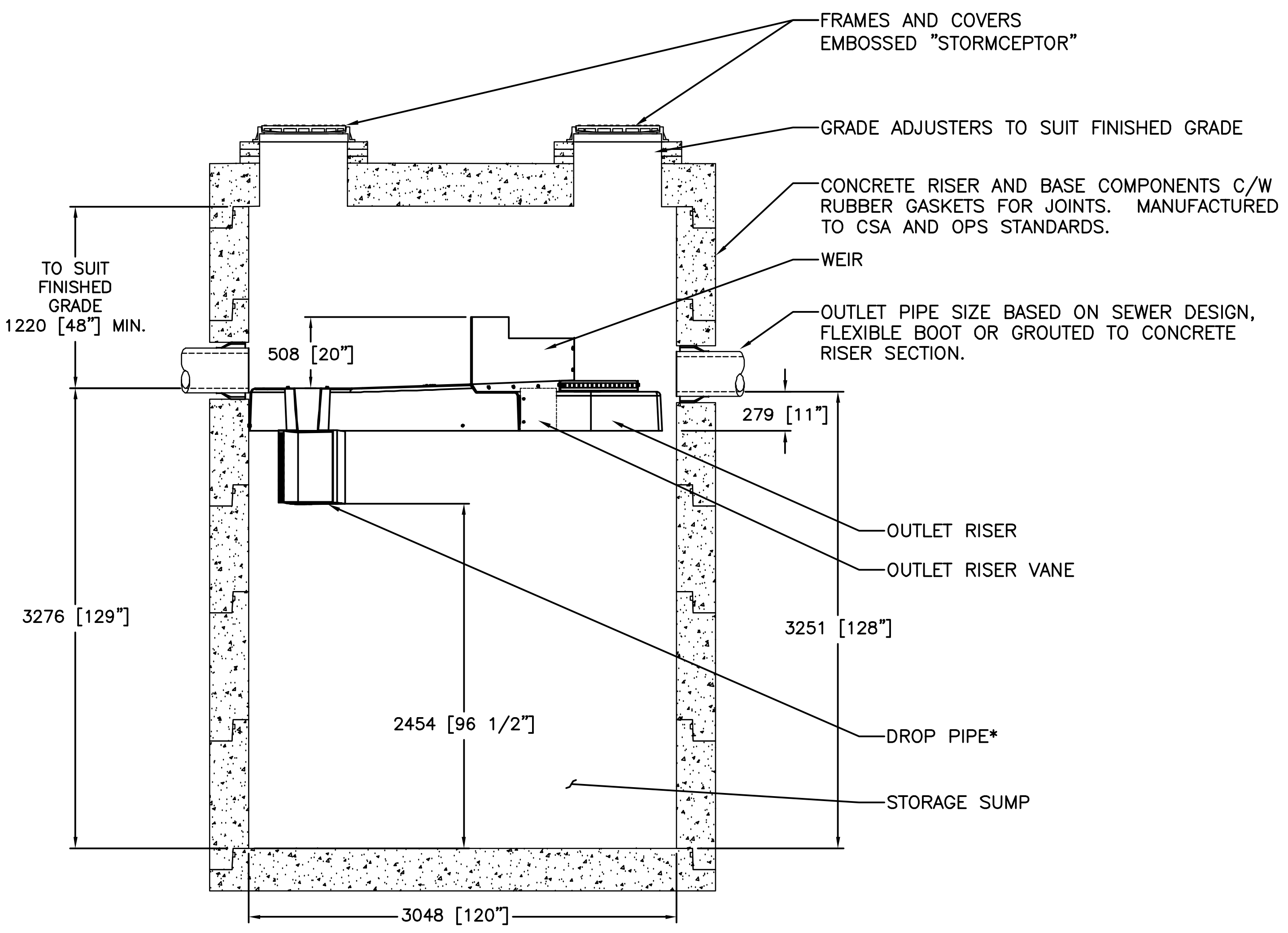
The OGS device shall also have sufficient annual sediment storage capacity as specified and calculated in Section 2.1.

3.3 CANADIAN ETV or ISO 14034 ETV VERIFICATION OF SCOUR TESTING

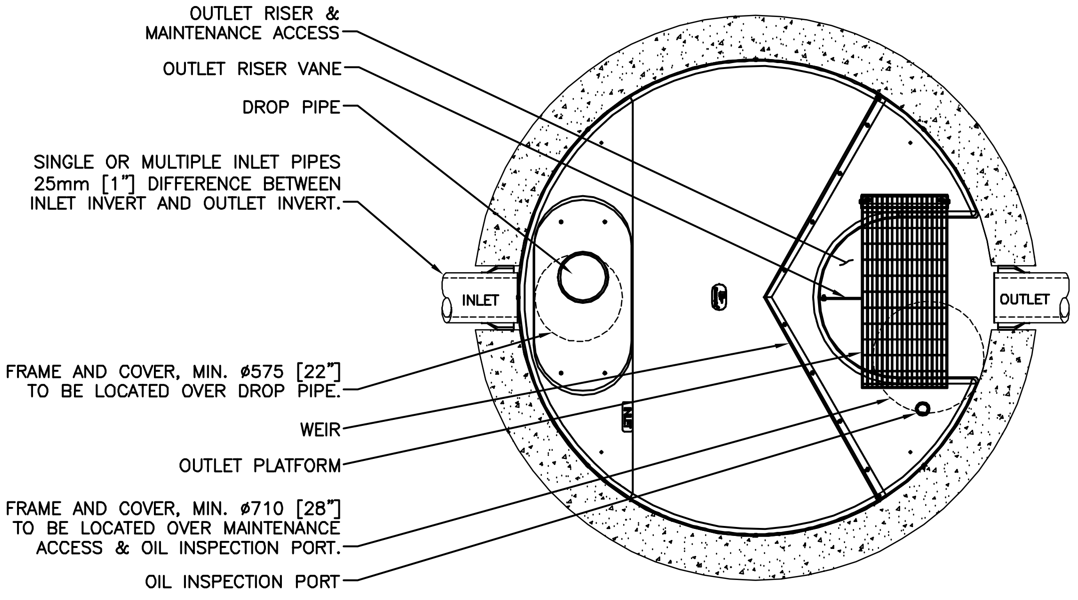
The OGS device shall have Canadian ETV or ISO 14034 ETV Verification of third-party scour testing conducted in accordance with the Canadian ETV Program's **Procedure for Laboratory Testing of Oil-Grit Separators.**

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

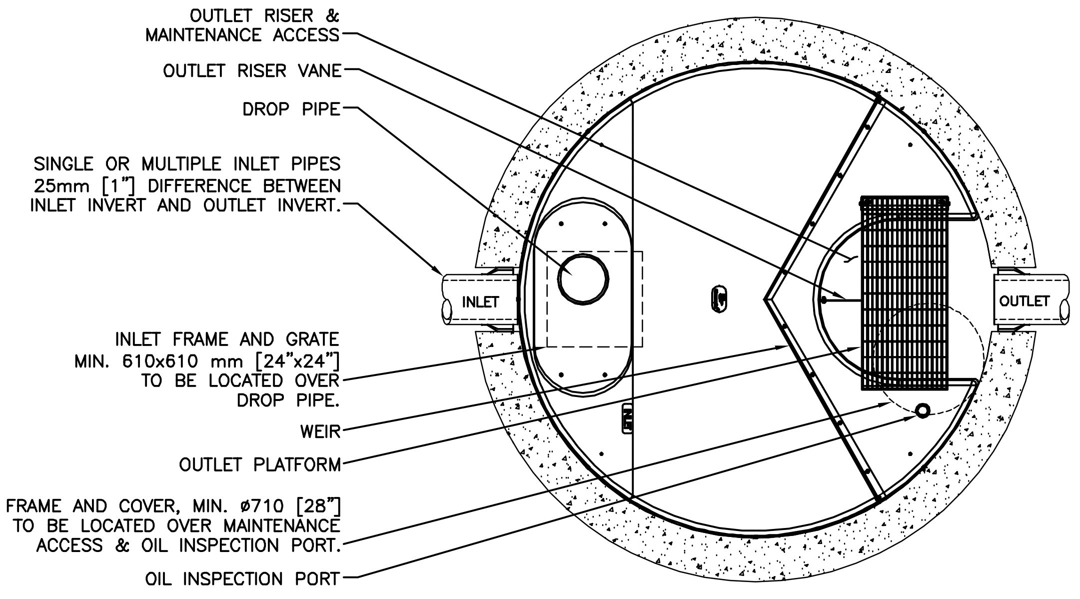
DRAWING NOT TO BE USED FOR CONSTRUCTION



SECTION VIEW



PLAN VIEW (STANDARD)



PLAN VIEW (INLET TOP)

GENERAL NOTES:

* MAXIMUM SURFACE LOADING RATE (SLR) INTO LOWER CHAMBER THROUGH DROP PIPE IS 1135 L/min/m^2 (27.9 gpm/ft^2) FOR STORMCEPTOR EF10 AND 535 L/min/m^2 (13.1 gpm/ft^2) FOR STORMCEPTOR EFO10 (OIL CAPTURE CONFIGURATION).

1. ALL DIMENSIONS INDICATED ARE IN MILLIMETERS (INCHES) UNLESS OTHERWISE SPECIFIED.
2. STORMCEPTOR STRUCTURE INLET AND OUTLET PIPE SIZE AND ORIENTATION SHOWN FOR INFORMATIONAL PURPOSES ONLY.
3. UNLESS OTHERWISE NOTED, BYPASS INFRASTRUCTURE, SUCH AS ALL UPSTREAM DIVERSION STRUCTURES, CONNECTING STRUCTURES, OR PIPE CONDUITS CONNECTING TO COMPLETE THE STORMCEPTOR SYSTEM SHALL BE PROVIDED AND ADDRESSED SEPARATELY.
4. DRAWING FOR INFORMATION PURPOSES ONLY. REFER TO ENGINEER'S SITE/UTILITY PLAN FOR STRUCTURE ORIENTATION.
5. NO PRODUCT SUBSTITUTIONS SHALL BE ACCEPTED UNLESS SUBMITTED 10 DAYS PRIOR TO PROJECT BID DATE, OR AS DIRECTED BY THE ENGINEER OF RECORD.

FOR SITE SPECIFIC DRAWINGS PLEASE CONTACT YOUR LOCAL STORMCEPTOR REPRESENTATIVE. SITE SPECIFIC DRAWINGS ARE BASED ON THE BEST AVAILABLE INFORMATION AT THE TIME. SOME FIELD REVISIONS TO THE SYSTEM LOCATION OR CONNECTION PIPING MAY BE NECESSARY BASED ON AVAILABLE SPACE OR SITE CONFIGURATION REVISIONS. ELEVATIONS SHOULD BE MAINTAINED EXCEPT WHERE NOTED ON BYPASS STRUCTURE (IF REQUIRED).

INSTALLATION NOTES

A. ANY SUB-BASE, BACKFILL DEPTH, AND/OR ANTI-FLOTATION PROVISIONS ARE SITE-SPECIFIC DESIGN CONSIDERATIONS AND SHALL BE SPECIFIED BY ENGINEER OF RECORD.
B. CONTRACTOR TO PROVIDE EQUIPMENT WITH SUFFICIENT LIFTING AND REACH CAPACITY TO LIFT AND SET THE STRUCTURE (LIFTING CLUTCHES PROVIDED)
C. CONTRACTOR WILL INSTALL AND LEVEL THE STRUCTURE, SEALING THE JOINTS, LINE ENTRY AND EXIT POINTS (NON-SHRINK GROUT WITH APPROVED WATERSTOP OR FLEXIBLE BOOT)
D. CONTRACTOR TO TAKE APPROPRIATE MEASURES TO PROTECT THE DEVICE FROM CONSTRUCTION-RELATED EROSION RUNOFF.
E. DEVICE ACTIVATION, BY CONTRACTOR, SHALL OCCUR ONLY AFTER SITE HAS BEEN STABILIZED AND THE STORMCEPTOR UNIT IS CLEAN AND FREE OF DEBRIS.

STANDARD DETAIL
NOT FOR CONSTRUCTION

SITE SPECIFIC DATA REQUIREMENTS

STORMCEPTOR MODEL	EF10				
STRUCTURE ID					*
WATER QUALITY FLOW RATE (L/s)					*
PEAK FLOW RATE (L/s)					*
RETURN PERIOD OF PEAK FLOW (yrs)					*
DRAINAGE AREA (HA)					*
DRAINAGE AREA IMPERVIOUSNESS (%)					*
PIPE DATA:	I.E.	MAT'L	DIA	SLOPE %	HGL
INLET #1	*	*	*	*	*
INLET #2	*	*	*	*	*
OUTLET	*	*	*	*	*

* PER ENGINEER OF RECORD

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MARK	DATE	REVISION DESCRIPTION	BY
####	####	####	####
####	####	####	####
####	####	####	####
1	6/8/18	OUTLET PLATFORM	JSK
0	5/26/17	INITIAL RELEASE	JSK

Stormceptor® EF

SCALE = NTS

imbrium®
407 FAIRVIEW DRIVE, WHITBY, ON L1N 3A9
TF 800-565-4801 CA 416-960-9900 INTL +1-416-960-9900
THE STORMCEPTOR SYSTEM IS PROTECTED BY ONE OR MORE OF THE FOLLOWING PATENTS
Australia Patent No. 693,164 • 707,133 • 729,096 • 779401 | Austrian Patent No. 289,647
| Canadian Patent
No. 2,009,280 • 2,137,942 • 2,175,277 • 2,180,305 • 2,180,383 • 2,206,338 • 2,327,768 | China Patent
No. 1,168,439 | Denmark DK 711,879 | German DE 69,534,021 | Indonesian Patent No 16,688
| Japan Patent No. 9-11476 (Pending) | Korea Patent No. 10-2000-0026101 (Pending)
| Malaysia Patent No. PI9701737 (Pending) | New Zealand Patent No. 314646
| United States Patent No. 4,985,148 • 5,498,331 • 5,725,760; 5,753,115 • 5,849,181 • 6,068,765 • 6,371,690

DATE: 5/26/2017	
DESIGNED: JSK	DRAWN: JSK
CHECKED: BSF	APPROVED: SP
PROJECT No.: EF10	SEQUENCE No.: *
SHEET: 1 OF 1	

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APPENDIX D

Stormwater Management Calculations

Project #: 123089
Project Name: Queensway Carleton Hospital - Part 4 Expansion
Location: 3045 Baseline Road, Ottawa

NOVATECH
Engineers, Planners & Landscape Architects

Date Prepared: 11/28/2025

Existing Stormwater Flows

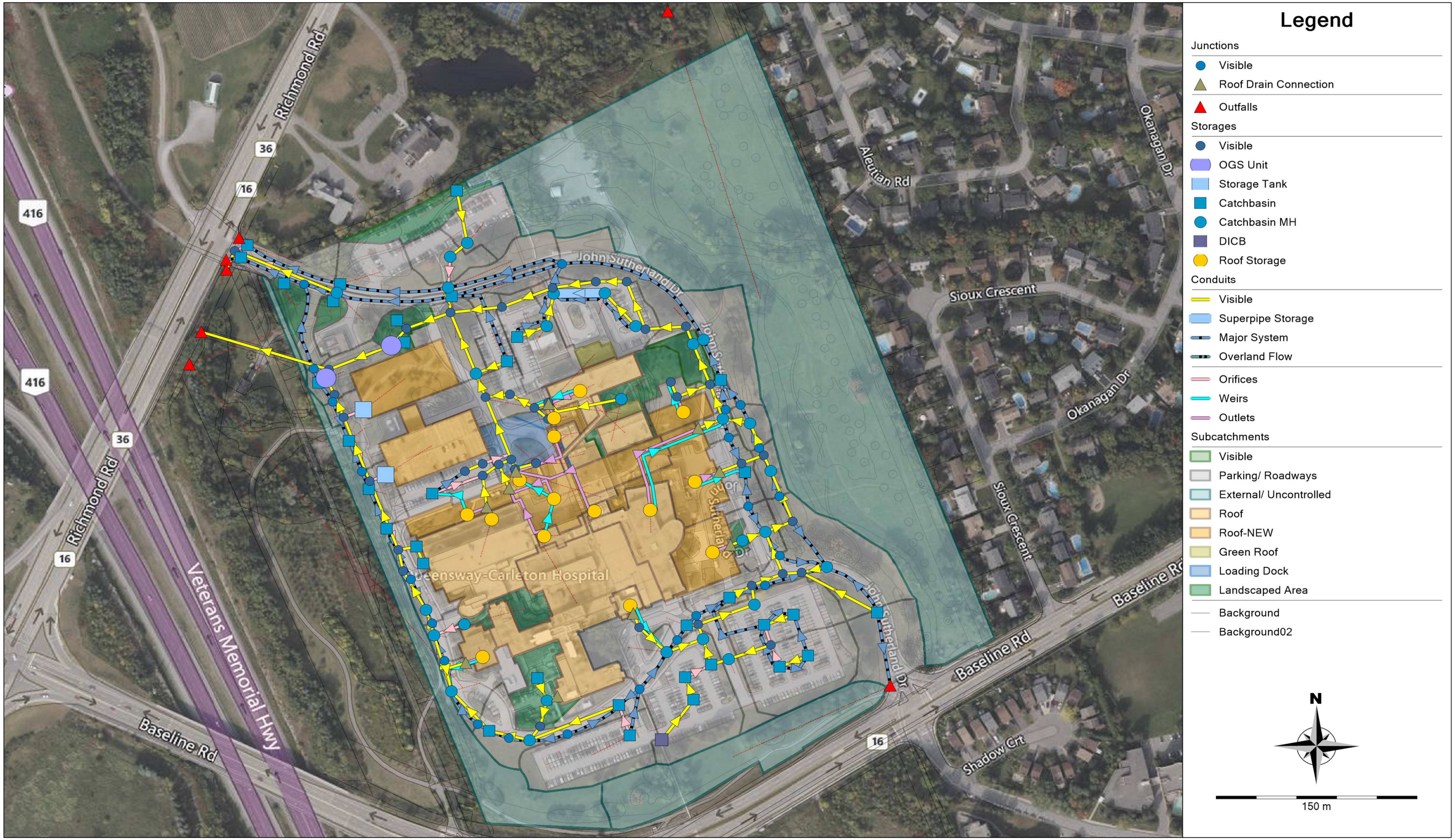
Description	*Area (ha)*	*$A_{impervious}$ (ha)*	*A_{gravel} (ha) C=0.75*	*$A_{pervious}$ (ha) C=0.2*	Weighted C_{w5}	Weighted C_{w100}	T_c**	5-Year Flow (L/s)	100-Year Flow (L/s)
Direct Runoff (Northeast)	5.883	0.399	0.190	5.293	0.27	0.32	51.58	159.7	328.2
Direct Runoff (West Ditch)	1.364	0.159	0.000	1.205	0.28	0.34	43.96	44.1	89.9
Direct Runoff (South Ditch)	0.676	0.039	0.000	0.637	0.24	0.29	31.49	23.5	48.9
Controlled Flow to On-Site Storm Sewer System*	4.176	**N/A**						229.6	272.8
Uncontrolled Flow to On-Site Storm Sewer System	8.102	3.810	0.000	4.293	0.53	0.60	19.70	845.3	1643.8
						Total Site Flows :		**1302.2**	**2383.6**

*Information taken directly from previous SWM report and design drawings.

**T_c for landscaped areas calculated using Airport Formula. T_c for on-site sewer system taken directly from previous SWM report.

Queensway-Carleton Hospital Part 4 Expansion
Overall Model Schematic

NOVATECH
Engineers, Planners & Landscape Architects



11/28/2025
PREPARED BY: NOVATECH

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Queensway-Carleton Hospital Part 4 Expansion
Model Parameters

Area ID	Description	Catchment Area (ha)	Runoff Coefficient (C)	Percent Impervious (%)	No Depression (%)	Flow Path Length (m)	Equivalent Width (m)	Average Slope (%)
A101	Ex. Ring Road - Uncontrolled	0.157	0.60	57%	0%	20.06	78.28	0.5%
A102	Ex. Landscaped Area - Uncontrolled	0.202	0.36	23%	0%	36.40	55.49	0.5%
A103	Ex. Ring Road - Uncontrolled	0.190	0.53	47%	0%	20.51	92.66	0.5%
A104	Ex. Ring Road - Uncontrolled	0.195	0.69	70%	0%	32.94	59.19	0.5%
A105	Ex. Landscaped Area - Uncontrolled	0.082	0.67	67%	0%	24.52	33.44	0.5%
A106	Ex. Landscaped Area - Uncontrolled	0.027	0.43	33%	0%	18.17	14.86	0.5%
A107	Ex. Ring Road - Uncontrolled	0.079	0.64	63%	0%	15.54	50.85	0.5%
A108	Modified Ring Road - Uncontrolled	0.087	0.66	66%	0%	19.39	44.86	0.5%
A113	Existing Building Roof - Uncontrolled	0.792	0.90	100%	0%	106.42	74.42	0.5%
A116a	Modified Building Roof - Uncontrolled	0.038	0.90	100%	0%	22.08	17.21	0.5%
A116b	Modified Building Roof - Uncontrolled	0.017	0.90	100%	0%	6.04	28.13	0.5%
A117	Modified Building Roof - Uncontrolled	0.023	0.90	100%	0%	13.57	16.96	0.5%
A119	Modified Paved Parking Area - Uncontrolled	0.122	0.64	63%	0%	47.78	25.53	0.5%
A120	Ex. Ring Road - Uncontrolled	0.227	0.55	50%	0%	41.94	54.12	0.5%
A121	Ex. Ring Road - Uncontrolled	0.100	0.80	86%	0%	19.31	51.78	0.5%
A122	Ex. John Sutherland Drive - Uncontrolled	0.283	0.38	25%	0%	28.93	97.82	0.5%
A137	Ex. Landscaped Area - Uncontrolled	0.020	0.74	77%	0%	7.80	25.65	0.5%
B101	Modified John Sutherland Drive - Uncontrolled	0.550	0.48	40%	0%	29.24	188.09	0.5%
B102	Modified Ring Road - Uncontrolled	0.127	0.71	73%	0%	28.01	45.35	0.5%
B103	Landscaped Area - Uncontrolled	0.030	0.55	51%	0%	9.59	31.28	0.5%
B104	Paved Parking Area - Uncontrolled	0.137	0.73	76%	0%	25.35	54.05	0.5%
B105	Modified John Sutherland Drive - Uncontrolled	0.077	0.63	62%	0%	14.96	51.48	0.5%
B106	Paved Parking Area - Uncontrolled	0.155	0.74	77%	0%	16.43	94.33	0.5%
B107	Modified John Sutherland Drive - Uncontrolled	0.081	0.52	46%	0%	18.78	43.12	0.5%
B108	Modified John Sutherland Drive - Uncontrolled	0.052	0.87	96%	0%	12.81	40.60	0.5%
B109	Paved Parking Area - Uncontrolled	0.052	0.64	63%	0%	14.15	36.75	0.5%
B110	Landscaped Area - Uncontrolled	0.153	0.51	45%	0%	18.48	82.77	0.5%
B111	Paved Parking Area - Uncontrolled	0.055	0.90	100%	0%	15.19	36.21	0.5%
B112	Modified John Sutherland Drive - Uncontrolled	0.660	0.43	33%	0%	32.21	204.88	0.5%
B113	Landscaped Area - Uncontrolled	0.091	0.20	0%	0%	18.79	48.42	0.5%
B114	Modified Paved Parking Area - Controlled (ICD)	0.394	0.77	82%	0%	44.07	89.40	0.5%
B115	Modified Paved Parking Area - Controlled (ICD)	0.290	0.81	87%	0%	35.39	81.94	0.5%
B116	Landscaped Area - Uncontrolled	0.175	0.27	9%	0%	63.88	27.39	0.5%
B117	Paved Parking Area - Uncontrolled	0.211	0.60	57%	0%	36.93	57.14	0.5%
B118	Paved Parking Area - Uncontrolled	0.164	0.32	17%	0%	23.94	68.50	0.5%
B119	Modified John Sutherland Drive - Uncontrolled	0.150	0.44	35%	0%	20.73	72.34	0.5%
B120	Modified John Sutherland Drive - Uncontrolled	0.089	0.69	69%	0%	12.85	69.28	0.5%
B121	Modified Paved Parking Area - Uncontrolled	0.089	0.62	60%	0%	17.67	50.36	0.5%
B122a	Modified Loading Dock Area - Uncontrolled	0.179	0.79	85%	0%	37.41	47.85	0.5%
B122a	Modified Loading Dock Area - Uncontrolled	0.002	0.79	85%	0%	6.34	3.16	0.5%
B122b	Modified Loading Dock Area - Uncontrolled	0.002	0.79	85%	0%	8.46	2.36	0.5%
B123	Modified Paved Parking Area - Controlled (ICD)	0.108	0.69	70%	0%	24.99	43.21	0.5%
B124	Modified Loading Dock Area - Uncontrolled	0.023	0.90	100%	0%	12.78	17.99	0.5%
B125	Loading Dock Access Road - Uncontrolled	0.267	0.73	76%	0%	45.79	58.31	0.5%

Queensway-Carleton Hospital Part 4 Expansion
Model Parameters

Area ID	Description	Catchment Area (ha)	Runoff Coefficient (C)	Percent Impervious (%)	No Depression (%)	Flow Path Length (m)	Equivalent Width (m)	Average Slope (%)
B126	Loading Dock Access Road - Uncontrolled	0.112	0.52	45%	0%	44.96	24.91	0.5%
B127	Loading Dock Access Road - Uncontrolled	0.203	0.53	47%	0%	22.86	88.79	0.5%
B128	Landscaped Area - Uncontrolled	0.086	0.41	30%	0%	18.33	46.92	0.5%
B129	Landscaped Area - Uncontrolled	0.016	0.20	0%	0%	6.66	24.04	0.5%
B130	Modified Ring Road - Uncontrolled	0.086	0.63	62%	0%	14.28	60.22	0.5%
B131	Modified Ring Road - Uncontrolled	0.093	0.69	70%	0%	14.33	64.90	0.5%
B132	Modified Ring Road - Uncontrolled	0.180	0.76	80%	0%	32.63	55.16	0.5%
B133	Modified Ring Road - Uncontrolled	0.145	0.46	37%	0%	41.43	35.00	0.5%
B134	Modified John Sutherland Drive - Uncontrolled	0.494	0.46	37%	0%	3.14	1575.26	0.5%
B135	Modified John Sutherland Drive - Uncontrolled	0.325	0.60	57%	0%	12.86	252.64	0.5%
EX-A01a	Modified Paved Parking Area - Controlled (ICD)	0.423	0.67	66%	0%	29.62	142.80	0.5%
EX-A01b	Modified Paved Parking Area - Controlled (ICD)	0.336	0.76	80%	0%	21.12	159.11	0.5%
EX-A02-01	Existing Green Building Roof - Uncontrolled	0.028	0.20	0%	0%	16.44	17.04	0.5%
EX-A02-02	Existing Green Building Roof - Uncontrolled	0.039	0.20	0%	0%	24.20	16.12	0.5%
EX-A02A	Modified Paved Parking Area - Controlled (ICD)	0.400	0.71	73%	0%	30.70	130.29	0.5%
EX-A02B	Modified Paved Parking Area - Controlled (ICD)	0.518	0.65	64%	0%	34.34	150.86	0.5%
EX-A03-01	Existing Bunker Roof - Controlled (Roof Drains)	0.080	0.90	100%	0%	18.92	42.28	0.5%
EX-A03-02	Ex. Cancer Centre Roof - Controlled (Roof Drains)	0.158	0.90	100%	0%	13.87	113.93	0.5%
EX-A04	Modified Building Roof - Controlled (Roof Drains)	0.040	0.90	100%	0%	10.31	38.81	0.5%
EX-R01	Existing Building Roof - Controlled (Roof Drains)	0.072	0.90	100%	0%	19.92	36.14	0.5%
EX-R02	Modified Building Roof - Controlled (Roof Drains)	0.295	0.90	100%	0%	55.27	53.37	0.5%
EX-R03	Existing Building Roof - Controlled (Roof Drains)	0.044	0.90	100%	0%	28.31	15.54	0.5%
P3-01	Modified Building Roof - Controlled (Roof Drains)	0.486	0.90	100%	0%	58.73	82.76	0.5%
P3-02	Existing Building Roof - Controlled (Roof Drains)	0.017	0.90	100%	0%	11.23	15.14	0.5%
P3-03	Existing Building Roof - Uncontrolled	0.038	0.90	100%	0%	11.65	32.62	0.5%
P4-01	Ambulatory Care Addition - Controlled (Roof Drains)	0.200	0.90	100%	0%	22.83	87.60	0.5%
P4-02	Emerg. Dept. Addition - Controlled (Roof Drains)	0.294	0.90	100%	0%	28.29	103.93	0.5%
P4-03	Ambulance Garage - Controlled (Roof Drains)	0.084	0.90	100%	0%	30.48	27.56	0.5%
P4-04	Generator/MEP Room - Controlled (Roof Drains)	0.128	0.90	100%	0%	37.20	34.41	0.5%
P4-05	Transitional Care Tower - Controlled (Roof Drains)	0.341	0.90	100%	0%	50.84	67.08	0.5%
P4-06	Loading Dock Building - Controlled (Roof Drains)	0.059	0.90	100%	0%	11.61	50.84	0.5%
P4-07	M.M. & E.V.S. Building - Controlled (Roof Drains)	0.046	0.90	100%	0%	19.42	23.68	0.5%
P4-08	Ex. Parking Garage - Controlled (UG Tank)	0.288	0.90	100%	0%	67.84	42.45	0.5%
P4-09	New Parking Garage - Controlled (UG Tank)	0.272	0.90	100%	0%	69.47	39.15	0.5%
P4-DR01a	Direct Runoff to West Ditch	0.721	0.26	8%	0%	288.33	25.01	1.5%
P4-DR01b	Direct Runoff to South Ditch	0.680	0.26	8%	0%	209.29	32.49	1.3%
P4-DR01c	Direct Runoff to West Ditch	0.038	0.26	8%	0%	76.00	5.00	0.5%
P4-DR02	Direct Runoff to Northeast Corner of Property	5.351	0.25	7%	0%	510.00	104.92	2.0%

Queensway-Carleton Hospital Part 4 Expansion
Design Storm Time Series Data
3-hour Chicago Design Storms

NOVATECH
Engineers, Planners & Landscape Architects

C25mm-3.stm		C2-3.stm		C5-3.stm	
Duration	Intensity	Duration	Intensity	Duration	Intensity
min	mm/hr	min	mm/hr	min	mm/hr
0:00	0	0:00	0	0:00	0
0:10	2.21	0:10	2.81	0:10	3.68
0:20	2.75	0:20	3.5	0:20	4.58
0:30	3.68	0:30	4.69	0:30	6.15
0:40	5.73	0:40	7.3	0:40	9.61
0:50	14.29	0:50	18.21	0:50	24.17
1:00	60.28	1:00	76.81	1:00	104.19
1:10	18.9	1:10	24.08	1:10	32.04
1:20	9.7	1:20	12.36	1:20	16.34
1:30	6.53	1:30	8.32	1:30	10.96
1:40	4.94	1:40	6.3	1:40	8.29
1:50	3.99	1:50	5.09	1:50	6.69
2:00	3.37	2:00	4.29	2:00	5.63
2:10	2.92	2:10	3.72	2:10	4.87
2:20	2.58	2:20	3.29	2:20	4.3
2:30	2.32	2:30	2.95	2:30	3.86
2:40	2.1	2:40	2.68	2:40	3.51
2:50	1.93	2:50	2.46	2:50	3.22
3:00	1.79	3:00	2.28	3:00	2.98

Queensway-Carleton Hospital Part 4 Expansion
Design Storm Time Series Data
3-hour Chicago Design Storms

C100-3.stm		C100-3+20%.stm	
Duration min	Intensity mm/hr	Duration min	Intensity mm/hr
0:00	0	0:00	0
0:10	6.05	0:10	6:14
0:20	7.54	0:20	9.05
0:30	10.16	0:30	12.19
0:40	15.97	0:40	19.16
0:50	40.65	0:50	48.78
1:00	178.56	1:00	214.27
1:10	54.05	1:10	64.86
1:20	27.32	1:20	32.78
1:30	18.24	1:30	21.89
1:40	13.74	1:40	16.49
1:50	11.06	1:50	13.27
2:00	9.29	2:00	11.15
2:10	8.02	2:10	9.62
2:20	7.08	2:20	8.5
2:30	6.35	2:30	7.62
2:40	5.76	2:40	6.91
2:50	5.28	2:50	6.34
3:00	4.88	3:00	5.86

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

  Queensway-Carleton Hospital Part 4 Expansion
  WARNING 03: negative offset ignored for Link 11
  WARNING 03: negative offset ignored for Link 38
  WARNING 04: minimum elevation drop used for Conduit 65
  WARNING 04: minimum elevation drop used for Conduit 66
  WARNING 04: minimum elevation drop used for Conduit 68
  WARNING 04: minimum elevation drop used for Conduit 72
  WARNING 04: minimum elevation drop used for Conduit 73
  WARNING 04: minimum elevation drop used for Conduit 75
  WARNING 03: negative offset ignored for Link 76
  WARNING 04: minimum elevation drop used for Conduit 77
  WARNING 03: negative offset ignored for Link P3-01-STOR_out
  WARNING 03: negative offset ignored for Link P4-06-STOR_out
  WARNING 02: maximum depth increased for Node 1
  WARNING 02: maximum depth increased for Node EX-A3-01&02-STOR
  WARNING 02: maximum depth increased for Node EX-R02-STOR
  WARNING 02: maximum depth increased for Node EX-R03-STOR
  WARNING 02: maximum depth increased for Node EX-R1-STOR
  WARNING 02: maximum depth increased for Node P3-01-STOR
  WARNING 02: maximum depth increased for Node P3-03-STOR
  WARNING 02: maximum depth increased for Node P4-02-STOR
  WARNING 02: maximum depth increased for Node P4-03-STOR
  WARNING 02: maximum depth increased for Node P4-04-STOR
  WARNING 02: maximum depth increased for Node P4-05-stor
  WARNING 02: maximum depth increased for Node P4-06-STOR

  *************
  Element Count
  *************
  Number of rain gages ...... 1
  Number of subcatchments ... 86
  Number of nodes ........... 161
  Number of links ........... 209
  Number of pollutants ...... 0
  Number of land uses ....... 0


  ****************
  Raingage Summary
  ****************
                                                    Data       Recording
  Name                Data Source                    Type       Interval
  ------------------------------------------------------------------------
  Raingage            03-C100yr-3hr                  INTENSITY   10 min.


  ********************
  Subcatchment Summary
  ********************
  Name                       Area     Width   %Imperv    %Slope Rain Gage
Outlet
  ---------------------------------------------------------------------------------
--------------------------
```

```
  A101                       0.16     78.28     57.00    0.5000 Raingage
EX_CB_XXZ_(STM)
  A102                       0.20     55.49     23.00    0.5000 Raingage
EX-CB004
  A103                       0.19     92.65     47.00    0.5000 Raingage
EX-CB_XYY
  A104                       0.20     59.19     70.00    0.5000 Raingage
EX-CBMH_XYZ
  A105                       0.08     33.44     67.00    0.5000 Raingage
EX-CBMH303
  A106                       0.03     14.86     33.00    0.5000 Raingage
EX-CBMH303
  A107                       0.08     50.85     63.00    0.5000 Raingage
EX-CBMH302
  A108                       0.09     44.86     66.00    0.5000 Raingage
EX-CBMH_XXX
  A113                       0.79     74.41    100.00    0.5000 Raingage
ROOF-02
  A116a                      0.04     17.21    100.00    0.5000 Raingage
ROOF-03
  A116b                      0.02     28.13    100.00    0.5000 Raingage
ROOF-03
  A117                       0.02     16.96    100.00    0.5000 Raingage
ROOF-03
  A119                       0.12     25.53     63.00    0.5000 Raingage
EX-CBMH_XXZ
  A120                       0.23     54.12     50.00    0.5000 Raingage
EX-CBMH301
  A121                       0.10     51.78     86.00    0.5000 Raingage
EX-CB301
  A122                       0.28     97.82     25.00    0.5000 Raingage
EX-CB100-101
  A137                       0.02     25.65     77.00    0.5000 Raingage
EX-CBMH008
  B101                       0.55    188.08     40.00    0.5000 Raingage
CBMH401-402
  B102                       0.13     45.35     73.00    0.5000 Raingage
CB401
  B103                       0.03     31.28     51.00    0.5000 Raingage
CBMH403
  B104                       0.14     54.05     76.00    0.5000 Raingage
CBMH402
  B105                       0.08     51.48     62.00    0.5000 Raingage
CBMH401-404
  B106                       0.15     94.33     77.00    0.5000 Raingage
CB403
  B107                       0.08     43.12     46.00    0.5000 Raingage
CBMH404-405
  B108                       0.05     40.60     96.00    0.5000 Raingage
CB405
  B109                       0.05     36.75     63.00    0.5000 Raingage
CBMH406
  B110                       0.15     82.77     45.00    0.5000 Raingage
EX-CBMH008
  B111                       0.06     36.21    100.00    0.5000 Raingage
TD01
  B112                       0.66    204.88     33.00    0.5000 Raingage
CBMH408-406
  B113                       0.09     48.42      0.00    0.5000 Raingage
CBMH407
```

```
  B114                        0.39     89.39     82.00    0.5000 Raingage
EX_CBMH_11_(STM)
  B115                        0.29     81.94     87.00    0.5000 Raingage
EX_CBMH_14_(STM)
  B116                        0.17     27.39      9.00    0.5000 Raingage
CB409
  B117                        0.21     57.14     57.00    0.5000 Raingage
CBMH411
  B118                        0.16     68.50     17.00    0.5000 Raingage
CBMH412
  B119                        0.15     72.34     35.00    0.5000 Raingage
CBMH413
  B120                        0.09     69.28     69.00    0.5000 Raingage
CB410
  B121                        0.09     50.36     60.00    0.5000 Raingage
EX_CB_1_(STM)
  B122a                       0.18     47.85     85.00    0.5000 Raingage
LD-TD01
  B122b                       0.00      3.15     85.00    0.5000 Raingage
LD-TD01
  B122c                       0.00      2.36     85.00    0.5000 Raingage
LD-TD01
  B123                        0.11     43.21     70.00    0.5000 Raingage
EX-CBMH048
  B124                        0.02     17.99    100.00    0.5000 Raingage
LD-TD02
  B125                        0.27     58.31     76.00    0.5000 Raingage
CBMH409
  B126                        0.11     24.91     45.00    0.5000 Raingage
CB408
  B127                        0.20     88.78     47.00    0.5000 Raingage
CB410
  B128                        0.09     46.91     30.00    0.5000 Raingage
CB411
  B129                        0.02     24.04      0.00    0.5000 Raingage
CB412
  B130                        0.09     60.22     62.00    0.5000 Raingage
CB413
  B131                        0.09     64.90     70.00    0.5000 Raingage
CB402
  B132                        0.18     55.16     80.00    0.5000 Raingage
CICB403
  B133                        0.14     35.00     37.00    0.5000 Raingage
CICB404
  B134_1                      0.05    146.37     10.00    0.5000 Raingage
CB414
  B134_3                      0.25    146.37     37.00    0.5000 Raingage
EX-CB03
  B134_4                      0.20    146.37     37.00    0.5000 Raingage
EX-CBMH01
  B135_2                      0.07     57.34     57.00    0.5000 Raingage
EX-LD01
  B135_3                      0.12     57.34     57.00    0.5000 Raingage
EX-CB02
  B135_4                      0.13     57.34     57.00    0.5000 Raingage
EX-CB01
  EX-A01a                     0.42    142.81     66.00    0.5000 Raingage
EX-CB_XZY
  EX-A01b                     0.34    159.11     80.00    0.5000 Raingage
EX-CB_XZZ
```

```
  EX-A02-01                   0.03     17.04      0.00    0.5000 Raingage
ROOF-04
  EX-A02-02                   0.04     16.12      0.00    0.5000 Raingage
ROOF-04
  EX-A02A                     0.40    130.29     73.00    0.5000 Raingage
EX-CB_XYU
  EX-A02B                     0.52    150.86     64.00    0.5000 Raingage
EX-CB130
  EX-A03-01                   0.08     42.28    100.00    0.5000 Raingage
EX-A3-01&02-STOR
  EX-A03-02                   0.16    113.93    100.00    0.5000 Raingage
EX-A3-01&02-STOR
  EX-A04                      0.04     38.81    100.00    0.5000 Raingage
EX-A04-STOR
  EX-R01                      0.07     36.14    100.00    0.5000 Raingage
EX-R1-STOR
  EX-R02                      0.29     53.37    100.00    0.5000 Raingage
EX-R02-STOR
  EX-R03                      0.04     15.54    100.00    0.5000 Raingage
EX-R03-STOR
  P3-01                       0.49     82.76    100.00    0.5000 Raingage
P3-01-STOR
  P3-02                       0.02     15.14    100.00    0.5000 Raingage
P3-02-STOR
  P3-03                       0.04     32.62    100.00    0.5000 Raingage
P3-03-STOR
  P4-01                       0.20     87.61    100.00    0.5000 Raingage
ROOF-08
  P4-02                       0.29    103.93    100.00    0.5000 Raingage
P4-02-STOR
  P4-03                       0.08     27.56    100.00    0.5000 Raingage
P4-03-STOR
  P4-04                       0.13     34.41    100.00    0.5000 Raingage
P4-04-STOR
  P4-05                       0.34     67.08    100.00    0.5000 Raingage
P4-05-stor
  P4-06                       0.06     50.84    100.00    0.5000 Raingage
P4-06-STOR
  P4-07                       0.05     23.68    100.00    0.5000 Raingage
P4-07-STOR
  P4-08                       0.29     42.45    100.00    0.5000 Raingage
TANK01
  P4-09                       0.27     39.16    100.00    0.5000 Raingage
TANK02
  P4-DR01a                    0.72     25.00      8.00    1.5000 Raingage
DR-WD
  P4-DR01b                    0.68     32.50      8.00    1.3000 Raingage
DR-SD
  P4-DR01c                    0.04      5.00      8.00    0.5000 Raingage
DR-WD
  P4-DR02                     5.35    105.00      6.00    2.0000 Raingage
DR-NW


  ************
  Node Summary
  ************
                                         Invert      Max.    Ponded    External
  Name                 Type               Elev.     Depth      Area    Inflow
```

```
  ---------------------------------------------------------------------------
  1                    JUNCTION            79.11      0.35       0.0
  10                   JUNCTION            78.97      0.35       0.0
  11                   JUNCTION            78.80      0.35       0.0
  12                   JUNCTION            78.70      0.35       0.0
  13                   JUNCTION            78.80      0.35       0.0
  14                   JUNCTION            80.05      0.35       0.0
  15                   JUNCTION            78.90      0.35       0.0
  16                   JUNCTION            79.10      0.35       0.0
  17                   JUNCTION            79.05      0.35       0.0
  18                   JUNCTION            79.05      0.35       0.0
  19                   JUNCTION            77.05      0.35       0.0
  2                    JUNCTION            78.48      0.35       0.0
  20                   JUNCTION            77.10      0.35       0.0
  21                   JUNCTION            75.69      0.35       0.0
  22                   JUNCTION            77.15      0.35       0.0
  3                    JUNCTION            78.95      0.35       0.0
  4                    JUNCTION            78.75      0.35       0.0
  5                    JUNCTION            78.95      0.35       0.0
  6                    JUNCTION            79.05      0.35       0.0
  7                    JUNCTION            78.95      0.35       0.0
  8                    JUNCTION            78.95      0.35       0.0
  9                    JUNCTION            78.95      0.35       0.0
  ROOF-01              JUNCTION            73.31     10.15       0.0
  ROOF-02              JUNCTION            72.85     10.00       0.0
  ROOF-03              JUNCTION            72.82     10.15       0.0
  ROOF-04              JUNCTION            73.02     10.00       0.0
  ROOF-06              JUNCTION            73.43     10.15       0.0
  ROOF-07              JUNCTION            74.01     10.00       0.0
  ROOF-08              JUNCTION            74.36     10.00       0.0
  ROOF-09              JUNCTION            77.37     10.15       0.0
  ROOF-10              JUNCTION            77.32      5.15       0.0
  ROOF-11              JUNCTION            75.97     10.00       0.0
  23                   OUTFALL             73.96      0.35       0.0
  24                   OUTFALL             74.00      0.35       0.0
  DR-NW                OUTFALL              0.00      0.00       0.0
  DR-SD                OUTFALL             79.21      0.35       0.0
  DR-WD                OUTFALL              0.00      0.00       0.0
  OUT13772             OUTFALL             71.56      0.91       0.0
  OUT16389             OUTFALL             72.90      0.35       0.0
  CB401                STORAGE             76.15      2.35       0.0
  CB402                STORAGE             74.65      2.45       0.0
  CB403                STORAGE             76.30      2.65       0.0
  CB405                STORAGE             76.45      2.36       0.0
  CB407                STORAGE             76.55      2.20       0.0
  CB408                STORAGE             74.40      1.45       0.0
  CB409                STORAGE             75.35      2.05       0.0
  CB410                STORAGE             75.60      2.65       0.0
  CB411                STORAGE             75.50      2.00       0.0
  CB412                STORAGE             75.80      2.00       0.0
  CB413                STORAGE             75.50      2.65       0.0
  CB414                STORAGE             74.98      0.87       0.0
  CBMH401-402          STORAGE             75.77      2.38       0.0
  CBMH401-404          STORAGE             73.31      5.79       0.0
  CBMH402              STORAGE             73.70      5.20       0.0
  CBMH403              STORAGE             74.11      4.79       0.0
  CBMH404-405          STORAGE             72.95      6.15       0.0
```

```
  CBMH406              STORAGE             72.88      6.32       0.0
  CBMH407              STORAGE             72.72      4.48       0.0
  CBMH408-406          STORAGE             75.11      2.54       0.0
  CBMH409              STORAGE             72.70      2.35       0.0
  CBMH410              STORAGE             72.13      3.92       0.0
  CBMH411              STORAGE             74.54      2.91       0.0
  CBMH412              STORAGE             74.43      2.92       0.0
  CBMH413              STORAGE             74.11      4.19       0.0
  CICB403              STORAGE             74.30      2.80       0.0
  CICB404              STORAGE             74.70      2.65       0.0
  EX._STMMH_1_(STM)    STORAGE             72.95      1.15       0.0
  EX_CB_1_(STM)        STORAGE             74.72      2.60       0.0
  EX_CB_XXZ_(STM)      STORAGE             76.90      2.12       0.0
  EX_CBMH_10_(STM)     STORAGE             75.25      3.33       0.0
  EX_CBMH_11_(STM)     STORAGE             75.38      3.34       0.0
  EX_CBMH_14_(STM)     STORAGE             76.57      2.17       0.0
  EX_CBMH12            STORAGE             76.70      2.07       0.0
  EX_STMMH_302_(STM)   STORAGE             72.62      3.70       0.0
  EX-A04-STOR          STORAGE             82.82      0.15       0.0
  EX-A3-01&02-STOR     STORAGE             83.02      0.25       0.0
  EX-CB_XYU            STORAGE             77.20      2.00       0.0
  EX-CB_XYY            STORAGE             75.94      2.90       0.0
  EX-CB_XZY            STORAGE             76.39      2.03       0.0
  EX-CB_XZZ            STORAGE             76.50      1.96       0.0
  EX-CB_XZZa           STORAGE             76.23      2.20       0.0
  EX-CB004             STORAGE             77.12      1.77       0.0
  EX-CB01              STORAGE             74.06      0.35       0.0
  EX-CB02              STORAGE             74.02      0.35       0.0
  EX-CB03              STORAGE             74.53      2.22       0.0
  EX-CB100-101         STORAGE             76.85      1.92       0.0
  EX-CB129             STORAGE             75.83      2.52       0.0
  EX-CB130             STORAGE             76.39      1.96       0.0
  EX-CB132             STORAGE             76.12      2.16       0.0
  EX-CB150             STORAGE             75.55      2.68       0.0
  EX-CB301             STORAGE             76.30      2.65       0.0
  EX-CB304             STORAGE             74.25      3.00       0.0
  EX-CB305             STORAGE             74.15      4.18       0.0
  EX-CBMH_XXX          STORAGE             74.95      3.89       0.0
  EX-CBMH_XXZ          STORAGE             76.06      2.18       0.0
  EX-CBMH_XYY          STORAGE             76.59      3.14       0.0
  EX-CBMH_XYZ          STORAGE             75.67      3.35       0.0
  EX-CBMH_XZY          STORAGE             75.69      2.93       0.0
  EX-CBMH_XZZ          STORAGE             75.51      2.77       0.0
  EX-CBMH003           STORAGE             77.23      2.08       0.0
  EX-CBMH008           STORAGE             74.10      0.59       0.0
  EX-CBMH01            STORAGE             74.73      2.11       0.0
  EX-CBMH048           STORAGE             74.06      2.95       0.0
  EX-CBMH301           STORAGE             77.00      2.10       0.0
  EX-CBMH302           STORAGE             75.21      3.04       0.0
  EX-CBMH303           STORAGE             76.08      2.40       0.0
  EX-DICB001-002       STORAGE             76.82      2.80       0.0
  EX-LD01              STORAGE             73.71      0.83       0.0
  EX-MH_XXZ            STORAGE             75.89      2.39       0.0
  EX-MH_XZY            STORAGE             75.29      3.26       0.0
  EX-MH001             STORAGE             76.79      3.11       0.0
  EX-MH301             STORAGE             76.90      1.96       0.0
  EX-R02-STOR          STORAGE             83.43      0.25       0.0
```

```
  EX-R03-STOR          STORAGE              82.90      0.25       0.0
  EX-R1-STOR           STORAGE              85.97      0.25       0.0
  EX-STMMH_XXX         STORAGE              74.27      5.32       0.0
  LD-TD01              STORAGE              72.99      1.14       0.0
  LD-TD02              STORAGE              73.20      1.45       0.0
  MH401                STORAGE              75.13      3.53       0.0
  MH402                STORAGE              73.87      4.71       0.0
  MH403                STORAGE              75.32      3.27       0.0
  MH404                STORAGE              73.54      5.04       0.0
  MH405                STORAGE              73.03      5.85       0.0
  MH406                STORAGE              73.51      5.23       0.0
  MH407                STORAGE              72.81      6.00       0.0
  MH410                STORAGE              73.58      5.36       0.0
  MH411                STORAGE              72.65      5.20       0.0
  MH412                STORAGE              72.54      6.00       0.0
  MH413                STORAGE              72.42      6.73       0.0
  MH414                STORAGE              72.35      6.22       0.0
  MH415                STORAGE              72.25      6.09       0.0
  MH416                STORAGE              72.13      6.82       0.0
  MH417                STORAGE              71.80      5.80       0.0
  MH418                STORAGE              72.27      2.59       0.0
  MH419                STORAGE              72.59      2.36       0.0
  MH420                STORAGE              72.18      3.67       0.0
  MH421                STORAGE              72.82      2.28       0.0
  MH422                STORAGE              72.57      2.84       0.0
  MH423                STORAGE              71.73      5.97       0.0
  MH424                STORAGE              71.76      5.49       0.0
  MH425                STORAGE              73.36      5.09       0.0
  MH426                STORAGE              72.64      4.44       0.0
  MH427                STORAGE              72.35      4.60       0.0
  MH428                STORAGE              72.14      4.94       0.0
  OGS_#1_(3600Ø)_(STM) STORAGE              72.17      4.86       0.0
  OGS_#2_(3600Ø)_(STM) STORAGE              71.88      6.02       0.0
  P3-01-STOR           STORAGE              83.34      0.26       0.0
  P3-02-STOR           STORAGE              82.82      0.15       0.0
  P3-03-STOR           STORAGE              87.37      0.25       0.0
  P4-01-STOR           STORAGE              84.36      0.15       0.0
  P4-02-STOR           STORAGE              84.01      0.25       0.0
  P4-03-STOR           STORAGE              83.57      0.25       0.0
  P4-04-STOR           STORAGE              83.31      0.25       0.0
  P4-05-stor           STORAGE              82.85      0.25       0.0
  P4-06-STOR           STORAGE              82.82      0.25       0.0
  P4-07-STOR           STORAGE              83.02      0.15       0.0
  Structure_-_(48)_(5)_(STM) STORAGE              72.36      3.88       0.0
  Structure_-_(68)_(1)_(STM) STORAGE              74.00      2.18       0.0
  TANK01               STORAGE              73.45      1.00       0.0
  TANK02               STORAGE              73.19      1.00       0.0
  TD01                 STORAGE              76.50      2.35       0.0


  ************
  Link Summary
  ************
  Name             From Node        To Node          Type            Length    %
Slope Roughness
  --------------------------------------------------------------------------------
------------
```

```
  1                EX._STMMH_1_(STM) OUT16389         CONDUIT           15.6
0.3206    0.0130
  11               EX-CB100-101     DR-SD            CONDUIT           57.3   -
1.3785    0.0160
  12               LD-TD01          MH419            CONDUIT           16.3
0.1231    0.0130
  16               EX-CB100-101     CBMH401-402      CONDUIT           53.2
1.1647    0.0160
  17               4                CBMH401-402      CONDUIT           37.1
2.5618    0.0160
  18               4                CBMH402          CONDUIT           21.6
0.9275    0.0160
  19               5                CBMH402          CONDUIT           23.8
1.6834    0.0160
  20               3                CBMH401-402      CONDUIT           65.0
1.7681    0.0160
  21               5                CB403            CONDUIT           26.3
1.3318    0.0160
  22               6                CB403            CONDUIT           29.5
1.5234    0.0160
  23               6                CBMH406          CONDUIT           15.1
1.3253    0.0160
  24               7                CBMH406          CONDUIT            7.3
1.3644    0.0160
  25               7                CB405            CONDUIT           23.0
2.1331    0.0160
  26               3                CBMH401-404      CONDUIT           20.8
0.9605    0.0160
  27               8                CBMH401-404      CONDUIT           19.6
1.0194    0.0160
  28               8                CBMH404-405      CONDUIT           20.3
0.9859    0.0160
  29               9                CBMH404-405      CONDUIT           16.0
1.2538    0.0160
  30               9                CB405            CONDUIT           24.0
2.0389    0.0160
  31               CB405            CBMH408-406      CONDUIT           33.8
3.4352    0.0160
  32               2                CBMH408-406      CONDUIT          130.1
0.9070    0.0160
  33               2                CB410            CONDUIT           85.9
0.6754    0.0160
  34               2                CBMH413          CONDUIT           88.6
0.5980    0.0160
  35               CB410            EX-CBMH01        CONDUIT           86.9
1.6221    0.0160
  36               CBMH413          EX-CB03          CONDUIT           81.0
1.9151    0.0160
  37               EX-CB03          EX-CB02          CONDUIT           75.9
3.1379    0.0160
  38               20               21               CONDUIT           68.2
2.0639    0.0130
  38_1             EX-CBMH01        21               CONDUIT           25.1
3.1737    0.0160
  38_3             21               EX-CB01          CONDUIT           51.4
3.1766    0.0160
  39               13               CBMH401-402      CONDUIT           48.2
2.0756    0.0130
  40               13               CB401            CONDUIT           28.0
2.3237    0.0130
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  41               12               CB401            CONDUIT           28.5
1.9311    0.0130
  42               12               EX-CB301         CONDUIT           10.5
0.9566    0.0130
  43               11               EX-CB301         CONDUIT           13.1
1.5258    0.0130
  44               11               EX-CBMH301       CONDUIT           12.3
0.4063    0.0130
  45               10               EX-CBMH301       CONDUIT           35.0
0.6293    0.0130
  46               10               EX_CB_XXZ_(STM)  CONDUIT           19.8
1.5117    0.0130
  47               14               EX_CB_XXZ_(STM)  CONDUIT           44.8
3.0824    0.0130
  48               14               EX-CBMH_XYY      CONDUIT           29.0
2.3101    0.0130
  49               LD-TD02          CBMH409          CONDUIT            3.6
1.1112    0.0130
  49_1             EX-CBMH_XYY      1                CONDUIT           15.5
1.7339    0.0130
  49_2             1                EX-CB_XYY        CONDUIT           15.7
1.7313    0.0130
  50               20               CICB404          CONDUIT           11.7
0.8581    0.0130
  51               19               CICB404          CONDUIT           17.9
0.2801    0.0130
  52               19               CICB403          CONDUIT           32.8
0.9139    0.0130
  53               22               CICB403          CONDUIT           25.4
1.5769    0.0130
  54               22               CB402            CONDUIT           14.8
0.3377    0.0130
  55               CB413            CB402            CONDUIT           33.2
2.1106    0.0130
  56               18               CB413            CONDUIT           43.0
2.9100    0.0130
  57               18               EX-CBMH_XXX      CONDUIT           26.4
0.7966    0.0130
  58               17               EX-CBMH_XXX      CONDUIT           11.2
1.8750    0.0130
  59               17               EX-CBMH302       CONDUIT            9.7
1.5544    0.0130
  60               16               EX-CBMH302       CONDUIT           20.9
0.9552    0.0130
  61               16               EX-CBMH_XYZ      CONDUIT           24.1
1.7842    0.0130
  62               15               EX-CBMH_XYZ      CONDUIT           32.5
0.7068    0.0130
  63               15               EX-CB_XYY        CONDUIT           10.2
0.5911    0.0130
  64               EX-CB_XYU        10               CONDUIT            5.0
2.8011    0.0160
  65               EX-CB_XZY        EX-CB_XZZ        CONDUIT            5.0
0.0061    0.0160
  66               EX-CB_XZZ        EX-CB_XZZa       CONDUIT           25.8
0.0012    0.0160
  67               EX-CB_XZZa       CB401            CONDUIT            5.0
4.8055    0.0160
  68               EX-CB132         EX-CB_XZY        CONDUIT            5.0
0.0061    0.0160
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  69               EX-CBMH048       Structure_-_(68)_(1)_(STM) CONDUIT
11.7    0.5133    0.0130
  70               EX_CB_1_(STM)    EX-CBMH048       CONDUIT            5.0
6.2120    0.0130
  72               CB407            EX_CBMH_14_(STM) CONDUIT            5.0
0.0061    0.0160
  73               EX_CBMH_14_(STM) EX_CBMH_10_(STM) CONDUIT            5.0
0.0061    0.0160
  74               EX_CBMH_10_(STM) 2                CONDUIT            5.0
1.4001    0.0160
  75               EX_CBMH12        EX_CBMH_11_(STM) CONDUIT            5.0
0.0061    0.0160
  76               EX_CBMH_11_(STM) EX_CBMH_10_(STM) CONDUIT            5.0
90.2526    0.0160
  77               EX-CB132         EX-CB_XZZa       CONDUIT            5.0
0.0061    0.0160
  79               EX-CB02          23               CONDUIT            8.4
0.7154    0.0160
  80               EX-CB01          24               CONDUIT           11.1
0.5387    0.0160
  81               EX-CBMH008       MH421            CONDUIT           35.9
1.6994    0.0130
  Pipe_-_(1)_(1)_(STM) EX-CB305         MH425            CONDUIT           13.6
0.6627    0.0130
  Pipe_-_(1)_(STM) EX-STMMH_XXX     MH425            CONDUIT           16.9
1.0070    0.0130
  Pipe_-_(10)_(1)_(1)_(STM) EX_CB_XXZ_(STM)  EX-CBMH_XYY      CONDUIT
71.8    0.7794    0.0130
  Pipe_-_(10)_(1)_(2)_(_(1)_(1)_(2)_(STM) ROOF-03          MH419            CONDUIT
2.0    1.0001    0.0130
  Pipe_-_(10)_(1)_(2)_(_(1)_(1)_(STM) MH419            MH418            CONDUIT
8.0    0.2488    0.0130
  Pipe_-_(10)_(1)_(2)_(_(2)_(1)_(STM) ROOF-02          Structure_-_(48)_(5)_(STM)
CONDUIT          20.0    0.7499    0.0130
  Pipe_-_(10)_(1)_(2)_(_(2)_(STM) ROOF-01          EX_STMMH_302_(STM) CONDUIT
24.7    0.9698    0.0130
  Pipe_-_(10)_(1)_(2)_(1)_(STM) EX-CB004         EX-CBMH003       CONDUIT
18.4    0.9760    0.0130
  Pipe_-_(10)_(1)_(2)_(100)_(4)_(STM) EX_STMMH_302_(STM) Structure_-_(48)_(5)_(STM)
CONDUIT          14.8    1.0129    0.0130
  Pipe_-_(10)_(1)_(2)_(103)_(STM) MH422            MH420            CONDUIT
18.5    0.4859    0.0130
  Pipe_-_(10)_(1)_(2)_(104)_(STM) Structure_-_(48)_(5)_(STM) MH418
CONDUIT          10.0    0.2002    0.0130
  Pipe_-_(10)_(1)_(2)_(11)_(STM) EX-CBMH302       EX-CBMH_XXX      CONDUIT
20.7    1.0167    0.0130
  Pipe_-_(10)_(1)_(2)_(15)_(STM) EX-CBMH_XXX      EX-STMMH_XXX     CONDUIT
34.6    1.0969    0.0130
  Pipe_-_(10)_(1)_(2)_(16)_(STM) EX-CB304         EX-CB305         CONDUIT
14.0    0.7150    0.0130
  Pipe_-_(10)_(1)_(2)_(2)_(STM) ROOF-10          EX-CBMH003       CONDUIT
8.5    0.9400    0.0130
  Pipe_-_(10)_(1)_(2)_(22)_(STM) MH426            MH427            CONDUIT
53.0    0.5093    0.0130
  Pipe_-_(10)_(1)_(2)_(27)_(STM) MH428            OGS_#1_(3600Ø)_(STM) CONDUIT
14.2    0.9868    0.0130
  Pipe_-_(10)_(1)_(2)_(28)_(STM) OGS_#1_(3600Ø)_(STM) MH424            CONDUIT
7.0    1.0067    0.0130
  Pipe_-_(10)_(1)_(2)_(3)_(STM) EX-CBMH003       EX-MH001         CONDUIT
20.7    0.5805    0.0130
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  Pipe_-_(10)_(1)_(2)_(31)_(STM) MH424            OUT13772         CONDUIT
99.0    0.2021    0.0130
  Pipe_-_(10)_(1)_(2)_(32)_(STM) OGS_#2_(3600Ø)_(STM) MH424            CONDUIT
50.1    0.1397    0.0130
  Pipe_-_(10)_(1)_(2)_(33)_(STM) MH423            OGS_#2_(3600Ø)_(STM) CONDUIT
17.2    0.1742    0.0130
  Pipe_-_(10)_(1)_(2)_(35)_(1)_(STM) CB409            CBMH411          CONDUIT
41.2    0.9952    0.0130
  Pipe_-_(10)_(1)_(2)_(35)_(2)_(STM) CBMH411          CBMH412          CONDUIT
16.4    0.4865    0.0130
  Pipe_-_(10)_(1)_(2)_(35)_(STM) CBMH413          MH417            CONDUIT
19.2    0.9887    0.0130
  Pipe_-_(10)_(1)_(2)_(39)_(STM) EX-CB03          EX-CBMH01        CONDUIT
7.1    1.1265    0.0130
  Pipe_-_(10)_(1)_(2)_(4)_(STM) EX-CBMH_XYY      EX-CB_XYY        CONDUIT
30.8    0.9728    0.0130
  Pipe_-_(10)_(1)_(2)_(40)_(2)_(STM) EX-CBMH01        EX._STMMH_1_(STM) CONDUIT
82.6    2.0945    0.0130
  Pipe_-_(10)_(1)_(2)_(45)_(STM) EX-DICB001-002   EX-CB130         CONDUIT
38.9    1.0022    0.0130
  Pipe_-_(10)_(1)_(2)_(46)_(STM) EX-CB130         EX-CB129         CONDUIT
18.5    2.7623    0.0130
  Pipe_-_(10)_(1)_(2)_(48)_(STM) EX-CB150         EX-CBMH_XZY      CONDUIT
20.7    0.2412    0.0130
  Pipe_-_(10)_(1)_(2)_(49)_(STM) EX-CBMH_XXZ      EX-CB150         CONDUIT
13.8    0.7989    0.0130
  Pipe_-_(10)_(1)_(2)_(5)_(STM) EX-CB_XYY        EX-CBMH_XYZ      CONDUIT
41.8    1.0051    0.0130
  Pipe_-_(10)_(1)_(2)_(50)_(STM) EX-MH_XXZ        EX-CBMH_XXZ      CONDUIT
33.0    0.3631    0.0130
  Pipe_-_(10)_(1)_(2)_(52)_(STM) EX-CB_XZY        EX-CB132         CONDUIT
22.9    1.0022    0.0130
  Pipe_-_(10)_(1)_(2)_(54)_(STM) EX-CB_XZZ        EX-CB_XZZa       CONDUIT
23.0    0.9573    0.0130
  Pipe_-_(10)_(1)_(2)_(55)_(STM) EX-CBMH_XZY      EX-MH_XZY        CONDUIT
11.8    0.1691    0.0130
  Pipe_-_(10)_(1)_(2)_(57)_(STM) EX-CB301         EX-MH_XZY        CONDUIT
8.6    4.7623    0.0130
  Pipe_-_(10)_(1)_(2)_(58)_(STM) EX-MH_XZY        EX-CBMH_XZZ      CONDUIT
44.5    0.1799    0.0130
  Pipe_-_(10)_(1)_(2)_(59)_(STM) EX-CBMH_XZZ      MH401            CONDUIT
15.0    0.1998    0.0130
  Pipe_-_(10)_(1)_(2)_(61)_(STM) EX-CB100-101     MH403            CONDUIT
64.1    0.9981    0.0130
  Pipe_-_(10)_(1)_(2)_(63)_(STM) CBMH401-402      MH403            CONDUIT
19.1    0.5223    0.0130
  Pipe_-_(10)_(1)_(2)_(64)_(STM) MH403            MH402            CONDUIT
14.4    0.4873    0.0130
  Pipe_-_(10)_(1)_(2)_(66)_(STM) CB401            MH401            CONDUIT
19.1    0.9959    0.0130
  Pipe_-_(10)_(1)_(2)_(7)_(STM) EX-CBMH_XYZ      EX-CBMH302       CONDUIT
44.9    1.0244    0.0130
  Pipe_-_(10)_(1)_(2)_(70)_(STM) ROOF-09          EX-MH301         CONDUIT
11.6    1.0354    0.0130
  Pipe_-_(10)_(1)_(2)_(71)_(STM) EX-MH301         EX-CBMH301       CONDUIT
28.0    0.5000    0.0130
  Pipe_-_(10)_(1)_(2)_(72)_(STM) EX-CBMH301       EX-CBMH_XZY      CONDUIT
28.8    2.9880    0.0130
  Pipe_-_(10)_(1)_(2)_(73)_(STM) ROOF-08          CBMH403          CONDUIT
9.5    1.0557    0.0130
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  Pipe_-_(10)_(1)_(2)_(74)_(STM) CBMH403          CBMH402          CONDUIT
18.1    0.9922    0.0130
  Pipe_-_(10)_(1)_(2)_(76)_(STM) CB403            MH406            CONDUIT
7.3    0.9528    0.0130
  Pipe_-_(10)_(1)_(2)_(79)_(STM) ROOF-07          MH406            CONDUIT
17.6    1.0244    0.0130
  Pipe_-_(10)_(1)_(2)_(8)_(STM) ROOF-11          EX-CBMH_XYZ      CONDUIT
16.7    1.0161    0.0130
  Pipe_-_(10)_(1)_(2)_(80)_(STM) CBMH406          MH407            CONDUIT
28.3    0.2120    0.0130
  Pipe_-_(10)_(1)_(2)_(82)_(STM) MH406            MH405            CONDUIT
17.8    1.0122    0.0130
  Pipe_-_(10)_(1)_(2)_(89)_(1)_(STM) ROOF-04          MH421            CONDUIT
1.2    0.8489    0.0130
  Pipe_-_(10)_(1)_(2)_(89)_(STM) ROOF-06          CBMH406          CONDUIT
19.7    0.6096    0.0130
  Pipe_-_(10)_(1)_(2)_(94)_(1)_(4)_(STM) MH410            MH407            CONDUIT
26.3    0.3419    0.0130
  Pipe_-_(10)_(1)_(2)_(98)_(STM) MH416            MH417            CONDUIT
38.5    0.2601    0.0130
  Pipe_-_(10)_(1)_(2)_(99)_(STM) CB408            CBMH410          CONDUIT
25.1    0.9947    0.0130
  Pipe_-_(10)_(1)_(2)_(STM) EX-MH001         EX-CBMH_XYY      CONDUIT
13.4    2.6146    0.0130
  Pipe_-_(11)_(STM) MH427            MH428            CONDUIT           18.8
1.0113    0.0130
  Pipe_-_(12)_(STM) MH417            MH423            CONDUIT           35.0
0.1429    0.0130
  Pipe_-_(14)_(1)_(2)_(STM) CBMH410          MH417            CONDUIT
51.0    0.1960    0.0130
  Pipe_-_(14)_(1)_(STM) MH420            CBMH410          CONDUIT           19.4
0.2065    0.0130
  Pipe_-_(15)_(STM) MH418            MH420            CONDUIT           51.8
0.1545    0.0130
  Pipe_-_(16)_(1)_(STM) MH421            CBMH409          CONDUIT           11.2
0.3587    0.0130
  Pipe_-_(16)_(STM) CBMH409          MH422            CONDUIT           20.8
0.4796    0.0130
  Pipe_-_(17)_(1)_(2)_(STM) EX_CBMH_11_(STM) EX_CBMH_10_(STM) CONDUIT
37.9    0.2111    0.0130
  Pipe_-_(17)_(1)_(3)_(3)_(STM) EX_CBMH_14_(STM) EX_CBMH_10_(STM) CONDUIT
25.6    0.3514    0.0130
  Pipe_-_(17)_(1)_(3)_(STM) EX_CBMH12        EX_CBMH_11_(STM) CONDUIT
34.3    0.3503    0.0130
  Pipe_-_(17)_(2)_(STM) CB407            EX_CBMH_14_(STM) CONDUIT           23.4
0.9844    0.0130
  Pipe_-_(17)_(3)_(STM) MH415            MH416            CONDUIT           40.5
0.2467    0.0130
  Pipe_-_(17)_(4)_(STM) MH413            MH414            CONDUIT           23.0
0.2175    0.0130
  Pipe_-_(17)_(STM) MH414            MH415            CONDUIT           32.4
0.2467    0.0130
  Pipe_-_(18)_(STM) MH412            MH413            CONDUIT           39.1
0.2555    0.0130
  Pipe_-_(19)_(STM) MH411            MH412            CONDUIT           30.2
0.2649    0.0130
  Pipe_-_(20)_(4)_(STM) CBMH407          MH411            CONDUIT           14.5
0.2750    0.0130
  Pipe_-_(20)_(STM) MH407            CBMH407          CONDUIT           33.7
0.2376    0.0130
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  Pipe_-_(22)_(STM) CBMH404-405      CBMH406          CONDUIT           20.4
0.1958    0.0130
  Pipe_-_(24)_(STM) MH405            CBMH404-405      CONDUIT           26.4
0.1893    0.0130
  Pipe_-_(25)_(STM) CBMH401-404      MH405            CONDUIT           13.4
0.9674    0.0130
  Pipe_-_(26)_(STM) MH404            CBMH401-404      CONDUIT           42.2
0.4973    0.0130
  Pipe_-_(27)_(STM) CBMH402          MH404            CONDUIT           22.1
0.4982    0.0130
  Pipe_-_(28)_(STM) MH402            CBMH402          CONDUIT           34.9
0.3439    0.0130
  Pipe_-_(29)_(STM) MH401            MH402            CONDUIT           24.5
0.2445    0.0130
  Pipe_-_(9)_(1)_(STM) TD01             MH410            CONDUIT           12.3
0.9719    0.0130
  Pipe_-_(9)_(STM) MH425            MH426            CONDUIT           57.2
0.9969    0.0130
  OCB01            EX_CB_1_(STM)    EX_STMMH_302_(STM) ORIFICE
  OCB0408-406      CBMH408-406      CBMH407          ORIFICE
  OCB10            EX_CBMH_10_(STM) MH415            ORIFICE
  OCB129           EX-CB129         EX-CB150         ORIFICE
  OCB132           EX-CB132         EX-MH_XXZ        ORIFICE
  OCB303           EX-CBMH303       EX-CBMH302       ORIFICE
  OCB402           CB402            MH426            ORIFICE
  OCB403           CICB403          MH426            ORIFICE
  OCB404           CICB404          OGS_#1_(3600Ø)_(STM) ORIFICE
  OCB405           CB405            MH407            ORIFICE
  OCB410           CB410            MH417            ORIFICE
  OCB411           CB411            MH423            ORIFICE
  OCB412           CB412            OGS_#2_(3600Ø)_(STM) ORIFICE
  OCB413           CB413            MH425            ORIFICE
  OCB414           CB414            EX-CBMH01        ORIFICE
  OCBLD01          EX-LD01          EX._STMMH_1_(STM) ORIFICE
  OCBMH048         Structure_-_(68)_(1)_(STM) MH418            ORIFICE
  OCBMH412         CBMH412          CBMH413          ORIFICE
  OCBXYU           EX-CB_XYU        EX_CB_XXZ_(STM)  ORIFICE
  OCBXZZa          EX-CB_XZZa       EX-MH_XXZ        ORIFICE
  O-TANK01         TANK01           MH426            ORIFICE
  O-TANK02         TANK02           MH427            ORIFICE
  78               P4-06-STOR       LD-TD01          WEIR
  82               P3-01-STOR       P4-04-STOR       WEIR
  EX-A3-01&02-OVF  EX-A3-01&02-STOR CBMH409          WEIR
  EX-R02-OVF       EX-R02-STOR      CBMH406          WEIR
  EX-R03-OVF       EX-R03-STOR      P4-05-stor       WEIR
  EX-R1-OVF        EX-R1-STOR       EX-CBMH_XYZ      WEIR
  P3-03-OVF        P3-03-STOR       EX-CBMH301       WEIR
  P4-02-OVF        P4-02-STOR       CB403            WEIR
  P4-03-OVF        P4-03-STOR       TD01             WEIR
  P4-04-OVF        P4-04-STOR       EX_CB_1_(STM)    WEIR
  P4-05-OVF        P4-05-stor       P4-06-STOR       WEIR
  13               EX-CB01          EX._STMMH_1_(STM) OUTLET
  14               EX-CB02          EX._STMMH_1_(STM) OUTLET
  EX-A04-STOR_out  EX-A04-STOR      ROOF-03          OUTLET
  EX-A3-01&02-STOR_out EX-A3-01&02-STOR ROOF-04          OUTLET
  EX-R02-STOR_out  EX-R02-STOR      ROOF-06          OUTLET
  EX-R03-STOR_out  EX-R03-STOR      ROOF-02          OUTLET
  EX-R1-STOR_out   EX-R1-STOR       ROOF-11          OUTLET
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  P3-01-STOR_out   P3-01-STOR       ROOF-01          OUTLET
  P3-02-STOR_out   P3-02-STOR       ROOF-03          OUTLET
  P3-03-STOR_out   P3-03-STOR       ROOF-09          OUTLET
  P4-01-STOR_out   P4-01-STOR       ROOF-08          OUTLET
  P4-02-STOR_out   P4-02-STOR       ROOF-07          OUTLET
  P4-03-STOR_out   P4-03-STOR       MH410            OUTLET
  P4-04-STOR_out   P4-04-STOR       ROOF-01          OUTLET
  P4-05-STOR_out   P4-05-stor       ROOF-02          OUTLET
  P4-06-STOR_out   P4-06-STOR       ROOF-03          OUTLET
  P4-07-STOR_out   P4-07-STOR       ROOF-04          OUTLET


  *********************
  Cross Section Summary
  *********************
                                        Full     Full     Hyd.     Max.   No. of
Full
  Conduit          Shape               Depth     Area     Rad.    Width  Barrels
Flow
  ---------------------------------------------------------------------------------
------
  1                CIRCULAR             0.35     0.10     0.09     0.35        1
82.60
  11               RECT_OPEN            0.35     3.50     0.33    10.00        1
12193.56
  12               CIRCULAR             0.30     0.07     0.08     0.30        1
35.45
  16               RECT_OPEN            0.35     3.50     0.33    10.00        1
11208.26
  17               RECT_OPEN            0.35     3.50     0.33    10.00        1
16622.86
  18               RECT_OPEN            0.35     3.50     0.33    10.00        1
10001.84
  19               RECT_OPEN            0.35     3.50     0.33    10.00        1
13474.80
  20               RECT_OPEN            0.35     3.50     0.33    10.00        1
13809.87
  21               RECT_OPEN            0.35     3.50     0.33    10.00        1
11985.45
  22               RECT_OPEN            0.35     3.50     0.33    10.00        1
12818.42
  23               RECT_OPEN            0.35     3.50     0.33    10.00        1
11956.14
  24               RECT_OPEN            0.35     3.50     0.33    10.00        1
12131.06
  25               RECT_OPEN            0.35     3.50     0.33    10.00        1
15168.10
  26               RECT_OPEN            0.35     3.50     0.33    10.00        1
10178.50
  27               RECT_OPEN            0.35     3.50     0.33    10.00        1
10485.94
  28               RECT_OPEN            0.35     3.50     0.33    10.00        1
10312.10
  29               RECT_OPEN            0.35     3.50     0.33    10.00        1
11628.97
  30               RECT_OPEN            0.35     3.50     0.33    10.00        1
14829.43
  31               RECT_OPEN            0.35     3.50     0.33    10.00        1
19248.91
```

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  32                RECT_OPEN              0.35     3.50     0.33    10.00        1
9890.81
  33                RECT_OPEN              0.35     1.75     0.31     5.00        1
4091.11
  34                RECT_OPEN              0.35     1.75     0.31     5.00        1
3849.59
  35                RECT_OPEN              0.35     1.75     0.31     5.00        1
6340.03
  36                RECT_OPEN              0.35     1.75     0.31     5.00        1
6888.86
  37                RECT_OPEN              0.35     1.75     0.31     5.00        1
8818.06
  38                RECT_OPEN              0.35     3.50     0.33    10.00        1
18363.52
  38_1              RECT_OPEN              0.35     1.75     0.31     5.00        1
8868.26
  38_3              RECT_OPEN              0.35     1.75     0.31     5.00        1
8872.27
  39                RECT_OPEN              0.35     3.50     0.33    10.00        1
18415.34
  40                RECT_OPEN              0.35     3.50     0.33    10.00        1
19484.91
  41                RECT_OPEN              0.35     3.50     0.33    10.00        1
17762.87
  42                RECT_OPEN              0.35     3.50     0.33    10.00        1
12501.89
  43                RECT_OPEN              0.35     3.50     0.33    10.00        1
15789.29
  44                RECT_OPEN              0.35     3.50     0.33    10.00        1
8148.04
  45                RECT_OPEN              0.35     3.50     0.33    10.00        1
10140.27
  46                RECT_OPEN              0.35     3.50     0.33    10.00        1
15716.11
  47                RECT_OPEN              0.35     3.50     0.33    10.00        1
22441.62
  48                RECT_OPEN              0.35     3.50     0.33    10.00        1
19427.68
  49                CIRCULAR               0.25     0.05     0.06     0.25        1
62.69
  49_1              RECT_OPEN              0.35     3.50     0.33    10.00        1
16831.25
  49_2              RECT_OPEN              0.35     3.50     0.33    10.00        1
16818.78
  50                RECT_OPEN              0.35     3.50     0.33    10.00        1
11840.70
  51                RECT_OPEN              0.35     3.50     0.33    10.00        1
6764.52
  52                RECT_OPEN              0.35     3.50     0.33    10.00        1
12219.72
  53                RECT_OPEN              0.35     3.50     0.33    10.00        1
16051.38
  54                RECT_OPEN              0.35     3.50     0.33    10.00        1
7427.79
  55                RECT_OPEN              0.35     3.50     0.33    10.00        1
18569.72
  56                RECT_OPEN              0.35     3.50     0.33    10.00        1
21804.75
  57                RECT_OPEN              0.35     3.50     0.33    10.00        1
11408.44
```

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  58                RECT_OPEN              0.35     3.50     0.33    10.00        1
17502.78
  59                RECT_OPEN              0.35     3.50     0.33    10.00        1
15936.49
  60                RECT_OPEN              0.35     3.50     0.33    10.00        1
12492.33
  61                RECT_OPEN              0.35     3.50     0.33    10.00        1
17073.84
  62                RECT_OPEN              0.35     3.50     0.33    10.00        1
10746.02
  63                RECT_OPEN              0.35     3.50     0.33    10.00        1
9827.25
  64                RECT_OPEN              0.35     1.75     0.31     5.00        1
8331.38
  65                RECT_OPEN              0.35     1.75     0.31     5.00        1
388.67
  66                RECT_OPEN              0.35     1.75     0.31     5.00        1
171.22
  67                RECT_OPEN              0.35     1.75     0.31     5.00        1
10912.50
  68                RECT_OPEN              0.35     1.75     0.31     5.00        1
388.67
  69                CIRCULAR               1.52     1.82     0.38     1.52        1
5283.61
  70                RECT_OPEN              0.35     3.50     0.33    10.00        1
31858.18
  72                RECT_OPEN              0.35     3.50     0.33    10.00        1
810.87
  73                RECT_OPEN              0.35     3.50     0.33    10.00        1
810.87
  74                RECT_OPEN              0.35     3.50     0.33    10.00        1
12288.98
  75                RECT_OPEN              0.35     3.50     0.33    10.00        1
810.87
  76                RECT_OPEN              0.35     3.50     0.33    10.00        1
98664.33
  77                RECT_OPEN              0.35     1.75     0.31     5.00        1
388.67
  79                RECT_OPEN              0.35     1.75     0.31     5.00        1
4210.47
  80                RECT_OPEN              0.35     1.75     0.31     5.00        1
3653.50
  81                CIRCULAR               0.25     0.05     0.06     0.25        1
77.53
  Pipe_-_(1)_(1)_(STM) CIRCULAR                0.25     0.05     0.06     0.25
1    50.51
  Pipe_-_(1)_(STM) CIRCULAR                0.53     0.22     0.13     0.53        1
449.35
  Pipe_-_(10)_(1)_(1)_(STM) CIRCULAR               0.30     0.07     0.08     0.30
1    89.23
  Pipe_-_(10)_(1)_(2)_(_(1)_(1)_(2)_(STM) CIRCULAR              0.30     0.07
0.08     0.30        1   101.07
  Pipe_-_(10)_(1)_(2)_(_(1)_(1)_(STM) CIRCULAR             0.53     0.22     0.13
0.53         1   223.36
  Pipe_-_(10)_(1)_(2)_(_(2)_(1)_(STM) CIRCULAR             0.38     0.11     0.10
0.38         1   158.41
  Pipe_-_(10)_(1)_(2)_(_(2)_(STM) CIRCULAR             0.40     0.13     0.10
0.40         1   205.10
  Pipe_-_(10)_(1)_(2)_(1)_(STM) CIRCULAR             0.20     0.03     0.05
0.20         1    32.40
```

```
  Pipe_-_(10)_(1)_(2)_(100)_(4)_(STM) CIRCULAR             0.53     0.22     0.13
0.53        1   450.68
  Pipe_-_(10)_(1)_(2)_(103)_(STM) CIRCULAR             0.38     0.11     0.10
0.38        1   127.51
  Pipe_-_(10)_(1)_(2)_(104)_(STM) CIRCULAR             0.53     0.22     0.13
0.53        1   200.37
  Pipe_-_(10)_(1)_(2)_(11)_(STM) CIRCULAR             0.46     0.16     0.11
0.46        1   299.58
  Pipe_-_(10)_(1)_(2)_(15)_(STM) CIRCULAR             0.46     0.16     0.11
0.46        1   311.16
  Pipe_-_(10)_(1)_(2)_(16)_(STM) CIRCULAR             0.25     0.05     0.06
0.25        1    52.46
  Pipe_-_(10)_(1)_(2)_(2)_(STM) CIRCULAR             0.20     0.03     0.05
0.20        1    31.80
  Pipe_-_(10)_(1)_(2)_(22)_(STM) CIRCULAR             0.53     0.22     0.13
0.53        1   319.58
  Pipe_-_(10)_(1)_(2)_(27)_(STM) CIRCULAR             0.69     0.37     0.17
0.69        1   871.86
  Pipe_-_(10)_(1)_(2)_(28)_(STM) CIRCULAR             0.69     0.37     0.17
0.69        1   880.59
  Pipe_-_(10)_(1)_(2)_(3)_(STM) CIRCULAR             0.20     0.03     0.05
0.20        1    24.99
  Pipe_-_(10)_(1)_(2)_(31)_(STM) CIRCULAR             0.91     0.66     0.23
0.91        1   847.99
  Pipe_-_(10)_(1)_(2)_(32)_(STM) CIRCULAR             0.91     0.66     0.23
0.91        1   705.02
  Pipe_-_(10)_(1)_(2)_(33)_(STM) CIRCULAR             0.91     0.66     0.23
0.91        1   787.36
  Pipe_-_(10)_(1)_(2)_(35)_(1)_(STM) CIRCULAR             0.20     0.03     0.05
0.20        1    32.72
  Pipe_-_(10)_(1)_(2)_(35)_(2)_(STM) CIRCULAR             0.30     0.07     0.08
0.30        1    70.49
  Pipe_-_(10)_(1)_(2)_(35)_(STM) CIRCULAR             0.38     0.11     0.10
0.38        1   181.88
  Pipe_-_(10)_(1)_(2)_(39)_(STM) CIRCULAR             0.25     0.05     0.06
0.25        1    65.85
  Pipe_-_(10)_(1)_(2)_(4)_(STM) CIRCULAR             0.30     0.07     0.08
0.30        1    99.68
  Pipe_-_(10)_(1)_(2)_(40)_(2)_(STM) CIRCULAR             0.38     0.11     0.10
0.38        1   264.73
  Pipe_-_(10)_(1)_(2)_(45)_(STM) CIRCULAR             0.30     0.07     0.08
0.30        1   101.17
  Pipe_-_(10)_(1)_(2)_(46)_(STM) CIRCULAR             0.30     0.07     0.08
0.30        1   167.97
  Pipe_-_(10)_(1)_(2)_(48)_(STM) CIRCULAR             0.46     0.16     0.11
0.46        1   145.92
  Pipe_-_(10)_(1)_(2)_(49)_(STM) CIRCULAR             0.38     0.11     0.10
0.38        1   163.49
  Pipe_-_(10)_(1)_(2)_(5)_(STM) CIRCULAR             0.30     0.07     0.08
0.30        1   101.32
  Pipe_-_(10)_(1)_(2)_(50)_(STM) CIRCULAR             0.30     0.07     0.08
0.30        1    60.90
  Pipe_-_(10)_(1)_(2)_(52)_(STM) CIRCULAR             0.20     0.03     0.05
0.20        1    32.84
  Pipe_-_(10)_(1)_(2)_(54)_(STM) CIRCULAR             0.20     0.03     0.05
0.20        1    32.09
  Pipe_-_(10)_(1)_(2)_(55)_(STM) CIRCULAR             0.53     0.22     0.13
0.53        1   184.13
  Pipe_-_(10)_(1)_(2)_(57)_(STM) CIRCULAR             0.20     0.03     0.05
0.20        1    71.58
```

```
  Pipe_-_(10)_(1)_(2)_(58)_(STM) CIRCULAR             0.53     0.22     0.13
0.53        1   189.91
  Pipe_-_(10)_(1)_(2)_(59)_(STM) CIRCULAR             0.53     0.22     0.13
0.53        1   200.17
  Pipe_-_(10)_(1)_(2)_(61)_(STM) CIRCULAR             0.30     0.07     0.08
0.30        1   100.97
  Pipe_-_(10)_(1)_(2)_(63)_(STM) CIRCULAR             0.25     0.05     0.06
0.25        1    44.84
  Pipe_-_(10)_(1)_(2)_(64)_(STM) CIRCULAR             0.30     0.07     0.08
0.30        1    70.55
  Pipe_-_(10)_(1)_(2)_(66)_(STM) CIRCULAR             0.20     0.03     0.05
0.20        1    32.73
  Pipe_-_(10)_(1)_(2)_(7)_(STM) CIRCULAR             0.46     0.16     0.11
0.46        1   300.70
  Pipe_-_(10)_(1)_(2)_(70)_(STM) CIRCULAR             0.25     0.05     0.06
0.25        1    63.13
  Pipe_-_(10)_(1)_(2)_(71)_(STM) CIRCULAR             0.30     0.07     0.08
0.30        1    71.47
  Pipe_-_(10)_(1)_(2)_(72)_(STM) CIRCULAR             0.30     0.07     0.08
0.30        1   174.70
  Pipe_-_(10)_(1)_(2)_(73)_(STM) CIRCULAR             0.30     0.07     0.08
0.30        1   103.84
  Pipe_-_(10)_(1)_(2)_(74)_(STM) CIRCULAR             0.30     0.07     0.08
0.30        1   100.67
  Pipe_-_(10)_(1)_(2)_(76)_(STM) CIRCULAR             0.20     0.03     0.05
0.20        1    32.02
  Pipe_-_(10)_(1)_(2)_(79)_(STM) CIRCULAR             0.38     0.11     0.10
0.38        1   185.14
  Pipe_-_(10)_(1)_(2)_(8)_(STM) CIRCULAR             0.15     0.02     0.04
0.15        1    15.35
  Pipe_-_(10)_(1)_(2)_(80)_(STM) CIRCULAR             0.69     0.37     0.17
0.69        1   404.10
  Pipe_-_(10)_(1)_(2)_(82)_(STM) CIRCULAR             0.38     0.11     0.10
0.38        1   184.03
  Pipe_-_(10)_(1)_(2)_(89)_(1)_(STM) CIRCULAR             0.30     0.07     0.08
0.30        1    93.12
  Pipe_-_(10)_(1)_(2)_(89)_(STM) CIRCULAR             0.38     0.11     0.10
0.38        1   142.82
  Pipe_-_(10)_(1)_(2)_(94)_(1)_(4)_(STM) CIRCULAR             0.30     0.07
0.08     0.30        1    59.09
  Pipe_-_(10)_(1)_(2)_(98)_(STM) CIRCULAR             0.84     0.55     0.21
0.84        1   763.23
  Pipe_-_(10)_(1)_(2)_(99)_(STM) CIRCULAR             0.20     0.03     0.05
0.20        1    32.71
  Pipe_-_(10)_(1)_(2)_(STM) CIRCULAR             0.20     0.03     0.05     0.20
1    53.04
  Pipe_-_(11)_(STM) CIRCULAR             0.69     0.37     0.17     0.69        1
882.63
  Pipe_-_(12)_(STM) CIRCULAR             0.91     0.66     0.23     0.91        1
713.02
  Pipe_-_(14)_(1)_(2)_(STM) CIRCULAR             0.84     0.55     0.21     0.84
1   662.57
  Pipe_-_(14)_(1)_(STM) CIRCULAR             0.76     0.46     0.19     0.76
1   527.74
  Pipe_-_(15)_(STM) CIRCULAR             0.76     0.46     0.19     0.76        1
456.53
  Pipe_-_(16)_(1)_(STM) CIRCULAR             0.30     0.07     0.08     0.30
1    60.52
  Pipe_-_(16)_(STM) CIRCULAR             0.38     0.11     0.10     0.38        1
126.69
```

```
  Pipe_-_(17)_(1)_(2)_(STM) CIRCULAR             1.52     1.82     0.38     1.52
1  3388.33
  Pipe_-_(17)_(1)_(3)_(3)_(STM) CIRCULAR             0.30     0.07     0.08
0.30        1    59.91
  Pipe_-_(17)_(1)_(3)_(STM) CIRCULAR             0.30     0.07     0.08     0.30
1    59.82
  Pipe_-_(17)_(2)_(STM) CIRCULAR             0.25     0.05     0.06     0.25
1    61.56
  Pipe_-_(17)_(3)_(STM) CIRCULAR             0.84     0.55     0.21     0.84
1   743.29
  Pipe_-_(17)_(4)_(STM) CIRCULAR             0.69     0.37     0.17     0.69
1   409.29
  Pipe_-_(17)_(STM) CIRCULAR             0.76     0.46     0.19     0.76        1
576.86
  Pipe_-_(18)_(STM) CIRCULAR             0.69     0.37     0.17     0.69        1
443.63
  Pipe_-_(19)_(STM) CIRCULAR             0.69     0.37     0.17     0.69        1
451.72
  Pipe_-_(20)_(4)_(STM) CIRCULAR             0.69     0.37     0.17     0.69
1   460.28
  Pipe_-_(20)_(STM) CIRCULAR             0.69     0.37     0.17     0.69        1
427.85
  Pipe_-_(22)_(STM) CIRCULAR             0.69     0.37     0.17     0.69        1
388.40
  Pipe_-_(24)_(STM) CIRCULAR             0.69     0.37     0.17     0.69        1
381.89
  Pipe_-_(25)_(STM) CIRCULAR             0.53     0.22     0.13     0.53        1
440.42
  Pipe_-_(26)_(STM) CIRCULAR             0.53     0.22     0.13     0.53        1
315.78
  Pipe_-_(27)_(STM) CIRCULAR             0.53     0.22     0.13     0.53        1
316.06
  Pipe_-_(28)_(STM) CIRCULAR             0.53     0.22     0.13     0.53        1
262.61
  Pipe_-_(29)_(STM) CIRCULAR             0.53     0.22     0.13     0.53        1
221.42
  Pipe_-_(9)_(1)_(STM) CIRCULAR             0.20     0.03     0.05     0.20
1    32.34
  Pipe_-_(9)_(STM) CIRCULAR             0.53     0.22     0.13     0.53        1
447.09


  ****************
  Analysis Options
  ****************
  Flow Units ............... LPS
  Process Models:
    Rainfall/Runoff ........ YES
    RDII ................... NO
    Snowmelt ............... NO
    Groundwater ............ NO
    Flow Routing ........... YES
    Ponding Allowed ........ NO
    Water Quality .......... NO
  Infiltration Method ...... HORTON
  Flow Routing Method ...... DYNWAVE
  Surcharge Method ......... EXTRAN
  Starting Date ............ 10/03/2025 00:00:00
  Ending Date .............. 10/04/2025 00:00:00
```

```
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:01:00
Wet Time Step ............ 00:01:00
Dry Time Step ............ 00:01:00
Routing Time Step ........ 2.00 sec
Variable Time Step ....... YES
Maximum Trials ........... 8
Number of Threads ........ 8
Head Tolerance ........... 0.001500 m


*************************        Volume         Depth
Runoff Quantity Continuity     hectare-m            mm
*************************      ---------       -------
Total Precipitation ......         1.449        71.667
Evaporation Loss .........         0.000         0.000
Infiltration Loss ........         0.575        28.436
Surface Runoff ...........         0.860        42.525
Final Storage ............         0.015         0.744
Continuity Error (%) .....        -0.053


*************************        Volume        Volume
Flow Routing Continuity        hectare-m      10^6 ltr
*************************      ---------     ---------
Dry Weather Inflow .......         0.000         0.000
Wet Weather Inflow .......         0.860         8.603
Groundwater Inflow .......         0.000         0.000
RDII Inflow ..............         0.000         0.000
External Inflow ..........         0.000         0.000
External Outflow .........         0.857         8.574
Flooding Loss ............         0.000         0.000
Evaporation Loss .........         0.000         0.000
Exfiltration Loss ........         0.000         0.000
Initial Stored Volume ....         0.000         0.000
Final Stored Volume ......         0.002         0.023
Continuity Error (%) .....         0.082


************************
Highest Continuity Errors
************************
Node EX-CB305 (11.08%)
Node LD-TD01 (10.10%)
Node ROOF-09 (7.12%)
Node ROOF-03 (1.90%)


***************************
Time-Step Critical Elements
***************************
Link Pipe_-_(10)_(1)_(2)_(89)_(1)_(STM) (42.43%)


********************************
Highest Flow Instability Indexes
********************************
```

```
  Link OCB132 (90)
  Link OCB129 (88)
  Link P3-03-STOR_out (30)
  Link EX-R03-STOR_out (12)
  Link Pipe_-_(10)_(1)_(2)_(_(2)_(1)_(STM) (11)


  *********************************
  Most Frequent Nonconverging Nodes
  *********************************
  Node 23 (0.15%)
  Node 24 (0.15%)
  Node DR-NW (0.15%)
  Node DR-SD (0.15%)
  Node DR-WD (0.15%)


  *************************
  Routing Time Step Summary
  *************************
  Minimum Time Step           :     0.50 sec
  Average Time Step           :     1.45 sec
  Maximum Time Step           :     2.00 sec
  % of Time in Steady State   :     0.00
  Average Iterations per Step :     2.11
  % of Steps Not Converging   :     0.15
  Time Step Frequencies       :
     2.000 -  1.516 sec      :    56.60 %
     1.516 -  1.149 sec      :     0.41 %
     1.149 -  0.871 sec      :    18.48 %
     0.871 -  0.660 sec      :     6.87 %
     0.660 -  0.500 sec      :    17.64 %


  ***************************
  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
  --------------------------------------------------------------------------------
--------------------------------------------
  A101                      71.67       0.00       0.00      19.49      40.01
11.34      51.35        0.08    62.89   0.716
  A102                      71.67       0.00       0.00      37.15      16.15
18.04      34.19        0.07    42.41   0.477
  A103                      71.67       0.00       0.00      24.23      32.99
13.77      46.76        0.09    68.64   0.652
  A104                      71.67       0.00       0.00      13.67      49.11
7.84      56.96        0.11    82.60   0.795
  A105                      71.67       0.00       0.00      14.93      47.02
8.73      55.75        0.05    34.90   0.778
```

```
  A106                      71.67       0.00       0.00      30.78      23.17
17.25      40.42        0.01     8.51   0.564
  A107                      71.67       0.00       0.00      16.58      44.22
9.95      54.18        0.04    34.27   0.756
  A108                      71.67       0.00       0.00      15.29      46.32
9.09      55.41        0.05    37.66   0.773
  A113                      71.67       0.00       0.00       0.00      70.12
0.00      70.12        0.56   371.50   0.978
  A116a                     71.67       0.00       0.00       0.00      70.16
0.00      70.16        0.03    18.84   0.979
  A116b                     71.67       0.00       0.00       0.00      70.21
0.00      70.21        0.01     8.43   0.980
  A117                      71.67       0.00       0.00       0.00      70.18
0.00      70.18        0.02    11.41   0.979
  A119                      71.67       0.00       0.00      17.32      44.20
9.20      53.40        0.07    46.04   0.745
  A120                      71.67       0.00       0.00      23.65      35.08
12.19      47.28        0.11    73.98   0.660
  A121                      71.67       0.00       0.00       6.19      60.35
3.85      64.20        0.06    48.22   0.896
  A122                      71.67       0.00       0.00      35.55      17.55
18.21      35.76        0.10    67.35   0.499
  A137                      71.67       0.00       0.00      10.13      54.06
6.38      60.44        0.01     9.55   0.843
  B101                      71.67       0.00       0.00      28.08      28.07
14.93      43.01        0.24   167.69   0.600
  B102                      71.67       0.00       0.00      12.19      51.22
7.17      58.39        0.07    55.99   0.815
  B103                      71.67       0.00       0.00      21.86      35.81
13.28      49.09        0.01    12.75   0.685
  B104                      71.67       0.00       0.00      10.77      53.33
6.44      59.77        0.08    62.18   0.834
  B105                      71.67       0.00       0.00      17.02      43.52
10.23      53.75        0.04    33.31   0.750
  B106                      71.67       0.00       0.00      10.22      54.04
6.28      60.32        0.09    72.48   0.842
  B107                      71.67       0.00       0.00      24.62      32.29
14.09      46.38        0.04    29.48   0.647
  B108                      71.67       0.00       0.00       1.75      67.38
1.12      68.50        0.04    25.65   0.956
  B109                      71.67       0.00       0.00      16.54      44.22
9.99      54.22        0.03    22.77   0.757
  B110                      71.67       0.00       0.00      25.08      31.59
14.35      45.94        0.07    55.28   0.641
  B111                      71.67       0.00       0.00       0.00      70.18
0.00      70.18        0.04    27.28   0.979
  B112                      71.67       0.00       0.00      31.75      23.16
16.28      39.44        0.26   175.50   0.550
  B113                      71.67       0.00       0.00      46.98       0.00
24.70      24.70        0.02    15.38   0.345
  B114                      71.67       0.00       0.00       8.14      57.52
4.77      62.29        0.25   180.06   0.869
  B115                      71.67       0.00       0.00       5.80      61.03
3.53      64.56        0.19   138.27   0.901
  B116                      71.67       0.00       0.00      46.78       6.32
18.44      24.76        0.04    18.44   0.346
  B117                      71.67       0.00       0.00      20.01      39.99
10.81      50.81        0.11    76.90   0.709
  B118                      71.67       0.00       0.00      39.13      11.94
20.37      32.31        0.05    35.91   0.451
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  B119                  71.67      0.00       0.00      30.00      24.57
16.60      41.17        0.06    46.71   0.574
  B120                  71.67      0.00       0.00      13.79      48.44
8.45      56.88        0.05    40.61   0.794
  B121                  71.67      0.00       0.00      18.02      42.11
10.66      52.78        0.05    37.21   0.736
  B122a                 71.67      0.00       0.00       6.72      59.63
4.04      63.67        0.11    84.22   0.888
  B122b                 71.67      0.00       0.00       6.58      59.68
4.19      63.87        0.00     0.97   0.891
  B122c                 71.67      0.00       0.00       6.59      59.67
4.18      63.85        0.00     0.97   0.891
  B123                  71.67      0.00       0.00      13.54      49.12
7.97      57.09        0.06    47.00   0.797
  B124                  71.67      0.00       0.00       0.00      70.18
0.00      70.18        0.02    11.41   0.979
  B125                  71.67      0.00       0.00      10.98      53.31
6.23      59.54        0.16   115.80   0.831
  B126                  71.67      0.00       0.00      26.30      31.57
13.12      44.70        0.05    33.46   0.624
  B127                  71.67      0.00       0.00      24.35      32.99
13.65      46.64        0.09    71.70   0.651
  B128                  71.67      0.00       0.00      32.24      21.06
17.95      39.01        0.03    25.96   0.544
  B129                  71.67      0.00       0.00      44.98       0.00
26.73      26.73        0.00     4.95   0.373
  B130                  71.67      0.00       0.00      17.00      43.52
10.25      53.77        0.05    37.39   0.750
  B131                  71.67      0.00       0.00      13.36      49.13
8.16      57.29        0.05    42.34   0.799
  B132                  71.67      0.00       0.00       8.99      56.13
5.35      61.48        0.11    82.60   0.858
  B133                  71.67      0.00       0.00      30.24      25.97
14.92      40.88        0.06    38.65   0.570
  B134_1                71.67      0.00       0.00      39.82       7.01
24.74      31.76        0.01    18.62   0.443
  B134_3                71.67      0.00       0.00      28.80      25.98
16.37      42.34        0.11    84.67   0.591
  B134_4                71.67      0.00       0.00      28.54      25.98
16.63      42.61        0.08    70.20   0.595
  B135_2                71.67      0.00       0.00      19.25      40.02
11.59      51.60        0.04    31.49   0.720
  B135_3                71.67      0.00       0.00      19.50      40.01
11.33      51.33        0.06    46.75   0.716
  B135_4                71.67      0.00       0.00      19.60      40.00
11.23      51.23        0.07    52.45   0.715
  EX-A01a               71.67      0.00       0.00      15.50      46.31
8.88      55.19        0.23   174.75   0.770
  EX-A01b               71.67      0.00       0.00       8.90      56.14
5.44      61.58        0.21   157.65   0.859
  EX-A02-01             71.67      0.00       0.00      46.63       0.00
25.06      25.06        0.01     5.20   0.350
  EX-A02-02             71.67      0.00       0.00      47.75       0.00
23.94      23.94        0.01     5.45   0.334
  EX-A02A               71.67      0.00       0.00      12.22      51.22
7.14      58.36        0.23   174.98   0.814
  EX-A02B               71.67      0.00       0.00      16.55      44.90
9.26      54.16        0.28   206.12   0.756
  EX-A03-01             71.67      0.00       0.00       0.00      70.17
0.00      70.17        0.06    39.67   0.979
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  EX-A03-02             71.67      0.00       0.00       0.00      70.18
0.00      70.18        0.11    78.37   0.979
  EX-A04                71.67      0.00       0.00       0.00      70.19
0.00      70.19        0.03    19.84   0.979
  EX-R01                71.67      0.00       0.00       0.00      70.17
0.00      70.17        0.05    35.71   0.979
  EX-R02                71.67      0.00       0.00       0.00      70.14
0.00      70.14        0.21   144.68   0.979
  EX-R03                71.67      0.00       0.00       0.00      70.55
0.00      70.55        0.03    21.80   0.984
  P3-01                 71.67      0.00       0.00       0.00      70.13
0.00      70.13        0.34   237.84   0.979
  P3-02                 71.67      0.00       0.00       0.00      70.19
0.00      70.19        0.01     8.43   0.979
  P3-03                 71.67      0.00       0.00       0.00      70.19
0.00      70.19        0.03    18.85   0.979
  P4-01                 71.67      0.00       0.00       0.00      70.16
0.00      70.16        0.14    99.16   0.979
  P4-02                 71.67      0.00       0.00       0.00      70.16
0.00      70.16        0.21   145.67   0.979
  P4-03                 71.67      0.00       0.00       0.00      70.15
0.00      70.15        0.06    41.60   0.979
  P4-04                 71.67      0.00       0.00       0.00      70.15
0.00      70.15        0.09    63.29   0.979
  P4-05                 71.67      0.00       0.00       0.00      70.14
0.00      70.14        0.24   167.65   0.979
  P4-06                 71.67      0.00       0.00       0.00      70.19
0.00      70.19        0.04    29.26   0.979
  P4-07                 71.67      0.00       0.00       0.00      70.17
0.00      70.17        0.03    22.81   0.979
  P4-08                 71.67      0.00       0.00       0.00      70.13
0.00      70.13        0.20   140.05   0.979
  P4-09                 71.67      0.00       0.00       0.00      70.13
0.00      70.13        0.19   132.10   0.979
  P4-DR01a              71.67      0.00       0.00      52.53       5.61
13.41      19.02        0.14    46.54   0.265
  P4-DR01b              71.67      0.00       0.00      51.07       5.62
14.87      20.48        0.14    48.44   0.286
  P4-DR01c              71.67      0.00       0.00      48.18       5.62
17.76      23.37        0.01     3.48   0.326
  P4-DR02               71.67      0.00       0.00      56.38       4.21
10.99      15.20        0.81   247.49   0.212


  ******************
  Node Depth Summary
  ******************

  ---------------------------------------------------------------------------------
                                 Average  Maximum  Maximum  Time of Max    Reported
                                   Depth    Depth      HGL   Occurrence   Max Depth
  Node                 Type       Meters   Meters   Meters  days hr:min      Meters
  ---------------------------------------------------------------------------------
  1                    JUNCTION     0.00     0.00    79.11     0  00:00        0.00
  10                   JUNCTION     0.00     0.02    78.99     0  01:10        0.02
  11                   JUNCTION     0.00     0.00    78.80     0  00:00        0.00
  12                   JUNCTION     0.00     0.00    78.70     0  00:00        0.00
  13                   JUNCTION     0.00     0.00    78.80     0  00:00        0.00
  14                   JUNCTION     0.00     0.00    80.05     0  00:00        0.00
```

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15                   JUNCTION     0.00      0.00    78.90      0  00:00          0.00
16                   JUNCTION     0.00      0.00    79.10      0  00:00          0.00
17                   JUNCTION     0.00      0.00    79.05      0  00:00          0.00
18                   JUNCTION     0.00      0.00    79.05      0  00:00          0.00
19                   JUNCTION     0.00      0.00    77.05      0  00:00          0.00
2                    JUNCTION     0.00      0.00    78.48      0  00:00          0.00
20                   JUNCTION     0.00      0.00    77.10      0  00:00          0.00
21                   JUNCTION     0.00      0.00    75.69      0  00:00          0.00
22                   JUNCTION     0.00      0.00    77.15      0  00:00          0.00
3                    JUNCTION     0.00      0.00    78.95      0  00:00          0.00
4                    JUNCTION     0.00      0.00    78.75      0  00:00          0.00
5                    JUNCTION     0.00      0.00    78.95      0  00:00          0.00
6                    JUNCTION     0.00      0.00    79.05      0  00:00          0.00
7                    JUNCTION     0.00      0.00    78.95      0  00:00          0.00
8                    JUNCTION     0.00      0.00    78.95      0  00:00          0.00
9                    JUNCTION     0.00      0.00    78.95      0  00:00          0.00
ROOF-01              JUNCTION     0.05      1.16    74.47      0  01:10          1.15
ROOF-02              JUNCTION     0.09      3.23    76.08      0  01:10          3.22
ROOF-03              JUNCTION     0.21      1.39    74.21      0  01:16          1.38
ROOF-04              JUNCTION     0.22      1.91    74.93      0  01:10          1.88
ROOF-06              JUNCTION     0.22      2.02    75.45      0  01:16          2.02
ROOF-07              JUNCTION     0.04      1.62    75.63      0  01:16          1.62
ROOF-08              JUNCTION     0.22      2.21    76.57      0  01:10          2.20
ROOF-09              JUNCTION     0.01      0.25    77.62      0  01:11          0.25
ROOF-10              JUNCTION     0.01      0.74    78.06      0  01:14          0.74
ROOF-11              JUNCTION     0.02      0.05    76.02      0  01:34          0.05
23                   OUTFALL      0.00      0.02    73.98      0  01:10          0.02
24                   OUTFALL      0.00      0.02    74.02      0  01:10          0.02
DR-NW                OUTFALL      0.00      0.00     0.00      0  00:00          0.00
DR-SD                OUTFALL      0.00      0.00    79.21      0  00:00          0.00
DR-WD                OUTFALL      0.00      0.00     0.00      0  00:00          0.00
OUT13772             OUTFALL      0.13      0.79    72.35      0  01:13          0.79
OUT16389             OUTFALL      0.02      0.33    73.23      0  01:10          0.33
CB401                STORAGE      0.02      1.06    77.21      0  01:10          1.04
CB402                STORAGE      0.03      2.37    77.02      0  01:10          2.36
CB403                STORAGE      0.33      1.14    77.44      0  01:10          1.14
CB405                STORAGE      0.04      2.01    78.46      0  01:10          2.01
CB407                STORAGE      0.29      0.92    77.47      0  01:19          0.92
CB408                STORAGE      0.31      0.52    74.92      0  01:10          0.52
CB409                STORAGE      0.02      1.77    77.12      0  01:11          1.77
CB410                STORAGE      0.04      2.30    77.90      0  01:10          2.30
CB411                STORAGE      0.02      1.44    76.94      0  01:10          1.40
CB412                STORAGE      0.00      0.14    75.94      0  01:10          0.14
CB413                STORAGE      0.03      2.23    77.73      0  01:10          2.21
CB414                STORAGE      0.01      0.84    75.82      0  01:10          0.83
CBMH401-402          STORAGE      0.05      2.04    77.81      0  01:11          2.04
CBMH401-404          STORAGE      0.38      2.42    75.73      0  01:16          2.42
CBMH402              STORAGE      0.40      2.76    76.46      0  01:14          2.76
CBMH403              STORAGE      0.34      2.39    76.50      0  01:10          2.37
CBMH404-405          STORAGE      0.42      2.58    75.53      0  01:16          2.57
CBMH406              STORAGE      0.42      2.56    75.44      0  01:16          2.56
CBMH407              STORAGE      0.43      2.52    75.24      0  01:16          2.52
CBMH408-406          STORAGE      0.07      2.22    77.33      0  01:12          2.22
CBMH409              STORAGE      0.36      2.08    74.78      0  01:10          2.05
CBMH410              STORAGE      0.28      2.03    74.16      0  01:12          2.03
CBMH411              STORAGE      0.34      2.50    77.04      0  01:10          2.49
CBMH412              STORAGE      0.34      2.51    76.94      0  01:10          2.51
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CBMH413              STORAGE      0.32      0.62    74.73      0  01:10          0.62
CICB403              STORAGE      0.04      2.45    76.75      0  01:10          2.45
CICB404              STORAGE      0.33      2.30    77.00      0  01:10          2.27
EX._STMMH_1_(STM)    STORAGE      0.03      0.62    73.57      0  01:10          0.61
EX_CB_1_(STM)        STORAGE      0.07      2.25    76.97      0  01:10          2.25
EX_CB_XXZ_(STM)      STORAGE      0.33      1.79    78.69      0  01:12          1.79
EX_CBMH_10_(STM)     STORAGE      0.14      2.17    77.42      0  01:19          2.16
EX_CBMH_11_(STM)     STORAGE      0.11      2.04    77.42      0  01:19          2.04
EX_CBMH_14_(STM)     STORAGE      0.04      0.90    77.47      0  01:17          0.90
EX_CBMH12            STORAGE      0.01      0.73    77.43      0  01:19          0.73
EX_STMMH_302_(STM)   STORAGE      0.35      1.84    74.46      0  01:10          1.83
EX-A04-STOR          STORAGE      0.00      0.10    82.92      0  01:10          0.10
EX-A3-01&02-STOR     STORAGE      0.01      0.17    83.19      0  01:21          0.17
EX-CB_XYU            STORAGE      0.29      1.94    79.14      0  01:10          1.94
EX-CB_XYY            STORAGE      0.33      1.33    77.27      0  01:11          1.33
EX-CB_XZY            STORAGE      0.72      2.01    78.40      0  01:11          2.01
EX-CB_XZZ            STORAGE      0.64      1.90    78.40      0  01:10          1.90
EX-CB_XZZa           STORAGE      0.47      2.03    78.26      0  01:43          2.03
EX-CB004             STORAGE      0.31      1.05    78.17      0  01:14          1.05
EX-CB01              STORAGE      0.00      0.02    74.08      0  01:10          0.02
EX-CB02              STORAGE      0.00      0.02    74.04      0  01:10          0.02
EX-CB03              STORAGE      0.31      0.77    75.30      0  01:10          0.77
EX-CB100-101         STORAGE      0.31      0.51    77.36      0  01:10          0.51
EX-CB129             STORAGE      0.73      2.41    78.24      0  01:53          2.41
EX-CB130             STORAGE      0.74      1.90    78.29      0  01:21          1.90
EX-CB132             STORAGE      0.62      2.16    78.28      0  01:40          2.16
EX-CB150             STORAGE      0.37      1.60    77.15      0  01:13          1.60
EX-CB301             STORAGE      0.31      0.82    77.12      0  01:12          0.82
EX-CB304             STORAGE      0.27      0.31    74.56      0  01:13          0.31
EX-CB305             STORAGE      0.28      0.47    74.62      0  01:11          0.46
EX-CBMH_XXX          STORAGE      0.04      0.50    75.45      0  01:10          0.49
EX-CBMH_XXZ          STORAGE      0.06      1.12    77.18      0  01:13          1.12
EX-CBMH_XYY          STORAGE      0.04      1.23    77.82      0  01:13          1.23
EX-CBMH_XYZ          STORAGE      0.03      0.32    75.99      0  01:10          0.32
EX-CBMH_XZY          STORAGE      0.09      1.45    77.14      0  01:13          1.45
EX-CBMH_XZZ          STORAGE      0.09      1.47    76.98      0  01:13          1.47
EX-CBMH003           STORAGE      0.02      0.83    78.06      0  01:14          0.83
EX-CBMH008           STORAGE      0.02      1.35    75.45      0  01:08          1.17
EX-CBMH01            STORAGE      0.01      0.22    74.95      0  01:10          0.22
EX-CBMH048           STORAGE      0.06      1.38    75.44      0  01:15          1.38
EX-CBMH301           STORAGE      0.01      0.60    77.60      0  01:11          0.59
EX-CBMH302           STORAGE      0.04      0.47    75.68      0  01:10          0.44
EX-CBMH303           STORAGE      0.03      1.49    77.57      0  01:10          1.48
EX-DICB001-002       STORAGE      0.59      1.48    78.30      0  01:21          1.48
EX-LD01              STORAGE      0.01      0.46    74.17      0  01:10          0.46
EX-MH_XXZ            STORAGE      0.35      1.32    77.21      0  01:13          1.32
EX-MH_XZY            STORAGE      0.39      1.80    77.09      0  01:13          1.80
EX-MH001             STORAGE      0.31      1.14    77.93      0  01:14          1.14
EX-MH301             STORAGE      0.31      0.71    77.61      0  01:11          0.70
EX-R02-STOR          STORAGE      0.03      0.26    83.69      0  01:22          0.26
EX-R03-STOR          STORAGE      0.01      0.18    83.08      0  01:13          0.18
EX-R1-STOR           STORAGE      0.03      0.17    86.14      0  01:30          0.17
EX-STMMH_XXX         STORAGE      0.25      0.58    74.85      0  01:10          0.58
LD-TD01              STORAGE      0.05      1.96    74.95      0  01:16          1.13
LD-TD02              STORAGE      0.02      1.58    74.78      0  01:10          1.55
MH401                STORAGE      0.39      1.80    76.93      0  01:13          1.80
MH402                STORAGE      0.41      2.95    76.82      0  01:14          2.95
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  MH403                STORAGE      0.34     1.96    77.28     0  01:14         1.96
  MH404                STORAGE      0.39     2.52    76.06     0  01:15         2.52
  MH405                STORAGE      0.42     2.59    75.62     0  01:16         2.59
  MH406                STORAGE      0.35     2.12    75.63     0  01:16         2.12
  MH407                STORAGE      0.43     2.54    75.35     0  01:16         2.54
  MH410                STORAGE      0.06     1.78    75.36     0  01:16         1.78
  MH411                STORAGE      0.44     2.50    75.15     0  01:15         2.50
  MH412                STORAGE      0.43     2.32    74.86     0  01:15         2.32
  MH413                STORAGE      0.42     2.12    74.54     0  01:14         2.12
  MH414                STORAGE      0.35     2.06    74.41     0  01:14         2.06
  MH415                STORAGE      0.28     2.07    74.32     0  01:13         2.07
  MH416                STORAGE      0.29     2.09    74.22     0  01:13         2.09
  MH417                STORAGE      0.49     2.33    74.13     0  01:13         2.33
  MH418                STORAGE      0.34     1.93    74.20     0  01:12         1.93
  MH419                STORAGE      0.20     1.62    74.21     0  01:16         1.61
  MH420                STORAGE      0.34     2.00    74.18     0  01:12         2.00
  MH421                STORAGE      0.36     2.11    74.93     0  01:10         2.08
  MH422                STORAGE      0.36     1.90    74.47     0  01:10         1.90
  MH423                STORAGE      0.49     2.19    73.92     0  01:13         2.19
  MH424                STORAGE      0.18     1.52    73.28     0  01:13         1.52
  MH425                STORAGE      0.33     1.26    74.62     0  01:12         1.26
  MH426                STORAGE      0.35     1.62    74.26     0  01:12         1.62
  MH427                STORAGE      0.34     1.32    73.67     0  01:12         1.32
  MH428                STORAGE      0.35     1.46    73.60     0  01:12         1.46
  OGS_#1_(3600Ø)_(STM) STORAGE      0.15     1.28    73.45     0  01:12         1.28
  OGS_#2_(3600Ø)_(STM) STORAGE      0.28     1.77    73.65     0  01:13         1.76
  P3-01-STOR           STORAGE      0.02     0.16    83.50     0  01:34         0.16
  P3-02-STOR           STORAGE      0.01     0.14    82.96     0  01:20         0.14
  P3-03-STOR           STORAGE      0.00     0.22    87.59     0  01:10         0.22
  P4-01-STOR           STORAGE      0.00     0.00    84.36     0  00:00         0.00
  P4-02-STOR           STORAGE      0.07     0.22    84.23     0  01:43         0.22
  P4-03-STOR           STORAGE      0.09     0.19    83.76     0  01:43         0.19
  P4-04-STOR           STORAGE      0.08     0.20    83.51     0  01:40         0.20
  P4-05-stor           STORAGE      0.07     0.18    83.03     0  02:23         0.18
  P4-06-STOR           STORAGE      0.09     0.19    83.01     0  02:42         0.19
  P4-07-STOR           STORAGE      0.03     0.13    83.15     0  01:52         0.13
  Structure_-_(48)_(5)_(STM) STORAGE      0.42     2.10    74.46     0  01:10
2.09
  Structure_-_(68)_(1)_(STM) STORAGE      0.07     1.44    75.44     0  01:15
1.44
  TANK01               STORAGE      0.04     0.98    74.43     0  01:14         0.98
  TANK02               STORAGE      0.04     0.86    74.05     0  01:14         0.86
  TD01                 STORAGE      0.02     0.19    76.69     0  01:10         0.19


  ******************
  Node Inflow Summary
  ******************

  ---------------------------------------------------------------------------------
----------------
                                  Maximum  Maximum                  Lateral
Total         Flow
                                  Lateral    Total  Time of Max      Inflow
Inflow     Balance
                                   Inflow   Inflow   Occurrence      Volume
Volume       Error
```

```
  Node                 Type           LPS      LPS  days hr:min    10^6 ltr    10^6
ltr     Percent
  ---------------------------------------------------------------------------------
----------------
  1                    JUNCTION      0.00      0.00     0  00:00           0
0       0.000 ltr
  10                   JUNCTION      0.00    157.98     0  01:10           0
0.0816       0.638
  11                   JUNCTION      0.00      0.00     0  00:00           0
0       0.000 ltr
  12                   JUNCTION      0.00      0.00     0  00:00           0
0       0.000 ltr
  13                   JUNCTION      0.00      0.00     0  00:00           0
0       0.000 ltr
  14                   JUNCTION      0.00      0.00     0  00:00           0
0       0.000 ltr
  15                   JUNCTION      0.00      0.00     0  00:00           0
0       0.000 ltr
  16                   JUNCTION      0.00      0.00     0  00:00           0
0       0.000 ltr
  17                   JUNCTION      0.00      0.00     0  00:00           0
0       0.000 ltr
  18                   JUNCTION      0.00      0.00     0  00:00           0
0       0.000 ltr
  19                   JUNCTION      0.00      0.00     0  00:00           0
0       0.000 ltr
  2                    JUNCTION      0.00      0.00     0  00:00           0
0       0.000 ltr
  20                   JUNCTION      0.00      0.00     0  00:00           0
0       0.000 ltr
  21                   JUNCTION      0.00      0.00     0  00:00           0
0       0.000 ltr
  22                   JUNCTION      0.00      0.00     0  00:00           0
0       0.000 ltr
  3                    JUNCTION      0.00      0.00     0  00:00           0
0       0.000 ltr
  4                    JUNCTION      0.00      0.00     0  00:00           0
0       0.000 ltr
  5                    JUNCTION      0.00      0.00     0  00:00           0
0       0.000 ltr
  6                    JUNCTION      0.00      0.00     0  00:00           0
0       0.000 ltr
  7                    JUNCTION      0.00      0.00     0  00:00           0
0       0.000 ltr
  8                    JUNCTION      0.00      0.00     0  00:00           0
0       0.000 ltr
  9                    JUNCTION      0.00      0.00     0  00:00           0
0       0.000 ltr
  ROOF-01              JUNCTION      0.00     38.33     0  01:05           0
0.408       0.192
  ROOF-02              JUNCTION    371.50    383.10     0  01:10       0.556
0.811       0.137
  ROOF-03              JUNCTION     38.68     52.30     0  01:10      0.0548
0.139       1.940
  ROOF-04              JUNCTION     10.66     36.72     0  01:10      0.0164
0.215      -0.194
  ROOF-06              JUNCTION      0.00     20.10     0  00:49           0
0.183       0.678
  ROOF-07              JUNCTION      0.00     27.02     0  01:04           0
0.168      -0.025
```

```
  ROOF-08             JUNCTION      99.16    99.16     0  01:10          0.14
0.14       0.231
  ROOF-09             JUNCTION       0.00    12.12     0  01:03             0
0.0324       7.669
  ROOF-10             JUNCTION       0.00     2.29     0  01:08             0
0.000259     -11.340
  ROOF-11             JUNCTION       0.00     3.90     0  00:36             0
0.0486       0.078
  23                  OUTFALL        0.00    35.26     0  01:10             0
0.0465       0.000
  24                  OUTFALL        0.00    37.78     0  01:10             0
0.0507       0.000
  DR-NW               OUTFALL      247.49   247.49     0  01:10         0.814
0.814       0.000
  DR-SD               OUTFALL       48.44    48.44     0  01:10         0.139
0.139       0.000
  DR-WD               OUTFALL       50.02    50.02     0  01:10         0.146
0.146       0.000
  OUT13772            OUTFALL        0.00  1843.35     0  01:13             0
7.1       0.000
  OUT16389            OUTFALL        0.00   218.62     0  01:10             0
0.275       0.000
  CB401               STORAGE       55.99    55.99     0  01:10        0.0742
0.0742       0.602
  CB402               STORAGE       42.34    42.34     0  01:10        0.0533
0.0533       0.003
  CB403               STORAGE       72.48    72.48     0  01:10        0.0936
0.132       0.185
  CB405               STORAGE       25.65    25.65     0  01:10        0.0356
0.0356      -0.114
  CB407               STORAGE        0.00    12.45     0  01:03             0
0.0017       7.812
  CB408               STORAGE       33.46    33.46     0  01:10        0.0501
0.0501       0.485
  CB409               STORAGE       18.44    18.44     0  01:10        0.0433
0.0436      -0.251
  CB410               STORAGE      112.31   112.31     0  01:10         0.145
0.145      -0.435
  CB411               STORAGE       25.96    25.96     0  01:10        0.0336
0.0336       0.003
  CB412               STORAGE        4.95     4.95     0  01:10       0.00428
0.00428       0.008
  CB413               STORAGE       37.39    37.39     0  01:10        0.0463
0.0463       0.003
  CB414               STORAGE       18.62    18.62     0  01:10        0.0146
0.0146       0.007
  CBMH401-402         STORAGE      167.69   167.69     0  01:10         0.237
0.237      -0.156
  CBMH401-404         STORAGE       33.31   470.75     0  01:06        0.0414
1.7      -0.112
  CBMH402             STORAGE       62.18   512.48     0  01:05        0.0819
1.67       0.104
  CBMH403             STORAGE       12.75   111.83     0  01:09        0.0147
0.155      -0.044
  CBMH404-405         STORAGE       29.48   508.83     0  01:10        0.0376
2.04      -0.131
  CBMH406             STORAGE       22.77   528.22     0  01:10        0.0282
2.28      -0.057
  CBMH407             STORAGE       15.38   626.32     0  01:19        0.0225
2.7       0.004
```

```
  CBMH408-406         STORAGE      175.50   179.26     0  01:10          0.26
0.261      -0.076
  CBMH409             STORAGE      115.80   215.46     0  01:09         0.159
0.475       0.082
  CBMH410             STORAGE        0.00   586.88     0  01:07             0
2.12       0.036
  CBMH411             STORAGE       76.90    86.39     0  01:10         0.107
0.151       0.178
  CBMH412             STORAGE       35.91   106.11     0  01:10         0.053
0.203       0.007
  CBMH413             STORAGE       46.71   143.92     0  01:10        0.0618
0.265       0.002
  CICB403             STORAGE       82.60    82.60     0  01:10         0.111
0.111       0.006
  CICB404             STORAGE       38.65    38.65     0  01:10        0.0593
0.0593       0.422
  EX._STMMH_1_(STM)   STORAGE        0.00   222.95     0  01:10             0
0.275      -0.065
  EX_CB_1_(STM)       STORAGE       37.21    37.21     0  01:10         0.047
0.0708      -0.035
  EX_CB_XXZ_(STM)     STORAGE       62.89   165.48     0  01:10        0.0807
0.283      -0.055
  EX_CBMH_10_(STM)    STORAGE        0.00   249.72     0  01:09             0
0.431      -0.203
  EX_CBMH_11_(STM)    STORAGE      180.06   180.06     0  01:10         0.246
0.25       0.041
  EX_CBMH_14_(STM)    STORAGE      138.27   138.27     0  01:10         0.187
0.189       0.980
  EX_CBMH12           STORAGE        0.00    37.81     0  01:09             0
0.00402       0.132
  EX_STMMH_302_(STM)  STORAGE        0.00    56.72     0  01:35             0
0.474      -0.022
  EX-A04-STOR         STORAGE       19.84    19.84     0  01:10        0.0281
0.0281     -12.787
  EX-A3-01&02-STOR    STORAGE      118.04   118.04     0  01:10         0.167
0.167      -0.192
  EX-CB_XYU           STORAGE      174.98   174.98     0  01:10         0.234
0.234       0.012
  EX-CB_XYY           STORAGE       68.64   182.82     0  01:10        0.0889
0.441       0.018
  EX-CB_XZY           STORAGE      174.75   174.75     0  01:10         0.234
0.248       0.314
  EX-CB_XZZ           STORAGE      157.65   203.45     0  01:08         0.207
0.213       0.103
  EX-CB_XZZa          STORAGE        0.00    80.61     0  01:11             0
0.2      -0.018
  EX-CB004            STORAGE       42.41    42.41     0  01:10        0.0691
0.0691       0.523
  EX-CB01             STORAGE       52.45    52.45     0  01:10        0.0687
0.0687      -0.039
  EX-CB02             STORAGE       46.75    46.75     0  01:10        0.0601
0.0601      -0.040
  EX-CB03             STORAGE       84.67    84.67     0  01:10         0.107
0.107       0.013
  EX-CB100-101        STORAGE       67.35    67.35     0  01:10         0.101
0.101       0.681
  EX-CB129            STORAGE        0.00    68.59     0  01:11             0
0.281       0.032
  EX-CB130            STORAGE      206.12   206.82     0  01:10         0.281
0.289       0.267
```

```
  EX-CB132             STORAGE       0.00   139.25     0  01:11           0
0.242       0.111
  EX-CB150             STORAGE       0.00    97.07     0  01:05           0
0.785       0.007
  EX-CB301             STORAGE      48.22    48.22     0  01:10      0.0642
0.0642       0.485
  EX-CB304             STORAGE       0.00     4.71     0  01:11           0
0.000358     208.364
  EX-CB305             STORAGE       0.00    15.21     0  01:11           0
0.00115      12.461
  EX-CBMH_XXX          STORAGE      37.66   347.55     0  01:09      0.0482
0.749      -0.012
  EX-CBMH_XXZ          STORAGE      46.04    80.81     0  01:06      0.0652
0.505       0.069
  EX-CBMH_XYY          STORAGE       0.00   142.56     0  01:09           0
0.351      -0.219
  EX-CBMH_XYZ          STORAGE      82.60   248.26     0  01:10       0.111
0.602       0.002
  EX-CBMH_XZY          STORAGE       0.00   183.02     0  01:09           0
0.954      -0.096
  EX-CBMH_XZZ          STORAGE       0.00   205.04     0  01:05           0
1.02      -0.000
  EX-CBMH003           STORAGE       0.00    37.59     0  01:10           0
0.0689      -0.014
  EX-CBMH008           STORAGE      64.83    64.83     0  01:10      0.0824
0.0824       0.426
  EX-CBMH01            STORAGE      70.20   171.04     0  01:10      0.0836
0.205      -0.011
  EX-CBMH048           STORAGE      47.00    61.96     0  01:10      0.0617
0.0658      -0.020
  EX-CBMH301           STORAGE      73.98   141.11     0  01:09       0.107
0.171       0.220
  EX-CBMH302           STORAGE      34.27   323.42     0  01:10      0.0428
0.701       0.015
  EX-CBMH303           STORAGE      43.41    43.41     0  01:10      0.0567
0.0567       0.002
  EX-DICB001-002       STORAGE       0.00    27.25     0  01:00           0
0.0081      -3.689
  EX-LD01              STORAGE      31.49    31.49     0  01:10      0.0382
0.0382       0.002
  EX-MH_XXZ            STORAGE       0.00    42.37     0  01:42           0
0.44      -0.123
  EX-MH_XZY            STORAGE       0.00   211.77     0  01:05           0
1.02      -0.028
  EX-MH001             STORAGE       0.00    31.34     0  01:07           0
0.0687       0.032
  EX-MH301             STORAGE       0.00    30.19     0  01:09           0
0.0307      -0.112
  EX-R02-STOR          STORAGE     144.68   144.68     0  01:10       0.207
0.207      -0.415
  EX-R03-STOR          STORAGE      21.80    21.80     0  01:10      0.0311
0.0311      -4.934
  EX-R1-STOR           STORAGE      35.71    35.71     0  01:10      0.0506
0.0506      -0.073
  EX-STMMH_XXX         STORAGE       0.00   342.67     0  01:10           0
0.75       0.001
  LD-TD01              STORAGE      86.16   178.82     0  01:10       0.117
0.181      11.234
  LD-TD02              STORAGE      11.41    18.91     0  01:08      0.0162
0.0173      -0.037
```

```
  MH401                STORAGE       0.00   248.81     0  01:05           0
1.09       0.051
  MH402                STORAGE       0.00   403.44     0  01:05           0
1.43      -0.071
  MH403                STORAGE       0.00   193.31     0  01:07           0
0.337      -0.085
  MH404                STORAGE       0.00   473.30     0  01:06           0
1.66       0.097
  MH405                STORAGE       0.00   506.23     0  01:07           0
2      -0.013
  MH406                STORAGE       0.00    79.77     0  01:05           0
0.3       0.066
  MH407                STORAGE       0.00   541.68     0  01:10           0
2.41      -0.033
  MH410                STORAGE       0.00    27.91     0  01:10           0
0.0976       0.205
  MH411                STORAGE       0.00   628.56     0  01:19           0
2.69       0.014
  MH412                STORAGE       0.00   630.64     0  01:19           0
2.69      -0.002
  MH413                STORAGE       0.00   633.53     0  01:19           0
2.69       0.024
  MH414                STORAGE       0.00   636.56     0  01:19           0
2.69       0.014
  MH415                STORAGE       0.00   743.24     0  01:18           0
3.12      -0.005
  MH416                STORAGE       0.00   748.67     0  01:18           0
3.12      -0.038
  MH417                STORAGE       0.00  1323.69     0  01:10           0
5.66       0.010
  MH418                STORAGE       0.00   479.16     0  01:07           0
1.63       0.008
  MH419                STORAGE       0.00   139.83     0  01:34           0
0.323      -0.085
  MH420                STORAGE       0.00   593.11     0  01:07           0
2.07      -0.090
  MH421                STORAGE       0.00   101.39     0  01:10           0
0.298      -0.174
  MH422                STORAGE       0.00   196.81     0  01:10           0
0.473       0.057
  MH423                STORAGE       0.00  1312.88     0  01:11           0
5.69      -0.018
  MH424                STORAGE       0.00  1844.37     0  01:12           0
7.1       0.003
  MH425                STORAGE       0.00   377.99     0  01:10           0
0.796       0.161
  MH426                STORAGE       0.00   502.02     0  01:09           0
1.16       0.288
  MH427                STORAGE       0.00   535.46     0  01:10           0
1.35      -0.187
  MH428                STORAGE       0.00   525.50     0  01:11           0
1.35      -0.019
  OGS_#1_(3600Ø)_(STM) STORAGE       0.00   552.97     0  01:11           0
1.41       0.023
  OGS_#2_(3600Ø)_(STM) STORAGE       0.00  1304.62     0  01:11           0
5.69      -0.071
  P3-01-STOR           STORAGE     237.84   237.84     0  01:10       0.341
0.342      -0.247
  P3-02-STOR           STORAGE       8.43     8.43     0  01:10      0.0119
0.0119      -1.348
```

```
  P3-03-STOR           STORAGE      18.85    18.85     0  01:10      0.0267
0.0267     -23.196
  P4-01-STOR           STORAGE       0.00     0.00     0  00:00           0
0       0.000 ltr
  P4-02-STOR           STORAGE     145.67   145.67     0  01:10       0.206
0.206      -0.010
  P4-03-STOR           STORAGE      41.60    41.60     0  01:10       0.059
0.059       0.001
  P4-04-STOR           STORAGE      63.29    63.29     0  01:10      0.0899
0.0899      -0.003
  P4-05-stor           STORAGE     167.65   167.79     0  01:10       0.239
0.24      -0.006
  P4-06-STOR           STORAGE      29.26    29.26     0  01:10      0.0414
0.0582       0.002
  P4-07-STOR           STORAGE      22.81    22.81     0  01:10      0.0323
0.0323      -0.010
  Structure_-_(48)_(5)_(STM) STORAGE       0.00   427.97     0  01:10           0
1.28       0.051
  Structure_-_(68)_(1)_(STM) STORAGE       0.00    40.20     0  01:09           0
0.0658       0.005
  TANK01               STORAGE     140.05   140.05     0  01:10       0.202
0.202      -0.001
  TANK02               STORAGE     132.10   132.10     0  01:10       0.191
0.191      -0.000
  TD01                 STORAGE      27.28    27.28     0  01:10      0.0386
0.055       0.000


  **********************
  Node Surcharge Summary
  **********************

  Surcharging occurs when water rises above the top of the highest conduit.
  ---------------------------------------------------------------------
                                               Max. Height   Min. Depth
                                   Hours       Above Crown    Below Rim
  Node                 Type      Surcharged        Meters       Meters
  ---------------------------------------------------------------------
  ROOF-01              JUNCTION        0.45         0.763        8.987
  ROOF-02              JUNCTION        0.64         2.844        6.775
  ROOF-03              JUNCTION        0.54         0.915        8.760
  ROOF-04              JUNCTION        0.56         1.436        8.089
  ROOF-06              JUNCTION        0.56         1.465        8.134
  ROOF-07              JUNCTION        0.49         1.239        8.380
  ROOF-08              JUNCTION        0.51         1.724        7.791
  ROOF-10              JUNCTION        0.24         0.536        4.414
  CBMH409              STORAGE         0.57         1.366        0.274
  EX-CB004             STORAGE         0.26         0.550        0.720
  EX-CBMH008           STORAGE         0.23         1.095        0.000
  EX-R02-STOR          STORAGE         0.11         0.007        0.000
  LD-TD01              STORAGE         0.54         1.654        0.000
  LD-TD02              STORAGE         0.55         1.327        0.000


  *********************
  Node Flooding Summary
  *********************
```

```
  No nodes were flooded.


  **********************
  Storage Volume Summary
  **********************

  ---------------------------------------------------------------------------------
---------------
                         Average     Avg    Evap  Exfil     Maximum    Max    Time of
Max    Maximum
                          Volume    Pcnt    Pcnt   Pcnt      Volume   Pcnt
Occurrence    Outflow
  Storage Unit          1000 m³    Full    Loss   Loss     1000 m³    Full    days
hr:min        LPS
  ---------------------------------------------------------------------------------
---------------
  CB401                   0.000     0.9     0.0    0.0       0.000   45.3        0
01:10      51.96
  CB402                   0.000     1.4     0.0    0.0       0.001   96.9        0
01:10      40.19
  CB403                   0.000    12.3     0.0    0.0       0.000   43.0        0
01:10      72.17
  CB405                   0.000     1.6     0.0    0.0       0.001   85.3        0
01:10      24.66
  CB407                   0.000    13.0     0.0    0.0       0.000   41.7        0
01:19       2.44
  CB408                   0.000    21.1     0.0    0.0       0.000   36.1        0
01:10      32.20
  CB409                   0.000     1.1     0.0    0.0       0.001   86.5        0
01:11      18.35
  CB410                   0.000     1.5     0.0    0.0       0.001   86.8        0
01:10     107.19
  CB411                   0.000     1.1     0.0    0.0       0.001   72.1        0
01:10      22.51
  CB412                   0.000     0.1     0.0    0.0       0.000    7.0        0
01:10       4.66
  CB413                   0.000     1.2     0.0    0.0       0.001   84.0        0
01:10      34.70
  CB414                   0.000     0.9     0.0    0.0       0.000   97.1        0
01:10      17.03
  CBMH401-402             0.000     2.0     0.0    0.0       0.002   85.6        0
01:11     138.39
  CBMH401-404             0.001     6.5     0.0    0.0       0.004   41.8        0
01:16     444.70
  CBMH402                 0.001     7.8     0.0    0.0       0.005   53.0        0
01:14     473.30
  CBMH403                 0.000     7.1     0.0    0.0       0.003   49.9        0
01:10     102.83
  CBMH404-405             0.001     6.8     0.0    0.0       0.005   41.9        0
01:16     486.11
  CBMH406                 0.001     6.6     0.0    0.0       0.005   40.5        0
01:16     501.02
  CBMH407                 0.001     9.6     0.0    0.0       0.004   56.2        0
01:16     628.56
  CBMH408-406             0.000     2.9     0.0    0.0       0.003   87.3        0
01:12      99.71
  CBMH409                 0.000    15.2     0.0    0.0       0.002   88.4        0
01:10     196.81
```

```
  CBMH410                   0.000    7.1    0.0    0.0       0.004   51.8        0
01:12     555.32
  CBMH411                   0.000   11.5    0.0    0.0       0.003   85.8        0
01:10      71.22
  CBMH412                   0.000   11.8    0.0    0.0       0.003   86.1        0
01:10      99.67
  CBMH413                   0.000    7.6    0.0    0.0       0.001   14.8        0
01:10     142.65
  CICB403                   0.000    1.4    0.0    0.0       0.001   87.5        0
01:10      80.53
  CICB404                   0.000   12.4    0.0    0.0       0.001   86.8        0
01:10      35.10
  EX._STMMH_1_(STM)         0.000    2.4    0.0    0.0       0.001   53.9        0
01:10     218.62
  EX_CB_1_(STM)             0.000    2.6    0.0    0.0       0.001   86.7        0
01:10      37.09
  EX_CB_XXZ_(STM)           0.000   15.6    0.0    0.0       0.001   84.3        0
01:12     125.47
  EX_CBMH_10_(STM)          0.000    4.2    0.0    0.0       0.006   65.1        0
01:19     103.30
  EX_CBMH_11_(STM)          0.000    3.3    0.0    0.0       0.006   61.0        0
01:19     150.21
  EX_CBMH_14_(STM)          0.000    1.7    0.0    0.0       0.001   41.3        0
01:17     136.33
  EX_CBMH12                 0.000    0.4    0.0    0.0       0.001   35.3        0
01:19      10.30
  EX_STMMH_302_(STM)        0.000    9.6    0.0    0.0       0.002   49.8        0
01:10      73.06
  EX-A04-STOR               0.000    0.6    0.0    0.0       0.005   69.7        0
01:10      11.00
  EX-A3-01&02-STOR          0.005    5.0    0.0    0.0       0.064   67.7        0
01:21      26.05
  EX-CB_XYU                 0.003    4.6    0.0    0.0       0.049   70.2        0
01:10     170.19
  EX-CB_XYY                 0.000   11.5    0.0    0.0       0.001   45.7        0
01:11     168.82
  EX-CB_XZY                 0.005    9.5    0.0    0.0       0.048   88.2        0
01:11     139.25
  EX-CB_XZZ                 0.006    6.4    0.0    0.0       0.062   68.5        0
01:10     104.31
  EX-CB_XZZa                0.007    3.7    0.0    0.0       0.047   26.0        0
01:43      22.77
  EX-CB004                  0.000   17.6    0.0    0.0       0.000   59.3        0
01:14      37.59
  EX-CB01                   0.000    0.4    0.0    0.0       0.000    6.3        0
01:10      51.40
  EX-CB02                   0.000    0.3    0.0    0.0       0.000    5.5        0
01:10      45.42
  EX-CB03                   0.000   14.1    0.0    0.0       0.001   34.8        0
01:10      83.67
  EX-CB100-101              0.000   16.1    0.0    0.0       0.000   26.7        0
01:10      61.87
  EX-CB129                  0.016    9.1    0.0    0.0       0.087   49.1        0
01:53      20.96
  EX-CB130                  0.012   10.6    0.0    0.0       0.082   70.9        0
01:21      72.95
  EX-CB132                  0.016   17.0    0.0    0.0       0.096   98.8        0
01:40      22.46
  EX-CB150                  0.000   13.7    0.0    0.0       0.001   59.8        0
01:13      97.18
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  EX-CB301                  0.000   11.6    0.0    0.0       0.000   30.9        0
01:12      47.50
  EX-CB304                  0.000    9.2    0.0    0.0       0.000   10.2        0
01:13       0.07
  EX-CB305                  0.000    6.6    0.0    0.0       0.000   11.2        0
01:11      12.35
  EX-CBMH_XXX               0.000    0.9    0.0    0.0       0.001   12.8        0
01:10     342.67
  EX-CBMH_XXZ               0.000    2.5    0.0    0.0       0.001   51.4        0
01:13      77.87
  EX-CBMH_XYY               0.000    1.1    0.0    0.0       0.001   39.3        0
01:13     136.45
  EX-CBMH_XYZ               0.000    1.0    0.0    0.0       0.000    9.5        0
01:10     249.45
  EX-CBMH_XZY               0.000    3.2    0.0    0.0       0.002   49.6        0
01:13     167.69
  EX-CBMH_XZZ               0.000    3.3    0.0    0.0       0.002   53.2        0
01:13     200.33
  EX-CBMH003                0.000    0.9    0.0    0.0       0.001   39.7        0
01:14      32.38
  EX-CBMH008                0.000    2.4    0.0    0.0       0.001  100.0        0
01:08      64.80
  EX-CBMH01                 0.000    0.6    0.0    0.0       0.000   10.7        0
01:10     168.31
  EX-CBMH048                0.000    2.0    0.0    0.0       0.002   46.8        0
01:15      40.20
  EX-CBMH301                0.000    0.7    0.0    0.0       0.001   28.8        0
01:11     132.04
  EX-CBMH302                0.000    1.2    0.0    0.0       0.001   15.5        0
01:10     313.73
  EX-CBMH303                0.000    1.1    0.0    0.0       0.002   62.1        0
01:10      41.58
  EX-DICB001-002            0.001   21.1    0.0    0.0       0.002   53.0        0
01:21      13.96
  EX-LD01                   0.000    1.6    0.0    0.0       0.000   55.9        0
01:10      31.05
  EX-MH_XXZ                 0.000   14.8    0.0    0.0       0.001   55.3        0
01:13      48.39
  EX-MH_XZY                 0.000   11.8    0.0    0.0       0.002   55.2        0
01:13     205.04
  EX-MH001                  0.000    9.8    0.0    0.0       0.001   36.7        0
01:14      32.68
  EX-MH301                  0.000   15.7    0.0    0.0       0.001   36.3        0
01:11      18.04
  EX-R02-STOR               0.009   10.8    0.0    0.0       0.085  100.0        0
01:20      33.42
  EX-R03-STOR               0.000    2.0    0.0    0.0       0.008   71.5        0
01:13       8.44
  EX-R1-STOR                0.004   11.6    0.0    0.0       0.026   68.5        0
01:30       5.13
  EX-STMMH_XXX              0.000    4.7    0.0    0.0       0.001   10.9        0
01:10     343.56
  LD-TD01                   0.001    1.2    0.0    0.0       0.077  100.0        0
01:16     126.70
  LD-TD02                   0.000    1.7    0.0    0.0       0.006  100.0        0
01:09      13.20
  MH401                     0.000   11.0    0.0    0.0       0.002   50.9        0
01:13     244.58
  MH402                     0.001    8.6    0.0    0.0       0.005   62.6        0
01:14     361.31
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  MH403                    0.000   10.4    0.0    0.0       0.002   59.9       0
01:14     163.36
  MH404                    0.001    7.7    0.0    0.0       0.004   50.1       0
01:15     441.35
  MH405                    0.001    7.2    0.0    0.0       0.005   44.3       0
01:16     482.74
  MH406                    0.000    6.8    0.0    0.0       0.002   40.5       0
01:16      65.89
  MH407                    0.001    7.1    0.0    0.0       0.005   42.4       0
01:16     515.62
  MH410                    0.000    1.1    0.0    0.0       0.002   33.1       0
01:16      30.21
  MH411                    0.001    8.4    0.0    0.0       0.004   48.1       0
01:15     630.64
  MH412                    0.001    7.2    0.0    0.0       0.004   38.7       0
01:15     633.53
  MH413                    0.001    6.2    0.0    0.0       0.004   31.4       0
01:14     636.56
  MH414                    0.001    5.6    0.0    0.0       0.004   33.2       0
01:14     640.03
  MH415                    0.000    4.6    0.0    0.0       0.004   33.9       0
01:13     748.67
  MH416                    0.001    4.2    0.0    0.0       0.004   30.6       0
01:13     753.83
  MH417                    0.001    8.4    0.0    0.0       0.006   40.1       0
01:13    1291.05
  MH418                    0.001   13.1    0.0    0.0       0.003   74.7       0
01:12     450.19
  MH419                    0.000    8.4    0.0    0.0       0.003   68.5       0
01:16     140.54
  MH420                    0.001    9.3    0.0    0.0       0.004   54.6       0
01:12     557.45
  MH421                    0.000   15.7    0.0    0.0       0.002   92.5       0
01:10      87.29
  MH422                    0.000   12.6    0.0    0.0       0.002   66.8       0
01:10     187.93
  MH423                    0.001    8.1    0.0    0.0       0.006   36.8       0
01:13    1300.23
  MH424                    0.000    3.2    0.0    0.0       0.004   27.7       0
01:13    1843.35
  MH425                    0.000    6.5    0.0    0.0       0.001   24.7       0
01:12     368.33
  MH426                    0.001    7.9    0.0    0.0       0.003   36.5       0
01:12     484.34
  MH427                    0.001    7.4    0.0    0.0       0.002   28.7       0
01:12     525.50
  MH428                    0.001    7.1    0.0    0.0       0.003   29.6       0
01:12     521.64
  OGS_#1_(3600Ø)_(STM)     0.002    3.2    0.0    0.0       0.013   26.4       0
01:12     547.33
  OGS_#2_(3600Ø)_(STM)     0.003    4.6    0.0    0.0       0.018   29.3       0
01:13    1304.22
  P3-01-STOR               0.025    9.3    0.0    0.0       0.163   61.1       0
01:34      31.60
  P3-02-STOR               0.000    6.4    0.0    0.0       0.004   95.3       0
01:20       2.20
  P3-03-STOR               0.000    0.9    0.0    0.0       0.002   86.3       0
01:10      18.80
  P4-01-STOR               0.000    0.0    0.0    0.0       0.000    0.0       0
00:00       0.00
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  P4-02-STOR               0.042   27.2    0.0    0.0       0.134   87.0       0
01:43      12.65
  P4-03-STOR               0.020   35.7    0.0    0.0       0.042   75.5       0
01:43       3.66
  P4-04-STOR               0.022   30.1    0.0    0.0       0.060   80.6       0
01:40       6.60
  P4-05-stor               0.073   30.0    0.0    0.0       0.179   73.3       0
02:23       7.47
  P4-06-STOR               0.017   35.4    0.0    0.0       0.036   74.1       0
02:42       3.25
  P4-07-STOR               0.005   22.3    0.0    0.0       0.020   84.0       0
01:52       1.59
  Structure_-_(48)_(5)_(STM)     0.000   10.8    0.0    0.0       0.002   54.1
0  01:10     416.71
  Structure_-_(68)_(1)_(STM)     0.000    3.3    0.0    0.0       0.002   66.1
0  01:15      17.89
  TANK01                   0.002    3.7    0.0    0.0       0.064   98.4       0
01:14      83.59
  TANK02                   0.003    3.9    0.0    0.0       0.056   85.6       0
01:14      64.78
  TD01                     0.000    0.7    0.0    0.0       0.001    8.1       0
01:10      27.27


  ***********************
  Outfall Loading Summary
  ***********************

  -----------------------------------------------------------
                         Flow       Avg       Max       Total
                         Freq      Flow      Flow      Volume
  Outfall Node           Pcnt       LPS       LPS    10^6 ltr
  -----------------------------------------------------------
  23                    28.31      2.99     35.26       0.046
  24                    28.16      3.34     37.78       0.051
  DR-NW                 32.82     57.82    247.49       0.814
  DR-SD                 28.03     11.09     48.44       0.139
  DR-WD                 28.53     11.57     50.02       0.146
  OUT13772              91.85    156.02   1843.35       7.103
  OUT16389              32.80     14.97    218.62       0.275
  -----------------------------------------------------------
  System                38.64    257.81   2356.71       8.574


  ********************
  Link Flow Summary
  ********************

  -----------------------------------------------------------------------------
                                 Maximum  Time of Max   Maximum    Max/    Max/
                                  |Flow|   Occurrence   |Veloc|    Full    Full
  Link                 Type          LPS  days hr:min    m/sec     Flow   Depth
  -----------------------------------------------------------------------------
  1                    CONDUIT    218.62     0  01:10     2.30     2.65    0.97
  11                   CONDUIT      0.00     0  00:00     0.00     0.00    0.00
  12                   CONDUIT    126.70     0  01:33     1.73     3.57    1.00
  16                   CONDUIT      0.00     0  00:00     0.00     0.00    0.01
  17                   CONDUIT      0.00     0  00:00     0.00     0.00    0.01
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  18                   CONDUIT      0.00      0  00:00      0.00    0.00    0.00
  19                   CONDUIT      0.00      0  00:00      0.00    0.00    0.00
  20                   CONDUIT      0.00      0  00:00      0.00    0.00    0.01
  21                   CONDUIT      0.00      0  00:00      0.00    0.00    0.00
  22                   CONDUIT      0.00      0  00:00      0.00    0.00    0.00
  23                   CONDUIT      0.00      0  00:00      0.00    0.00    0.00
  24                   CONDUIT      0.00      0  00:00      0.00    0.00    0.00
  25                   CONDUIT      0.00      0  00:00      0.00    0.00    0.00
  26                   CONDUIT      0.00      0  00:00      0.00    0.00    0.00
  27                   CONDUIT      0.00      0  00:00      0.00    0.00    0.00
  28                   CONDUIT      0.00      0  00:00      0.00    0.00    0.00
  29                   CONDUIT      0.00      0  00:00      0.00    0.00    0.00
  30                   CONDUIT      0.00      0  00:00      0.00    0.00    0.00
  31                   CONDUIT      3.79      0  01:10      0.11    0.00    0.04
  32                   CONDUIT      0.00      0  00:00      0.00    0.00    0.04
  33                   CONDUIT      0.00      0  00:00      0.00    0.00    0.00
  34                   CONDUIT      0.00      0  00:00      0.00    0.00    0.00
  35                   CONDUIT      0.59      0  01:10      0.00    0.00    0.00
  36                   CONDUIT      0.00      0  00:00      0.00    0.00    0.00
  37                   CONDUIT      0.00      0  00:00      0.00    0.00    0.03
  38                   CONDUIT      0.00      0  00:00      0.00    0.00    0.00
  38_1                 CONDUIT      0.00      0  00:00      0.00    0.00    0.00
  38_3                 CONDUIT      0.00      0  00:00      0.00    0.00    0.03
  39                   CONDUIT      0.00      0  00:00      0.00    0.00    0.01
  40                   CONDUIT      0.00      0  00:00      0.00    0.00    0.00
  41                   CONDUIT      0.00      0  00:00      0.00    0.00    0.00
  42                   CONDUIT      0.00      0  00:00      0.00    0.00    0.00
  43                   CONDUIT      0.00      0  00:00      0.00    0.00    0.00
  44                   CONDUIT      0.00      0  00:00      0.00    0.00    0.00
  45                   CONDUIT     60.05      0  01:10      0.39    0.01    0.04
  46                   CONDUIT     93.56      0  01:10      0.59    0.01    0.05
  47                   CONDUIT      0.00      0  00:00      0.00    0.00    0.03
  48                   CONDUIT      0.00      0  00:00      0.00    0.00    0.00
  49                   CONDUIT     13.20      0  01:09      0.62    0.21    1.00
  49_1                 CONDUIT      0.00      0  00:00      0.00    0.00    0.00
  49_2                 CONDUIT      0.00      0  00:00      0.00    0.00    0.00
  50                   CONDUIT      0.00      0  00:00      0.00    0.00    0.00
  51                   CONDUIT      0.00      0  00:00      0.00    0.00    0.00
  52                   CONDUIT      0.00      0  00:00      0.00    0.00    0.00
  53                   CONDUIT      0.00      0  00:00      0.00    0.00    0.00
  54                   CONDUIT      0.00      0  00:00      0.00    0.00    0.00
  55                   CONDUIT      0.00      0  00:00      0.00    0.00    0.00
  56                   CONDUIT      0.00      0  00:00      0.00    0.00    0.00
  57                   CONDUIT      0.00      0  00:00      0.00    0.00    0.00
  58                   CONDUIT      0.00      0  00:00      0.00    0.00    0.00
  59                   CONDUIT      0.00      0  00:00      0.00    0.00    0.00
  60                   CONDUIT      0.00      0  00:00      0.00    0.00    0.00
  61                   CONDUIT      0.00      0  00:00      0.00    0.00    0.00
  62                   CONDUIT      0.00      0  00:00      0.00    0.00    0.00
  63                   CONDUIT      0.00      0  00:00      0.00    0.00    0.00
  64                   CONDUIT    157.98      0  01:10      1.31    0.02    0.07
  65                   CONDUIT     48.61      0  01:08      0.27    0.13    0.17
  66                   CONDUIT     51.63      0  01:11      0.25    0.30    0.12
  67                   CONDUIT      0.00      0  00:00      0.00    0.00    0.00
  68                   CONDUIT    107.20      0  01:11      0.45    0.28    0.14
  69                   CONDUIT     40.20      0  01:09      0.21    0.01    0.93
  70                   CONDUIT     14.98      0  01:10      0.44    0.00    0.01
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  72                   CONDUIT      0.00      0  00:00      0.00    0.00    0.00
  73                   CONDUIT      0.00      0  00:00      0.00    0.00    0.00
  74                   CONDUIT      0.00      0  00:00      0.00    0.00    0.00
  75                   CONDUIT      0.00      0  00:00      0.00    0.00    0.00
  76                   CONDUIT      0.00      0  00:00      0.00    0.00    0.50
  77                   CONDUIT      1.46      0  01:40      0.06    0.00    0.01
  79                   CONDUIT     35.26      0  01:10      0.39    0.01    0.05
  80                   CONDUIT     37.78      0  01:10      0.38    0.01    0.06
  81                   CONDUIT     64.80      0  01:10      1.63    0.84    1.00
  Pipe_-_(1)_(1)_(STM) CONDUIT     15.21      0  01:11      0.44    0.30    0.83
  Pipe_-_(1)_(STM)     CONDUIT    343.56      0  01:10      2.18    0.76    0.67
  Pipe_-_(10)_(1)_(1)_(STM) CONDUIT    125.47      0  01:09      1.72    1.41
1.00
  Pipe_-_(10)_(1)_(2)_(_(1)_(1)_(2)_(STM) CONDUIT     54.76      0  01:04      1.38
0.54    1.00
  Pipe_-_(10)_(1)_(2)_(_(1)_(1)_(STM) CONDUIT    140.54      0  01:33      1.05
0.63    1.00
  Pipe_-_(10)_(1)_(2)_(_(2)_(1)_(STM) CONDUIT    383.06      0  01:10      3.36
2.42    1.00
  Pipe_-_(10)_(1)_(2)_(_(2)_(STM) CONDUIT     47.87      0  01:35      1.20    0.23
1.00
  Pipe_-_(10)_(1)_(2)_(1)_(STM) CONDUIT     37.59      0  01:10      1.20    1.16
1.00
  Pipe_-_(10)_(1)_(2)_(100)_(4)_(STM) CONDUIT     73.06      0  01:17      1.19
0.16    1.00
  Pipe_-_(10)_(1)_(2)_(103)_(STM) CONDUIT    187.93      0  01:10      1.65    1.47
1.00
  Pipe_-_(10)_(1)_(2)_(104)_(STM) CONDUIT    416.71      0  01:10      1.87    2.08
1.00
  Pipe_-_(10)_(1)_(2)_(11)_(STM) CONDUIT    313.73      0  01:10      2.06    1.05
0.99
  Pipe_-_(10)_(1)_(2)_(15)_(STM) CONDUIT    342.67      0  01:10      2.17    1.10
0.94
  Pipe_-_(10)_(1)_(2)_(16)_(STM) CONDUIT      4.71      0  01:11      0.23    0.09
0.43
  Pipe_-_(10)_(1)_(2)_(2)_(STM) CONDUIT      2.35      0  01:23      0.15    0.07
1.00
  Pipe_-_(10)_(1)_(2)_(22)_(STM) CONDUIT    484.34      0  01:10      2.17    1.52
1.00
  Pipe_-_(10)_(1)_(2)_(27)_(STM) CONDUIT    521.64      0  01:12      1.42    0.60
1.00
  Pipe_-_(10)_(1)_(2)_(28)_(STM) CONDUIT    547.33      0  01:12      1.57    0.62
1.00
  Pipe_-_(10)_(1)_(2)_(3)_(STM) CONDUIT     31.34      0  01:07      1.04    1.25
1.00
  Pipe_-_(10)_(1)_(2)_(31)_(STM) CONDUIT   1843.35      0  01:13      2.90    2.17
0.93
  Pipe_-_(10)_(1)_(2)_(32)_(STM) CONDUIT   1304.22      0  01:15      1.99    1.85
1.00
  Pipe_-_(10)_(1)_(2)_(33)_(STM) CONDUIT   1300.23      0  01:11      1.98    1.65
1.00
  Pipe_-_(10)_(1)_(2)_(35)_(1)_(STM) CONDUIT     18.35      0  01:14      0.88
0.56    1.00
  Pipe_-_(10)_(1)_(2)_(35)_(2)_(STM) CONDUIT     71.22      0  01:10      0.97
1.01    1.00
  Pipe_-_(10)_(1)_(2)_(35)_(STM) CONDUIT    142.65      0  01:10      1.56    0.78
0.75
  Pipe_-_(10)_(1)_(2)_(39)_(STM) CONDUIT     83.67      0  01:10      1.69    1.27
0.95
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  Pipe_-_(10)_(1)_(2)_(4)_(STM) CONDUIT    136.45     0  01:15      1.87    1.37
1.00
  Pipe_-_(10)_(1)_(2)_(40)_(2)_(STM) CONDUIT    168.31     0  01:10      1.73
0.64    0.80
  Pipe_-_(10)_(1)_(2)_(45)_(STM) CONDUIT     27.25     0  01:00      0.37    0.27
1.00
  Pipe_-_(10)_(1)_(2)_(46)_(STM) CONDUIT     68.59     0  01:11      1.13    0.41
1.00
  Pipe_-_(10)_(1)_(2)_(48)_(STM) CONDUIT     97.18     0  01:27      1.05    0.67
1.00
  Pipe_-_(10)_(1)_(2)_(49)_(STM) CONDUIT     77.87     0  01:05      1.16    0.48
1.00
  Pipe_-_(10)_(1)_(2)_(5)_(STM) CONDUIT    168.82     0  01:12      2.33    1.67
0.98
  Pipe_-_(10)_(1)_(2)_(50)_(STM) CONDUIT     48.39     0  01:26      1.00    0.79
1.00
  Pipe_-_(10)_(1)_(2)_(52)_(STM) CONDUIT     35.11     0  01:07      1.12    1.07
1.00
  Pipe_-_(10)_(1)_(2)_(54)_(STM) CONDUIT     29.91     0  01:09      0.95    0.93
1.00
  Pipe_-_(10)_(1)_(2)_(55)_(STM) CONDUIT    167.69     0  01:12      0.84    0.91
1.00
  Pipe_-_(10)_(1)_(2)_(57)_(STM) CONDUIT     47.50     0  01:07      2.39    0.66
1.00
  Pipe_-_(10)_(1)_(2)_(58)_(STM) CONDUIT    205.04     0  01:05      0.92    1.08
1.00
  Pipe_-_(10)_(1)_(2)_(59)_(STM) CONDUIT    200.33     0  01:05      0.92    1.00
1.00
  Pipe_-_(10)_(1)_(2)_(61)_(STM) CONDUIT     61.87     0  01:09      1.35    0.61
0.85
  Pipe_-_(10)_(1)_(2)_(63)_(STM) CONDUIT    138.39     0  01:07      2.73    3.09
1.00
  Pipe_-_(10)_(1)_(2)_(64)_(STM) CONDUIT    163.36     0  01:06      2.24    2.32
1.00
  Pipe_-_(10)_(1)_(2)_(66)_(STM) CONDUIT     51.96     0  01:10      1.65    1.59
1.00
  Pipe_-_(10)_(1)_(2)_(7)_(STM) CONDUIT    249.45     0  01:10      1.82    0.83
0.85
  Pipe_-_(10)_(1)_(2)_(70)_(STM) CONDUIT     16.05     0  01:10      0.96    0.25
1.00
  Pipe_-_(10)_(1)_(2)_(71)_(STM) CONDUIT     18.05     0  01:09      0.67    0.25
1.00
  Pipe_-_(10)_(1)_(2)_(72)_(STM) CONDUIT    123.26     0  01:09      2.12    0.71
1.00
  Pipe_-_(10)_(1)_(2)_(73)_(STM) CONDUIT     99.15     0  01:09      1.54    0.95
1.00
  Pipe_-_(10)_(1)_(2)_(74)_(STM) CONDUIT    102.83     0  01:10      1.41    1.02
1.00
  Pipe_-_(10)_(1)_(2)_(76)_(STM) CONDUIT     72.17     0  01:10      2.30    2.25
1.00
  Pipe_-_(10)_(1)_(2)_(79)_(STM) CONDUIT     21.31     0  01:04      0.75    0.12
1.00
  Pipe_-_(10)_(1)_(2)_(8)_(STM) CONDUIT      4.10     0  01:01      0.72    0.27
0.67
  Pipe_-_(10)_(1)_(2)_(80)_(STM) CONDUIT    501.02     0  01:10      1.36    1.24
1.00
  Pipe_-_(10)_(1)_(2)_(82)_(STM) CONDUIT     65.89     0  01:10      1.16    0.36
1.00
  Pipe_-_(10)_(1)_(2)_(89)_(1)_(STM) CONDUIT     38.04     0  01:11      1.18
0.41    1.00
```

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  Pipe_-_(10)_(1)_(2)_(89)_(STM) CONDUIT     27.66     0  01:39      0.86    0.19
1.00
  Pipe_-_(10)_(1)_(2)_(94)_(1)_(4)_(STM) CONDUIT     30.21     0  01:04      0.68
0.51    1.00
  Pipe_-_(10)_(1)_(2)_(98)_(STM) CONDUIT    753.83     0  01:18      1.37    0.99
1.00
  Pipe_-_(10)_(1)_(2)_(99)_(STM) CONDUIT     32.20     0  01:10      1.10    0.98
0.89
  Pipe_-_(10)_(1)_(2)_(STM) CONDUIT     32.68     0  01:19      1.50    0.62
1.00
  Pipe_-_(11)_(STM)    CONDUIT    525.50     0  01:11      1.72    0.60    1.00
  Pipe_-_(12)_(STM)    CONDUIT   1291.05     0  01:11      1.97    1.81    1.00
  Pipe_-_(14)_(1)_(2)_(STM) CONDUIT    555.32     0  01:07      1.01    0.84
1.00
  Pipe_-_(14)_(1)_(STM) CONDUIT    557.45     0  01:07      1.29    1.06    1.00
  Pipe_-_(15)_(STM)    CONDUIT    450.19     0  01:07      1.02    0.99    1.00
  Pipe_-_(16)_(1)_(STM) CONDUIT     87.29     0  01:10      1.19    1.44    1.00
  Pipe_-_(16)_(STM)    CONDUIT    196.81     0  01:10      1.73    1.55    1.00
  Pipe_-_(17)_(1)_(2)_(STM) CONDUIT    127.91     0  01:10      0.51    0.04
1.00
  Pipe_-_(17)_(1)_(3)_(3)_(STM) CONDUIT    136.30     0  01:08      1.88    2.28
1.00
  Pipe_-_(17)_(1)_(3)_(STM) CONDUIT     37.81     0  01:09      0.58    0.63
1.00
  Pipe_-_(17)_(2)_(STM) CONDUIT     12.45     0  01:03      0.34    0.20    1.00
  Pipe_-_(17)_(3)_(STM) CONDUIT    748.67     0  01:18      1.36    1.01    1.00
  Pipe_-_(17)_(4)_(STM) CONDUIT    636.56     0  01:19      1.72    1.56    1.00
  Pipe_-_(17)_(STM)    CONDUIT    640.03     0  01:18      1.40    1.11    1.00
  Pipe_-_(18)_(STM)    CONDUIT    633.53     0  01:19      1.71    1.43    1.00
  Pipe_-_(19)_(STM)    CONDUIT    630.64     0  01:19      1.71    1.40    1.00
  Pipe_-_(20)_(4)_(STM) CONDUIT    628.56     0  01:19      1.70    1.37    1.00
  Pipe_-_(20)_(STM)    CONDUIT    515.62     0  01:19      1.40    1.21    1.00
  Pipe_-_(22)_(STM)    CONDUIT    486.11     0  01:10      1.32    1.25    1.00
  Pipe_-_(24)_(STM)    CONDUIT    482.74     0  01:10      1.31    1.26    1.00
  Pipe_-_(25)_(STM)    CONDUIT    444.70     0  01:07      1.99    1.01    1.00
  Pipe_-_(26)_(STM)    CONDUIT    441.35     0  01:06      1.98    1.40    1.00
  Pipe_-_(27)_(STM)    CONDUIT    473.30     0  01:06      2.12    1.50    1.00
  Pipe_-_(28)_(STM)    CONDUIT    361.31     0  01:05      1.62    1.38    1.00
  Pipe_-_(29)_(STM)    CONDUIT    244.58     0  01:05      1.24    1.10    1.00
  Pipe_-_(9)_(1)_(STM) CONDUIT     27.27     0  01:10      0.99    0.84    0.83
  Pipe_-_(9)_(STM)     CONDUIT    354.51     0  01:12      1.98    0.79    1.00
  OCB01                ORIFICE     22.10     0  01:10                      1.00
  OCB0408-406          ORIFICE     99.71     0  01:12                      1.00
  OCB10                ORIFICE    103.30     0  01:19                      1.00
  OCB129               ORIFICE     20.96     0  01:56                      1.00
  OCB132               ORIFICE     20.99     0  01:41                      1.00
  OCB303               ORIFICE     41.58     0  01:10                      1.00
  OCB402               ORIFICE     40.19     0  01:10                      1.00
  OCB403               ORIFICE     80.53     0  01:09                      1.00
  OCB404               ORIFICE     35.10     0  01:10                      1.00
  OCB405               ORIFICE     20.86     0  01:10                      1.00
  OCB410               ORIFICE    106.59     0  01:10                      1.00
  OCB411               ORIFICE     22.51     0  01:10                      1.00
  OCB412               ORIFICE      4.66     0  01:10                      1.00
  OCB413               ORIFICE     34.70     0  01:10                      1.00
  OCB414               ORIFICE     17.03     0  01:10                      1.00
  OCBLD01              ORIFICE     31.05     0  01:10                      1.00
  OCBMH048             ORIFICE     17.89     0  01:18                      1.00
```

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  OCBMH412            ORIFICE     99.67     0  01:10                     1.00
  OCBXYU              ORIFICE     23.85     0  01:37                     1.00
  OCBXZZa             ORIFICE     21.38     0  01:44                     1.00
  O-TANK01            ORIFICE     83.59     0  01:24                     1.00
  O-TANK02            ORIFICE     64.78     0  01:25                     1.00
  78                  WEIR         2.61     0  02:42                     0.35
  82                  WEIR         0.48     0  01:40                     0.11
  EX-A3-01&02-OVF     WEIR         1.05     0  01:21                     0.19
  EX-R02-OVF          WEIR        13.32     0  01:22                     1.00
  EX-R03-OVF          WEIR         1.94     0  01:13                     0.29
  EX-R1-OVF           WEIR         1.23     0  01:30                     0.21
  P3-03-OVF           WEIR         6.68     0  01:10                     0.66
  P4-02-OVF           WEIR         6.94     0  01:43                     0.67
  P4-03-OVF           WEIR         3.02     0  01:43                     0.39
  P4-04-OVF           WEIR         4.61     0  01:40                     0.51
  P4-05-OVF           WEIR         2.37     0  02:20                     0.33
  13                  DUMMY       13.62     0  01:10
  14                  DUMMY       10.16     0  01:10
  EX-A04-STOR_out     DUMMY       11.00     0  01:00
  EX-A3-01&02-STOR_out DUMMY      25.00     0  01:11
  EX-R02-STOR_out     DUMMY       20.10     0  00:49
  EX-R03-STOR_out     DUMMY        6.50     0  00:52
  EX-R1-STOR_out      DUMMY        3.90     0  00:36
  P3-01-STOR_out      DUMMY       31.60     0  00:48
  P3-02-STOR_out      DUMMY        2.20     0  01:20
  P3-03-STOR_out      DUMMY       12.12     0  01:03
  P4-01-STOR_out      DUMMY        0.00     0  00:00
  P4-02-STOR_out      DUMMY        5.71     0  00:31
  P4-03-STOR_out      DUMMY        0.64     0  00:28
  P4-04-STOR_out      DUMMY        1.50     0  00:30
  P4-05-STOR_out      DUMMY        5.10     0  00:32
  P4-06-STOR_out      DUMMY        0.64     0  00:27
  P4-07-STOR_out      DUMMY        1.59     0  00:31


  ***************************
  Flow Classification Summary
  ***************************

  ---------------------------------------------------------------------------------
----
                    Adjusted    ---------- Fraction of Time in Flow Class -------
---
                     /Actual         Up    Down  Sub   Sup   Up    Down  Norm
Inlet
  Conduit             Length    Dry  Dry   Dry   Crit  Crit  Crit  Crit  Ltd
Ctrl
  ---------------------------------------------------------------------------------
----
  1                     1.00   0.02  0.00  0.00  0.97  0.01  0.00  0.00  0.00
0.00
  11                    1.00   1.00  0.00  0.00  0.00  0.00  0.00  0.00  0.00
0.00
  12                    1.00   0.02  0.00  0.00  0.03  0.00  0.00  0.96  0.00
0.00
  16                    1.00   0.99  0.01  0.00  0.00  0.00  0.00  0.00  0.00
0.00
  17                    1.00   0.99  0.01  0.00  0.00  0.00  0.00  0.00  0.00
```

```
  18                    1.00   1.00  0.00  0.00  0.00  0.00  0.00  0.00  0.00
0.00
  19                    1.00   1.00  0.00  0.00  0.00  0.00  0.00  0.00  0.00
0.00
  20                    1.00   0.99  0.01  0.00  0.00  0.00  0.00  0.00  0.00
0.00
  21                    1.00   1.00  0.00  0.00  0.00  0.00  0.00  0.00  0.00
0.00
  22                    1.00   1.00  0.00  0.00  0.00  0.00  0.00  0.00  0.00
0.00
  23                    1.00   1.00  0.00  0.00  0.00  0.00  0.00  0.00  0.00
0.00
  24                    1.00   1.00  0.00  0.00  0.00  0.00  0.00  0.00  0.00
0.00
  25                    1.00   1.00  0.00  0.00  0.00  0.00  0.00  0.00  0.00
0.00
  26                    1.00   1.00  0.00  0.00  0.00  0.00  0.00  0.00  0.00
0.00
  27                    1.00   1.00  0.00  0.00  0.00  0.00  0.00  0.00  0.00
0.00
  28                    1.00   1.00  0.00  0.00  0.00  0.00  0.00  0.00  0.00
0.00
  29                    1.00   1.00  0.00  0.00  0.00  0.00  0.00  0.00  0.00
0.00
  30                    1.00   1.00  0.00  0.00  0.00  0.00  0.00  0.00  0.00
0.00
  31                    1.00   0.98  0.01  0.00  0.00  0.00  0.00  0.00  0.95
0.00
  32                    1.00   0.98  0.02  0.00  0.00  0.00  0.00  0.00  0.00
0.00
  33                    1.00   1.00  0.00  0.00  0.00  0.00  0.00  0.00  0.00
0.00
  34                    1.00   1.00  0.00  0.00  0.00  0.00  0.00  0.00  0.00
0.00
  35                    1.00   1.00  0.00  0.00  0.00  0.00  0.00  0.00  0.00
0.00
  36                    1.00   1.00  0.00  0.00  0.00  0.00  0.00  0.00  0.00
0.00
  37                    1.00   0.78  0.22  0.00  0.00  0.00  0.00  0.00  0.00
0.00
  38                    1.00   1.00  0.00  0.00  0.00  0.00  0.00  0.00  0.00
0.00
  38_1                  1.00   1.00  0.00  0.00  0.00  0.00  0.00  0.00  0.00
0.00
  38_3                  1.00   0.77  0.23  0.00  0.00  0.00  0.00  0.00  0.00
0.00
  39                    1.00   0.99  0.01  0.00  0.00  0.00  0.00  0.00  0.00
0.00
  40                    1.00   1.00  0.00  0.00  0.00  0.00  0.00  0.00  0.00
0.00
  41                    1.00   1.00  0.00  0.00  0.00  0.00  0.00  0.00  0.00
0.00
  42                    1.00   1.00  0.00  0.00  0.00  0.00  0.00  0.00  0.00
0.00
  43                    1.00   1.00  0.00  0.00  0.00  0.00  0.00  0.00  0.00
0.00
  44                    1.00   1.00  0.00  0.00  0.00  0.00  0.00  0.00  0.00
0.00
  45                    1.00   0.90  0.00  0.00  0.00  0.00  0.00  0.10  0.00
0.00
```

```
  46                      1.00   0.90  0.00  0.00  0.00  0.00  0.00  0.10  0.00
0.00
  47                      1.00   1.00  0.00  0.00  0.00  0.00  0.00  0.00  0.00
0.00
  48                      1.00   1.00  0.00  0.00  0.00  0.00  0.00  0.00  0.00
0.00
  49                      1.00   0.02  0.00  0.00  0.03  0.00  0.00  0.95  0.00
0.00
  49_1                    1.00   1.00  0.00  0.00  0.00  0.00  0.00  0.00  0.00
0.00
  49_2                    1.00   1.00  0.00  0.00  0.00  0.00  0.00  0.00  0.00
0.00
  50                      1.00   1.00  0.00  0.00  0.00  0.00  0.00  0.00  0.00
0.00
  51                      1.00   1.00  0.00  0.00  0.00  0.00  0.00  0.00  0.00
0.00
  52                      1.00   1.00  0.00  0.00  0.00  0.00  0.00  0.00  0.00
0.00
  53                      1.00   1.00  0.00  0.00  0.00  0.00  0.00  0.00  0.00
0.00
  54                      1.00   1.00  0.00  0.00  0.00  0.00  0.00  0.00  0.00
0.00
  55                      1.00   1.00  0.00  0.00  0.00  0.00  0.00  0.00  0.00
0.00
  56                      1.00   1.00  0.00  0.00  0.00  0.00  0.00  0.00  0.00
0.00
  57                      1.00   1.00  0.00  0.00  0.00  0.00  0.00  0.00  0.00
0.00
  58                      1.00   1.00  0.00  0.00  0.00  0.00  0.00  0.00  0.00
0.00
  59                      1.00   1.00  0.00  0.00  0.00  0.00  0.00  0.00  0.00
0.00
  60                      1.00   1.00  0.00  0.00  0.00  0.00  0.00  0.00  0.00
0.00
  61                      1.00   1.00  0.00  0.00  0.00  0.00  0.00  0.00  0.00
0.00
  62                      1.00   1.00  0.00  0.00  0.00  0.00  0.00  0.00  0.00
0.00
  63                      1.00   1.00  0.00  0.00  0.00  0.00  0.00  0.00  0.00
0.00
  64                      1.00   0.90  0.08  0.00  0.00  0.02  0.00  0.00  0.93
0.00
  65                      1.00   0.97  0.00  0.00  0.03  0.00  0.00  0.00  0.00
0.00
  66                      1.00   0.97  0.00  0.00  0.00  0.00  0.00  0.03  0.00
0.00
  67                      1.00   1.00  0.00  0.00  0.00  0.00  0.00  0.00  0.00
0.00
  68                      1.00   0.97  0.00  0.00  0.00  0.00  0.03  0.00  0.00
0.00
  69                      1.00   0.02  0.08  0.00  0.90  0.00  0.00  0.00  0.53
0.00
  70                      1.00   1.00  0.00  0.00  0.00  0.00  0.00  0.00  0.00
0.00
  72                      1.00   1.00  0.00  0.00  0.00  0.00  0.00  0.00  0.00
0.00
  73                      1.00   1.00  0.00  0.00  0.00  0.00  0.00  0.00  0.00
0.00
  74                      1.00   1.00  0.00  0.00  0.00  0.00  0.00  0.00  0.00
0.00
```

```
  75                      1.00   1.00  0.00  0.00  0.00  0.00  0.00  0.00  0.00
0.00
  76                      1.00   0.02  0.98  0.00  0.00  0.00  0.00  0.00  0.00
0.00
  77                      1.00   0.98  0.00  0.00  0.00  0.00  0.00  0.02  0.00
0.00
  79                      1.00   0.78  0.00  0.00  0.22  0.00  0.00  0.00  0.00
0.00
  80                      1.00   0.77  0.00  0.00  0.23  0.00  0.00  0.00  0.00
0.00
  81                      1.00   0.02  0.00  0.00  0.02  0.00  0.00  0.96  0.01
0.00
  Pipe_-_(1)_(1)_(STM)    1.00   0.05  0.00  0.00  0.00  0.00  0.00  0.95  0.00
0.00
  Pipe_-_(1)_(STM)        1.00   0.02  0.00  0.00  0.00  0.00  0.00  0.98  0.00
0.00
  Pipe_-_(10)_(1)_(1)_(STM)    1.00   0.02  0.00  0.00  0.02  0.00  0.00  0.96
0.00  0.00
  Pipe_-_(10)_(1)_(2)_(_(1)_(1)_(2)_(STM)    1.00   0.02  0.00  0.00  0.03  0.00
0.00  0.95  0.00  0.00
  Pipe_-_(10)_(1)_(2)_(_(1)_(1)_(STM)    1.00   0.02  0.00  0.00  0.03  0.00  0.00
0.95  0.00  0.00
  Pipe_-_(10)_(1)_(2)_(_(2)_(1)_(STM)    1.00   0.01  0.00  0.00  0.13  0.00  0.00
0.86  0.07  0.00
  Pipe_-_(10)_(1)_(2)_(_(2)_(STM)    1.00   0.02  0.00  0.00  0.03  0.00  0.00
0.96  0.00  0.00
  Pipe_-_(10)_(1)_(2)_(1)_(STM)    1.00   0.02  0.00  0.00  0.02  0.02  0.00  0.94
0.00  0.00
  Pipe_-_(10)_(1)_(2)_(100)_(4)_(STM)    1.00   0.02  0.00  0.00  0.05  0.06  0.00
0.87  0.02  0.00
  Pipe_-_(10)_(1)_(2)_(103)_(STM)    1.00   0.02  0.00  0.00  0.03  0.00  0.00
0.95  0.00  0.00
  Pipe_-_(10)_(1)_(2)_(104)_(STM)    1.00   0.02  0.00  0.00  0.03  0.00  0.00
0.95  0.00  0.00
  Pipe_-_(10)_(1)_(2)_(11)_(STM)    1.00   0.02  0.00  0.00  0.00  0.00  0.00  0.98
0.00  0.00
  Pipe_-_(10)_(1)_(2)_(15)_(STM)    1.00   0.02  0.00  0.00  0.00  0.00  0.00  0.98
0.00  0.00
  Pipe_-_(10)_(1)_(2)_(16)_(STM)    1.00   0.05  0.91  0.00  0.04  0.00  0.00  0.00
0.95  0.00
  Pipe_-_(10)_(1)_(2)_(2)_(STM)    1.00   0.88  0.04  0.00  0.07  0.00  0.00  0.00
0.93  0.00
  Pipe_-_(10)_(1)_(2)_(22)_(STM)    1.00   0.02  0.00  0.00  0.02  0.00  0.00  0.96
0.00  0.00
  Pipe_-_(10)_(1)_(2)_(27)_(STM)    1.00   0.03  0.00  0.00  0.03  0.03  0.00  0.91
0.00  0.00
  Pipe_-_(10)_(1)_(2)_(28)_(STM)    1.00   0.03  0.00  0.00  0.03  0.00  0.00  0.94
0.00  0.00
  Pipe_-_(10)_(1)_(2)_(3)_(STM)    1.00   0.02  0.00  0.00  0.01  0.00  0.00  0.96
0.00  0.00
  Pipe_-_(10)_(1)_(2)_(31)_(STM)    1.00   0.03  0.00  0.00  0.97  0.00  0.00  0.00
0.00  0.00
  Pipe_-_(10)_(1)_(2)_(32)_(STM)    1.00   0.03  0.00  0.00  0.04  0.00  0.00  0.94
0.00  0.00
  Pipe_-_(10)_(1)_(2)_(33)_(STM)    1.00   0.02  0.00  0.00  0.52  0.03  0.00  0.43
0.00  0.00
  Pipe_-_(10)_(1)_(2)_(35)_(1)_(STM)    1.00   0.02  0.00  0.00  0.02  0.00  0.00
0.96  0.01  0.00
  Pipe_-_(10)_(1)_(2)_(35)_(2)_(STM)    1.00   0.02  0.00  0.00  0.06  0.00  0.00
0.91  0.02  0.00
```

```
  Pipe_-_(10)_(1)_(2)_(35)_(STM)    1.00   0.02  0.00  0.00  0.00  0.00  0.00  0.98
0.00  0.00
  Pipe_-_(10)_(1)_(2)_(39)_(STM)    1.00   0.02  0.00  0.00  0.00  0.00  0.00  0.98
0.00  0.00
  Pipe_-_(10)_(1)_(2)_(4)_(STM)    1.00   0.02  0.00  0.00  0.02  0.00  0.00  0.96
0.00  0.00
  Pipe_-_(10)_(1)_(2)_(40)_(2)_(STM)    1.00   0.02  0.00  0.00  0.01  0.03  0.00
0.95  0.03  0.00
  Pipe_-_(10)_(1)_(2)_(45)_(STM)    1.00   0.02  0.01  0.00  0.15  0.00  0.00  0.81
0.00  0.00
  Pipe_-_(10)_(1)_(2)_(46)_(STM)    1.00   0.02  0.00  0.00  0.17  0.00  0.00  0.81
0.01  0.00
  Pipe_-_(10)_(1)_(2)_(48)_(STM)    1.00   0.02  0.00  0.00  0.02  0.00  0.00  0.95
0.00  0.00
  Pipe_-_(10)_(1)_(2)_(49)_(STM)    1.00   0.02  0.00  0.00  0.03  0.00  0.00  0.95
0.01  0.00
  Pipe_-_(10)_(1)_(2)_(5)_(STM)    1.00   0.02  0.00  0.00  0.00  0.00  0.00  0.98
0.00  0.00
  Pipe_-_(10)_(1)_(2)_(50)_(STM)    1.00   0.02  0.00  0.00  0.04  0.00  0.00  0.94
0.00  0.00
  Pipe_-_(10)_(1)_(2)_(52)_(STM)    1.00   0.02  0.00  0.00  0.14  0.00  0.00  0.84
0.00  0.00
  Pipe_-_(10)_(1)_(2)_(54)_(STM)    1.00   0.02  0.00  0.00  0.11  0.00  0.00  0.87
0.00  0.00
  Pipe_-_(10)_(1)_(2)_(55)_(STM)    1.00   0.02  0.00  0.00  0.05  0.00  0.00  0.93
0.00  0.00
  Pipe_-_(10)_(1)_(2)_(57)_(STM)    1.00   0.02  0.00  0.00  0.01  0.00  0.00  0.96
0.00  0.00
  Pipe_-_(10)_(1)_(2)_(58)_(STM)    1.00   0.02  0.00  0.00  0.98  0.00  0.00  0.00
0.81  0.00
  Pipe_-_(10)_(1)_(2)_(59)_(STM)    1.00   0.02  0.00  0.00  0.12  0.00  0.00  0.86
0.00  0.00
  Pipe_-_(10)_(1)_(2)_(61)_(STM)    1.00   0.02  0.00  0.00  0.01  0.00  0.00  0.97
0.00  0.00
  Pipe_-_(10)_(1)_(2)_(63)_(STM)    1.00   0.02  0.00  0.00  0.03  0.00  0.00  0.95
0.00  0.00
  Pipe_-_(10)_(1)_(2)_(64)_(STM)    1.00   0.02  0.00  0.00  0.02  0.00  0.00  0.96
0.00  0.00
  Pipe_-_(10)_(1)_(2)_(66)_(STM)    1.00   0.02  0.00  0.00  0.01  0.00  0.00  0.97
0.00  0.00
  Pipe_-_(10)_(1)_(2)_(7)_(STM)    1.00   0.02  0.00  0.00  0.83  0.15  0.00  0.00
0.95  0.00
  Pipe_-_(10)_(1)_(2)_(70)_(STM)    1.00   0.02  0.00  0.00  0.00  0.00  0.00  0.98
0.00  0.00
  Pipe_-_(10)_(1)_(2)_(71)_(STM)    1.00   0.02  0.00  0.00  0.01  0.00  0.00  0.97
0.00  0.00
  Pipe_-_(10)_(1)_(2)_(72)_(STM)    1.00   0.02  0.00  0.00  0.01  0.00  0.00  0.97
0.00  0.00
  Pipe_-_(10)_(1)_(2)_(73)_(STM)    1.00   0.02  0.00  0.00  0.02  0.00  0.00  0.96
0.00  0.00
  Pipe_-_(10)_(1)_(2)_(74)_(STM)    1.00   0.02  0.00  0.00  0.03  0.01  0.00  0.94
0.01  0.00
  Pipe_-_(10)_(1)_(2)_(76)_(STM)    1.00   0.02  0.00  0.00  0.00  0.00  0.00  0.98
0.00  0.00
  Pipe_-_(10)_(1)_(2)_(79)_(STM)    1.00   0.02  0.00  0.00  0.06  0.04  0.00  0.88
0.07  0.00
  Pipe_-_(10)_(1)_(2)_(8)_(STM)    1.00   0.02  0.00  0.00  0.02  0.00  0.00  0.96
0.02  0.00
  Pipe_-_(10)_(1)_(2)_(80)_(STM)    1.00   0.02  0.00  0.00  0.77  0.00  0.00  0.20
0.44  0.00
```

```
  Pipe_-_(10)_(1)_(2)_(82)_(STM)    1.00   0.02  0.00  0.00  0.03  0.00  0.00  0.95
0.00  0.00
  Pipe_-_(10)_(1)_(2)_(89)_(1)_(STM)    1.00   0.02  0.00  0.00  0.03  0.01  0.00
0.93  0.00  0.00
  Pipe_-_(10)_(1)_(2)_(89)_(STM)    1.00   0.02  0.00  0.00  0.03  0.00  0.00  0.95
0.00  0.00
  Pipe_-_(10)_(1)_(2)_(94)_(1)_(4)_(STM)    1.00   0.02  0.00  0.00  0.03  0.00
0.00  0.95  0.00  0.00
  Pipe_-_(10)_(1)_(2)_(98)_(STM)    1.00   0.02  0.00  0.00  0.13  0.00  0.00  0.84
0.00  0.00
  Pipe_-_(10)_(1)_(2)_(99)_(STM)    1.00   0.02  0.00  0.00  0.00  0.00  0.00  0.98
0.00  0.00
  Pipe_-_(10)_(1)_(2)_(STM)    1.00   0.03  0.00  0.00  0.01  0.00  0.00  0.96
0.00  0.00
  Pipe_-_(11)_(STM)       1.00   0.02  0.00  0.00  0.02  0.04  0.00  0.91  0.02
0.00
  Pipe_-_(12)_(STM)       1.00   0.02  0.00  0.00  0.52  0.00  0.00  0.46  0.00
0.00
  Pipe_-_(14)_(1)_(2)_(STM)    1.00   0.02  0.00  0.00  0.17  0.00  0.00  0.80
0.06  0.00
  Pipe_-_(14)_(1)_(STM)    1.00   0.02  0.00  0.00  0.06  0.00  0.00  0.92  0.00
0.00
  Pipe_-_(15)_(STM)       1.00   0.02  0.00  0.00  0.73  0.00  0.00  0.25  0.00
0.00
  Pipe_-_(16)_(1)_(STM)    1.00   0.02  0.00  0.00  0.03  0.00  0.00  0.95  0.00
0.00
  Pipe_-_(16)_(STM)       1.00   0.02  0.00  0.00  0.03  0.00  0.00  0.95  0.00
0.00
  Pipe_-_(17)_(1)_(2)_(STM)    1.00   0.02  0.00  0.00  0.11  0.00  0.00  0.87
0.04  0.00
  Pipe_-_(17)_(1)_(3)_(3)_(STM)    1.00   0.02  0.00  0.00  0.02  0.00  0.00  0.96
0.00  0.00
  Pipe_-_(17)_(1)_(3)_(STM)    1.00   0.05  0.00  0.00  0.02  0.00  0.00  0.93
0.00  0.00
  Pipe_-_(17)_(2)_(STM)    1.00   0.89  0.05  0.00  0.06  0.00  0.00  0.00  0.93
0.00
  Pipe_-_(17)_(3)_(STM)    1.00   0.02  0.00  0.00  0.12  0.00  0.00  0.86  0.00
0.00
  Pipe_-_(17)_(4)_(STM)    1.00   0.03  0.00  0.00  0.03  0.00  0.00  0.95  0.00
0.00
  Pipe_-_(17)_(STM)       1.00   0.03  0.00  0.00  0.04  0.00  0.00  0.94  0.00
0.00
  Pipe_-_(18)_(STM)       1.00   0.03  0.00  0.00  0.16  0.00  0.00  0.81  0.00
0.00
  Pipe_-_(19)_(STM)       1.00   0.02  0.00  0.00  0.15  0.00  0.00  0.83  0.00
0.00
  Pipe_-_(20)_(4)_(STM)    1.00   0.02  0.00  0.00  0.15  0.00  0.00  0.83  0.00
0.00
  Pipe_-_(20)_(STM)       1.00   0.02  0.00  0.00  0.77  0.00  0.00  0.20  0.00
0.00
  Pipe_-_(22)_(STM)       1.00   0.02  0.00  0.00  0.12  0.00  0.00  0.86  0.00
0.00
  Pipe_-_(24)_(STM)       1.00   0.02  0.00  0.00  0.15  0.00  0.00  0.83  0.00
0.00
  Pipe_-_(25)_(STM)       1.00   0.02  0.00  0.00  0.03  0.00  0.00  0.95  0.00
0.00
  Pipe_-_(26)_(STM)       1.00   0.02  0.00  0.00  0.03  0.00  0.00  0.95  0.00
0.00
  Pipe_-_(27)_(STM)       1.00   0.02  0.00  0.00  0.02  0.00  0.00  0.95  0.00
0.00
```

```
  Pipe_-_(28)_(STM)       1.00   0.02  0.00  0.00  0.06  0.00  0.00  0.92  0.00
0.00
  Pipe_-_(29)_(STM)       1.00   0.02  0.00  0.00  0.02  0.00  0.00  0.96  0.00
0.00
  Pipe_-_(9)_(1)_(STM)    1.00   0.02  0.00  0.00  0.00  0.00  0.00  0.98  0.00
0.00
  Pipe_-_(9)_(STM)        1.00   0.02  0.00  0.00  0.02  0.00  0.00  0.96  0.01
0.00


  *************************
  Conduit Surcharge Summary
  *************************

  ---------------------------------------------------------------------------
                                                         Hours        Hours
                        --------- Hours Full --------   Above Full   Capacity
  Conduit                Both Ends  Upstream  Dnstream   Normal Flow   Limited
  ---------------------------------------------------------------------------
  1                           0.01      0.15      0.01      0.32         0.01
  12                          0.54      0.54      0.55      0.49         0.27
  49                          0.55      0.55      0.57      0.01         0.01
  81                          0.23      0.23      0.47      0.01         0.01
  Pipe_-_(1)_(1)_(STM)        0.01      0.01      0.01      0.01         0.01
  Pipe_-_(10)_(1)_(1)_(STM)        0.26      0.26      0.33      0.15         0.14
  Pipe_-_(10)_(1)_(2)_(_(1)_(1)_(2)_(STM)        0.54      0.54      0.55      0.01
0.01
  Pipe_-_(10)_(1)_(2)_(_(1)_(1)_(STM)        0.55      0.55      0.56      0.01
0.01
  Pipe_-_(10)_(1)_(2)_(_(2)_(1)_(STM)        0.63      0.64      0.67      0.29
0.36
  Pipe_-_(10)_(1)_(2)_(_(2)_(STM)        0.45      0.45      0.51      0.01
0.01
  Pipe_-_(10)_(1)_(2)_(1)_(STM)        0.26      0.26      0.28      0.05
0.06
  Pipe_-_(10)_(1)_(2)_(100)_(4)_(STM)        0.51      0.51      0.56      0.01
0.01
  Pipe_-_(10)_(1)_(2)_(103)_(STM)        0.57      0.59      0.58      0.21
0.29
  Pipe_-_(10)_(1)_(2)_(104)_(STM)        0.58      0.61      0.58      0.31
0.58
  Pipe_-_(10)_(1)_(2)_(11)_(STM)        0.01      0.01      0.01      0.04
0.01
  Pipe_-_(10)_(1)_(2)_(15)_(STM)        0.01      0.03      0.01      0.08
0.01
  Pipe_-_(10)_(1)_(2)_(2)_(STM)        0.24      0.24      0.28      0.01
0.01
  Pipe_-_(10)_(1)_(2)_(22)_(STM)        0.33      0.37      0.35      0.34
0.28
  Pipe_-_(10)_(1)_(2)_(27)_(STM)        0.38      0.38      0.42      0.01
0.08
  Pipe_-_(10)_(1)_(2)_(28)_(STM)        0.43      0.45      0.45      0.01
0.38
  Pipe_-_(10)_(1)_(2)_(3)_(STM)        0.26      0.29      0.26      0.28
0.26
  Pipe_-_(10)_(1)_(2)_(31)_(STM)        0.01      0.57      0.01      0.71
0.01
  Pipe_-_(10)_(1)_(2)_(32)_(STM)        0.49      0.57      0.49      0.70
0.49
```

```
  Pipe_-_(10)_(1)_(2)_(33)_(STM)        0.56      0.62      0.56      0.66
0.56
  Pipe_-_(10)_(1)_(2)_(35)_(1)_(STM)        0.36      0.36      0.50      0.01
0.01
  Pipe_-_(10)_(1)_(2)_(35)_(2)_(STM)        0.50      0.50      0.54      0.02
0.07
  Pipe_-_(10)_(1)_(2)_(39)_(STM)        0.01      0.14      0.01      0.07
0.01
  Pipe_-_(10)_(1)_(2)_(4)_(STM)        0.35      0.35      0.39      0.27
0.27
  Pipe_-_(10)_(1)_(2)_(40)_(2)_(STM)        0.01      0.01      0.10      0.01
0.01
  Pipe_-_(10)_(1)_(2)_(45)_(STM)        3.51      3.51      3.64      0.01
0.01
  Pipe_-_(10)_(1)_(2)_(46)_(STM)        3.66      3.66      3.87      0.01
0.01
  Pipe_-_(10)_(1)_(2)_(48)_(STM)        0.34      0.34      0.35      0.01
0.01
  Pipe_-_(10)_(1)_(2)_(49)_(STM)        0.31      0.31      0.33      0.01
0.01
  Pipe_-_(10)_(1)_(2)_(5)_(STM)        0.01      0.40      0.01      0.42
0.01
  Pipe_-_(10)_(1)_(2)_(50)_(STM)        0.31      0.31      0.33      0.01
0.01
  Pipe_-_(10)_(1)_(2)_(52)_(STM)        3.19      3.19      3.32      0.10
0.19
  Pipe_-_(10)_(1)_(2)_(54)_(STM)        2.56      2.56      2.64      0.01
0.10
  Pipe_-_(10)_(1)_(2)_(55)_(STM)        0.36      0.37      0.36      0.01
0.36
  Pipe_-_(10)_(1)_(2)_(57)_(STM)        0.21      0.21      0.30      0.01
0.01
  Pipe_-_(10)_(1)_(2)_(58)_(STM)        0.37      0.39      0.38      0.03
0.20
  Pipe_-_(10)_(1)_(2)_(59)_(STM)        0.37      0.38      0.37      0.01
0.37
  Pipe_-_(10)_(1)_(2)_(61)_(STM)        0.01      0.01      0.24      0.01
0.01
  Pipe_-_(10)_(1)_(2)_(63)_(STM)        0.47      0.47      0.47      0.48
0.47
  Pipe_-_(10)_(1)_(2)_(64)_(STM)        0.39      0.47      0.39      0.47
0.39
  Pipe_-_(10)_(1)_(2)_(66)_(STM)        0.31      0.38      0.33      0.16
0.08
  Pipe_-_(10)_(1)_(2)_(7)_(STM)        0.01      0.01      0.01      0.01
0.01
  Pipe_-_(10)_(1)_(2)_(70)_(STM)        0.01      0.01      0.05      0.01
0.01
  Pipe_-_(10)_(1)_(2)_(71)_(STM)        0.05      0.05      0.09      0.01
0.01
  Pipe_-_(10)_(1)_(2)_(72)_(STM)        0.11      0.11      0.30      0.01
0.01
  Pipe_-_(10)_(1)_(2)_(73)_(STM)        0.51      0.51      0.53      0.01
0.01
  Pipe_-_(10)_(1)_(2)_(74)_(STM)        0.53      0.53      0.56      0.06
0.06
  Pipe_-_(10)_(1)_(2)_(76)_(STM)        0.11      0.23      0.11      0.19
0.11
  Pipe_-_(10)_(1)_(2)_(79)_(STM)        0.49      0.49      0.53      0.01
0.01
```

```
  Pipe_-_(10)_(1)_(2)_(8)_(STM)        0.01      0.01      0.16      0.01
0.01
  Pipe_-_(10)_(1)_(2)_(80)_(STM)        0.59      0.59      0.59      0.49
0.48
  Pipe_-_(10)_(1)_(2)_(82)_(STM)        0.53      0.53      0.57      0.01
0.01
  Pipe_-_(10)_(1)_(2)_(89)_(1)_(STM)        0.56      0.56      0.56      0.01
0.01
  Pipe_-_(10)_(1)_(2)_(89)_(STM)        0.56      0.56      0.59      0.01
0.01
  Pipe_-_(10)_(1)_(2)_(94)_(1)_(4)_(STM)        0.57      0.57      0.59      0.01
0.01
  Pipe_-_(10)_(1)_(2)_(98)_(STM)        0.60      0.60      0.63      0.01
0.20
  Pipe_-_(10)_(1)_(2)_(99)_(STM)        0.01      0.02      0.01      0.01
0.01
  Pipe_-_(10)_(1)_(2)_(STM)        0.27      0.27      0.34      0.01         0.01
  Pipe_-_(11)_(STM)           0.27      0.27      0.37      0.01         0.01
  Pipe_-_(12)_(STM)           0.61      0.63      0.61      0.69         0.61
  Pipe_-_(14)_(1)_(2)_(STM)        0.59      0.59      0.63      0.01         0.01
  Pipe_-_(14)_(1)_(STM)        0.58      0.58      0.59      0.03         0.04
  Pipe_-_(15)_(STM)           0.55      0.55      0.58      0.01         0.01
  Pipe_-_(16)_(1)_(STM)        0.58      0.58      0.58      0.30         0.54
  Pipe_-_(16)_(STM)           0.56      0.58      0.58      0.21         0.28
  Pipe_-_(17)_(1)_(2)_(STM)        0.41      0.41      0.45      0.01         0.01
  Pipe_-_(17)_(1)_(3)_(3)_(STM)        0.44      0.55      0.47      0.19
0.07
  Pipe_-_(17)_(1)_(3)_(STM)        0.37      0.37      0.42      0.01         0.01
  Pipe_-_(17)_(2)_(STM)        0.42      0.42      0.55      0.01         0.01
  Pipe_-_(17)_(3)_(STM)        0.58      0.58      0.60      0.03         0.24
  Pipe_-_(17)_(4)_(STM)        0.56      0.56      0.56      0.63         0.56
  Pipe_-_(17)_(STM)           0.56      0.56      0.57      0.31         0.35
  Pipe_-_(18)_(STM)           0.56      0.59      0.56      0.60         0.56
  Pipe_-_(19)_(STM)           0.58      0.61      0.58      0.58         0.58
  Pipe_-_(20)_(4)_(STM)        0.60      0.60      0.60      0.53         0.60
  Pipe_-_(20)_(STM)           0.59      0.59      0.60      0.49         0.49
  Pipe_-_(22)_(STM)           0.58      0.58      0.58      0.47         0.52
  Pipe_-_(24)_(STM)           0.57      0.57      0.58      0.43         0.48
  Pipe_-_(25)_(STM)           0.56      0.56      0.57      0.04         0.04
  Pipe_-_(26)_(STM)           0.54      0.55      0.56      0.46         0.44
  Pipe_-_(27)_(STM)           0.54      0.56      0.54      0.44         0.53
  Pipe_-_(28)_(STM)           0.55      0.55      0.55      0.45         0.49
  Pipe_-_(29)_(STM)           0.37      0.38      0.37      0.02         0.37
  Pipe_-_(9)_(STM)            0.12      0.12      0.30      0.01         0.01


  Analysis begun on:  Fri Nov 28 09:37:31 2025
  Analysis ended on:  Fri Nov 28 09:37:37 2025
  Total elapsed time: 00:00:06
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APPENDIX E

MOE Amended Certificate of Approval For Existing Storm Sewers & SWM Facilities

RECEIVED DEC 0 6 2010

Ontario

Ministry of the Environment
Ministère de l'Environnement

AMENDED CERTIFICATE OF APPROVAL
INDUSTRIAL SEWAGE WORKS

NUMBER 6601-8B8MMR
Issue Date: November 30, 2010

Queensway-Carleton Hospital
3045 Baseline Road
Ottawa, Ontario
K2H 8P4

Site Location: 3045 Baseline Road
City of Ottawa,
K2H 8P4

You have applied in accordance with Section 53 of the Ontario Water Resources Act for approval of:

Construction of stormwater management Works for the collection, treatment and disposal of stormwater run-off from a proposed Part 3 expansion at the Queensway Carleton Hospital (comprising of the construction of additional medical facilities, renovations to the existing hospital, modifications to the existing parking lots, and re-alignment of the Ring Road along the west side of the hospital campus) to provide a Normal Level of water quality protection and to attenuate post-development peak flows to pre-development levels for all storm events up to and including the 100 year event, discharging to the existing drainage tributary to Graham Creek, consisting of the following:

Area A1 (Existing Surface Vehicle Parking Lot, located south east of main hospital building)

Replacing an existing 103 mm diameter plug type inlet control device (ICD) with a smaller 84 mm diameter plug type orifice in the outlet pipe of the existing south west catchbasin (CB 132) to reduce the controlled flow from the approximately southern half of the existing parking lot identified as A1a, controlling the discharge rate to 20.4 L/s, and providing approximately 100 cu.m. of storage during the 100 year storm event;

Replacing an existing 103 mm diameter plug type ICD with a smaller 85 mm diameter plug type orifice in the outlet pipe of the existing north west catchbasin to reduce the controlled flow from the approximately northern half of the existing parking lot identified as A1b, controlling the discharge rate to 20.4 L/s, and providing approximately 112 cu.m. of storage during the 100 year storm event;

Area A2-A (Existing Surface Vehicle Parking Lot, located south of main hospital building)

Modifying the drainage area by expanding the existing parking lot and regrading the adjacent berm, maintaining the discharge rate at 21 L/s, and maintaining approximately 54 cu.m. of storage during the 100 year storm event with the existing 91 mm diameter plug type ICD in the outlet pipe of the existing catchbasin;

Area A2-B (Existing Surface Vehicle Parking Lot, located south of main hospital building)

Replacing an existing 119 mm diameter plug type ICD with a smaller 81 mm diameter plug type orifice in the outlet pipe of the existing north west catchbasin (CB 129) to reduce the controlled flow from the existing parking lot and the overflow from parking lot A2-A, controlling the discharge rate to 20.5 L/s, and providing approximately 255 cu.m. of storage during the 100 year storm event;

Area P3-1 (New Medical Facility, attached to the north west of the main hospital building)

Providing roof top storage by installing twenty-three (23) roof drains which control the discharge, and another eight (8) uncontrolled roof drains and two (2) uncontrolled catchbasins (CB 302 and CB 303), resulting in a total discharge rate of 49.4 L/s, providing approximately 195 cu.m of storage during the 100 year storm event;

Area P3-2 (MRI Expansion, attached to the north of the main hospital building)

Providing roof top storage by installing two (2) roof drains which control the discharge rate to 1.14 L/s per drain, for a total discharge rate of approximately 2.3 L/s, providing approximately 4.7 cu.m of storage during the 100 year storm event;

resulting in the following pre-development and post-development flows for the 15.51 hectare portion of the Queensway Carleton Hospital campus draining to the existing ditch along the west property line for the 1:5 year and 1:100 year design events:

Design Event	Pre-Development Total Site Flow (L/s)	Post-Development Controlled Site Flow (L/s)	Post-Development Total Site Flow (L/s)
1:5 year	1191.8	220.8	1184.0
1:100 year	1961.0	261.6	1846.8

together with any storm and sanitary sewer installation and removals as noted in the submitted documents, including erosion/sedimentation control measures during construction and all other controls and appurtenances essential for the proper operation of the aforementioned Works;

all in accordance with the following submitted supporting documents:

1. Application for Approval of Sewage Works dated September 2, 2010 submitted by Peter Thompson, B.ARCH., MBA, Director, Planning & Facility Redevelopment, Queensway Carleton Hospital and forwarded by Richard Buchanan, C.E.T., City of Ottawa via letter dated September 8, 2010 to the Ministry.

2. Report entitled 'Queensway-Carleton Hospital, Overall Campus - Part 3 Expansion, Stormwater Management Report' dated June 26, 2009, amended July 27, 2010, prepared for the Queensway Carleton Hospital by Novatech Engineering Consultants Ltd.

Existing Works approved under Certificate of Approval No. 7898-7DGJUK dated April 18, 2008

Construction of stormwater management Works for the collection, treatment and disposal of stormwater run-off from a proposed expansion at the Queensway Carleton Hospital (comprising of the expansion to the Cancer Centre, a Power Plant addition, additional surface vehicle parking lots, a multilevel parking structure with adjoining Hydro sub-station and generators, access road re-alignment) to provide a Normal Level of water quality protection and to attenuate post-development peak flows to pre-development levels for all storm events up to and including the 100 year event, discharging to the existing drainage ditch tributary to Graham Creek, consisting of the following:

Areas A-3.1 and A-3.2 (Proposed Cancer Centre and adjoining Roof Area)

Roof top storage provided by ten (10) roof drains which control the discharge rate to 1.9 L/s per drain, for a total controlled release rate of 19 L/s, and providing approximately 57.2 cu.m. of storage during the 100 year storm event.

Area A-4 (Proposed Overhead Covered Link)

Roof top storage provided by eleven (11) roof drains which control the discharge rate to 1.0 L/s per drain, for a total controlled release rate of 11 L/s, and providing approximately 6.8 cu.m. of storage during the 100 year storm event.

Area A-5 (Proposed Multilevel Parking Structure)

Construction of an oversized pipe located below grade to provide an approximate storage of 100 cu.m and the installation of a flow restricting orifice located in the outlet pipe from catchbasin (CBMH 1) located immediately downstream of the oversized pipe, controlling the release rate to 24.8 L/s during the 100 year storm event.

Area A-6 (Proposed Surface Vehicle Parking Lot, area north-east of Cancer Centre)

Construction of an oversized pipe located below grade together with surface ponding to provide an approximate storage of 118.1 cu.m and the installation of a flow restricting orifice located in the outlet pipe from catchbasin (CBMH 10) located immediately downstream of the oversized pipe, controlling the release rate to 28.3 L/s during the 100 year storm event.

Area A-7 (Proposed Surface Vehicle Parking Lot, area north-west of Cancer Centre)

Construction of an oversized pipe located below grade together with surface ponding to provide an approximate storage of 98.0 cu.m and the installation of a flow restricting orifice located in the outlet pipe from catchbasin (MH 11) located immediately downstream of the oversized pipe, controlling the release rate to 8.0 L/s during the 100 year storm event.

Oil/Grit Interceptor

An oil/grit interceptor (Stormceptor STC 9000, located north of the multilevel parking structure) sized to provide a normal level of water quality protection, having a sediment capacity of 32.98 cu.m., an oil capacity of 10.56 cu.m., a total holding capacity of 44.36 cu.m., discharging to the existing 900 mm diameter storm sewer and drainage ditch, eventually discharging to Graham Creek,

together with any storm and sanitary sewer removals as noted in the submitted documents, including erosion/sedimentation control measures during construction and all other controls and appurtenances essential for the proper operation of the aforementioned Works;

all in accordance with the following submitted supporting documents:

1. Application for Approval of Municipal and Private Sewage Works dated March 8, 2009 submitted by Peter Thompson, B.ARCH., MBA, Director, Planning & Facility Redevelopment, Queensway Carleton Hospital and forwarded by Guy Bourgon, P. Eng., City of Ottawa via letter dated March 27, 2008 to the Ministry.

2. Report entitled 'Queensway Carleton Hospital, Overall Campus - Cancer Centre Expansion, Stormwater Management Report' dated March 10, 2008 prepared for the Queensway Carleton Hospital by Novatech Engineering Consultants Ltd.

Existing Works approved in December 2007

A **stormwater management** system on Queensway-Carleton Hospital property, to control the 100 year storm event to the lesser of the existing or 5 year post development storm event levels as per the Rational Method (the maximum allowable release flowrate is 6.5 L/s), with rooftop storage for expansion of the Operation Room building having an area of about 0.4 ha, and the installation of a post indicator valve for the related Operation Room building loading dock area's storm sewer system, comprising of the following:

Storage Component (for the 100 year storm event)

- **roof top storage** of approximately 7.12 cubic metres for the expanded Operation Room roof top;

Flow Control

- eight (8) **roof drains,** releasing a total maximum flowrate of about 6.5 L/s; for an average depth of about 18 mm for the expanded Operation Room roof top; and

- **post indicator valve** installed about 30 metres north-westerly of the loading dock catchbasin, in the existing outlet storm sewer (300 mm diameter), as part of the Queensway-Carleton Hospital's spill contingency plan, titled 'Chemical Spill and Containment' for the Operation Room Building's loading dock area;

as part of the Queensway-Carleton Hospital Building's expansion project, in the City of Ottawa;

all in accordance with the application dated November 28, 2006 and received on December 5, 2006, signed by R.P. Thompson, Director of Planning and Redevelopment, Queensway-Carleton Hospital, and all supporting documentation and information, including final plans and specifications prepared by The Walter Fedy Partnership.

Existing Works Previously Constructed

1. Storage provided within parking lots and the installation of flow restricting orifice(s) located in the outlet pipe from catchbasin to control the release rate during the 100 year storm event as event as follows:

Drainage Area	Area (ha)	Post-Development Flow 100 year event	Storage Volume Provided
Area A1	0.75	54 L/s	150 cu.m.
Area A2-A	0.29	21 L/s	54 cu.m.
Area A2-B	0.49	36 L/s	94 cu.m.
Area PL2a	0.16	11 L/s	20 cu.m.
Area PL3	0.23	24 L/s	24 cu.m.

2. Roof top storage provided by roof drains which control the discharge rate during the 100 year storm event as follows:

Drainage Area	Area (ha)	Post-Development Flow 100 year event	Storage Volume Provided
Area R1	0.07	3.9 L/s	10 cu.m.
Area R2	0.36	21.1 L/s	51 cu.m.
Area R3	0.40	6.5 L/s	7.1 cu.m.

For the purpose of this Certificate of Approval and the terms and conditions specified below, the following definitions apply:

"Certificate" means this entire certificate of approval document, issued in accordance with Section 53 of the Ontario Water Resources Act, and includes any schedules;

"Director" means any *Ministry* employee appointed by the Minister pursuant to section 5 of the Ontario Water Resources Act;

"District Manager" means the District Manager of the Ottawa District Office of the Ministry;

"Ministry" means the Ontario Ministry of the Environment;

"Owner" means Queensway-Carleton Hospital and includes its successors and assignees;

"Works" means the sewage works described in the Owner's application, this Certificate and in the supporting documentation referred to herein, to the extent approved by this Certificate.

You are hereby notified that this approval is issued to you subject to the terms and conditions outlined below:

TERMS AND CONDITIONS

1. GENERAL CONDITIONS

1.1 The Owner shall ensure that any person authorized to carry out work on or operate any aspect of the Works is notified of this Certificate and the conditions herein and shall take all reasonable measures to ensure any such person complies with the same.

1.2 Except as otherwise provided by these Conditions, the Owner shall design, build, install, operate and maintain the Works in accordance with the description given in this Certificate, the application for approval of the Works and the submitted supporting documents and plans and specifications as listed in this Certificate.

1.3 Where there is a conflict between a provision of any submitted document referred to in this Certificate and the Conditions of this Certificate, the Conditions in this Certificate shall take precedence, and where there is a conflict between the listed submitted documents, the document bearing the most recent date shall prevail.

1.4 Where there is a conflict between the listed submitted documents, and the application, the application shall take precedence unless it is clear that the purpose of the document was to amend the application.

1.5 The requirements of this Certificate are severable. If any requirement of this Certificate, or the application of any requirement of this Certificate to any circumstance, is held invalid or unenforceable, the application of such requirement to other circumstances and the remainder of this Certificate shall not be affected thereby.

2. EXPIRY OF APPROVAL

The approval issued by this Certificate will cease to apply to those parts of the Works which have not been constructed within **five (5) years** of the date of this Certificate.

3. CHANGE OF OWNER

The Owner shall notify the District Manager and the Director, in writing, of any of the following changes within **thirty (30) days** of the change occurring:

(a) change of Owner;

(b) change of address of the Owner;

(c) change of partners where the Owner is or at any time becomes a partnership, and a copy of the most recent declaration filed under the Business Names Act, R.S.O. 1990, c.B17 shall be included in the notification to the District Manager; and

(d) change of name of the corporation where the Owner is or at any time becomes a corporation, and a copy of the most current information filed under the Corporations Information Act, R.S.O. 1990, c. C39 shall be included in the notification to the District Manager.

4. OPERATION AND MAINTENANCE

4.1 The Owner shall ensure that the design storage volumes are maintained at all times.

4.2 The Owner shall inspect the Works regularly and, if necessary, clean and maintain the Works to prevent the excessive build-up of sediments and/or vegetation.

4.3 The Owner shall maintain a logbook to record the results of these inspections and any cleaning and maintenance operations undertaken, and shall keep the logbook at the site for inspection by the Ministry. The logbook shall include the following:

(a) the name of the Works; and
(b) the date and results of each inspection, maintenance and cleaning, including an estimate of the quantity of any materials removed.

4.4 The Owner shall design, construct and operate the oil/grit interceptor with the objective that no visible oil sheens occur in the effluent discharged from the oil/grit interceptor.

4.5 The Owner shall carry out and maintain an annual inspection and maintenance program on the operation of the oil/grit interceptor in accordance with the manufacturer's recommendation.

5. RECORD KEEPING

The Owner shall retain for a minimum of **five (5) years** from the date of their creation, all records and information related to or resulting from the operation and maintenance activities required by this Certificate.

The reasons for the imposition of these terms and conditions are as follows:

1. Condition No.1 is imposed to ensure that the Works are built and operated in the manner in which they were described for review and upon which approval was granted. This condition is also included to emphasize the precedence of Conditions in the Certificate and the practice that the Approval is based on the most current document, if several conflicting documents are submitted for review. The condition also advises the Owners their responsibility to notify any person they authorized to carry out work pursuant to this Certificate the existence of this Certificate.

2. Condition 2 is included to ensure that, when the Works are constructed, the Works will meet the standards that apply at the time of construction to ensure the ongoing protection of the environment.

3. Condition 3 is included to ensure that the Ministry records are kept accurate and current with respect to approved Works and to ensure that subsequent owners of the Works are made aware of the Certificate and continue to operate the Works in compliance with it.

4. Condition 4 is included to require that the Works be properly operated and maintained such that the

environment is protected and to ensure that the oil/grit interceptor is operated and maintained without any adverse impact on the environment.

5. Condition 5 is included to require that all records are retained for a sufficient time period to adequately evaluate the long-term operation and maintenance of the Works.

This Certificate of Approval revokes and replaces Certificate(s) of Approval No. 7898-7DGJUK issued on April 18, 2008

In accordance with Section 100 of the Ontario Water Resources Act, R.S.O. 1990, Chapter 0.40, as amended, you may by written notice served upon me and the Environmental Review Tribunal within 15 days after receipt of this Notice, require a hearing by the Tribunal. Section 101 of the Ontario Water Resources Act , R.S.O. 1990, Chapter 0.40, provides that the Notice requiring the hearing shall state:

1. The portions of the approval or each term or condition in the approval in respect of which the hearing is required, and;
2. The grounds on which you intend to rely at the hearing in relation to each portion appealed.

The Notice should also include:

3. The name of the appellant;
4. The address of the appellant;
5. The Certificate of Approval number;
6. The date of the Certificate of Approval;
7. The name of the Director;
8. The municipality within which the works are located;

And the Notice should be signed and dated by the appellant.

This Notice must be served upon:

The Secretary*
Environmental Review Tribunal
655 Bay Street, 15th Floor
Toronto, Ontario
M5G 1E5

AND

The Director
Section 53, *Ontario Water Resources Act*
Ministry of the Environment
2 St. Clair Avenue West, Floor 12A
Toronto, Ontario
M4V 1L5

*** Further information on the Environmental Review Tribunal's requirements for an appeal can be obtained directly from the Tribunal at: Tel: (416) 314-4600, Fax: (416) 314-4506 or www.ert.gov.on.ca**

The above noted sewage works are approved under Section 53 of the Ontario Water Resources Act.

DATED AT TORONTO this 30th day of November, 2010

THIS CERTIFICATE WAS MAILED
ON Dec. 2, 2010
(Signed)

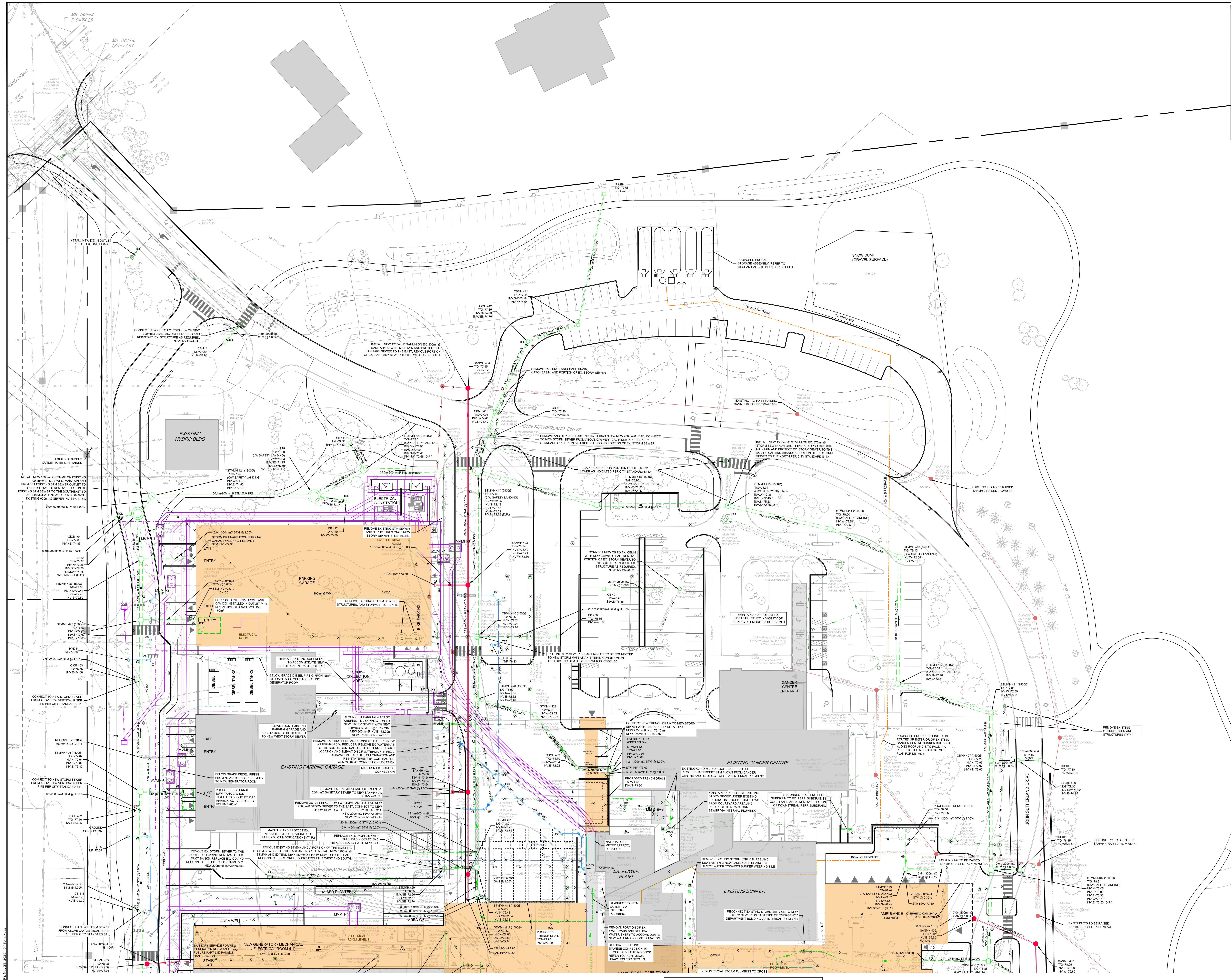
Ian Parrott, P.Eng.
Director
Section 53, *Ontario Water Resources Act*

DC/

c: District Manager, MOE Ottawa
François Thauvette, P.Eng., Novatech Engineering Consultants Ltd. √

APPENDIX F

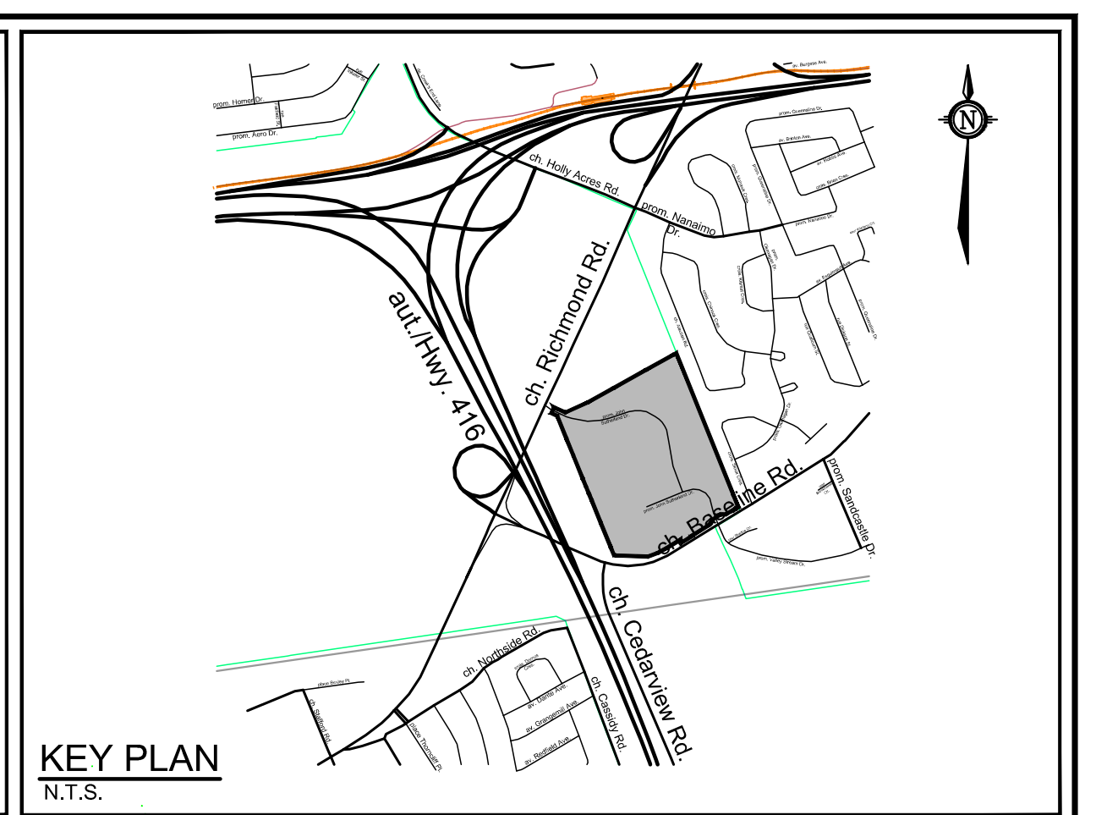
Engineering Plans



REFER TO PLAN 123089-GP2 FOR CONTINUATION

REFER TO PLAN 123089-NDT FOR ADDITIONAL NOTES

NORTH


KEY PLAN
N.T.S.

LEGEND

- PROPERTY LINE
- EASEMENT BOUNDARY
- PROPOSED SANITARY MANHOLE & SEWER WITH DIRECTION OF FLOW
- PROPOSED STORM MANHOLE & SEWER WITH DIRECTION OF FLOW
- PROPOSED CATCHBASIN AND LEAD
- PROPOSED CATCHBASIN MANHOLE
- PROPOSED STORM OGS UNIT
- ICD — PROPOSED INLET CONTROL DEVICE
- PROPOSED WATERMAIN / WATER SERVICE
- PROPOSED VALVE & VALVE BOX
- PROPOSED HYDRANT C/W VALVE & LEAD
- PROPOSED WATERMAIN BEND & THRUST BLOCK
- RED — PROPOSED WATERMAIN REDIUCER
- FDC — PROPOSED FIRE DEPARTMENT CONNECTION
- Ⓜ ⓇⓂ — PROPOSED WATER METER AND REMOTE METER
- X — REMOVALS
- [— PROPOSED CAP
- (D.P.) — PROPOSED DROP PIPE INVERT
- ⑳ — SEWER / HYDRANT LEAD CROSSING IDENTIFIER
- THERMAL INSULATION FOR SHALLOW SEWERS
- PROPOSED PROPANE ALIGNMENT
- PROPOSED ELECTRICAL ALIGNMENT
- PROPOSED ELECTRICAL GROUND CONDUCTOR
- PROPOSED OXYGEN ALIGNMENT
- PROPOSED DIESEL ALIGNMENT
- *EXISTING SANITARY MANHOLE & SEWER WITH DIRECTION OF FLOW*
- *EXISTING STORM MANHOLE & SEWER WITH DIRECTION OF FLOW*
- *EXISTING CATCHBASIN AND LEAD*
- *EXISTING CATCHBASIN MANHOLE*
- *EXISTING STORM OGS UNIT*
- *EXISTING LANDSCAPE DRAIN*
- *EXISTING WATERMAIN / WATER SERVICE*
- *EXISTING VALVE & VALVE BOX*
- *EXISTING HYDRANT C/W VALVE & LEAD*
- *EXISTING VEGETATION (TREES)*
- *EXISTING LIGHT STANDARD*
- GAS — *EXISTING GAS LINE*
- H-UG — *EXISTING HYDRO UNDERGROUND WIRES*
- OH — *EXISTING OVERHEAD WIRES*
- PROPOSED PART 4 EXPANSION BUILDING
- *EXISTING BUILDING*

BENCHMARK NOTES:

1. ELEVATIONS SHOWN ARE REFERRED TO THE CANADIAN GEODETIC VERTICAL DATUM (CGVD-1928:1978).
2. IT IS THE RESPONSIBILITY OF THE USER OF THIS INFORMATION TO VERIFY THAT THE JOB BENCHMARK HAS NOT BEEN ALTERED OR DISTURBED AND THAT IT'S RELATIVE ELEVATION AND DESCRIPTION AGREES WITH THE INFORMATION SHOWN ON THIS DRAWING.
3. BENCHMARK WAS PROVIDED ON THE PLAN OF SURVEY OF PART OF LOT 16, CONCESSION 2 (O.F.), GEOGRAPHIC TOWNSHIP OF NEPEAN, CITY OF OTTAWA, SURVEYED BY STANTEC GEOMATICS LTD., DATED NOVEMBER 5, 2024.

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.

Queensway Carleton Hospital

No.	REVISION	DATE	BY
1.	ISSUED FOR SITE PLAN CONTROL APPROVAL	NOV 28/25	FST

SCALE
1:400
1:400
0 4 8 12 16

DESIGN	KD
CHECKED	FST
DRAWN	KD
CHECKED	FST
APPROVED	FST

FOR REVIEW ONLY

LICENSED PROFESSIONAL ENGINEER
F.S. THAUVETTE
100041399
November 28, 2025
PROVINCE OF ONTARIO

NOVATECH
Engineers, Planners & Landscape Architects
Suite 200, 240 Michael Cowpland Drive
Ottawa, Ontario, Canada K2M 1P6
Telephone (613) 254-9643
Facsimile (613) 254-5867
Website www.novatech-eng.com

LOCATION
CITY OF OTTAWA
QUEENSWAY CARLETON HOSPITAL

DRAWING NAME
GENERAL PLAN OF SERVICES
PART 4 EXPANSION

PROJECT No. 123089
REV REV #1
DRAWING No. 123089-GP1

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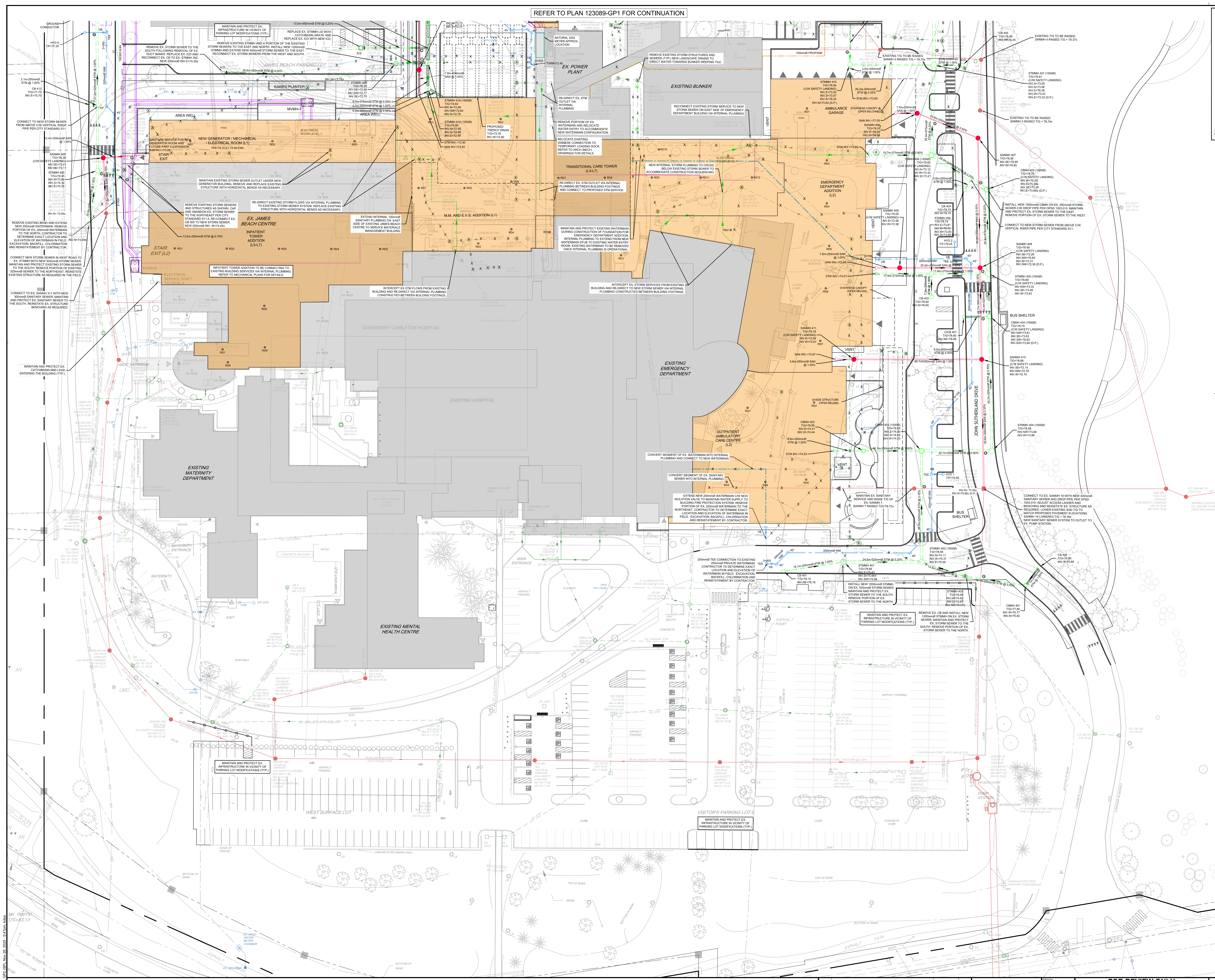
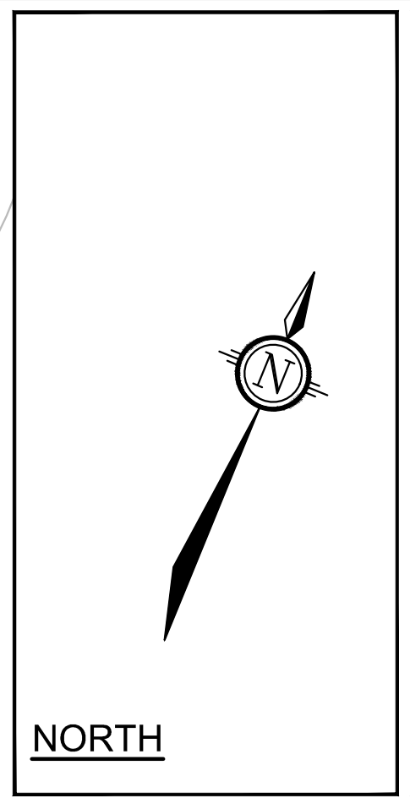
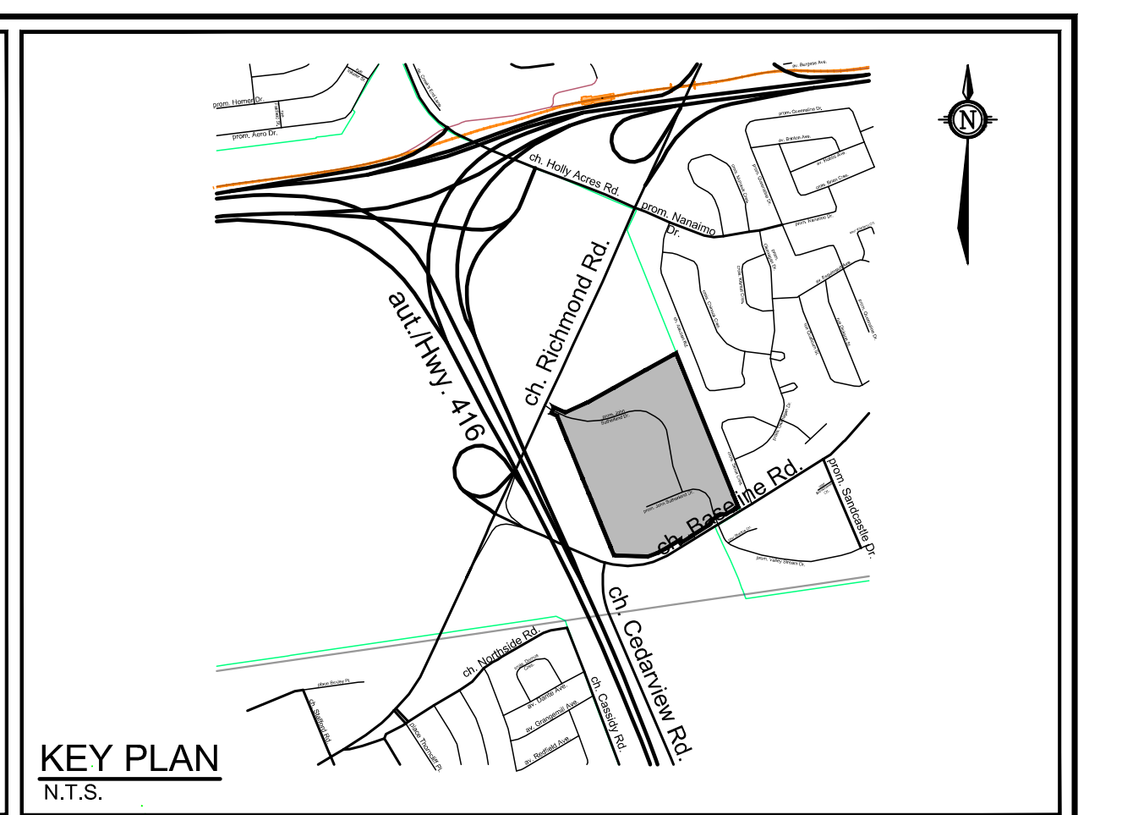
REFER TO PLAN 123089-GP1 FOR CONTINUATION







LEGEND

- PROPERTY LINE
- EASEMENT BOUNDARY
- PROPOSED SANITARY MANHOLE & SEWER WITH DIRECTION OF FLOW
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3. BENCHMARK WAS PROVIDED ON THE PLAN OF SURVEY OF PART OF LOT 16, CONCESSION 2 (O.F.), GEOGRAPHIC TOWNSHIP OF NEPEAN, CITY OF OTTAWA, SURVEYED BY STANTEC GEOMATICS LTD., DATED NOVEMBER 5, 2024.

REFER TO PLAN 123089-NDT FOR ADDITIONAL NOTES

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Queensway Carleton Hospital

No.	REVISION	DATE	BY
1.	ISSUED FOR SITE PLAN CONTROL APPROVAL	NOV 28/25	FST

SCALE
1:400
1:400
0 4 8 12 16

DESIGN KD
CHECKED FST
DRAWN KD
CHECKED FST
APPROVED FST

FOR REVIEW ONLY

LICENSED PROFESSIONAL ENGINEER
F.S. THAUVETTE
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November 28, 2025
PROVINCE OF ONTARIO

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Website www.novatech-eng.com

LOCATION
CITY OF OTTAWA
QUEENSWAY CARLETON HOSPITAL

DRAWING NAME
GENERAL PLAN OF SERVICES
PART 4 EXPANSION

PROJECT No.
123089
REV
REV #1
DRAWING No.
123089-GP2

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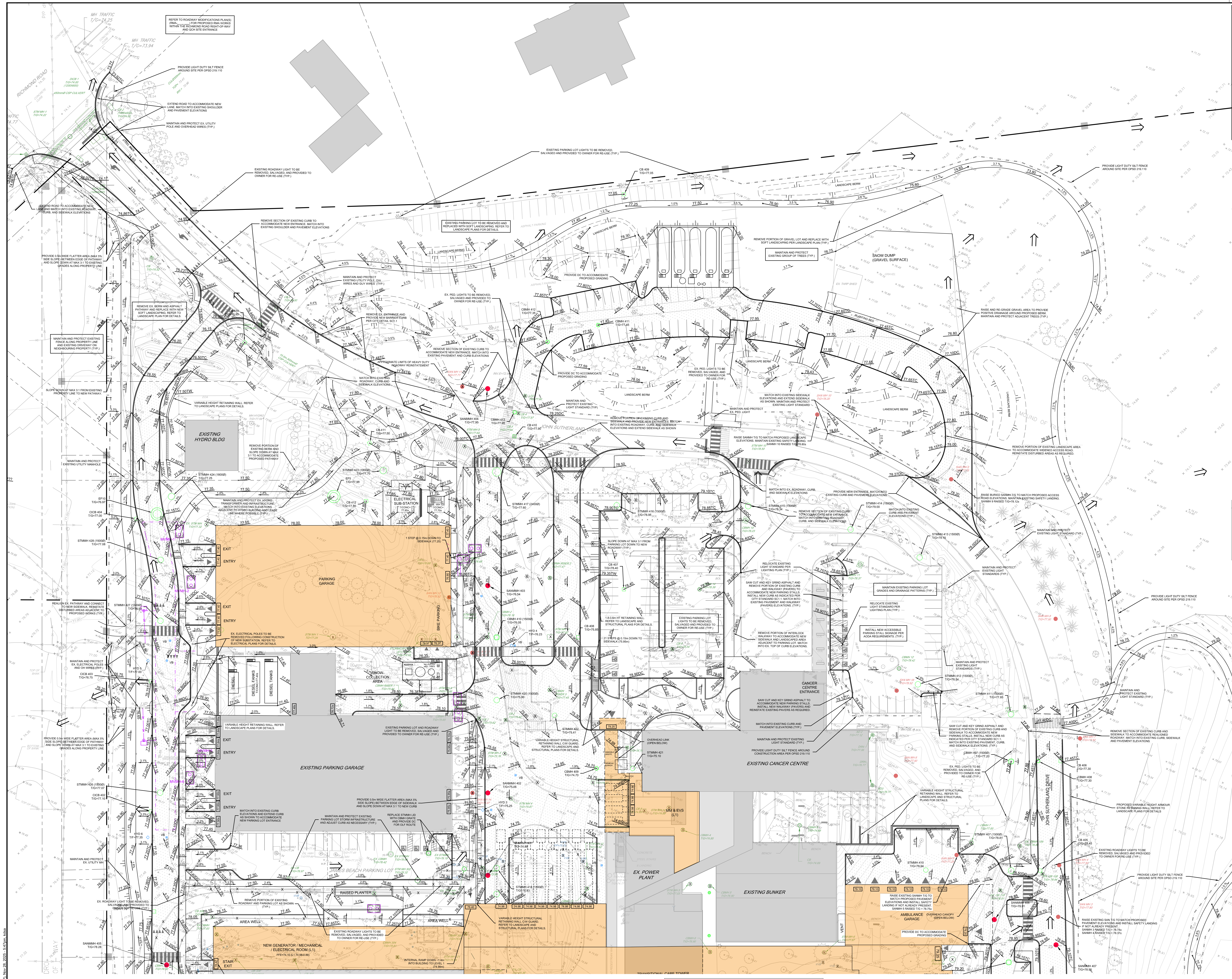
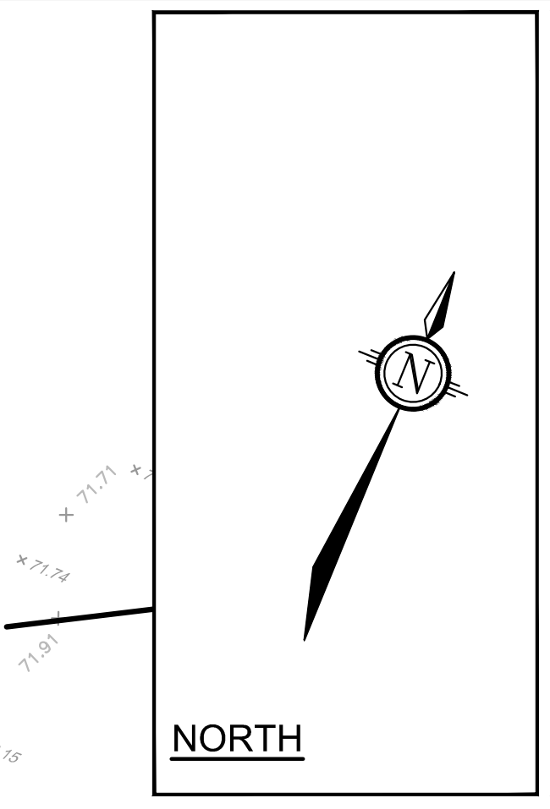
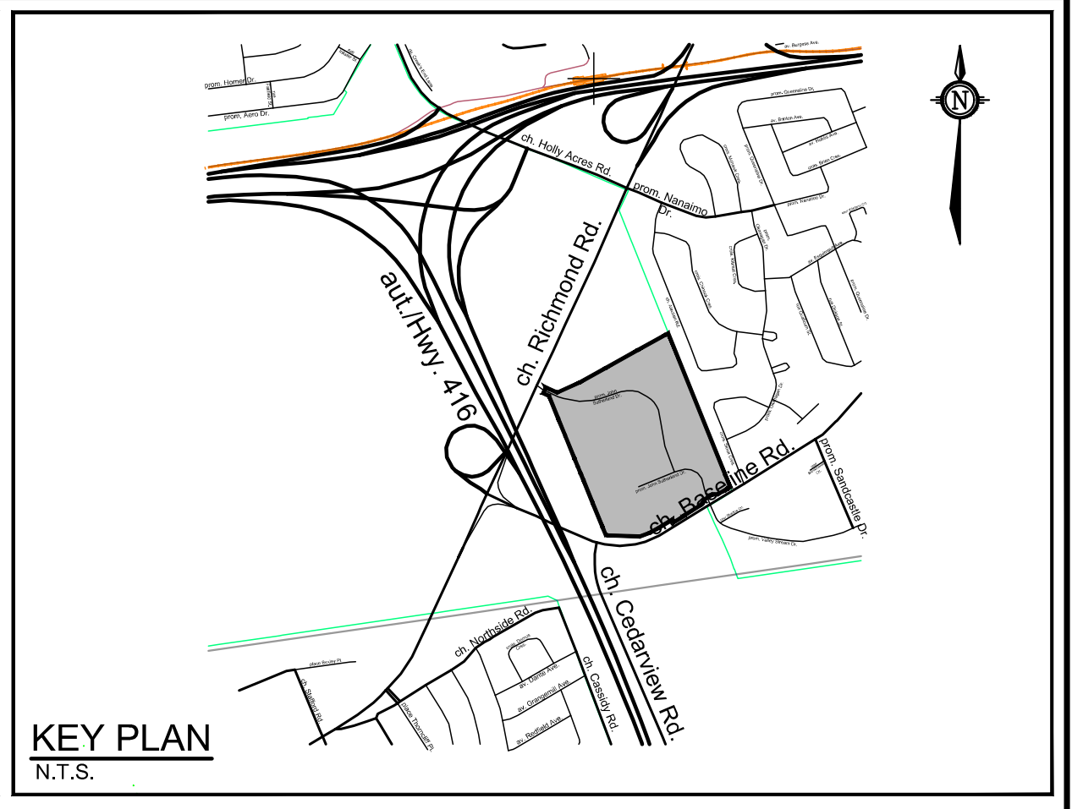


REFER TO PLAN 123089-GR2 FOR CONTINUATION





LEGEND

— - - — - - —	PROPERTY LINE
78.95 / *78.95*	PROPOSED ELEVATION / *EXISTING ELEVATION*
78.95TC	PROPOSED TOP OF CURB ELEVATION
78.95(s)	PROPOSED SWALE ELEVATION
78.95(DC)	PROPOSED DEPRESSED CURB ELEVATION
79.25	PROPOSED ENTRANCE/EXIT ELEVATION
	MAXIMUM 3:1 SIDESLOPE
3.0 % →	GRADE AND DIRECTION
⇒	EMERGENCY OVERLAND FLOW ROUTE
—□—□—□—	PROPOSED CHAIN LINK FENCE
═	PROPOSED CONCRETE CURB
DC	PROPOSED DEPRESSED CONCRETE CURB
▭	PROPOSED ARMOUR STONE RETAINING WALL
▨	PROPOSED TWSI
🔴	PROPOSED SANITARY MANHOLE
▣	PROPOSED CATCHBASIN
◎	PROPOSED CATCHBASIN MANHOLE
○	PROPOSED STORM MANHOLE
◎	PROPOSED STORM OGS UNIT
⊗	PROPOSED VALVE & VALVE BOX
⌖	PROPOSED HYDRANT
X	REMOVALS
🟧	PROPOSED PART 4 EXPANSION BUILDING

× 78.85 × 81.38	*EXISTING ELEVATION*
—	*EXISTING OVERHEAD WIRES*
═	*EXISTING CONCRETE CURB*
□- - -	*EXISTING CATCHBASIN AND LEAD*
◎	*EXISTING CATCHBASIN MANHOLE*
◎	*EXISTING STORM OGS UNIT*
⊕	*EXISTING STORM DRAIN*
⊗	*EXISTING VALVE & VALVE BOX*
⌖—⊗—	*EXISTING HYDRANT C/W VALVE & LEAD*
●	*EXISTING SANITARY MANHOLE*
✳	*EXISTING VEGETATION (TREES)*
☼	*EXISTING LIGHT STANDARD*
⊥	*EXISTING SIGN*
○	*EXISTING HYDRO POLE*
⬜	*EXISTING BUILDING*

BENCHMARK NOTES:

1. ELEVATIONS SHOWN ARE GEODETIC REFERENCING THE CGVD28 VERTICAL DATUM AND WERE DERIVED THROUGH CANNET REAL-TIME NETWORK OBSERVATIONS.
2. IT IS THE RESPONSIBILITY OF THE USER OF THIS INFORMATION TO VERIFY THAT THE SITE BENCHMARK HAS NOT BEEN ALTERED OR DISTURBED AND THAT ITS RELATIVE ELEVATION AND DESCRIPTION AGREES WITH THE INFORMATION SHOWN ON THIS DRAWING.
3. BENCHMARK WAS PROVIDED ON PLAN OF SURVEY OF PART OF LOT 16, CONCESSION 2, GEOGRAPHIC TOWNSHIP OF NEPEAN, SURVEYED BY STANTEC GEOMATICS LTD., DATED NOVEMBER 5, 2024.

Erosion and Sediment Control Responsibilities:

				During Construction			After Construction Prior to Final Acceptance		After Final Acceptance
	ESC Measure	Symbol	Specification	Installation Responsibility	Inspection/Maintenance Responsibility	Inspection Frequency	Approval to Remove	Removal Responsibility	Inspection/Maintenance Responsibility
Temporary Measures	Silt Fence	— · · — · · —	OPSD 219.110	Developer's Contractor	Developer's Contractor	Weekly (as a minimum)	Consultant	Developer's Contractor	N/A
	Filter Fabric	Location as Indicated in ESC Note #3	Erosion and Sediment Control Notes	Developer's Contractor	Developer's Contractor	Weekly (as a minimum)	Consultant	Developer's Contractor	N/A
	Mud Mat	MM	Drawing Details	Developer's Contractor	Developer's Contractor	Weekly (as a minimum)	Developer's Contractor	Developer's Contractor	N/A
	Dust Control	Location as Required Around Site	Erosion and Sediment Control Notes	Developer's Contractor	Developer's Contractor	Weekly (as a minimum)	Consultant	Developer's Contractor	N/A
	Stabilized Material Stockpiling	Location as Required by Contractor	Erosion and Sediment Control Notes	Developer's Contractor	Developer's Contractor	Weekly (as a minimum)	Developer's Contractor	Developer's Contractor	N/A
	Sediment Basin (for flows being pumped out of excavations)	Location as Required by Contractor	- - -	Developer's Contractor	Developer's Contractor	After Every Rainstorm	Developer's Contractor	Developer's Contractor	N/A

REFER TO PLAN 123089-NDT FOR ADDITIONAL NOTES, DETAILS AND TABLES

NOTE:
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Queensway Carleton Hospital

No.	REVISION	DATE	BY
1.	ISSUED FOR SITE PLAN CONTROL APPROVAL	NOV 28/25	FST

SCALE
1:400
1:400
0 4 8 12 16

DESIGN KD
CHECKED FST
DRAWN KD
CHECKED FST
APPROVED FST

FOR REVIEW ONLY

LICENSED PROFESSIONAL ENGINEER
F.S. THAUVETTE
100041399
November 28, 2025
PROVINCE OF ONTARIO

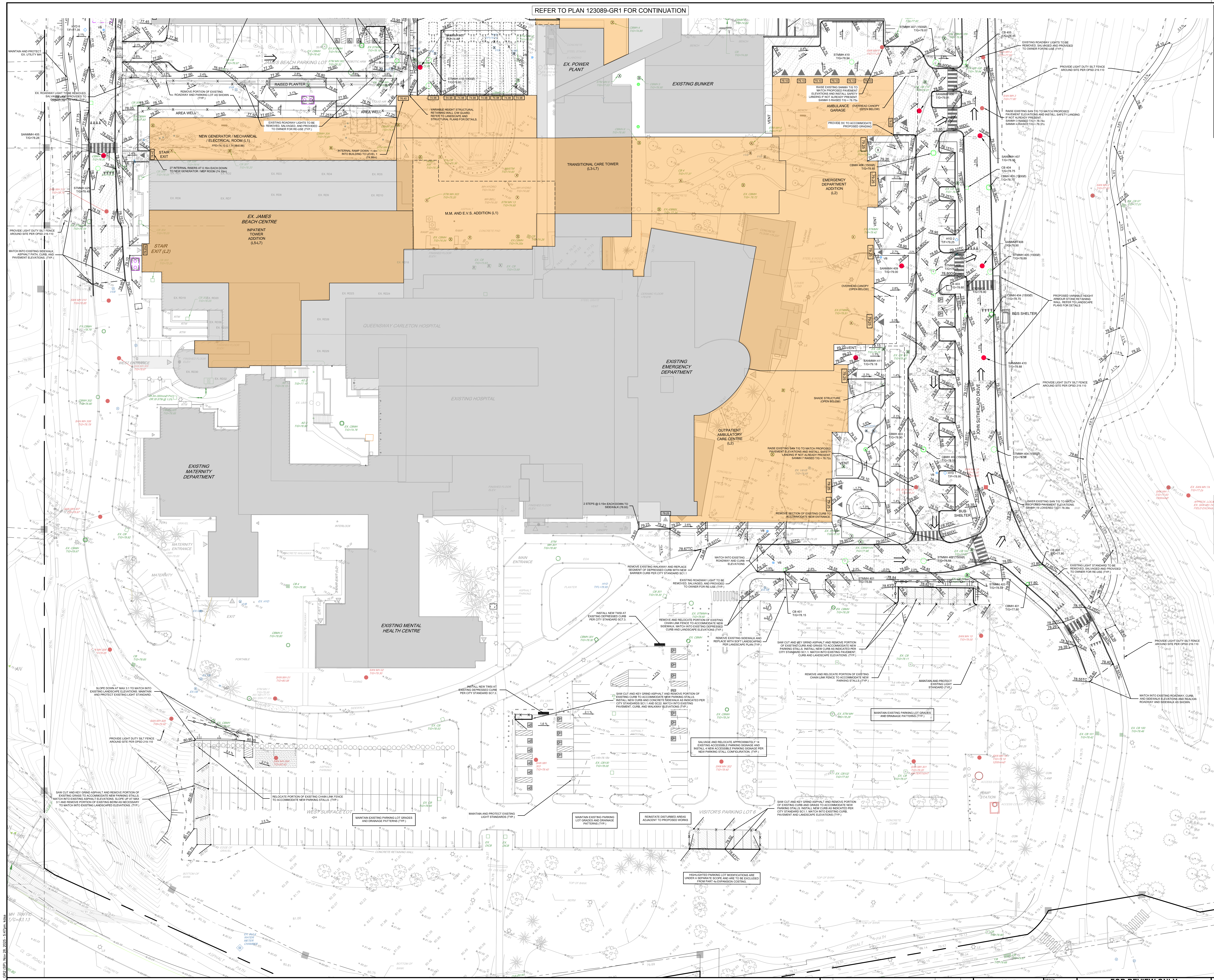
NOVATECH
Engineers, Planners & Landscape Architects
Suite 200, 240 Michael Cowpland Drive
Ottawa, Ontario, Canada K2M 1P6
Telephone (613) 254-9643
Facsimile (613) 254-5867
Website www.novatech-eng.com

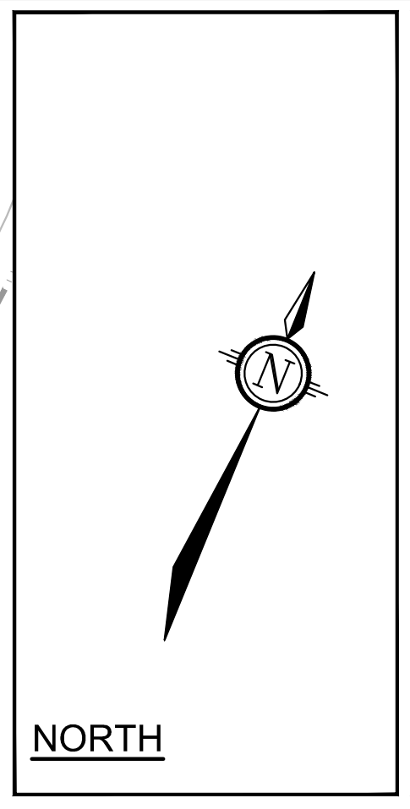
LOCATION
CITY OF OTTAWA
QUEENSWAY CARLETON HOSPITAL

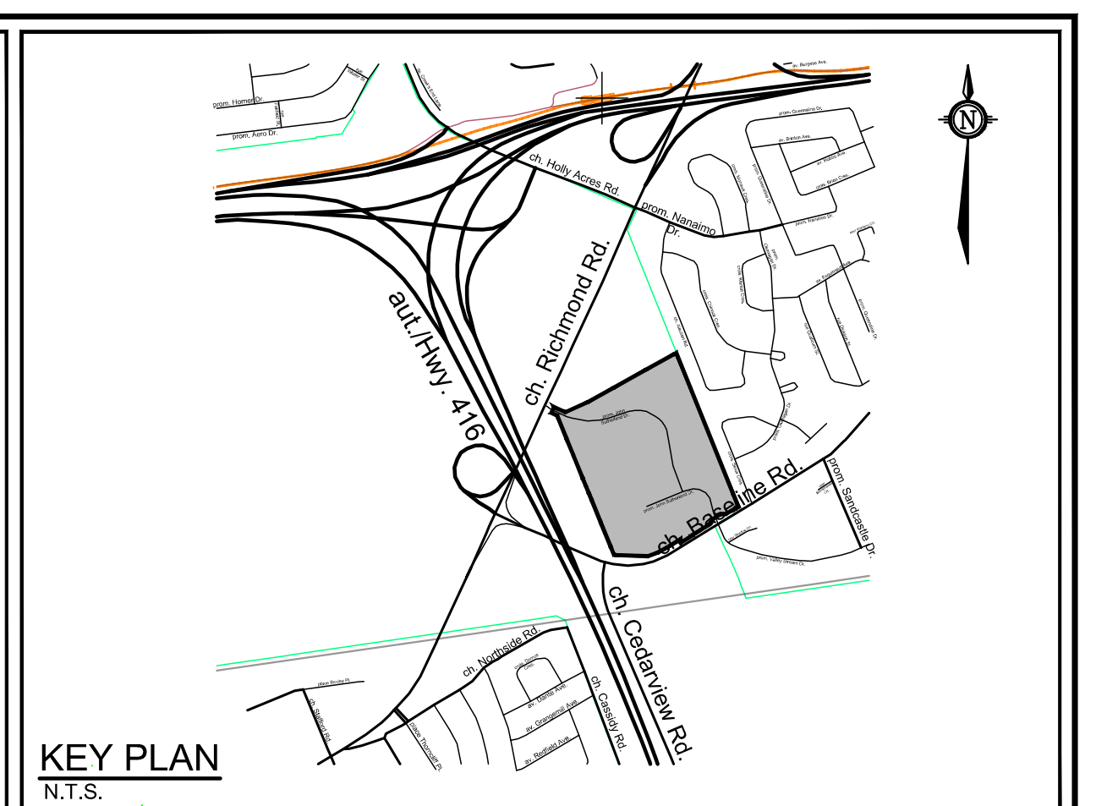
DRAWING NAME
GRADING AND EROSION & SEDIMENT CONTROL PLAN
PART 4 EXPANSION

PROJECT No. 123089
REV REV #1
DRAWING No. 123089-GR1

REFER TO PLAN 123089-GR1 FOR CONTINUATION







LEGEND

▬ ▬ ▬	PROPERTY LINE
78.95	PROPOSED ELEVATION
78.95	EXISTING ELEVATION
78.95TC	PROPOSED TOP OF CURB ELEVATION
78.95(s)	PROPOSED SWALE ELEVATION
78.95(DC)	PROPOSED DEPRESSED CURB ELEVATION
79.25	PROPOSED ENTRANCE/EXIT ELEVATION
	MAXIMUM 3:1 SIDESLOPE
3.0 %	GRADE AND DIRECTION
⇒	EMERGENCY OVERLAND FLOW ROUTE
	PROPOSED CHAIN LINK FENCE
	PROPOSED CONCRETE CURB
DC	PROPOSED DEPRESSED CONCRETE CURB
	PROPOSED ARMOUR STONE RETAINING WALL
	PROPOSED TWSI
●	PROPOSED SANITARY MANHOLE
▣	PROPOSED CATCHBASIN
	PROPOSED CATCHBASIN MANHOLE
○	PROPOSED STORM MANHOLE
◎	PROPOSED STORM OGS UNIT
⊗	PROPOSED VALVE & VALVE BOX
	PROPOSED HYDRANT
X	REMOVALS
🟧	PROPOSED PART 4 EXPANSION BUILDING
× 78.85 × 81.38	EXISTING ELEVATION
	EXISTING OVERHEAD WIRES
	EXISTING CONCRETE CURB
	EXISTING CATCHBASIN AND LEAD
	EXISTING CATCHBASIN MANHOLE
◎	EXISTING STORM OGS UNIT
	EXISTING STORM DRAIN
⊗	EXISTING VALVE & VALVE BOX
	EXISTING HYDRANT C/W VALVE & LEAD
●	EXISTING SANITARY MANHOLE
	EXISTING VEGETATION (TREES)
	EXISTING LIGHT STANDARD
	EXISTING SIGN
○	EXISTING HYDRO POLE
⬜	EXISTING BUILDING

BENCHMARK NOTES:

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	Filter Fabric	Location as Indicated in ESC Note #3	Erosion and Sediment Control Notes	Developer's Contractor	Developer's Contractor	Weekly (as a minimum)	Consultant	Developer's Contractor	N/A
	Mud Mat	MM	Drawing Details	Developer's Contractor	Developer's Contractor	Weekly (as a minimum)	Developer's Contractor	Developer's Contractor	N/A
	Dust Control	Location as Required Around Site	Erosion and Sediment Control Notes	Developer's Contractor	Developer's Contractor	Weekly (as a minimum)	Consultant	Developer's Contractor	N/A
	Stabilized Material Stockpiling	Location as Required by Contractor	Erosion and Sediment Control Notes	Developer's Contractor	Developer's Contractor	Weekly (as a minimum)	Developer's Contractor	Developer's Contractor	N/A
	Sediment Basin (for flows being pumped out of excavations)	Location as Required by Contractor	- - -	Developer's Contractor	Developer's Contractor	After Every Rainstorm	Developer's Contractor	Developer's Contractor	N/A

REFER TO PLAN 123089-NDT FOR ADDITIONAL NOTES, DETAILS AND TABLES

NOTE:
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Queensway Carleton Hospital

No.	REVISION	DATE	BY
1.	ISSUED FOR SITE PLAN CONTROL APPROVAL	NOV 28/25	FST

SCALE
1:400
1:400
0 4 8 12 16

DESIGN	KD
CHECKED	FST
DRAWN	KD
CHECKED	FST
APPROVED	FST

FOR REVIEW ONLY

F.S. THAUVETTE
100041399
November 28, 2025

NOVATECH
Engineers, Planners & Landscape Architects
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Ottawa, Ontario, Canada K2M 1P6
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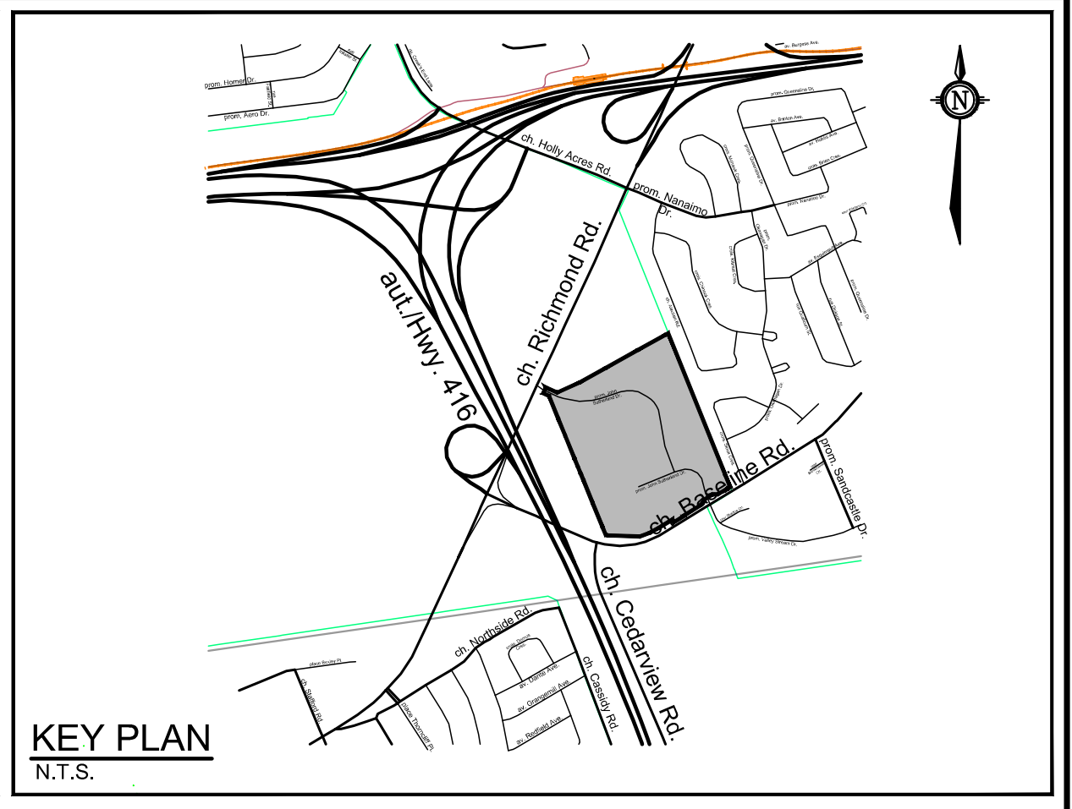
LOCATION
CITY OF OTTAWA
QUEENSWAY CARLETON HOSPITAL

DRAWING NAME
GRADING AND EROSION & SEDIMENT CONTROL PLAN PART 4 EXPANSION

PROJECT No. 123089
REV REV #1
DRAWING No. 123089-GR2

PLANA0.DWG - 1189mmx841mm

NORTH



KEY PLAN
N.T.S.

LEGEND

▬ ▬ ▬	DRAINAGE AREA LIMITS
B101	POST-DEVELOPMENT AREA ID
0.550	POST-DEVELOPMENT DRAINAGE AREA (ha)
0.48	1:5 YEAR WEIGHTED RUNOFF COEFICIENT
⊖ ═►═ ═	PROPOSED STORM MANHOLE & SEWER WITH DIRECTION OF FLOW
□═ ═	PROPOSED CATCHBASIN AND LEAD
▢	PROPOSED CATCHBASIN MANHOLE
◎	PROPOSED STORM OGS UNIT
° RD1	PROPOSED CONTROL FLOW ROOF DRAIN
⬚	LIMITS OF 100-YEAR ROOF PONDING
⇒	PROPOSED MAJOR OVERLAND FLOW ROUTE
X	REMOVALS
⊖ ► —	*EXISTING STORM MANHOLE & SEWER WITH DIRECTION OF FLOW*
□— —	*EXISTING CATCHBASIN AND LEAD*
▢	*EXISTING CATCHBASIN MANHOLE*
◎	*EXISTING STORM OGS UNIT*
⊕	*EXISTING LANDSCAPE DRAIN*
🟧	PROPOSED PART 4 EXPANSION BUILDING
⬜	*EXISTING BUILDING*

REFER TO PLAN 123089-NDT FOR ADDITIONAL NOTES, DETAILS AND TABLES

C:\Temp\AcPublish_25748\123089-SWM.dwg, SWM(POST), Nov 28, 2025 - 4:26pm, bnichols

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.

Queensway Carleton
Hospital

No.	REVISION	DATE	BY
1.	ISSUED FOR SITE PLAN CONTROL APPROVAL	NOV 28/25	FST

SCALE
1:750

1:750
0 10 20 30

DESIGN	FST/KD
CHECKED	FST
DRAWN	KD
CHECKED	FST
APPROVED	FST

FOR REVIEW ONLY

LICENSED PROFESSIONAL ENGINEER
Kallie Auld
K. J. AULD
100187063
Nov 28, 2025
PROVINCE OF ONTARIO

LICENSED PROFESSIONAL ENGINEER
F.S. THAUVETTE
100041399
November 28, 2025
PROVINCE OF ONTARIO

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LOCATION
CITY OF OTTAWA
QUEENSWAY CARLETON HOSPITAL

DRAWING NAME
STORMWATER
MANAGEMENT PLAN

PROJECT No.	123089
REV	REV #1
DRAWING No.	123089-SWM

PLANA0.DWG - 1189mmx841mm

GENERAL NOTES:

1. COORDINATE AND SCHEDULE ALL WORK WITH OTHER TRADES AND CONTRACTORS.
2. 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 THIS DRAWING.
3. OBTAIN ALL NECESSARY PERMITS AND APPROVALS FROM THE CITY OF OTTAWA BEFORE COMMENCING CONSTRUCTION.
4. BEFORE COMMENCING CONSTRUCTION OBTAIN AND PROVIDE PROOF OF COMPREHENSIVE, ALL RISK AND OPERATIONAL LIABILITY INSURANCE FOR $5,000,000.00. INSURANCE POLICY TO NAME OWNERS, ENGINEERS AND ARCHITECTS AS CO-INSURED.
5. COMPLETE ALL WORKS IN ACCORDANCE WITH THE MOST CURRENT CITY OF OTTAWA STANDARDS AND SPECIFICATIONS USING THE CURRENT GUIDELINES, BYLAWS AND STANDARDS INCLUDING MATERIALS OF CONSTRUCTION, DISINFECTION AND ALL RELEVANT REFERENCES TO OPSS, OPSD & AWWA GUIDELINES - ALL CURRENT VERSIONS AND 'AS AMENDED'.
6. RESTORE ALL DISTURBED AREAS ON-SITE AND OFF-SITE, INCLUDING TRENCHES AND SURFACES ON PUBLIC ROAD ALLOWANCES TO EXISTING CONDITIONS OR BETTER TO THE SATISFACTION OF THE CITY OF OTTAWA, OWNER, AND ENGINEER.
7. REMOVE FROM SITE ALL EXCESS EXCAVATED MATERIAL, ORGANIC MATERIAL AND DEBRIS UNLESS OTHERWISE INSTRUCTED BY ENGINEER. EXCAVATE AND REMOVE FROM SITE ANY CONTAMINATED MATERIAL. ALL CONTAMINATED MATERIAL SHALL BE DISPOSED OF AT A LICENSED LANDFILL FACILITY.
8. ALL ELEVATIONS ARE GEODETIC.
9. REFER TO THE GEOTECHNICAL REPORT (CA0033714.1722, DATED APRIL 10, 2025), PREPARED BY WSP CANADA INC., FOR SUBSURFACE CONDITIONS, CONSTRUCTION RECOMMENDATIONS, AND GEOTECHNICAL INSPECTION REQUIREMENTS. THE GEOTECHNICAL CONSULTANT SHALL REVIEW ON-SITE CONDITIONS AFTER EXCAVATION PRIOR TO PLACEMENT OF THE GRANULAR MATERIAL.
10. REFER TO ARCHITECT'S AND LANDSCAPE ARCHITECT'S DRAWINGS FOR BUILDING AND HARD SURFACED AREAS AND DIMENSIONS.
11. REFER TO THE 'QCH PART 4 SITE SERVICING REPORT' (R-2025-078) AND TO THE 'QCH PART 4 STORMWATER MANAGEMENT REPORT' (R-2025-085), PREPARED BY NOVATECH ENGINEERING CONSULTANTS LTD.
12. SAW CUT AND KEY GRIND ASPHALT AT ALL ROAD CUTS AND ASPHALT TIE IN POINTS AS PER CITY OF OTTAWA STANDARDS (R10).
13. PROVIDE LINE/PARKING PAINTING.
14. CONTRACTOR TO PROVIDE THE CONSULTANT WITH SERVICING PLANS OF 123089-GP1 & 123089-GP2 INDICATING ALL SERVICING AS-BUILT INFORMATION SHOWN ON THE SERVICING PLAN. AS-BUILT INFORMATION MUST INCLUDE: PIPE MATERIAL, SIZES, LENGTHS, SLOPES, INVERT AND T/G ELEVATIONS, STRUCTURE LOCATIONS, VALVE AND HYDRANT LOCATIONS, T/WM ELEVATIONS AND ANY ALIGNMENT CHANGES, ETC.

SEWER NOTES:

1. SUPPLY AND CONSTRUCT ALL SEWERS AND APPURTENANCES IN ACCORDANCE WITH THE MOST CURRENT CITY OF OTTAWA STANDARDS AND SPECIFICATIONS - ALL CURRENT VERSIONS AND 'AS AMENDED'.
2. SPECIFICATIONS:

ITEM	SPEC. No.	REFERENCE
CATCHBASIN (600x600mm)	705.010	OPSD
STORM / SANITARY MANHOLE (1200mmØ)	701.010	OPSD
STORM / CATCHBASIN MANHOLE (1500mmØ)	701.011	OPSD
STORM / CATCHBASIN MANHOLE (1800mmØ)	701.012	OPSD
CB, FRAME & COVER	S19.1	CITY OF OTTAWA
SANITARY MH FRAME & COVER	S24	CITY OF OTTAWA
STORM MH / CBMH FRAME & COVER	S24.1	CITY OF OTTAWA
WATERTIGHT MH FRAME AND COVER	401.030	OPSD
SEWER TRENCH	S6	CITY OF OTTAWA
SEWER CONNECTION - RIGID MAIN	S11	CITY OF OTTAWA
SEWER CONNECTION - FLEXIBLE MAIN	S11.1	CITY OF OTTAWA
INSULATION FOR SHALLOW SEWERS	S35	CITY OF OTTAWA
MH DROP STRUCTURES	1003.010	OPSD
SANITARY SEWER	PVC DR 35	
CATCHBASIN LEAD	PVC DR 35	
STORM SEWER (450mm DIAMETER AND UNDER)	PVC DR 35	
STORM SEWER (525mm DIAMETER AND OVER)	CONCRETE 65-D, 100-D, 140-D	

3. ALL STORM AND SANITARY SERVICE LATERALS SHALL BE EQUIPPED WITH A BACKFLOW PREVENTION DEVICE AS PER THE CITY OF OTTAWA STANDARD DETAILS S14 AND S14.1 / S14.2.
4. INSULATE ALL PIPES (SAN/STM) THAT HAVE LESS THAN 1.8m COVER WITH HI-40 INSULATION PER CITY OF OTTAWA STANDARD DETAIL S35. PROVIDE 150mm CLEARANCE BETWEEN PIPE AND INSULATION.
5. SERVICES ARE TO BE CONSTRUCTED TO 1.0m FROM FACE OF BUILDING AT A MINIMUM SLOPE OF 1.0%.
6. 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.
7. FLEXIBLE CONNECTIONS ARE REQUIRED FOR CONNECTING PIPES TO MANHOLES (FOR EXAMPLE KOR-N-SEAL, PSX: POSITIVE SEAL AND DURASEAL). THE CONCRETE CRADLE FOR THE PIPE CAN BE ELIMINATED.
8. THE OWNER SHALL REQUIRE THAT THE SITE SERVICING CONTRACTOR PERFORM FIELD TESTS FOR QUALITY CONTROL OF ALL SANITARY SEWERS. LEAKAGE TESTING SHALL BE COMPLETED IN ACCORDANCE WITH OPSS 410.07.16, 410.07.16.04 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 A CERTIFIED PROFESSIONAL ENGINEER WHO SHALL SUBMIT A CERTIFIED COPY OF THE TEST RESULTS.
9. ALL STORM MANHOLES AND CATCHBASIN MANHOLES WITH PIPES LESS THAN 900mm DIAMETER AND UNDER ARE TO HAVE 300mm SUMPS UNLESS OTHERWISE INDICATED. ALL CATCHBASINS ARE TO HAVE 600mm SUMPS UNLESS OTHERWISE INDICATED. MANHOLES WITH PIPES LARGER THAN 900mm DIAMETER TO BE BENCHED WITHOUT A SUMP.
10. ALL CATCHBASINS, MANHOLES AND/OR CATCHBASIN MANHOLES THAT ARE TO HAVE ICD'S INSTALLED WITHIN THEM ARE TO HAVE 600mm SUMPS.
11. ALL WEEPING TILE CONNECTIONS TO BE MADE TO THE PROPOSED STORM SEWER SYSTEM DOWNSTREAM OF ANY INLET CONTROL DEVICES.
12. THE CONTRACTOR IS 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. PROVIDE A COPY OF ALL CCTV INSPECTION REPORTS TO THE ENGINEER FOR REVIEW.

WATERMAIN NOTES:

1. SUPPLY AND CONSTRUCT ALL WATERMAINS AND APPURTENANCES IN ACCORDANCE WITH THE CITY OF OTTAWA STANDARDS AND SPECIFICATIONS - ALL CURRENT VERSIONS AND 'AS AMENDED'. EXCAVATION, INSTALLATION, BACKFILL AND RESTORATION OF ALL WATERMAINS BY THE CONTRACTOR. CONNECTIONS AND SHUT-OFFS AT THE MAIN BY CITY OF OTTAWA FORCES. CHLORINATION OF THE WATER SYSTEM SHALL BE PERFORMED BY THE CONTRACTOR IN THE PRESENCE CITY OF OTTAWA FORCES.
2. SPECIFICATIONS:

ITEM	SPEC. No.	REFERENCE
WATERMAIN TRENCHING	W17	CITY OF OTTAWA
HYDRANT INSTALLATION	W19	CITY OF OTTAWA
THERMAL INSULATION IN SHALLOW TRENCHES	W22	CITY OF OTTAWA
THERMAL INSULATION AT OPEN STRUCTURES	W23	CITY OF OTTAWA
VALVE BOX ASSEMBLY	W24	CITY OF OTTAWA
WATERMAIN CROSSING BELOW SEWER	W25	CITY OF OTTAWA
WATERMAIN CROSSING OVER SEWER	W25.2	CITY OF OTTAWA
WATERMAIN MATERIAL	PVC DR 18	

3. WATERMAIN SHALL BE MINIMUM 2.4m DEPTH BELOW GRADE UNLESS OTHERWISE INDICATED.
4. PROVIDE MINIMUM 0.5m CLEARANCE BETWEEN OUTSIDE OF PIPES AT ALL CROSSINGS, WHERE POSSIBLE UNLESS OTHERWISE INDICATED.
5. WATER SERVICE IS TO BE CONSTRUCTED TO WITHIN 1.0m OF FOUNDATION WALL AND CAPPED, UNLESS OTHERWISE INDICATED.
6. HYDRANTS SHALL BE ROTATED AT THE FLANGE TO FACE THE ROAD AND ALLOW FIRE SERVICES TO OPERATE THE NUTS.

CRITICAL SEWER PIPE CROSSING TABLE

CROSSING	LOWER PIPE	HIGHER PIPE	CLEARANCE	SURFACE ELEVATION
①	450mmØ STM T/INSUL=73.29	200mmØ SAN INV=73.72	± 0.43m	74.86 m
②	200mmØ STM T/INSUL=73.44	200mmØ SAN INV=73.70	± 0.26m	74.82 m
③ ✱	300mmØ SAN T/P=73.80	U/S DUCT BANK C-C=74.07	± 0.25m	75.93 m
④	300mmØ STM T/P=73.24	300mmØ SAN INV=73.50	± 0.26m	75.95 m
⑤ ✱	200mmØ SAN T/P=73.80	U/S DUCT BANK E-E=75.05	± 1.25m	76.80 m
⑥	900mmØ STM T/P=73.08	300mmØ SAN INV=73.33	± 0.25m	77.60 m
⑦ ✱	300mmØ SAN T/P=73.41	U/S DUCT BANK F-F=76.61	± 3.20m	78.36 m
⑧	300mmØ SAN T/P=73.29	250mmØ STM INV=74.36	± 1.07m	78.33 m
⑨	675mmØ STM T/P=73.89	200mmØ SAN INV=76.93	± 3.04m	78.96 m
⑩	675mmØ STM T/P=74.03	200mmØ SAN INV=76.73	± 2.70m	78.77 m
⑪	300mmØ SAN T/P=72.56	375mmØ STM INV=73.66	± 1.10m	78.89 m
⑫	300mmØ SAN T/P=72.54	200mmØ STM INV=76.74	± 4.20m	78.75 m
⑬	300mmØ SAN T/P=72.35	525mmØ STM U/S=73.81	± 1.46m	78.59 m
⑭	*400mmØ SAN T/P=71.34±*	250mmØ STM INV=75.69	± 4.35m	78.23 m
⑮	*300mmØ SAN T/P=71.55±*	525mmØ STM U/S=74.00	± 2.45m	78.72 m
⑯	*200mmØ SAN T/P=72.61±*	250mmØ STM INV=73.76	± 1.15m	79.01 m
⑰	*200mmØ SAN T/P=72.57±*	250mmØ STM INV=73.75	± 1.18m	78.91 m
⑱	*200mmØ SAN T/P=72.40±*	200mmØ STM INV=76.35	± 3.95m	78.75 m
⑲	*200mmØ SAN T/P=71.97±*	675mmØ STM U/S=72.95	± 0.98m	78.77 m
⑳ ✱	675mmØ STM T/P=73.21	U/S DUCT BANK C-C=73.87	± 0.66m	75.75 m
㉑	*300mmØ SAN T/P=73.21±*	300mmØ STM INV=74.56	± 1.35m	77.91 m
㉒ ✱	250mmØ STM T/P=74.69	U/S DUCT BANK F-F=76.79	± 2.10m	78.54 m
㉓ ✱	300mmØ STM T/P=73.76	U/S DUCT BANK F-F=75.64	± 1.88m	77.39 m
㉔ ✱	675mmØ STM T/P=73.62	U/S DUCT BANK E-E=75.17	± 1.55m	76.92 m
㉕ ✱	300mmØ STM T/P=73.49	U/S DUCT BANK F-F=75.58	± 2.09m	77.33 m
㉖ ✱	675mmØ STM T/P=73.36	U/S DUCT BANK E-E=75.27	± 1.91m	77.02 m
㉗ ✱	300mmØ STM T/P=73.28	U/S DUCT BANK F-F=75.62	± 2.34m	77.37 m

✱ REFER TO ELECTRICAL DRAWINGS PREPARED BY VR ENGINEERING FOR DUCT BANK CROSS-SECTIONS.

CRITICAL HYDRANT LEAD CROSSING TABLE

CROSSING	LOWER PIPE	HIGHER PIPE	CLEARANCE	SURFACE ELEVATION
(5A)	675mmØ STM T/P=73.52	150mmØ WM INV=74.21	± 0.69m	76.76 m
(6A)	525mmØ STM T/P=73.85	150mmØ WM INV=74.56	± 0.71m	77.11 m

GRADING NOTES:

1. ALL TOPSOIL, ORGANIC OR DELETERIOUS MATERIAL MUST BE ENTIRELY REMOVED FROM BENEATH THE PROPOSED PAVED AREAS AS DIRECTED BY THE SITE ENGINEER OR GEOTECHNICAL ENGINEER.
2. EXPOSED SUBGRADES IN PROPOSED PAVED AREAS SHOULD BE PROOF ROLLED WITH A LARGE STEEL DRUM ROLLER 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 COMPACTED TO AT LEAST 98% OF THE STANDARD PROCTOR MAXIMUM DRY DENSITY VALUE. ANY ADDITIONAL GRANULAR FILL USED BELOW THE PROPOSED PAVEMENT SHOULD BE COMPACTED TO AT LEAST 98% OF THE STANDARD PROCTOR MAXIMUM DRY DENSITY VALUE.
5. MINIMUM OF 2% GRADE FOR ALL GRASS AREAS UNLESS OTHERWISE NOTED.
6. MAXIMUM TERRACING GRADE TO BE 3:1 UNLESS OTHERWISE NOTED.
7. ALL GRADES BY CURBS ARE EDGE OF PAVEMENT GRADES UNLESS OTHERWISE INDICATED.
8. ALL CURBS SHALL BE BARRIER CURB (150mm) UNLESS OTHERWISE NOTED AND CONSTRUCTED AS PER CITY OF OTTAWA STANDARDS (SC1.1).
9. ALL CONCRETE SIDEWALKS SHALL BE CONSTRUCTED AS PER CITY OF OTTAWA STANDARDS (SC1.4) UNLESS OTHERWISE INDICATED.
10. ALL RETAINING WALLS OF AT LEAST 0.6m IN HEIGHT SHALL HAVE FENCING/RAILING ALONG TOP SURFACE OF WALL PER OBC ARTICLE 9.8.8.1.
11. SEPARATE RETAINING WALL DRAWINGS AND REPORT SHALL BE REQUIRED FOR ALL STRUCTURAL RETAINING WALLS WITH A HEIGHT GREATER THAN 1.0m. THE RETAINING WALL DOCUMENTS SHALL BE STAMPED BY A GEOTECHNICAL OR STRUCTURAL ENGINEER LICENSED IN THE PROVINCE OF ONTARIO PER CITY OF OTTAWA GUIDELINES.
12. REFER TO LANDSCAPE PLAN FOR PLANTING AND OTHER LANDSCAPE FEATURE DETAILS.
13. CONTRACTOR TO PROVIDE THE CONSULTANT WITH GRADING PLANS INDICATING AS-BUILT ELEVATIONS OF ALL DESIGN GRADES SHOWN ON PLANS 123089-GR1 AND 123089-GR2.

EROSION AND SEDIMENT CONTROL NOTES :

1. ALL EROSION AND SEDIMENT CONTROLS ARE TO BE INSTALLED TO THE SATISFACTION OF THE OWNER, ENGINEER, AND THE CITY OF OTTAWA. THEY ARE TO 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 ARE TO 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. 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). THE CONTRACTOR SHALL BE SOLELY RESPONSIBLE FOR MEETING ALL REGULATORY AGENCY REQUIREMENTS.
3. TO PREVENT SURFACE EROSION FROM ENTERING ANY STORM SEWER SYSTEM DURING CONSTRUCTION, FILTER BAGS WILL BE PLACED UNDER GRATES OF NEARBY CATCHBASINS AND STRUCTURES. A LIGHT DUTY SILT FENCE BARRIER WILL ALSO BE INSTALLED AROUND THE CONSTRUCTION AREA (WHERE APPLICABLE). THESE CONTROL MEASURES WILL REMAIN IN PLACE UNTIL CONSTRUCTION IS COMPLETE.
4. TO LIMIT EROSION: MINIMIZE THE AMOUNT OF EXPOSED SOILS AT ANY GIVEN TIME, RE-VEGETATE EXPOSED AREAS AND SLOPES AS SOON AS POSSIBLE AND PROTECT EXPOSED SLOPES WITH NATURAL OR SYNTHETIC MULCHES.
5. FOR MATERIAL STOCKPILING: MINIMIZE THE AMOUNT OF EXPOSED MATERIALS AT ANY GIVEN TIME; APPLY TEMPORARY SEEDING, TARPS, COMPACTION AND/OR SURFACE ROUGHENING AS REQUIRED TO STABILIZE STOCKPILED MATERIALS THAT WILL NOT BE USED WITHIN 14 DAYS.
6. 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.
7. THE CONTRACTOR SHALL IMMEDIATELY REPORT TO THE ENGINEER ANY ACCIDENTAL DISCHARGES OF SEDIMENT MATERIAL INTO ANY 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.
8. THE CONTRACTOR SHALL IMPLEMENT BEST MANAGEMENT PRACTICES, TO PROVIDE FOR PROTECTION OF THE AREA DRAINAGE SYSTEM AND THE RECEIVING WATERCOURSE, DURING CONSTRUCTION ACTIVITIES. THE CONTRACTOR ACKNOWLEDGES THAT FAILURE TO IMPLEMENT APPROPRIATE EROSION AND SEDIMENT CONTROL MEASURES MAY BE SUBJECT TO PENALTIES IMPOSED BY ANY APPLICABLE REGULATORY AGENCY.
9. ROADWAYS ARE TO BE SWEPT AS REQUIRED OR AS DIRECTED BY THE OWNER AND/OR ENGINEER.
10. THE CONTRACTOR SHALL ENSURE PROPER DUST CONTROL IS PROVIDED WITH THE APPLICATION OF WATER (AND IF REQUIRED, CALCIUM CHLORIDE) DURING DRY PERIODS. MONITOR DUST LEVELS DURING SITE PREPARATION/EXCAVATION, AND CONSTRUCTION ACTIVITIES, AND WHEN DUST LEVELS BECOME VISUALLY APPARENT SPRAY WATER TO MINIMIZE THE RELEASE OF DUST FROM GRAVEL, PAVED AREAS AND EXPOSED SOILS. USE CHEMICAL DUST SUPPRESSANTS ONLY WHERE NECESSARY ON PROBLEM AREAS.

PAVEMENT STRUCTURES:

☐ LIGHT DUTY (PARKING GARAGE - CARS ONLY)
50mm SUPERPAVE 12.5
150mm GRANULAR "A"
300mm GRANULAR "B"
ASPHALT GRADE PG 58-34
*INSTALLED PER GEOTECHNICAL REPORT

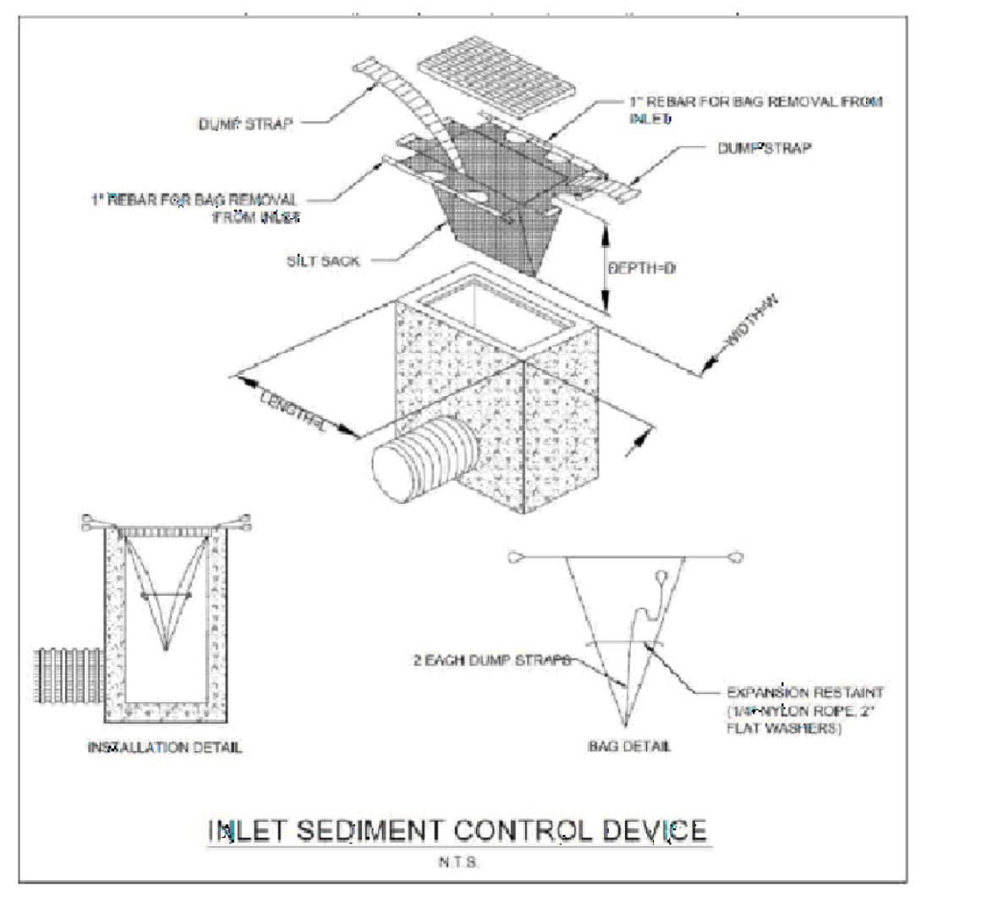
☐ HEAVY DUTY (AMBULANCE PARKING / PARKING GARAGE- TRUCK TRAFFIC)
50mm SUPERPAVE 12.5
60mm SUPERPAVE 19.0
200mm GRANULAR "A"
400mm GRANULAR "B"
ASPHALT GRADE PG 58-34
*INSTALLED PER GEOTECHNICAL REPORT

▨ HEAVY DUTY (NEW ROADWAYS / LOADING DOCK AREA)
60mm SUPERPAVE 12.5
60mm SUPERPAVE 19.0
300mm GRANULAR "A"
400mm GRANULAR "B"
ASPHALT GRADE PG 58-34
*INSTALLED PER GEOTECHNICAL REPORT

▨ RIGID PAVEMENT STRUCTURE (LOADING DOCKS)
150mm PORTLAND LIMESTONE CEMENT CONCRETE OR EQUIVALENT
50mm (MIN.) HIGH-DENISTY RIGID STYROFOAM INSULATION
300mm GRANULAR "A"
900mm GRANULAR "B"
*INSTALLED PER GEOTECHNICAL REPORT

Erosion and Sediment Control Responsibilities:

				During Construction			After Construction Prior to Final Acceptance		After Final Acceptance
	ESC Measure	Symbol	Specification	Installation Responsibility	Inspection/Maintenance Responsibility	Inspection Frequency	Approval to Remove	Removal Responsibility	Inspection/Maintenance Responsibility
Temporary Measures	Silt Fence (Light Duty)	— · · —	OPSD 219.110	Developer's Contractor	Developer's Contractor	Weekly (as a minimum)	Consultant	Developer's Contractor	N/A
	Filter Bags	Location as Indicated in ESC Note #3	Erosion and Sediment Control Notes	Developer's Contractor	Developer's Contractor	Weekly (as a minimum)	Consultant	Developer's Contractor	N/A
	Mud Mat	MM	Drawing Details	Developer's Contractor	Developer's Contractor	Weekly (as a minimum)	Developer's Contractor	Developer's Contractor	N/A
	Dust Control	Location as Required Around Site	Erosion and Sediment Control Notes	Developer's Contractor	Developer's Contractor	Weekly (as a minimum)	Consultant	Developer's Contractor	N/A
	Stabilized Material Stockpiling	Location as Required by Contractor	Erosion and Sediment Control Notes	Developer's Contractor	Developer's Contractor	Weekly (as a minimum)	Developer's Contractor	Developer's Contractor	N/A
	Sediment Basin (for flows being pumped out of excavations)	Location as Required by Contractor	- - -	Developer's Contractor	Developer's Contractor	After Every Rainstorm	Developer's Contractor	Developer's Contractor	N/A



INLET SEDIMENT CONTROL DEVICE
N.T.S.

PROPOSED 200mmØ WATERMAIN TABLE - NORTHWEST EXTENSION

STATION	SURFACE ELEVATION	T/WM ELEVATION	COMMENTS
2+000.00	78.55	76.15± ✱	REMOVAL OF EX. BEND & CONNECTION TO EX. 200mmØ WATERMAIN
2+008.80	78.33	75.93 ✱✱✱	CROSS ABOVE 250mmØ STM [T/P=74.65] (±1.08m CLEARANCE)
2+014.20	78.26	75.86 ✱✱✱	CROSS ABOVE 200mmØ SAN [T/P=73.35] (±2.31m CLEARANCE)
2+024.00	77.98	75.58	45° VERTICAL BEND
2+024.50	77.97	75.08	45° VERTICAL BEND
2+025.00	77.96	75.08 ✱✱✱	CROSS BELOW EX.200mmØ WM [Inv=75.37±] (±0.29m CLEARANCE)
2+025.50	77.94	75.08	45° VERTICAL BEND
2+026.00	77.92	75.52	45° VERTICAL BEND
2+027.80	77.87	75.47	45° HORIZONTAL BEND
2+031.00	77.76	75.36	45° HORIZONTAL BEND
2+033.20	77.67	75.27 ✱✱✱	CROSS BELOW EX. GAS [Inv=76.75±] (±1.48m CLEARANCE)
2+050.00	77.22	74.82	- - -
2+054.00	77.17	74.77	150mmØ HYDRANT 6 TEE
2+067.90	77.12	✱✱ 74.72 ✱✱✱	CROSS ABOVE 300mmØ STM [T/P=73.66] (±0.86m CLEARANCE)
2+075.00	77.22	74.82	- - -
2+093.50	76.89	74.49 ✱✱✱	CROSS BELOW DUCT BANK E-E [U/S=75.14] (±0.65m CLEARANCE)
2+100.00	76.72	74.32	- - -
2+108.60	76.81	74.41	150mmØ HYDRANT 5 TEE
2+114.80	76.92	74.52	200mmØ VALVE & VALVE BOX
2+120.90	77.01	✱✱ 74.61 ✱✱✱	CROSS ABOVE 300mmØ STM [T/P=73.37] (±1.04m CLEARANCE)
2+126.70	77.05	74.65	45° HORIZONTAL BEND
2+129.10	77.10	74.70	45° HORIZONTAL BEND
2+132.50	77.17	74.77 ✱✱✱	CROSS BELOW DUCT BANK E-E [U/S=75.42] (±0.65m CLEARANCE)
2+136.70	77.28	74.88 ✱✱✱	CROSS BELOW DUCT BANK F-F [U/S=75.53] (±0.65m CLEARANCE)
2+150.00	77.40	75.00	WM BELOW PARKING GARAGE U/S FOOTING ELEVATION
2+175.00	77.40	75.00	WM BELOW PARKING GARAGE U/S FOOTING ELEVATION
2+200.00	77.40	74.85	WM BELOW PARKING GARAGE U/S FOOTING ELEVATION
2+216.10	76.73	74.33 ✱✱✱	CROSS BELOW DUCT BANK D-D [U/S=74.98] (±0.65m CLEARANCE)
2+219.70	76.68	74.28 ✱✱✱	CROSS BELOW DUCT BANK E-E [U/S=74.93] (±0.65m CLEARANCE)
2+223.40	76.50	✱✱ 74.21	200mmØ VALVE & VALVE BOX
2+225.40	76.46	✱✱ 74.17 ✱✱✱	CROSS ABOVE 300mmØ SAN [T/P=73.72] (±0.25m CLEARANCE)
2+228.10	76.43	74.03 ✱✱✱	CROSS ABOVE 825mmØ STM [T/P=73.18] (±0.65m CLEARANCE)
2+232.90	76.56	74.03	45° HORIZONTAL BEND
2+235.30	76.53	74.03	45° HORIZONTAL BEND
2+246.20	76.22	73.82 ✱✱✱	CROSS ABOVE 200mmØ STM [T/P=73.32] (±0.30m CLEARANCE)
2+248.90	76.12	73.72	150mmØ HYDRANT 4 TEE
2+267.10	75.76	✱✱ 73.64 ✱✱✱	CROSS ABOVE 450mmØ STM [T/P=73.14] (±0.30m CLEARANCE)
2+268.10	75.74	✱✱ 73.64	45° VERTICAL BEND
2+268.60	75.72	73.14	45° VERTICAL BEND
2+277.20	75.45	73.05 ✱✱✱	CROSS BELOW DUCT BANK E-E [U/S=73.70] (±0.65m CLEARANCE)
2+283.40	75.24	72.84 ✱✱✱	CROSS BELOW DUCT BANK C-C [U/S=73.36] (±0.52m CLEARANCE)
2+288.70	75.09	72.69	200 X 200 X 200 WATER SERVICE TEE (4+000.00)
2+291.20	75.03	72.63	45° HORIZONTAL BEND
2+293.10	74.97	72.57	200 X 200 X 200 HYDRANT LEAD TEE (5+000.00)
2+300.00	74.84	72.44	- - -
2+316.30	74.64	72.24	45° HORIZONTAL BEND
2+321.30	74.64	72.24	45° HORIZONTAL BEND
2+322.80	74.66	72.26	45° HORIZONTAL BEND
2+331.30	74.83	72.43	200mmØ VALVE & VALVE BOX
2+332.40	74.84	72.44	45° HORIZONTAL BEND
2+332.90	74.84	72.44	45° HORIZONTAL BEND
2+333.40	74.85	72.45	CAP AT FOUNDATION WALL

✱ CONNECTION TO EXISTING 200mmØ WATERMAIN. EXACT ELEVATIONS TO BE FIELD DETERMINED.

✱✱ PROVIDE THERMAL INSULATION AS PER CITY OF OTTAWA DETAILS W22 IN SHALLOW TRENCHES WHERE COVER IS LESS THAN 2.4m AND/OR W23 ADJACENT TO OPEN STRUCTURES.

✱✱✱ PIPE CROSSINGS ARE TO BE IN ACCORDANCE WITH CITY STANDARDS W25 AND W25.2 TO AVOID CONFLICTS, WHERE POSSIBLE. REFER TO ELECTRICAL DRAWINGS PREPARED BY VR ENGINEERING FOR DUCT BANK CROSS-SECTIONS.

PROPOSED 200mmØ WATERMAIN TABLE - SOUTHEAST EXTENSION

STATION	SURFACE ELEVATION	T/WM ELEVATION	COMMENTS
3+000.00	78.31	75.91± ✱	TEE CONNECTION TO EX 200mmØ WATERMAIN
3+001.50	78.28	75.88	200mmØ VALVE & VALVE BOX
3+003.00	78.25	75.85	45° HORIZONTAL BEND
3+007.90	78.34	75.94	45° HORIZONTAL BEND
3+025.00	78.73	76.33	- - -
3+046.00	78.71	76.31	45° HORIZONTAL BEND
3+051.20	78.72	76.32 ✱✱✱	CROSS ABOVE 525mmØ STM [T/P=74.77] (±1.35m CLEARANCE)
3+055.70	78.65	76.25	45° HORIZONTAL BEND
3+068.80	78.71	76.25 ✱✱✱	CROSS ABOVE 300mmØ SAN [T/P=71.51] (±4.54m CLEARANCE)
3+073.20	78.66	76.25	150mmØ HYDRANT 1 TEE
3+080.60	78.61	76.21 ✱✱✱	CROSS ABOVE 525mmØ STM [T/P=74.61] (±1.40m CLEARANCE)
3+088.10	78.70	76.30	45° HORIZONTAL BEND
3+100.00	79.01	76.45	- - -
3+106.60	78.95	76.55	45° HORIZONTAL BEND
3+113.90	78.88	76.48 ✱✱✱	CROSS ABOVE 250mmØ SAN [T/P=72.47] (±3.81m CLEARANCE)
3+125.00	78.77	76.37	- - -
3+127.30	78.75	76.35 ✱✱✱	CROSS BELOW 200mmØ STM [INV=76.86] (±0.51m CLEARANCE)
3+140.90	78.89	76.49 ✱✱✱	CROSS ABOVE 375mmØ STM [T/P=74.07] (±2.22m CLEARANCE)
3+142.70	78.90	76.49 ✱✱✱	CROSS ABOVE 250mmØ SAN [T/P=72.60] (±3.69m CLEARANCE)
3+144.10	78.91	76.49	45° HORIZONTAL BEND
3+146.10	78.93	76.49	45° HORIZONTAL BEND
3+149.60	78.89	76.49	150mmØ HYDRANT 2 TEE
3+173.40	79.19	76.79	200mmØ VALVE & VALVE BOX
3+174.60	79.21	76.80	CAP 1.0m FROM FOUNDATION WALL

✱ CONNECTION TO EXISTING 200mmØ WATERMAIN. EXACT ELEVATIONS TO BE FIELD DETERMINED.

✱✱ PROVIDE THERMAL INSULATION AS PER CITY OF OTTAWA DETAILS W22 IN SHALLOW TRENCHES WHERE COVER IS LESS THAN 2.4m AND/OR W23 ADJACENT TO OPEN STRUCTURES.

✱✱✱ PIPE CROSSINGS WITH WATERMAINS ARE TO BE IN ACCORDANCE WITH CITY STANDARDS W25 AND W25.2 TO AVOID CONFLICTS, WHERE POSSIBLE.

PROPOSED WATER SERVICE TABLE - EXISTING PARKING GARAGE

STATION	SURFACE ELEVATION	T/WM ELEVATION	COMMENTS
4+000.00	75.09	72.69	200 X 200 X 200 WATER SERVICE TEE (2+288.70)
4+000.80	75.11	72.69	200mmØ VALVE & VALVE BOX
4+001.60	75.12	72.69	45° HORIZONTAL BEND
4+006.65	75.30	72.66	45° VERTICAL BEND
4+007.50	75.33	71.71	45° VERTICAL BEND
4+008.50	75.37	71.81 ✱✱✱	CROSS BELOW 675mmØ STM [U/S=72.32] (±0.51m CLEARANCE)
4+012.30	75.55	71.81 ✱✱✱	CROSS BELOW 300mmØ SAN [INV=73.51] (±1.70m CLEARANCE)
4+012.80	75.57	71.81	45° VERTICAL BEND
4+014.30	75.73	73.31	45° VERTICAL BEND
4+015.90	75.81	73.35± ✱	REMOVAL OF EX. BEND AND CONNECTION TO EX. WM C/W REDUCER

✱ CONNECTION TO EXISTING 150mmØ WATERMAIN C/W REDUCER. EXACT ELEVATIONS TO BE FIELD DETERMINED.

✱✱ PROVIDE THERMAL INSULATION AS PER CITY OF OTTAWA DETAILS W22 IN SHALLOW TRENCHES WHERE COVER IS LESS THAN 2.4m AND/OR W23 ADJACENT TO OPEN STRUCTURES.

✱✱✱ PIPE CROSSINGS ARE TO BE IN ACCORDANCE WITH CITY STANDARDS W25 AND W25.2 TO AVOID CONFLICTS, WHERE POSSIBLE. REFER TO ELECTRICAL DRAWINGS PREPARED BY VR ENGINEERING FOR DUCT BANK CROSS-SECTIONS.

PROPOSED HYDRANT 3 LEAD TABLE

STATION	SURFACE ELEVATION	T/WM ELEVATION	COMMENTS
5+000.00	74.97	72.57	200 X 200 X 200 HYDRANT LEAD TEE (5+000.00)
5+008.00	74.89	72.49	200 X 150 REDUCER
5+009.00	74.88	72.48	45° HORIZONTAL BEND
5+009.95	74.88	72.48	45° VERTICAL BEND
5+010.60	74.88	71.83	45° VERTICAL BEND
5+011.10	74.88	71.83 ✱✱✱	CROSS BELOW 675mmØ STM [U/S=72.35] (±0.52m CLEARANCE)
5+011.60	74.88	71.83	45° VERTICAL BEND
5+012.25	74.88	72.48	45° VERTICAL BEND
5+012.90	74.88	72.48	150mmØ VALVE & VALVE BOX
5+013.90	74.88	72.48 ✱✱✱	CROSS BELOW 200mmØ SAN [INV=73.66] (±1.18m CLEARANCE)
5+015.40	75.10	72.50	CONNECTION TO NEW HYDRANT 3

✱✱ PROVIDE THERMAL INSULATION AS PER CITY OF OTTAWA DETAILS W22 IN SHALLOW TRENCHES WHERE COVER IS LESS THAN 2.4m AND/OR W23 ADJACENT TO OPEN STRUCTURES.

✱✱✱ PIPE CROSSINGS ARE TO BE IN ACCORDANCE WITH CITY STANDARDS W25 AND W25.2 TO AVOID CONFLICTS, WHERE POSSIBLE. REFER TO ELECTRICAL DRAWINGS PREPARED BY VR ENGINEERING FOR DUCT BANK CROSS-SECTIONS.

ROOF DRAIN TABLE

AREA ID *	BUILDING	NUMBER OF DRAINS	ROOF DRAIN OPENING SETTING	100-YEAR RELEASE RATE	MAXIMUM STORAGE VOLUME AVAILABLE (m^3)
P4-1	AMBULATORY CARE CENTRE	3	CLOSED	2.86 L/s	75.7
		2	1/4 OPEN		
P4-2	EMERGENCY DEPT. ADDITION	2	CLOSED	5.71 L/s	92.7
		5	1/4 OPEN		
P4-3	AMB. GARAGE	2	CLOSED	0.64 L/s	33.1
P4-4	GENERATOR BLDG.	3	CLOSED	0.96 L/s	44.6
P4-5	TRANSITIONAL CARE TOWER	10	CLOSED	5.10 L/s	146.9
		2	1/4 OPEN		
P4-6	LOADING DOCK	2	CLOSED	0.64 L/s	33.1
P4-7	MM & EVS BLDG.	2	CLOSED	1.59 L/s	23.8
		1	1/4 OPEN		

* REFER TO THE 'QCH PART 4 STORMWATER MANAGEMENT REPORT' (R-2025-085) PREPARED BY NOVATECH FOR DRAINAGE AREA IDENTIFIERS AND STORMWATER MANAGEMENT DETAILS.

**ALL CONTROLLED FLOW ROOF DRAINS FOR THE PROPOSED BUILDINGS TO BE WATTS 'ADJUSTABLE ACCUTROL' ROOF DRAINS.

INLET CONTROL DEVICE DATA TABLE: AREA B108

DESIGN EVENT	ICD TYPE AND SIZE	OUTLET STRUCTURE	DIAMETER OF OUTLET PIPE (mm)	PEAK DESIGN FLOW (L/s)	MAX PONDING DEPTH (m)
1:5 YR	SLIDE-IN PLATE 83mm	CB 405	200mmØ PVC	14.49	N/A
1:100 YR				20.86	

INLET CONTROL DEVICE DATA TABLE: AREA B112

DESIGN EVENT	ICD TYPE AND SIZE	OUTLET STRUCTURE	DIAMETER OF OUTLET PIPE (mm)	PEAK DESIGN FLOW (L/s)	MAX PONDING DEPTH (m)
1:5 YR	SLIDE-IN PLATE 178mm	CBMH 408 1200Ø	250mmØ PVC	72.13	N/A
1:100 YR				99.71	

INLET CONTROL DEVICE DATA TABLE: AREA B114-B115

DESIGN EVENT	ICD TYPE AND SIZE	OUTLET STRUCTURE	DIAMETER OF OUTLET PIPE (mm)	PEAK DESIGN FLOW (L/s)	MAX PONDING DEPTH (m)
1:5 YR	SLIDE-IN PLATE 178mm	EX. CBMH 10	375mmØ PVC	68.94	N/A
1:100 YR				103.30	

INLET CONTROL DEVICE DATA TABLE: AREA B116, B117, B118

DESIGN EVENT	ICD TYPE AND SIZE	OUTLET STRUCTURE	DIAMETER OF OUTLET PIPE (mm)	PEAK DESIGN FLOW (L/s)	MAX PONDING DEPTH (m)
1:5 YR	SLIDE-IN PLATE 178mm	CBMH 412	300mmØ PVC	50.46	N/A
1:100 YR				99.67	

INLET CONTROL DEVICE DATA TABLE: AREA B120, B127

DESIGN EVENT	ICD TYPE AND SIZE	OUTLET STRUCTURE	DIAMETER OF OUTLET PIPE (mm)	PEAK DESIGN FLOW (L/s)	MAX PONDING DEPTH (m)
1:5 YR	SLIDE-IN PLATE 178mm	CB 410	200mmØ PVC	51.79	N/A
1:100 YR				106.59	

INLET CONTROL DEVICE DATA TABLE: AREA B121

DESIGN EVENT	ICD TYPE AND SIZE	OUTLET STRUCTURE	DIAMETER OF OUTLET PIPE (mm)	PEAK DESIGN FLOW (L/s)	MAX PONDING DEPTH (m)
1:5 YR	SLIDE-IN PLATE 83mm	EX. CB	200mmØ PVC	16.31	0.35
1:100 YR				22.10	

INLET CONTROL DEVICE DATA TABLE: AREA B123

DESIGN EVENT	ICD TYPE AND SIZE	OUTLET STRUCTURE	DIAMETER OF OUTLET PIPE (mm)	PEAK DESIGN FLOW (L/s)	MAX PONDING DEPTH (m)
1:5 YR	SLIDE-IN PLATE 83mm	EX. STMMH (W/ NEW CB GRATE)	200mmØ PVC	16.31	0.35
1:100 YR				22.10	

INLET CONTROL DEVICE DATA TABLE: AREA B128

DESIGN EVENT	ICD TYPE AND SIZE	OUTLET STRUCTURE	DIAMETER OF OUTLET PIPE (mm)	PEAK DESIGN FLOW (L/s)	MAX PONDING DEPTH (m)
1:5 YR	SLIDE-IN PLATE 94mm	CB 411	200mmØ PVC	11.47	N/A
1:100 YR				18.08	

INLET CONTROL DEVICE DATA TABLE: AREA B129

DESIGN EVENT	ICD TYPE AND SIZE	OUTLET STRUCTURE	DIAMETER OF OUTLET PIPE (mm)	PEAK DESIGN FLOW (L/s)	MAX PONDING DEPTH (m)
1:5 YR	SLIDE-IN PLATE 83mm	CB 412	200mmØ PVC	0.99	N/A
1:100 YR				4.66	

INLET CONTROL DEVICE DATA TABLE: AREA B130

DESIGN EVENT	ICD TYPE AND SIZE	OUTLET STRUCTURE	DIAMETER OF OUTLET PIPE (mm)	PEAK DESIGN FLOW (L/s)	MAX PONDING DEPTH (m)
1:5 YR	SLIDE-IN PLATE 102mm	CB 413	200mmØ PVC	17.30	N/A
1:100 YR				34.70	

INLET CONTROL DEVICE DATA TABLE: AREA B131

DESIGN EVENT	ICD TYPE AND SIZE	OUTLET STRUCTURE	DIAMETER OF OUTLET PIPE (mm)	PEAK DESIGN FLOW (L/s)	MAX PONDING DEPTH (m)
1:5 YR	SLIDE-IN PLATE 108mm	EX. CB 402	200mmØ PVC	20.38	N/A
1:100 YR				41.58	

INLET CONTROL DEVICE DATA TABLE: AREA B132

DESIGN EVENT	ICD TYPE AND SIZE	OUTLET STRUCTURE	DIAMETER OF OUTLET PIPE (mm)	PEAK DESIGN FLOW (L/s)	MAX PONDING DEPTH (m)
1:5 YR	SLIDE-IN PLATE 152mm	CB 403	200mmØ PVC	43.54	N/A
1:100 YR				80.53	

INLET CONTROL DEVICE DATA TABLE: AREA B133

DESIGN EVENT	ICD TYPE AND SIZE	OUTLET STRUCTURE	DIAMETER OF OUTLET PIPE (mm)	PEAK DESIGN FLOW (L/s)	MAX PONDING DEPTH (m)
1:5 YR	SLIDE-IN PLATE 108mm	CB 404	200mmØ PVC	16.89	N/A
1:100 YR				35.10	

INLET CONTROL DEVICE DATA TABLE: AREA B134_1

DESIGN EVENT	ICD TYPE AND SIZE	OUTLET STRUCTURE	DIAMETER OF OUTLET PIPE (mm)	PEAK DESIGN FLOW (L/s)	MAX PONDING DEPTH (m)
1:5 YR	SLIDE-IN PLATE 94mm	CB 414	200mmØ PVC	5.77	N/A
1:100 YR				17.03	

INLET CONTROL DEVICE DATA TABLE: AREA B135_2

DESIGN EVENT	ICD TYPE AND SIZE	OUTLET STRUCTURE	DIAMETER OF OUTLET PIPE (mm)	PEAK DESIGN FLOW (L/s)	MAX PONDING DEPTH (m)
1:5 YR	SLIDE-IN PLATE 152mm	EX. LD01	200mmØ PVC	14.51	N/A
1:100 YR				31.05	

INLET CONTROL DEVICE DATA TABLE: AREA P4-8

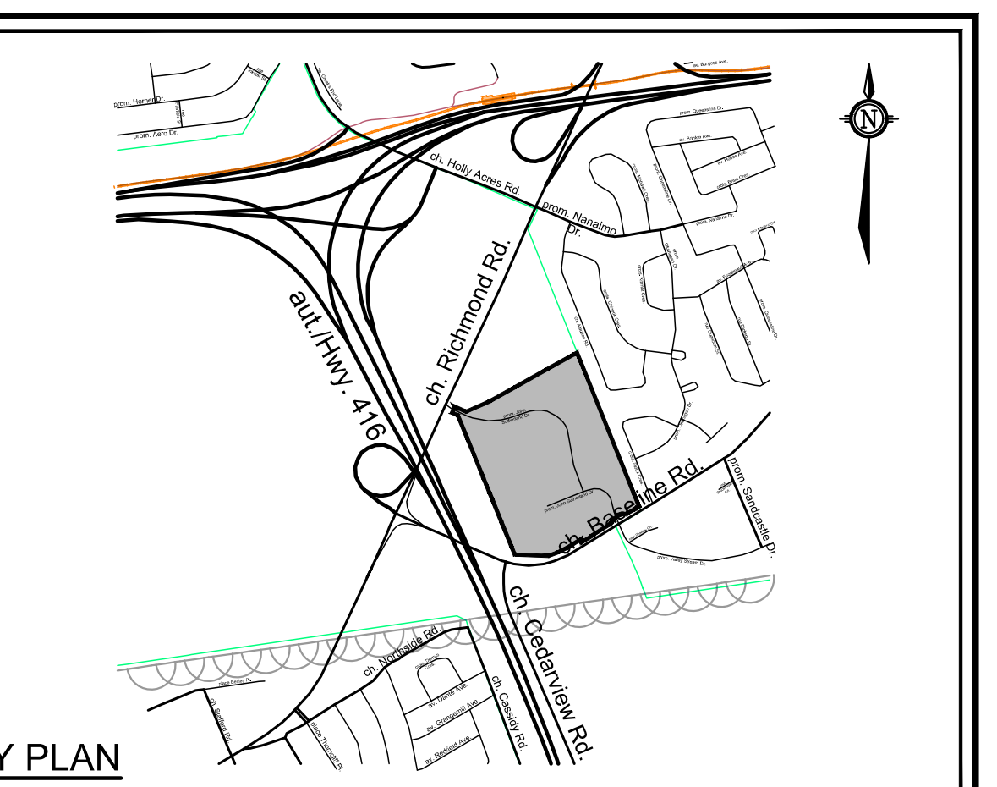
DESIGN EVENT	ICD TYPE AND SIZE	OUTLET STRUCTURE	DIAMETER OF OUTLET PIPE (mm)	PEAK DESIGN FLOW (L/s)	MAX PONDING DEPTH (m)
1:5 YR	SLIDE-IN PLATE 225mm	TANK 01	300mmØ PVC	55.08	N/A
1:100 YR				83.31	

INLET CONTROL DEVICE DATA TABLE: AREA P4-9

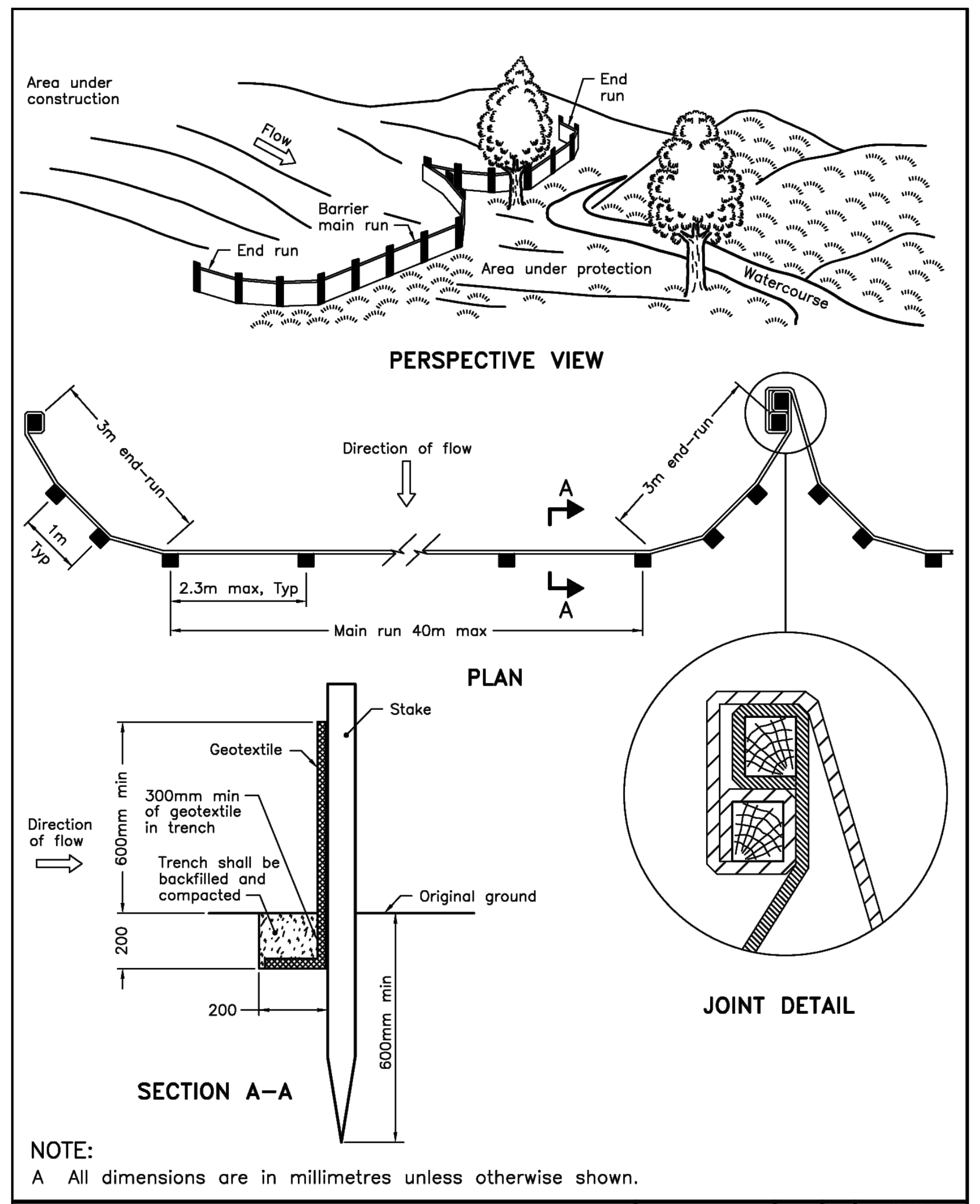
DESIGN EVENT	ICD TYPE AND SIZE	OUTLET STRUCTURE	DIAMETER OF OUTLET PIPE (mm)	PEAK DESIGN FLOW (L/s)	MAX PONDING DEPTH (m)
1:5 YR	SLIDE-IN PLATE 200mm	TANK 02	200mmØ PVC	46.50	N/A
1:100 YR				64.93	

BENCHMARK NOTES:

1. ELEVATIONS SHOWN ARE REFERRED TO THE CANADIAN GEODETIC VERTICAL DATUM (CGVD-1928:1978).
2. IT IS THE RESPONSIBILITY OF THE USER OF THIS INFORMATION TO VERIFY THAT THE JOB BENCHMARK HAS NOT BEEN ALTERED OR DISTURBED AND THAT IT'S RELATIVE ELEVATION AND DESCRIPTION AGREES WITH THE INFORMATION SHOWN ON THIS DRAWING.
3. BENCHMARK WAS PROVIDED ON THE PLAN OF SURVEY OF PART OF LOT 16, CONCESSION 2 (O.F.), GEOGRAPHIC TOWNSHIP OF NEPEAN, CITY OF OTTAWA, SURVEYED BY STANTEC GEOMATICS LTD., DATED NOVEMBER 5, 2024.

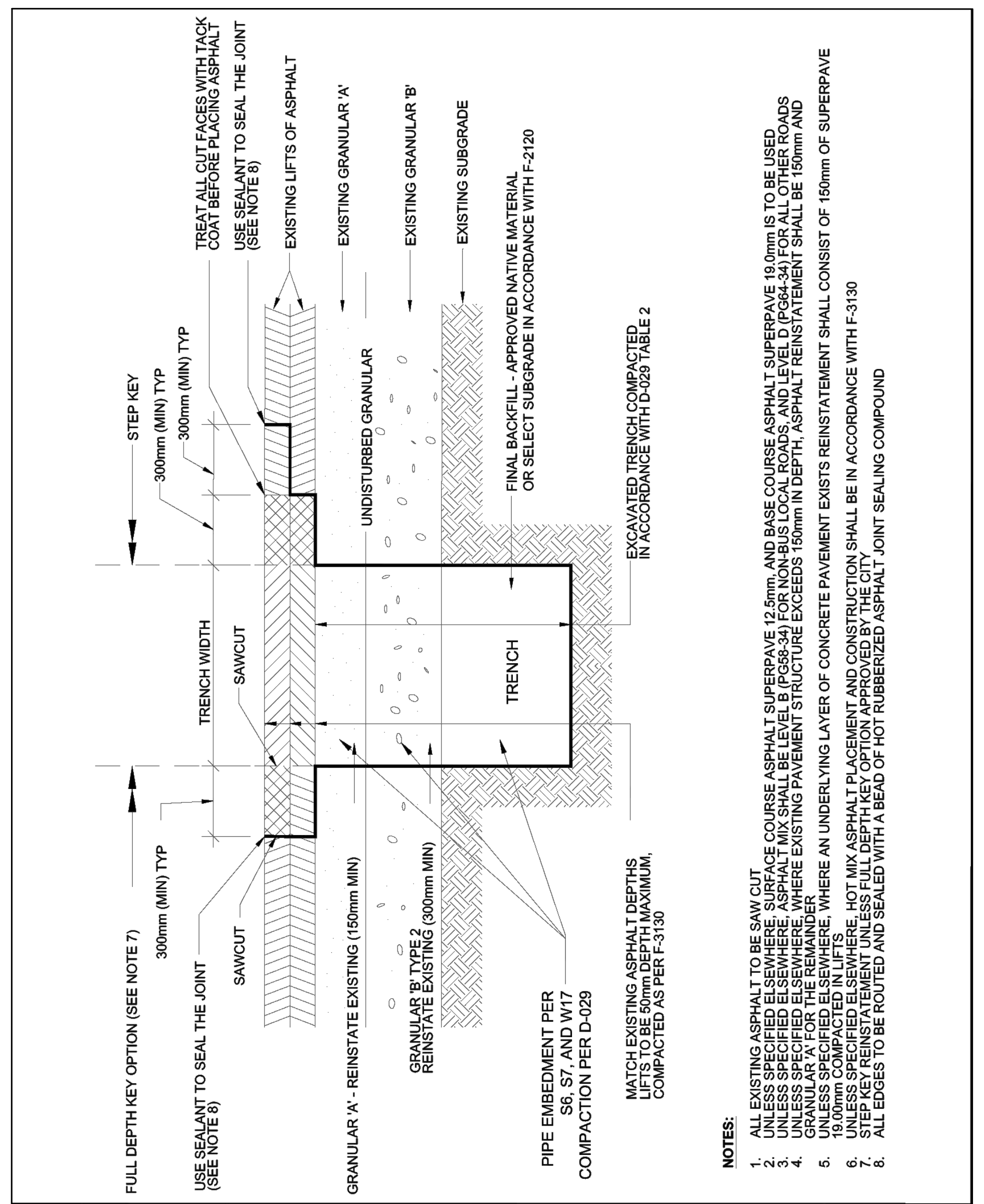


KEY PLAN
N.T.S.



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

ONTARIO PROVINCIAL STANDARD DRAWING | Nov 2021 | Rev 3
LIGHT-DUTY SILT FENCE BARRIER
OPSD 219.110



Ottawa
TITLE: STANDARD TRENCH REINSTATEMENT IN PAVED SURFACE
DATE: MAY 2001
REV: MAR 2023
DWG No: R10

ALL PROJECT NOTES, DETAILS AND SPECIFICATIONS ARE TO MEET THE MOST CURRENT AND AMENDED VERSIONS OF THE CITY OF OTTAWA AND PROVINCIAL STANDARDS

THIS PLAN IS TO BE READ IN CONJUNCTION WITH CIVIL PLANS 123089-GP1, 123089-GP2, 123089-GR1, AND 123089-GR2, AS WELL AS 123089-DET1 AND 123089-DET2

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.

Queensway Carleton Hospital

No.	REVISION	DATE	BY
1.	ISSUED FOR SITE PLAN CONTROL APPROVAL	NOV 28/25	FST

SCALE: NOT TO SCALE

DESIGN: KD
CHECKED: FST
DRAWN: KD
CHECKED: FST
APPROVED: FST

FOR REVIEW ONLY

LICENSED PROFESSIONAL ENGINEER
F.S. THAUVETTE
100041399
November 28, 2025
PROVINCE OF ONTARIO

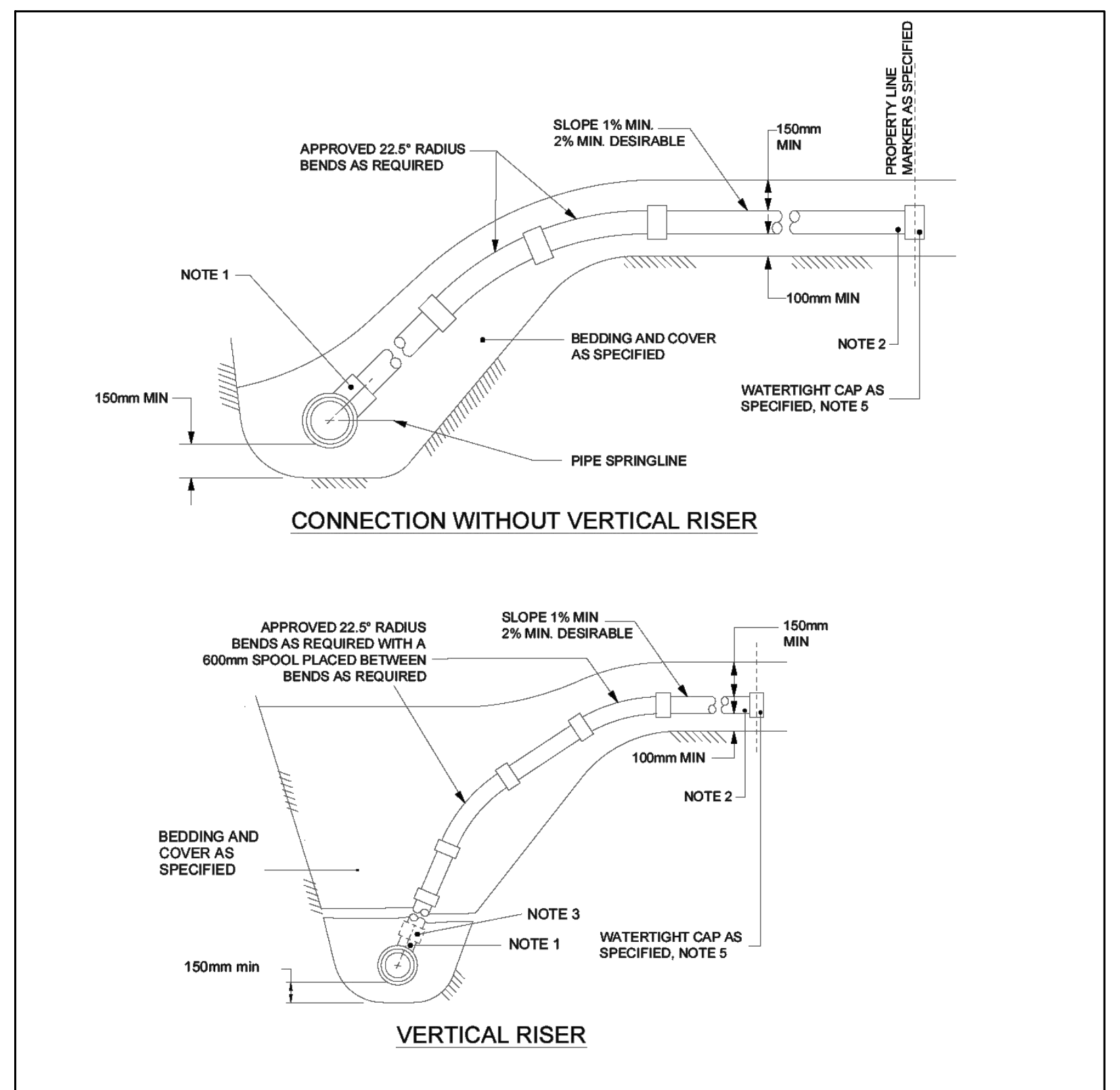
NOVATECH
Engineers, Planners & Landscape Architects
Suite 200, 240 Michael Cowpland Drive
Ottawa, Ontario, Canada K2M 1P6
Telephone (613) 254-9643
Facsimile (613) 254-5867
Website www.novatech-eng.com

LOCATION
CITY OF OTTAWA
QUEENSWAY CARLETON HOSPITAL

DRAWING NAME
CIVIL NOTES, DETAILS & TABLES
PART 4 EXPANSION

PROJECT No. 123089
REV: REV #1
DRAWING No. 123089-NDT

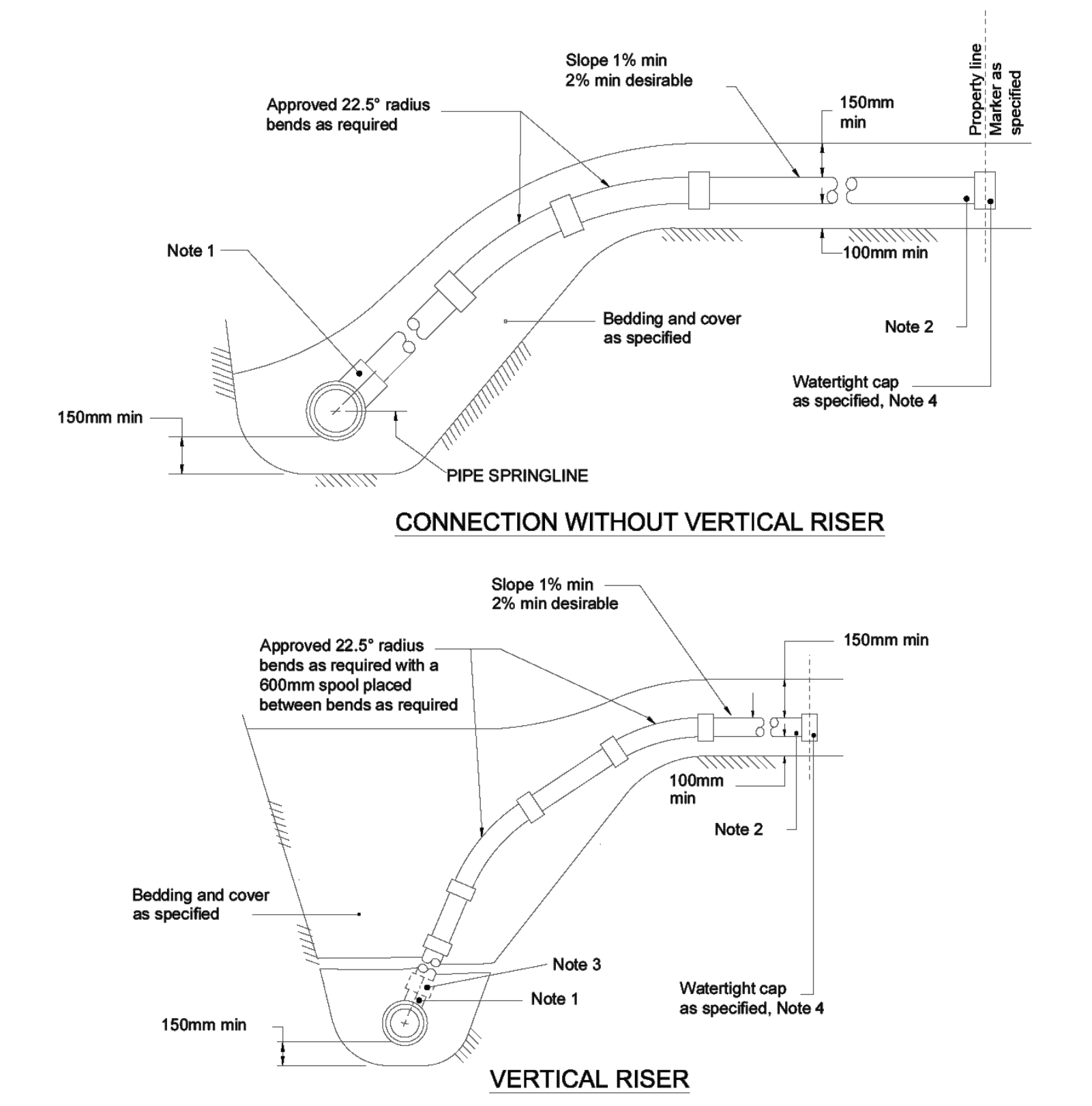
M:\2023\123089\CAD\Civil\123089-NDT.dwg, NDT, Nov 28, 2025 - 5:57pm, kthia



NOTES:

1. DIAMETER OF SERVICE CONNECTIONS SHALL BE NO GREATER THAN 50% OF THE DIAMETER OF THE RIGID SEWER MAIN DIAMETER. THE CONNECTION SHALL BE MADE USING A BELL END INSERT PER S11.2 OR AN APPROVED RUBBER GASKETED INSERT. INVERT OF SERVICE CONNECTION SHALL BE AT THE SAME ELEVATION OR GREATER THAN THE ELEVATION OF THE SPRINGLINE OF THE SEWER MAIN
2. SANITARY SERVICES TO BE 135mm AND STORM SERVICES TO BE 100mm FOR NEW RESIDENCES UNLESS SPECIFIED OTHERWISE.SERVICE PIPE AND RADIUS BENDS TO BE APPROVED CSA B182.2, SDR28 PRODUCTS UNLESS SPECIFIED OTHERWISE
3. APPROVED CONTROLLED SETTLEMENT JOINTS OPTIONAL FOR SERVICE CONNECTIONS TO MAIN SEWERS UP TO 5m DEEP. WHERE APPROVED, CONNECTIONS TO SEWERS OVER 5m DEEP REQUIRE APPROVED CONTROLLED SETTLEMENT JOINTS
4. VERTICAL RISER SHALL BE SAME AS SERVICE PIPE UNLESS OTHERWISE SPECIFIED
5. CAP AT THE PROPERTY LINE SHALL BE ADEQUATELY BRACED TO WITHSTAND TESTING PRESSURE
6. FOR NEW CONSTRUCTION, INSERTS MUST BE INSTALLED ON THE MAIN PIPE BEFORE THAT PIPE IS LAID. FOR SERVICES/BRANCHES 375mm DIA. OR LESS, APPROVED "CORED TEES" MAY BE USED
7. APPROVED CUT-IN TOOL MUST BE USED FOR FIELD MADE CONNECTIONS
8. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SHOWN
9. RADIUS BENDS GREATER THAN 22.5° ARE NOT ALLOWED

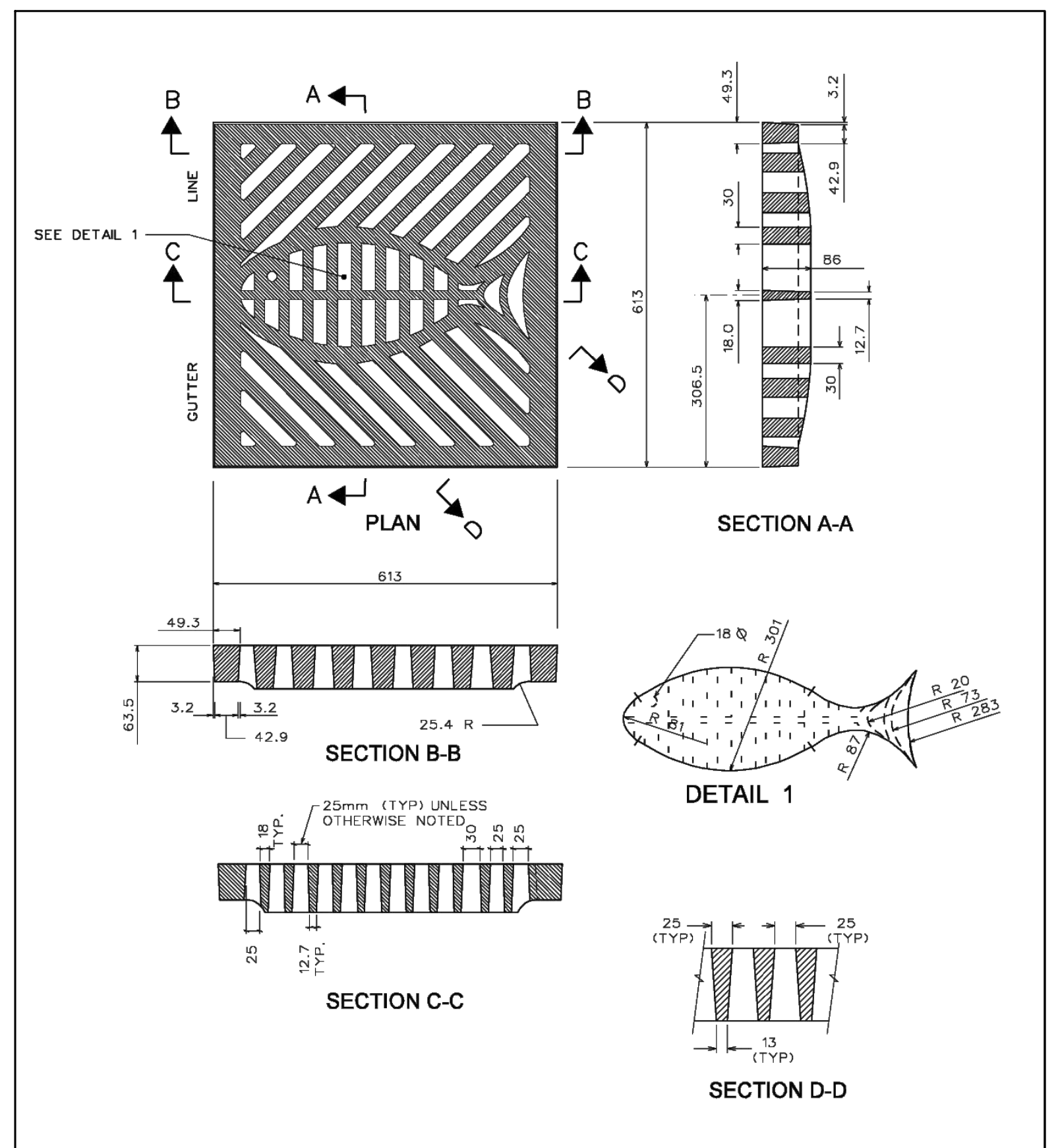
Ottawa
TITLE: SEWER SERVICE CONNECTIONS FOR RIGID MAIN SEWER PIPE (MODIFIED OPSD-1006.010)
DATE: MAR 2006
REV: MAR 2024
DWG No: S11



NOTES:

1. DIAMETER OF SERVICE CONNECTIONS SHALL BE NO GREATER THAN 50% OF THE DIAMETER OF THE FLEXABLR SEWER MAIN DIAMETER. THE CONNECTION SHALL BE MADE USING AN APPROVED TEE OR WYE FITTINGS. INVERT OF SERVICE CONNECTION SHALL BE AT THE SAME ELEVATION OR GREATER THAN THE ELEVATION OF THE SPRINGLINE OF THE SEWER MAIN
2. SANITARY SERVICES TO BE 135mm AND STORM SERVICES TO BE 100mm FOR NEW RESIDENCES UNLESS SPECIFIED OTHERWISE. SERVICE PIPE AND RADIUS BENDS TO BE APPROVED CSA B182.2, SDR28 PRODUCTS UNLESS SPECIFIED OTHERWISE
3. APPROVED CONTROLLED SETTLEMENT JOINTS OPTIONAL FOR SERVICE CONNECTIONS TO MAIN SEWERS UP TO 5m DEEP. WHERE APPROVED, CONNECTIONS TO SEWERS OVER 5m DEEP REQUIRE APPROVED CONTROLLED SETTLEMENT JOINTS
4. CAP AT THE PROPERTY LINE SHALL BE ADEQUATELY BRACED TO WITHSTAND TESTING PRESSURE
5. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SHOWN
6. RADIUS BENDS GREATER THAN 22.5° ARE NOT ALLOWED

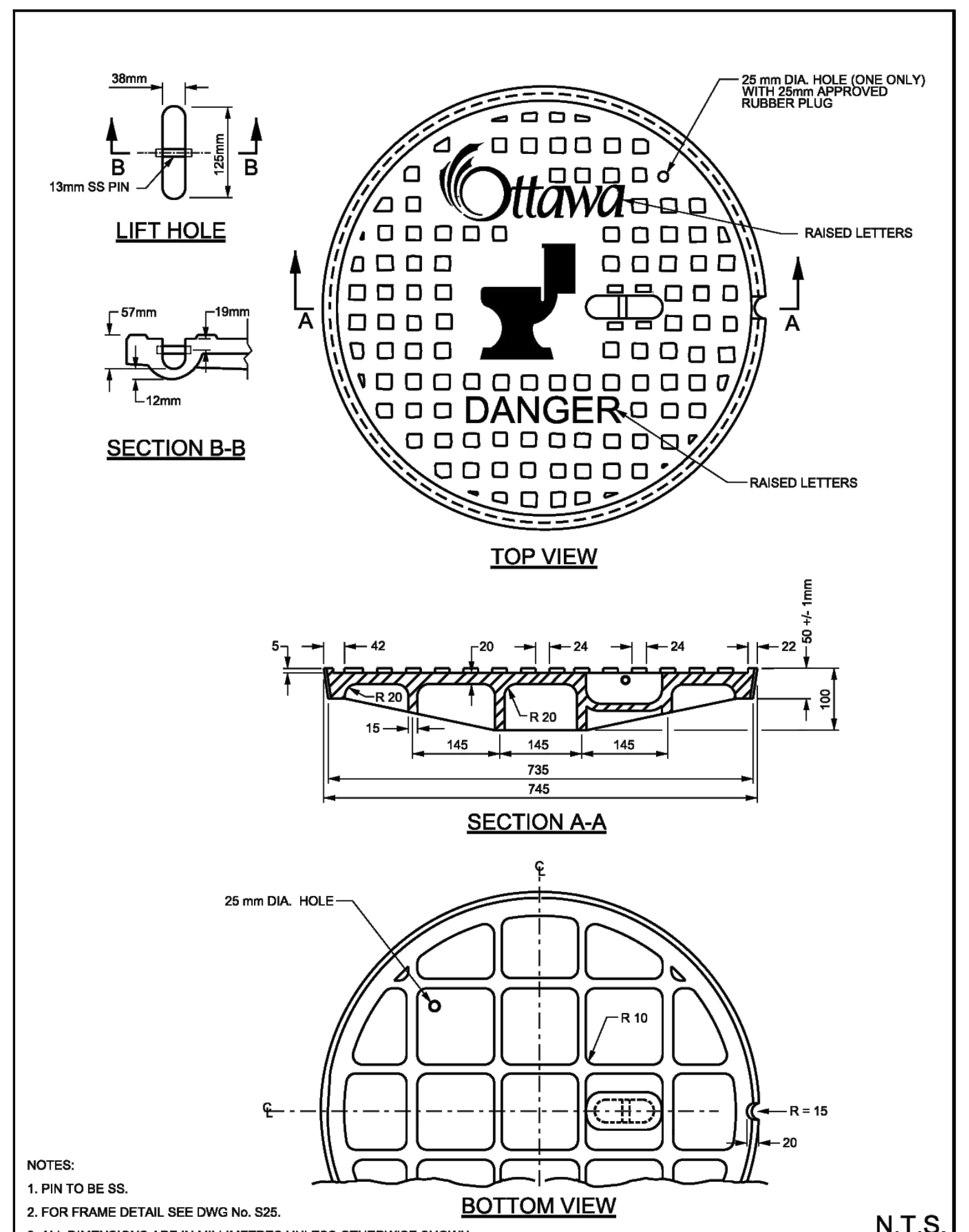
Ottawa
TITLE: SEWER SERVICE CONNECTIONS FOR FLEXIBLE MAIN SEWER PIPE
DATE: MAR 2006
REV: MAR 2024
DWG No: S11.1



NOTES:

1. ALL DIMENSIONS SHOWN ARE FOR FINISHED CASTINGS ONLY. PATTERN MAKERS AND CASTING SHOP SHOULD MAKE ALLOWANCES ACCORDINGLY.
2. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS SHOWN OTHERWISE.
3. IT IS ESSENTIAL THAT THE COVER BE INSTALLED IN THE DIRECTION OF THE GUTTER LINE AS SHOWN.
4. THE FRAME FOR THIS COVER SHALL BE AS PER OPSD 400.02 WITHOUT THE HINGE SLOT.
5. NOT FOR NEW CONSTRUCTION AFTER 31 DEC. 05, FOR REPLACEMENT OF BROKEN EXISTING ONLY.

Ottawa
HEAVY DUTY "FISH" TYPE SQUARE CATCH BASIN COVER
DATE: MARCH 2005
REV. DATE:
DWG. No.: S19.1

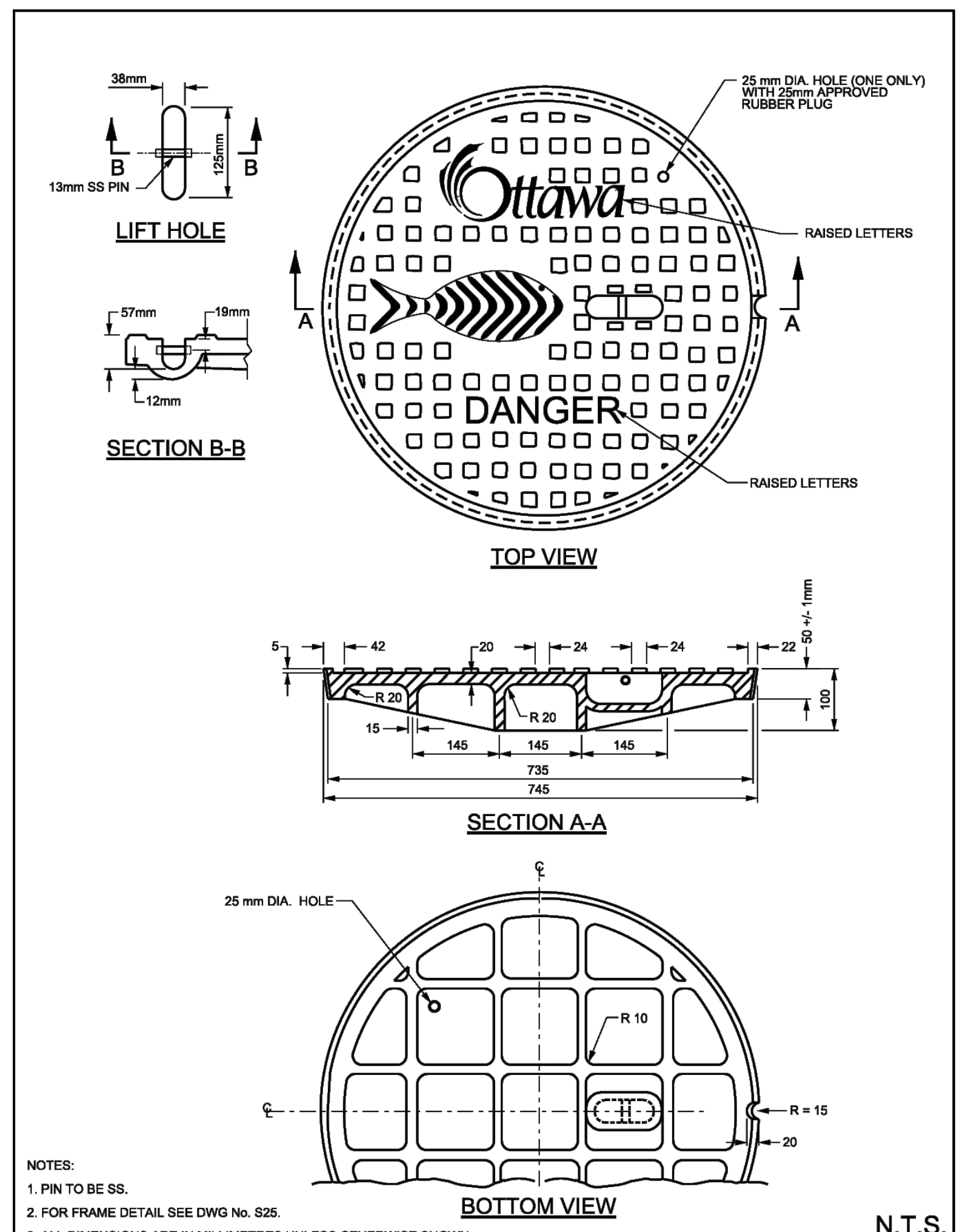


NOTES:

1. PIN TO BE SS.
2. FOR FRAME DETAIL SEE DWG No. S25.
3. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SHOWN.

N.T.S.

Ottawa
STANDARD CIRCULAR SANITARY & COMBINED MAINTENANCE HOLE COVER
DATE: MARCH 2008
REV. DATE: MARCH 2017
DWG. No.: S24

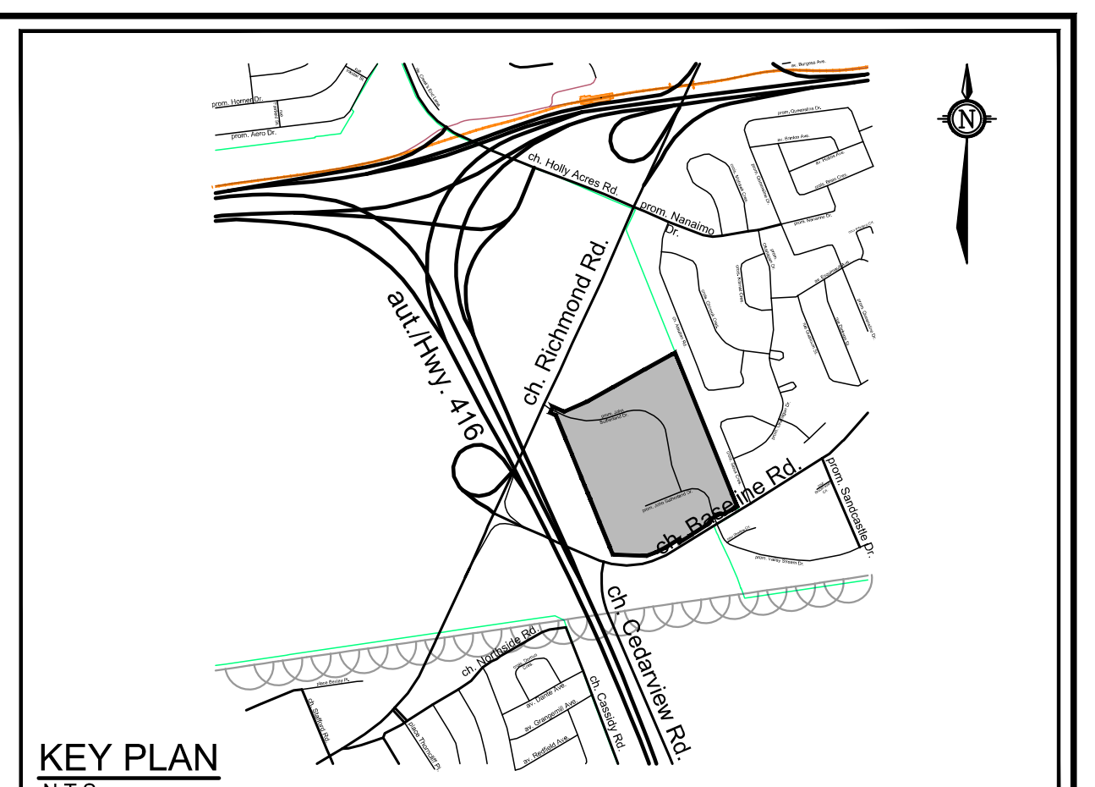


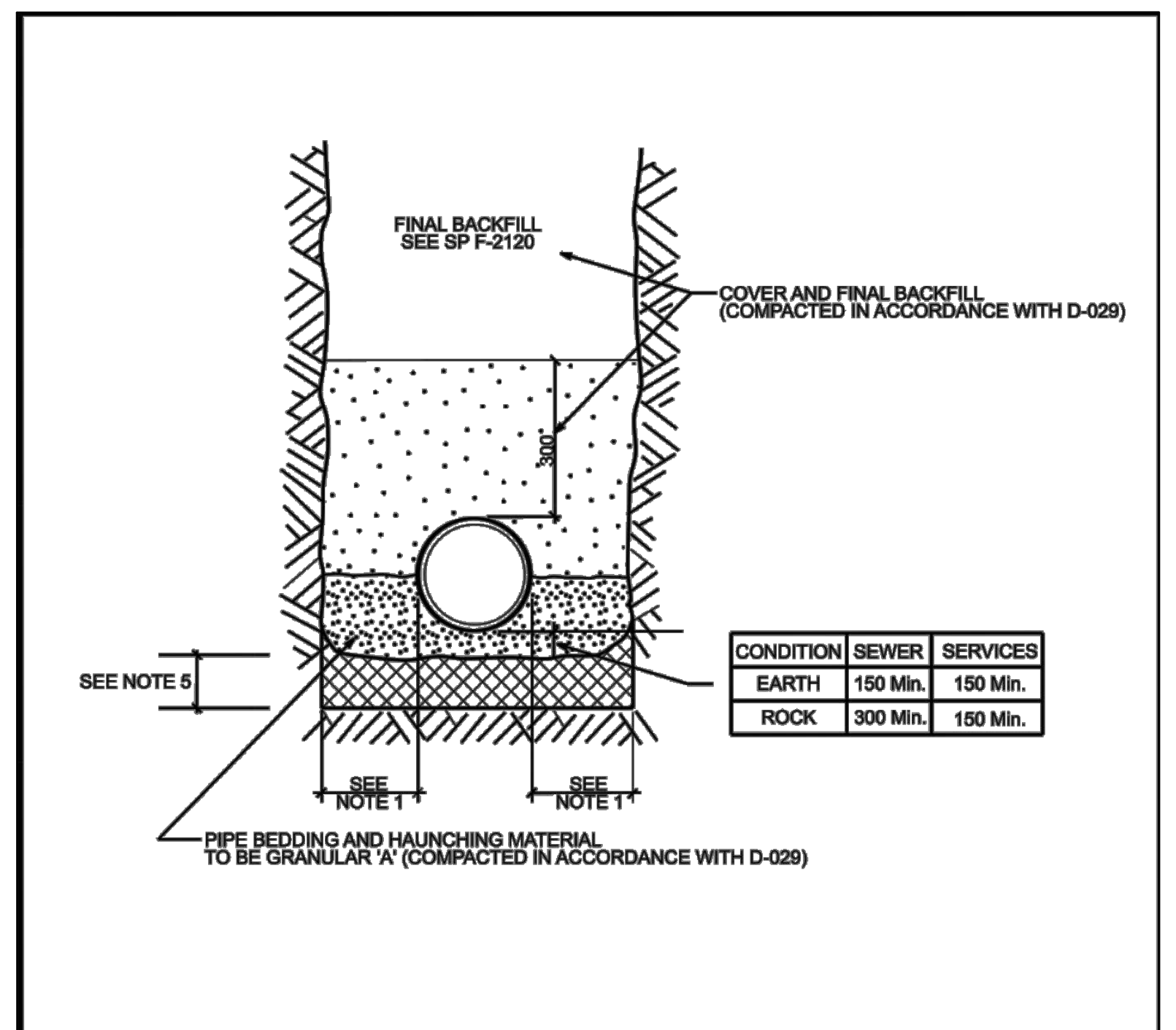
NOTES:

1. PIN TO BE SS.
2. FOR FRAME DETAIL SEE DWG No. S25.
3. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SHOWN.

N.T.S.

Ottawa
STANDARD CIRCULAR STORM MAINTENANCE HOLE COVER
DATE: MARCH 2010
REV. DATE: MARCH 2017
DWG. No.: S24.1





NOTES:

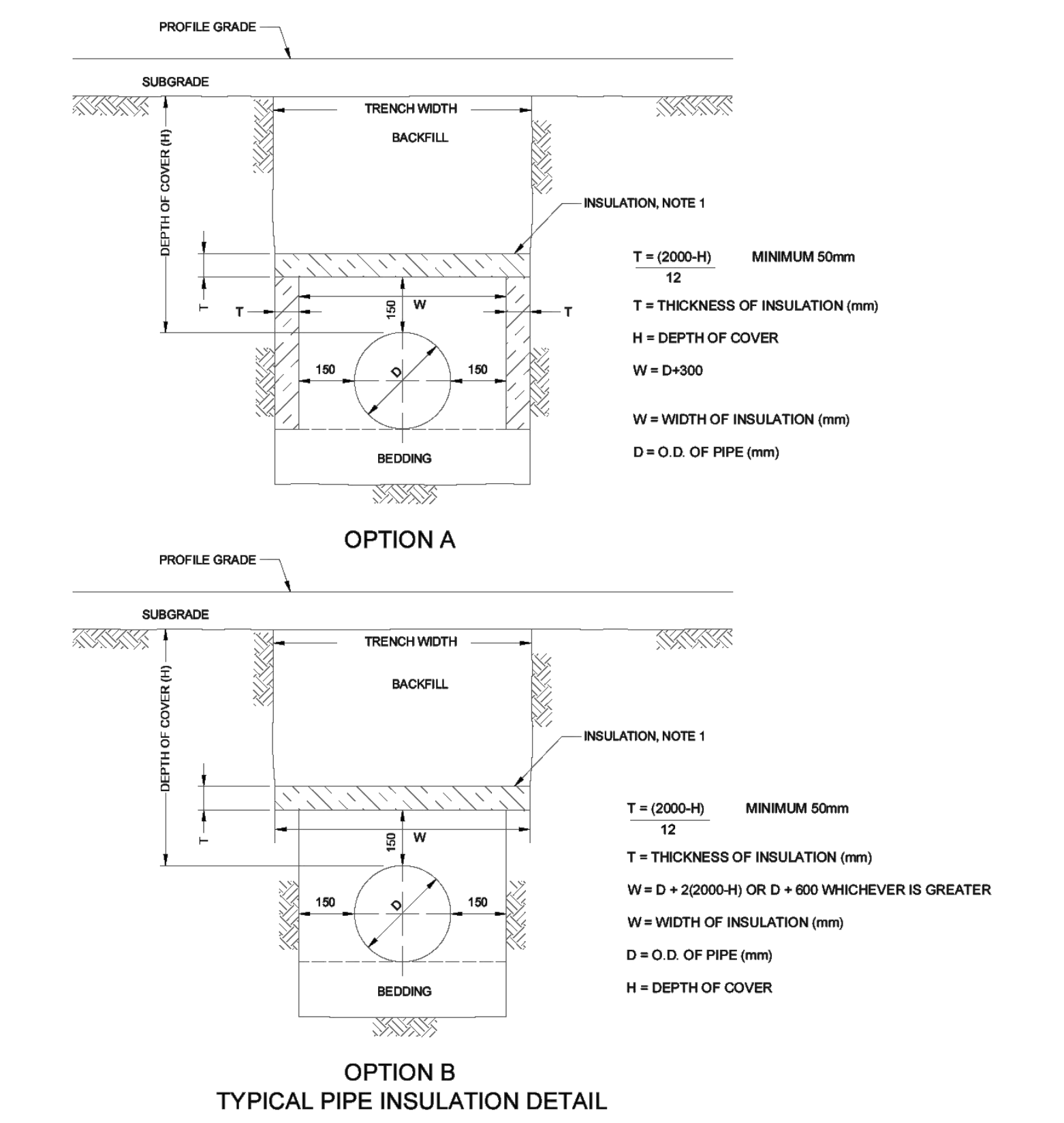
1.

PIPE INSIDE DIAMETER (mm)	CLEARANCE (mm)
900 OR LESS	CONC 450 PVC 450
OVER 900	500

2. FINAL BACKFILL - APPROVED NATIVE MATERIAL OR SELECT SUBGRADE IN ACCORDANCE WITH F-2120.
3. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS SHOWN OTHERWISE.
4. INITIAL BACKFILL MATERIAL
   - CONCRETE PIPE - GRANULAR 'A', GRANULAR 'B', OR SELECT SUBGRADE MATERIAL WITH 100% PASSING THE 37.5 mm SIEVE
   - PVC PIPE - GRANULAR 'A'
5. WHEN APPROVED BY THE CONTRACT ADMINISTRATOR, POOR SOILS SHALL BE EXCAVATED TO CREATE A FOUNDATION THAT SHALL BE FILLED TO THE BOTTOM OF THE BEDDING WITH GRANULAR 'B'.

N.T.S.

Ottawa
SINGLE TRENCH (SEWER & SEWER SERVICES)
DATE: MAY 2001
REV. DATE: MARCH 2021
DWG. No.: S6

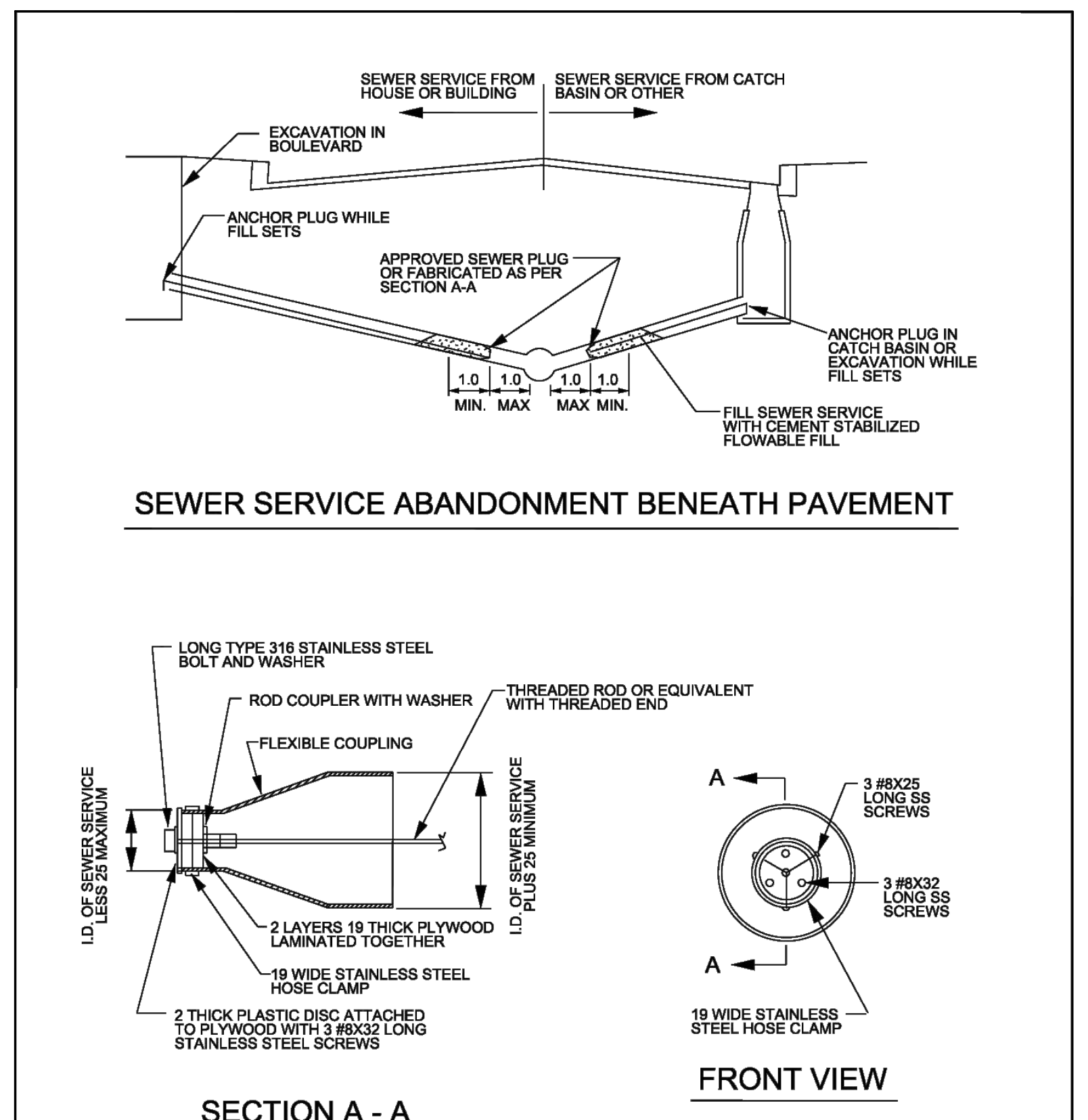


TYPICAL PIPE INSULATION DETAIL

NOTES:

1. THE INSULATION MATERIAL SHALL BE EXTRUDED POLYSTYRENE ACCORDING TO MW-19.15 WITH A MINIMUM COMPRESSIVE STRENGTH OF 275 kPa
2. MINIMUM INSULATION THICKNESS SHALL BE 50mm
3. JOINTS SHALL BE STAGGERED FOR MULTIPLE INSULATION SHEETS
4. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE NOTED

Ottawa
TITLE: INSULATION FOR SHALLOW SEWERS
DATE: MAY 2001
REV: JULY 2024
DWG No: S35



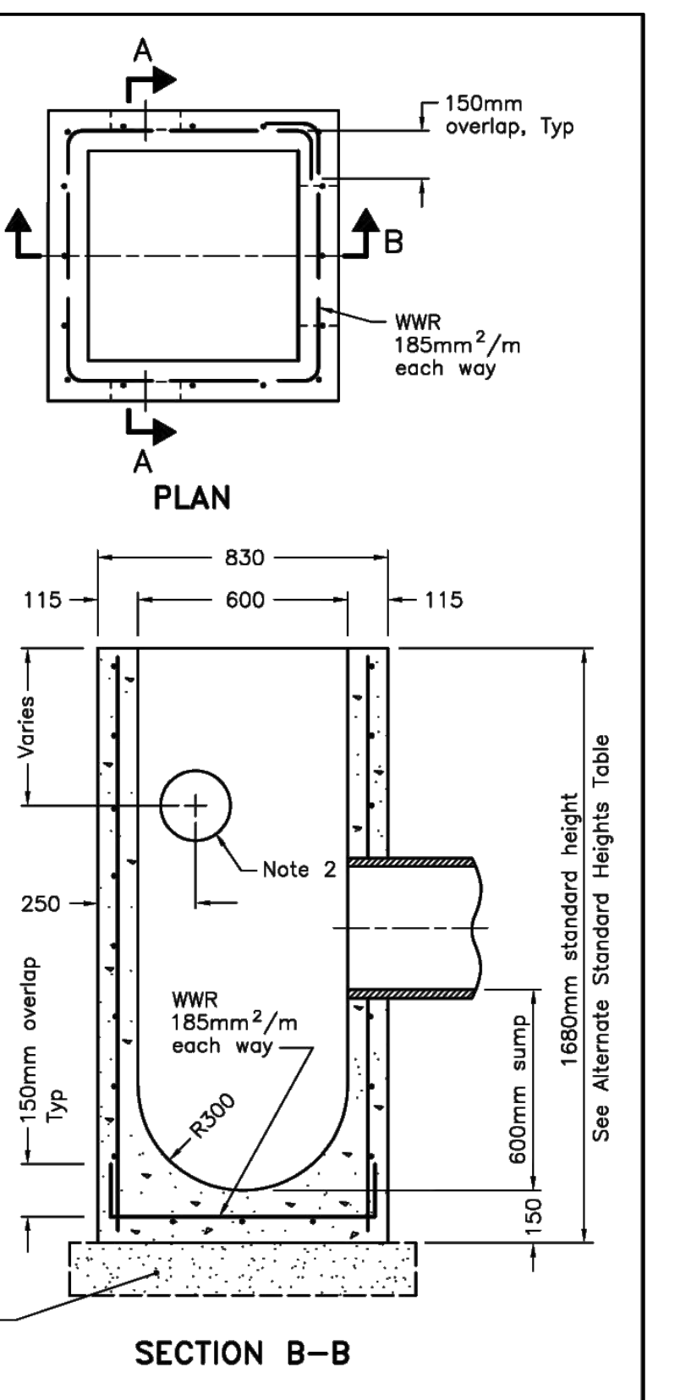
SECTION A - A FABRICATED SEWER PLUG

NOTES:

1. ALL DIMENSIONS IN MILLIMETERS UNLESS OTHERWISE SHOWN.

N.T.S.

Ottawa
SEWER SERVICE ABANDONMENT BENEATH PAVEMENT
DATE: MARCH 2011
REV. DATE:
DWG. No.: S11.4

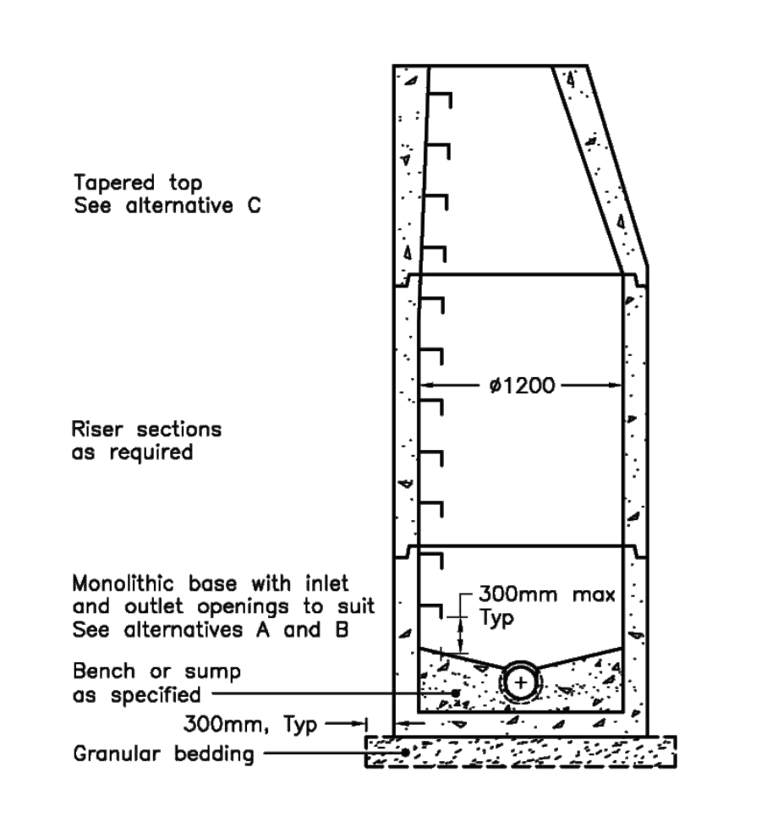


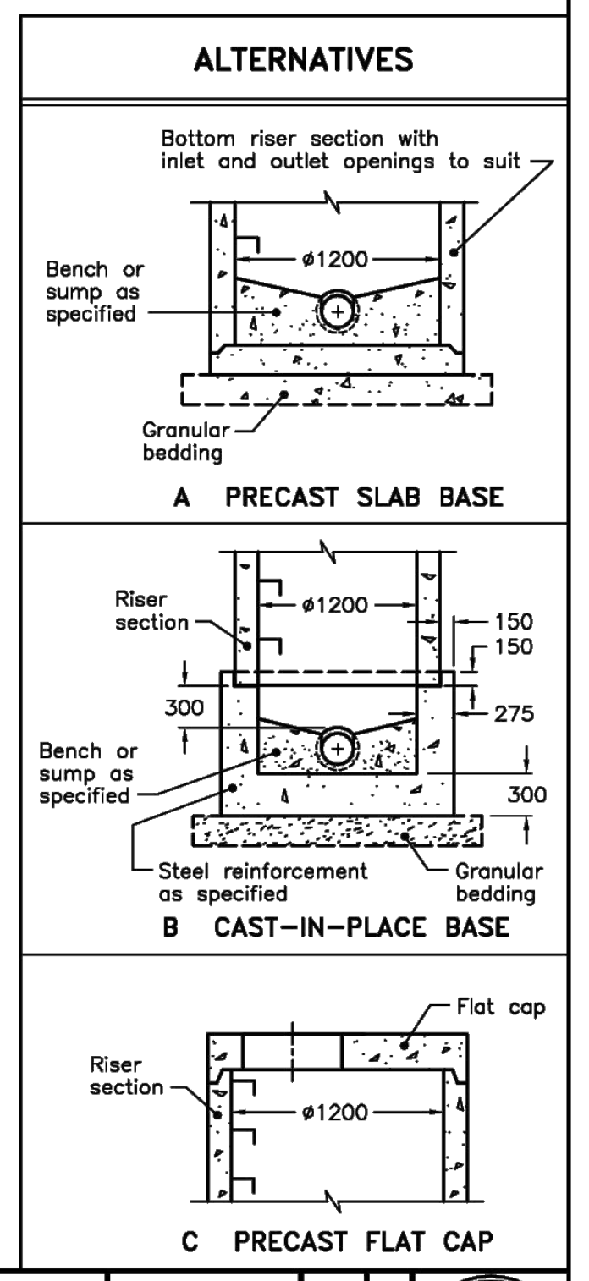
ALTERNATE STANDARD HEIGHTS	
ALTERNATIVE	DIMENSION
A	1980
B	1830
C	1520
D	1380

NOTES:

1 Outlet hole size 525mm diameter maximum, location as required.
2 200mm diameter knockout to accommodate subdrain. Knockout shall be 60mm deep.
A Centre reinforcing in base slab and walls ±20mm.
B Granular backfill shall be placed to a minimum thickness of 300mm all around the catch basin.
C Frame, grate, and adjustment units shall be installed according to OPSD 704.010.
D Pipe support shall be according to OPSD 708.020.
E All dimensions are nominal.
F All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING
Nov 2019 Rev 4
PRECAST CONCRETE CATCH BASIN 600x600mm
OPSD 705.010

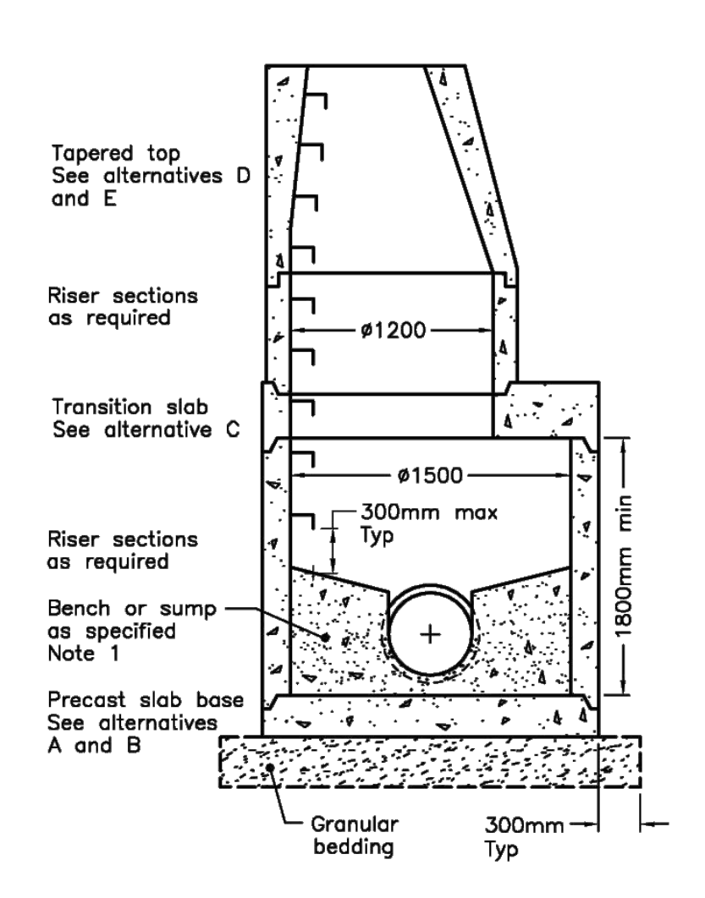


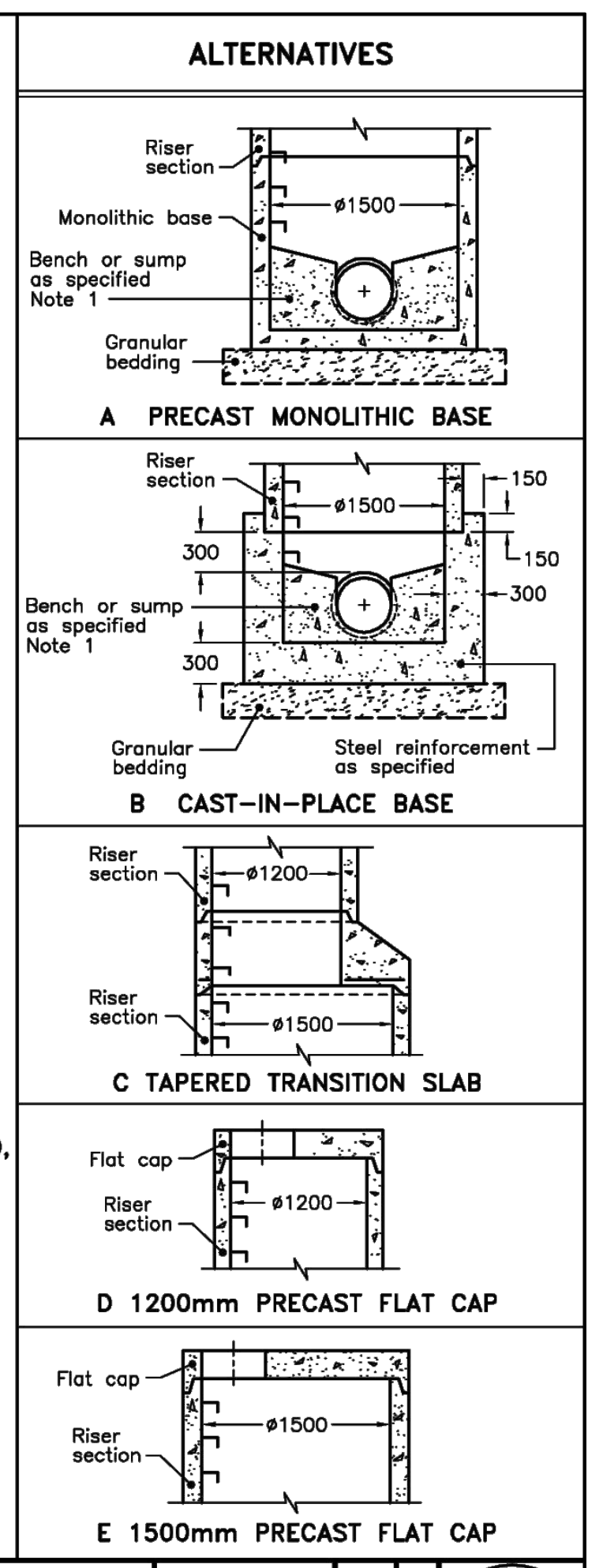


NOTES:

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

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

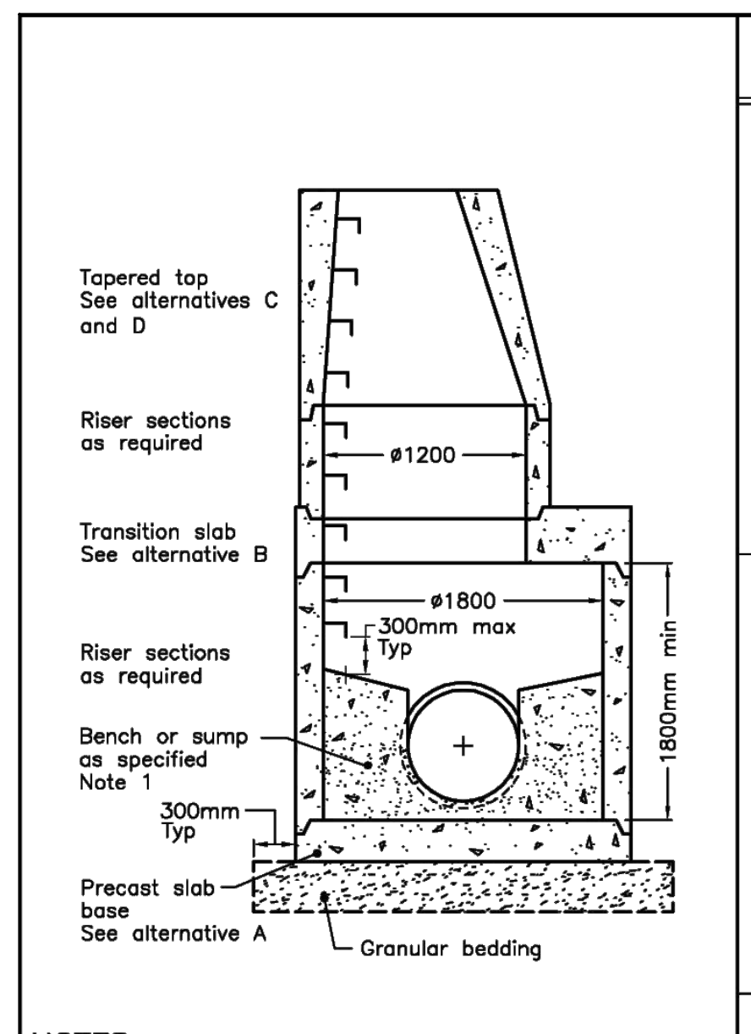


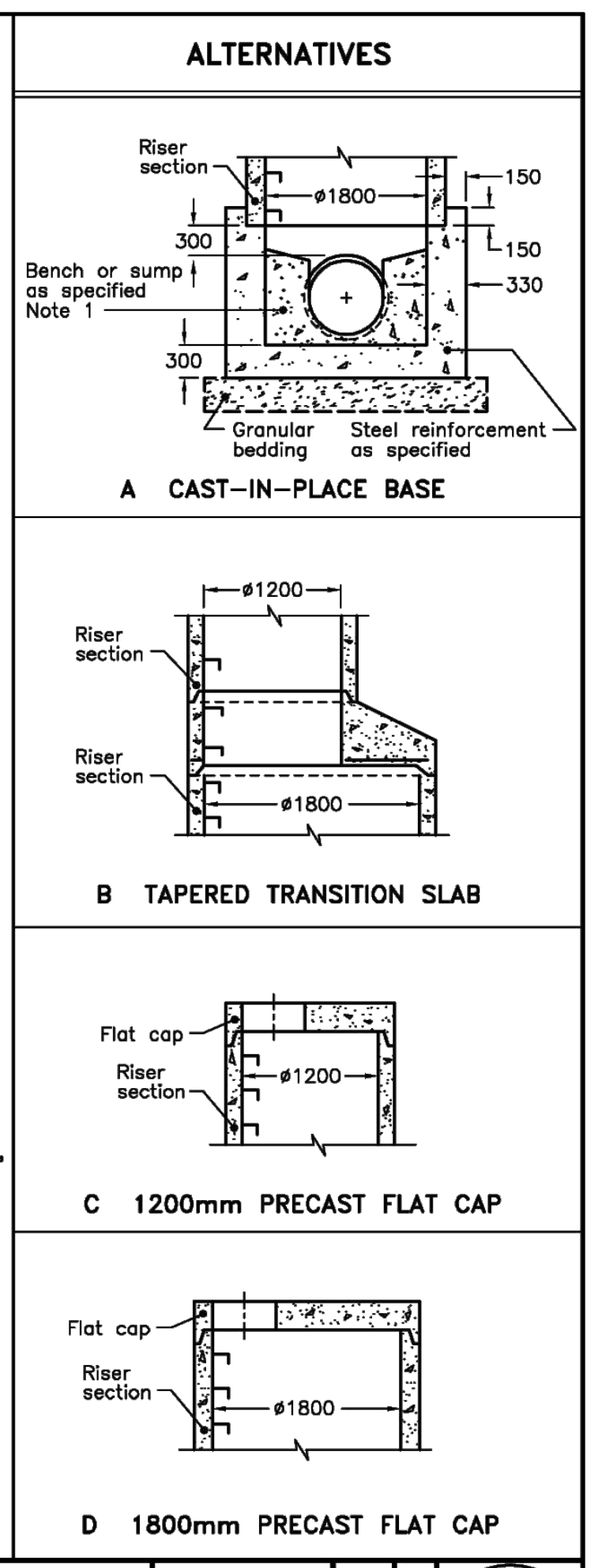


NOTES:

1 For sump detail, see OPSD 701.010.
A Granular backfill shall be placed to a minimum thickness of 300mm all around the maintenance hole.
B Precast concrete components shall be according to OPSD 701.030, 701.031, 701.040, 701.041, 703.011, 703.021, and 706.010.
C Structures exceeding 5.0m in depth shall include safety platform according to OPSD 404.020 or 404.021.
D Pipe support shall be according to OPSD 708.020.
E For benching and pipe opening details, see OPSD 701.021.
F For adjustment unit and frame installation, see OPSD 704.010.
G All dimensions are nominal.
H All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING
Nov 2014 Rev 5
PRECAST CONCRETE MAINTENANCE HOLE 1500mm DIAMETER
OPSD 701.011

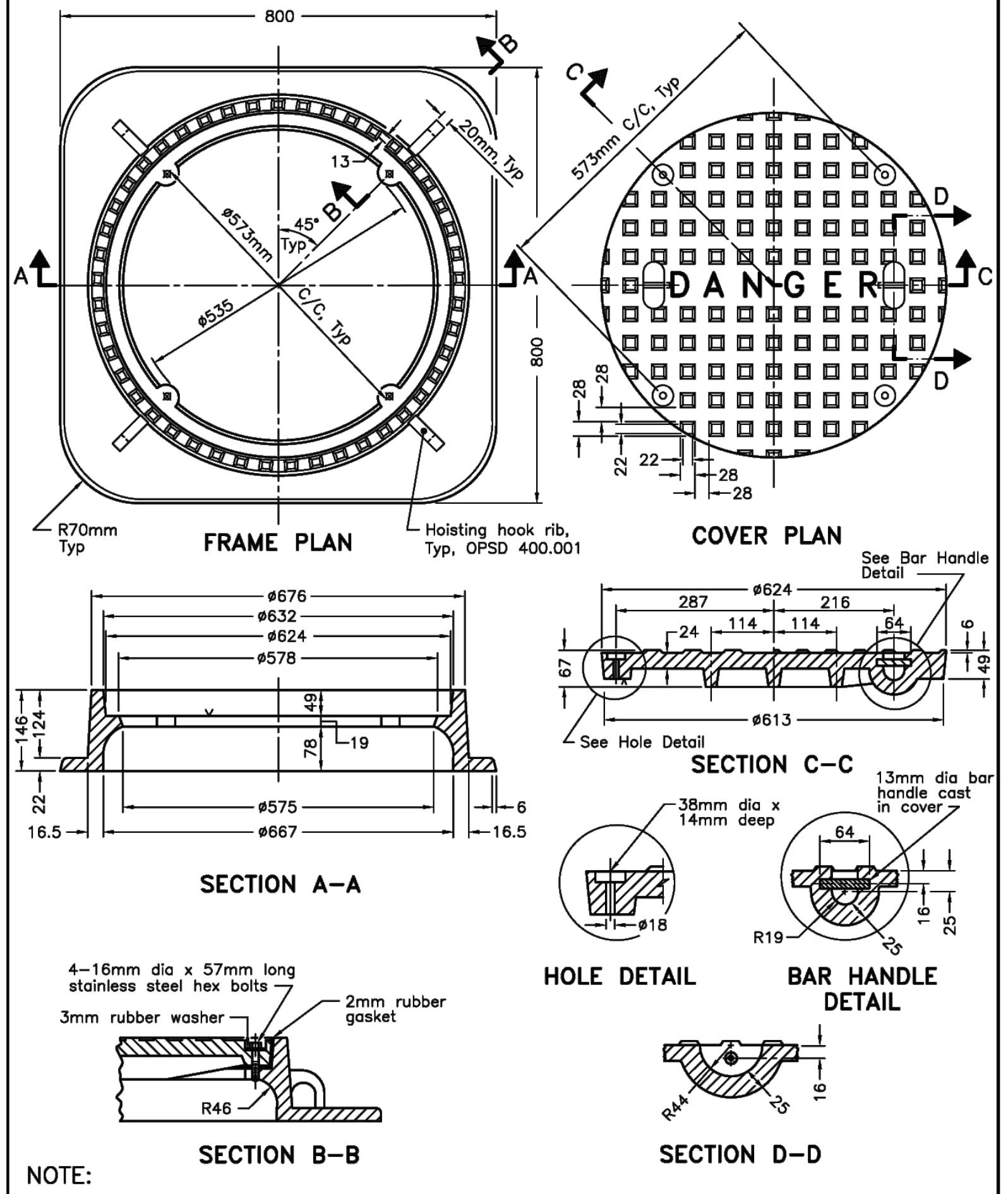




NOTES:

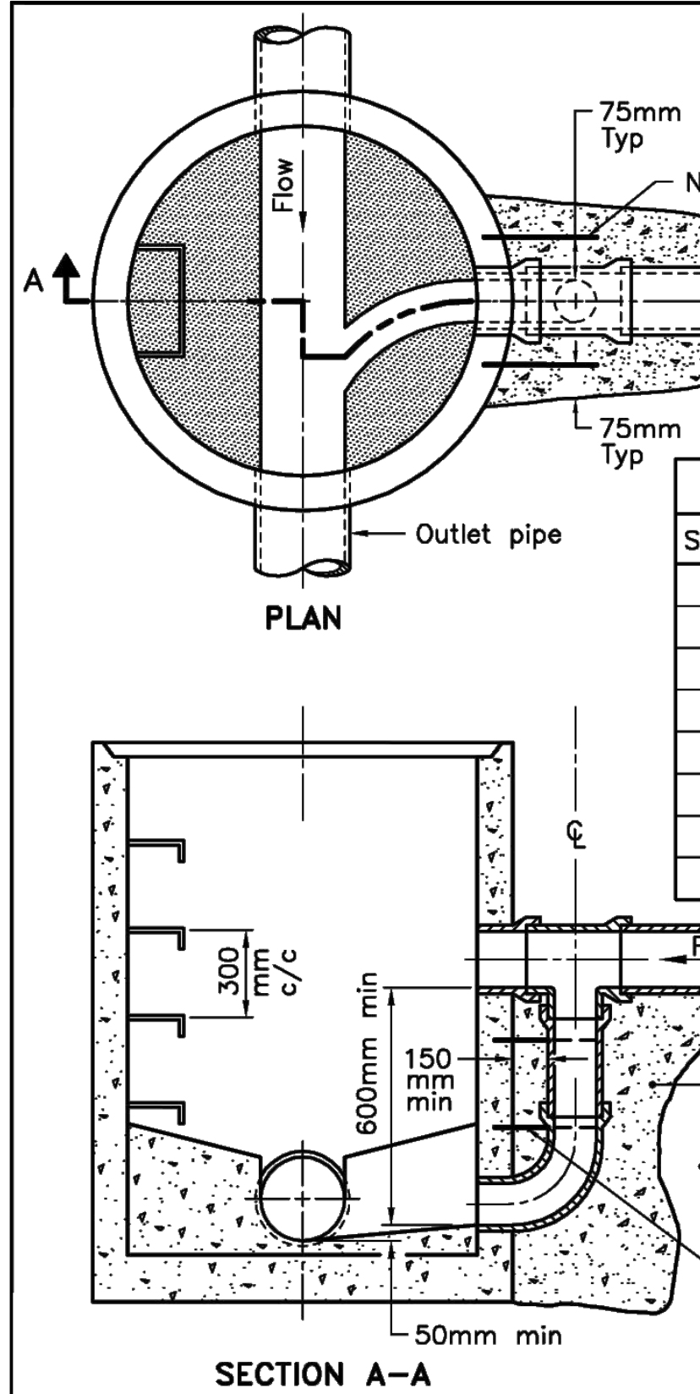
1 For sump detail, see OPSD 701.010.
A Granular backfill shall be placed to a minimum thickness of 300mm all around the maintenance hole.
B Precast concrete components shall be according to OPSD 701.030, 701.031, 701.050, 701.051, 703.012, 703.022, and 706.020.
C Structures exceeding 5.0m in depth shall include safety platform according to OPSD 404.020 or 404.022.
D Pipe support shall be according to OPSD 708.020.
E For benching and pipe opening details, see OPSD 701.021.
F For adjustment unit and frame installation, see OPSD 704.010.
G All dimensions are nominal.
H All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING
Nov 2014 Rev 5
PRECAST CONCRETE MAINTENANCE HOLE 1800mm DIAMETER
OPSD 701.012



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

ONTARIO PROVINCIAL STANDARD DRAWING
Nov 2018 Rev 4
CAST IRON, SQUARE FRAME WITH CIRCULAR WATERTIGHT COVER FOR MAINTENANCE HOLES
OPSD 401.030

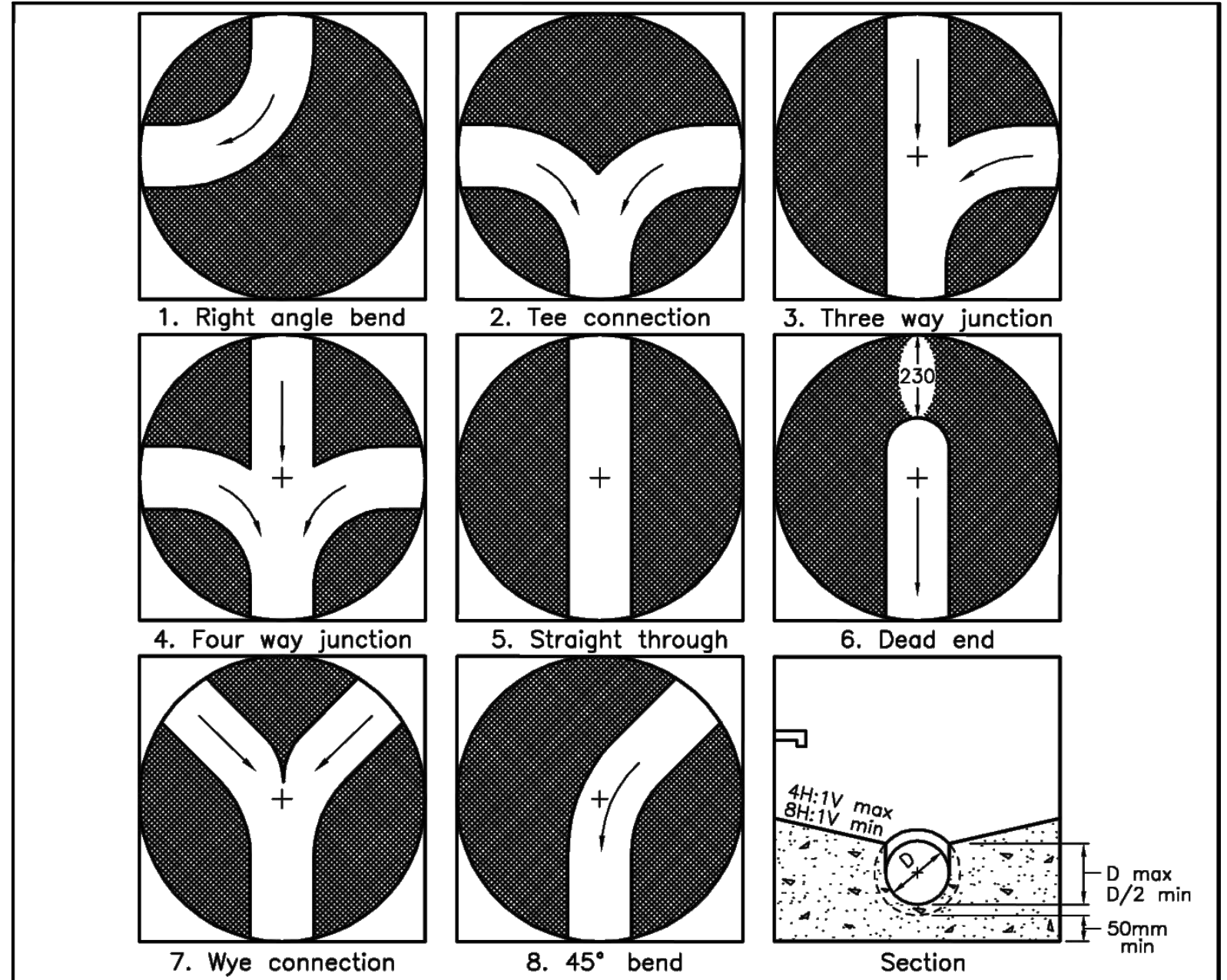


SIZE OF DROP PIPE		
SEWER ID	DROP PIPE ID	APPLICATION
200	200	Storm and Sanitary
250	200	Storm and Sanitary
300	250	Storm and Sanitary
375	300	Storm and Sanitary
450	375	Storm
525	450	Storm
600	525	Storm
675	600	Storm

NOTES:

1 Concrete shall be placed to undisturbed ground and the outside face of the maintenance hole, but there shall be a minimum of 150mm of 15MPa concrete around the drop pipe.
2 Concrete shall be secured to the maintenance hole with 450mm long, 13mm diameter threaded rods and drilled expansion anchors down either side of the drop pipe at 300mm centres.
A All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING
Nov 2016 Rev 3
CAST–IN–PLACE MAINTENANCE HOLE DROP STRUCTURE TEE
OPSD 1003.010



MAXIMUM SIZE HOLE IN THE WALL IN PRECAST RISER SECTIONS					
Maintenance Hole Diameter	No. 1–4	No. 5 and 6	No. 8	No.7	
				Inlet Hole	Outlet Hole
1200	700	860	780	700	860
1500	860	1220	960	860	1170
1800	1220	1485	1220	1220	1485
2400	1485	2020	1760	1485	2020
3000	1930	2450	2300	1930	2450
3600	2470	3085	2730	2470	3085

NOTES:

1 Slopes shall be maintained from the outlet hole opening for top of benching.
A Concrete for benching shall be 30MPa.
B When benching is hand–finshed, it shall be given wood float finish, channel shall be given steel trowel finish.
C Benching slope and height shall be as specified.
D When specified, maintenance holes that are 1200mm in diameter with a uniform channel for 200 or 250mm pipe may be prebenched at the manufacturer with standardized benching slope and channel orientation.
E All dimensions are nominal.
F All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING
Nov 2014 Rev 4
MAINTENANCE HOLE BENCHING AND PIPE OPENING ALTERNATIVES
OPSD 701.021

ALL PROJECT NOTES, DETAILS AND SPECIFICATIONS ARE TO MEET THE MOST CURRENT AND AMENDED VERSIONS OF THE CITY OF OTTAWA AND PROVINCIAL STANDARDS

THIS PLAN IS TO BE READ IN CONJUNCTION WITH CIVIL PLANS 123089-GP1, 123089-GP2, 123089-GR1, AND 123089-GR2

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Queensway Carleton Hospital

No.	REVISION	DATE	BY
1.	ISSUED FOR SITE PLAN CONTROL APPROVAL	NOV 28/25	FST

SCALE
NOT TO SCALE

DESIGN KD
CHECKED FST
DRAWN KD
CHECKED FST
APPROVED FST

FOR REVIEW ONLY

LICENSED PROFESSIONAL ENGINEER
F.S. THAUVETTE
100041399
November 28, 2025
PROVINCE OF ONTARIO

NOVATECH
Engineers, Planners & Landscape Architects
Suite 200, 240 Michael Cowpland Drive
Ottawa, Ontario, Canada K2M 1P6
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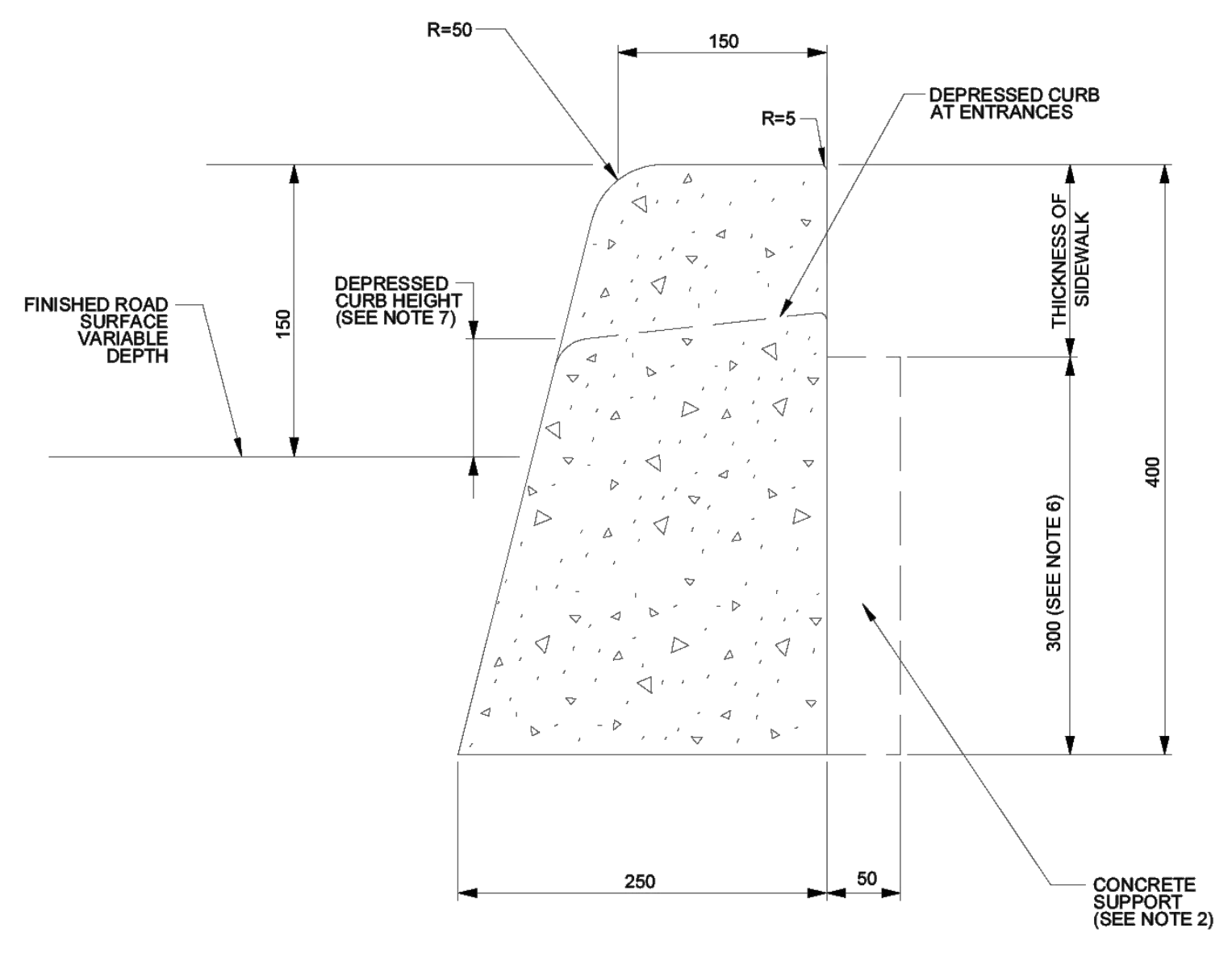
Website www.novatech-eng.com

LOCATION
CITY OF OTTAWA
QUEENSWAY CARLETON HOSPITAL

DRAWING NAME
CIVIL DETAILS
PART 4 EXPANSION

PROJECT No. 123089
REV REV #1
DRAWING No. 123089-DET 1

PLANA0.DWG - 1189mmx841mm

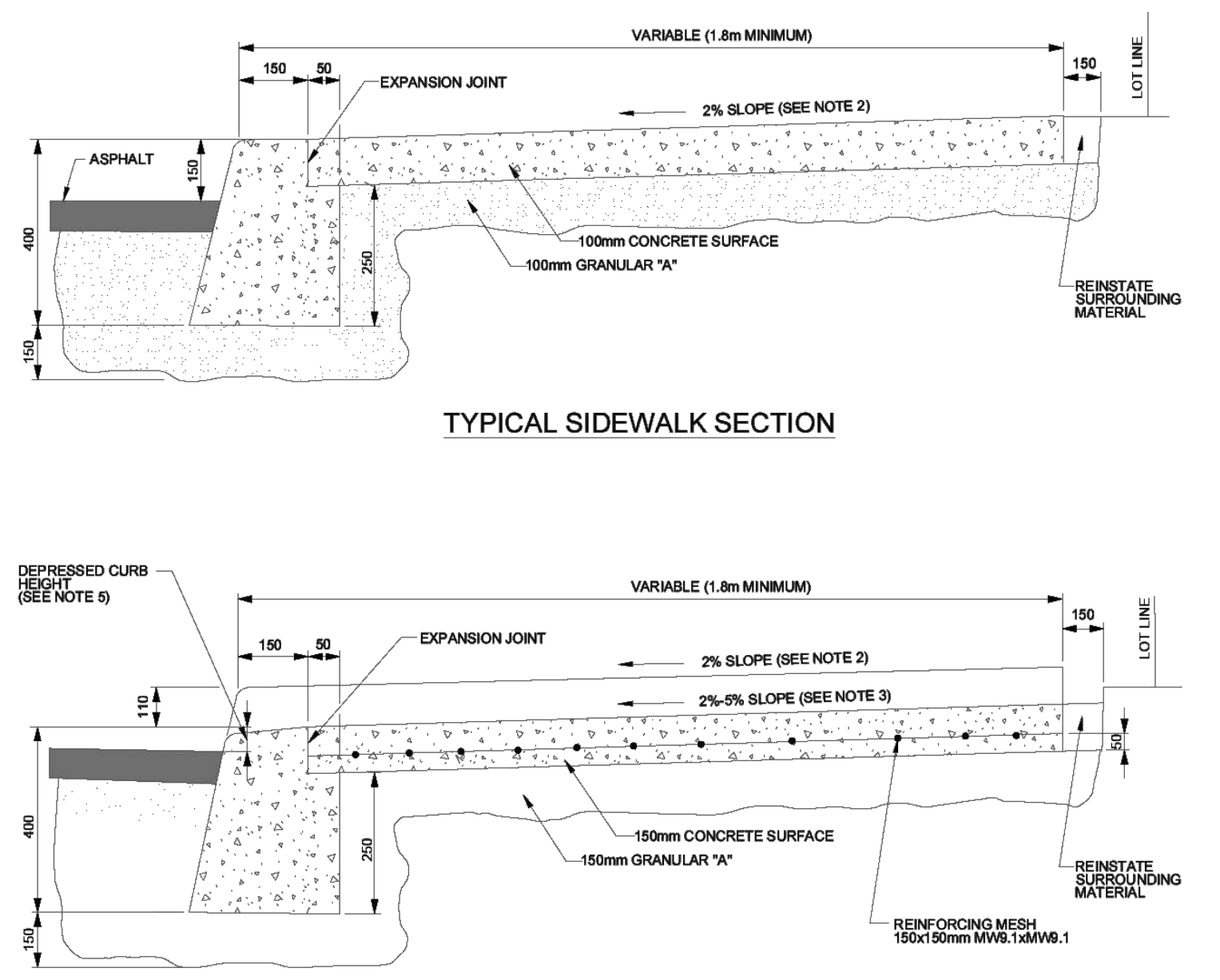


CONCRETE BARRIER CURB

NOTES:

1. THE FULL CURB DEPTH SHALL BE CARRIED THROUGH THE DEPRESSED ACCESS CROSSING
2. A CONCRETE SUPPORT IS REQUIRED WHEN BUILT ADJACENT TO THE SIDEWALK
3. IF AN EXTRUSION CURBING MACHINE IS USED, THE EXPANSION BITUMINOUS MATERIAL AND THE #15 DOWELS ARE TO BE PLACED AT THE END OF THE EXTRUSION
4. ALL MEASUREMENTS ARE IN MILLIMETRES UNLESS OTHERWISE NOTED
5. EXPANSION AND DUMMY JOINTS AS PER SC5
6. FOR DEPRESSED CURB AT ENTRANCES USE 250
7. DEPRESSED CURB HEIGHT - FOR PEDESTRIAN CURB RAMPS 0 TO 6 mm AND FOR PRIVATE ENTRANCES 0 TO 13mm

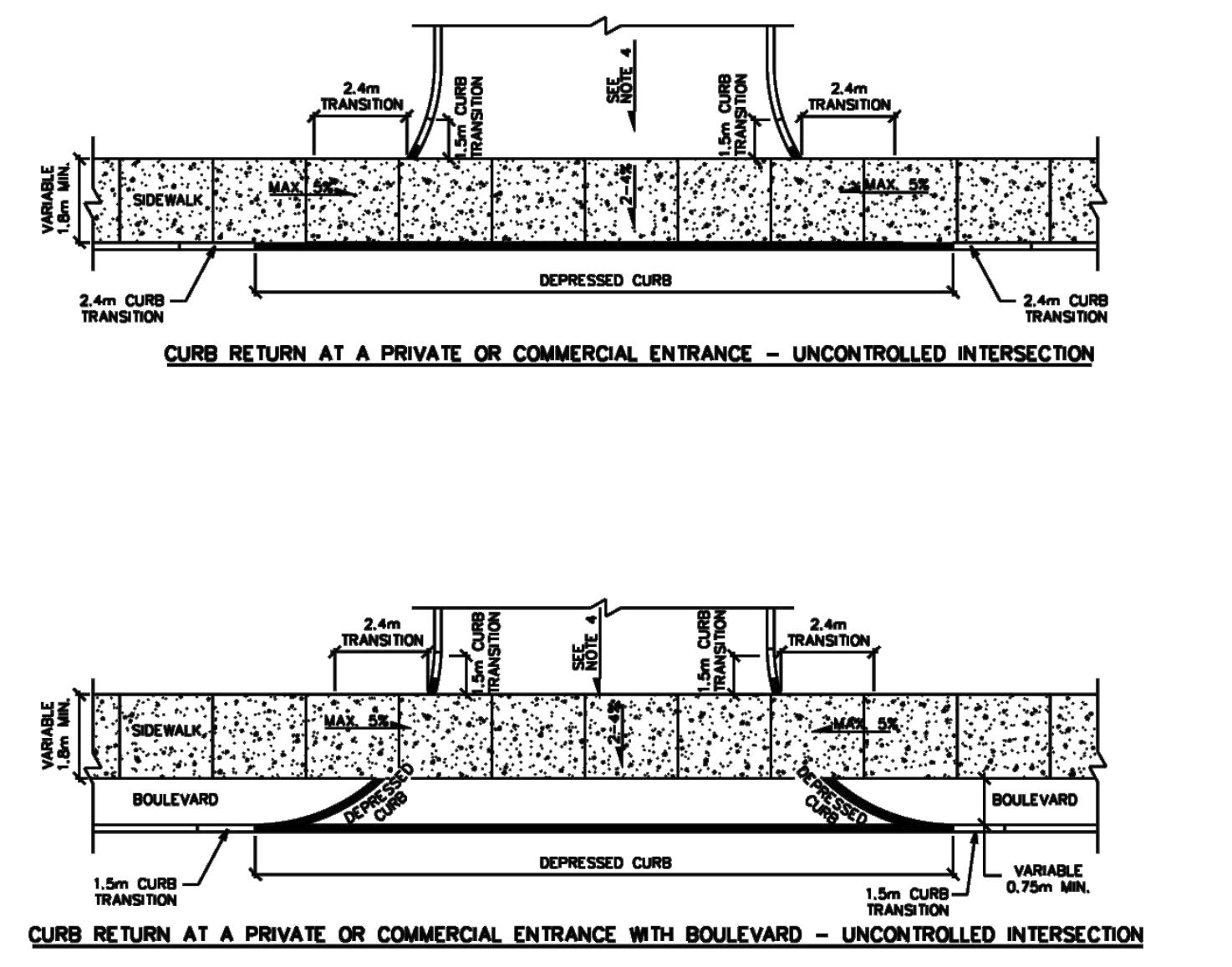
TITLE:	CONCRETE BARRIER CURB FOR GRANULAR BASE PAVEMENT (MODIFIED OPSD-600.110)	DATE:	JAN 2003
		REV:	MAR 2025
		DWG No:	SC1.1



NOTES:

1. ALL MEASUREMENTS ARE IN MILLIMETRES UNLESS OTHERWISE NOTED
2. THE MAXIMUM SLOPE IS NOT TO EXCEED 2%
3. FOR CURB RAMPS, SLOPE OF 2% TO 5%, MAXIMUM 8%
4. EXPANSION AND DUMMY JOINTS AS PER SC5
5. DEPRESSED CURB HEIGHT - FOR PEDESTRIAN CURB RAMPS 0 TO 6 mm AND FOR PRIVATE ENTRANCES 0 TO 13mm

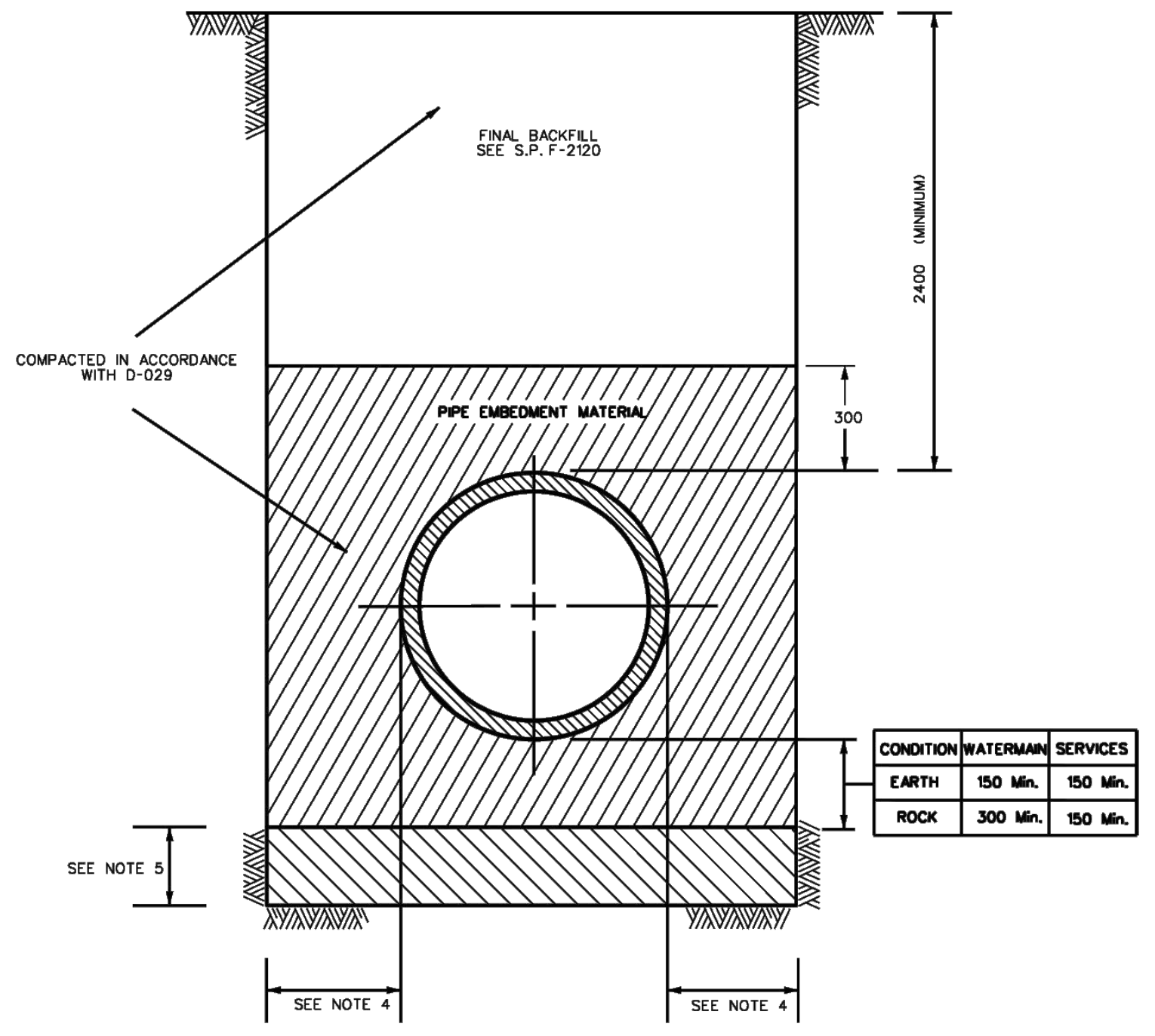
TITLE:	CONCRETE BARRIER CURB WITH SIDEWALK	DATE:	JAN 2003
		REV:	JULY 2025
		DWG No:	SC1.4



NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS SHOWN OTHERWISE.
2. CURB DETAILS SEE SC1.1, SC1.2 AND SC1.3.
3. SIDEWALK DETAILS SEE SC2 AND SC3.
4. MAXIMUM SLOPE VARIES, SEE PRIVATE APPROACH BYLAW.
5. UNCONTROLLED INTERSECTION MEANS AN ENTRANCE NOT LOCATED AT A TRAFFIC SIGNAL OR ALL-WAY STOP CONTROL.

CURB RETURN ENTRANCES - UNCONTROLLED INTERSECTIONS	DATE:	MARCH 2007
	REV. DATE:	MARCH 2021
	DWG. No.:	SC7.1



CONDITION	WATERMAIN	SERVICES
EARTH	150 Min.	150 Min.
ROCK	300 Min.	150 Min.

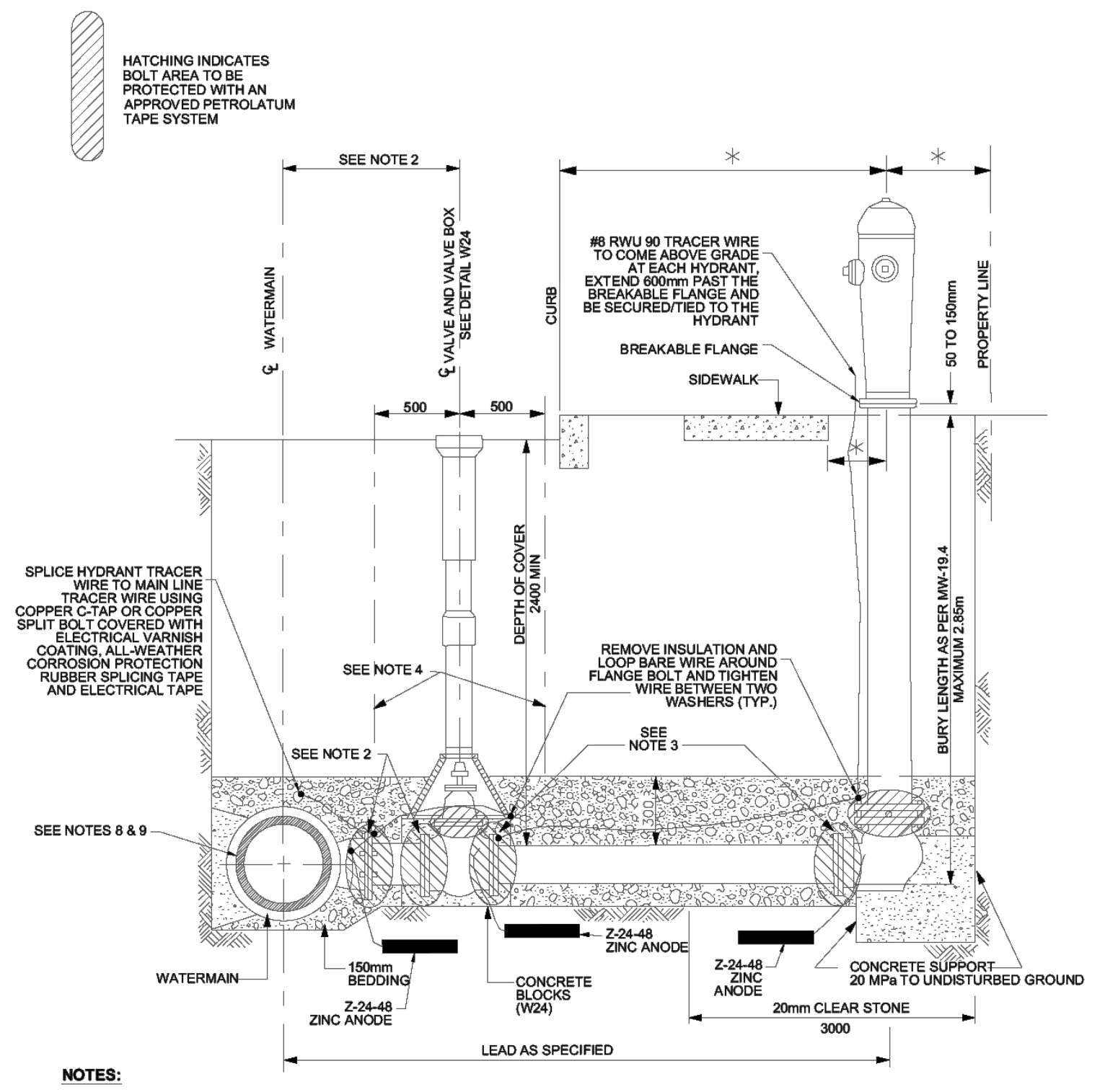
NOTES:

1. PIPE EMBEDMENT MATERIAL - GRANULAR 'A'.
2. FINAL BACKFILL - APPROVED NATIVE MATERIAL OR SELECT SUBGRADE IN ACCORDANCE WITH F-2120
3. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS SHOWN OTHERWISE.
4.

PIPE OUTSIDE DIA. (mm)	CLEARANCE (mm)
900 or LESS	450
OVER 900	500

5. WHEN APPROVED BY THE CONTRACT ADMINISTRATOR, POOR SOILS SHALL BE EXCAVATED TO CREATE A FOUNDATION THAT SHALL BE FILLED TO THE BEDDING WITH GRANULAR 'B'.

STANDARD TRENCH DETAIL	DATE:	MAY 2001
	REV. DATE:	MARCH 2016
	DWG. No.:	W17



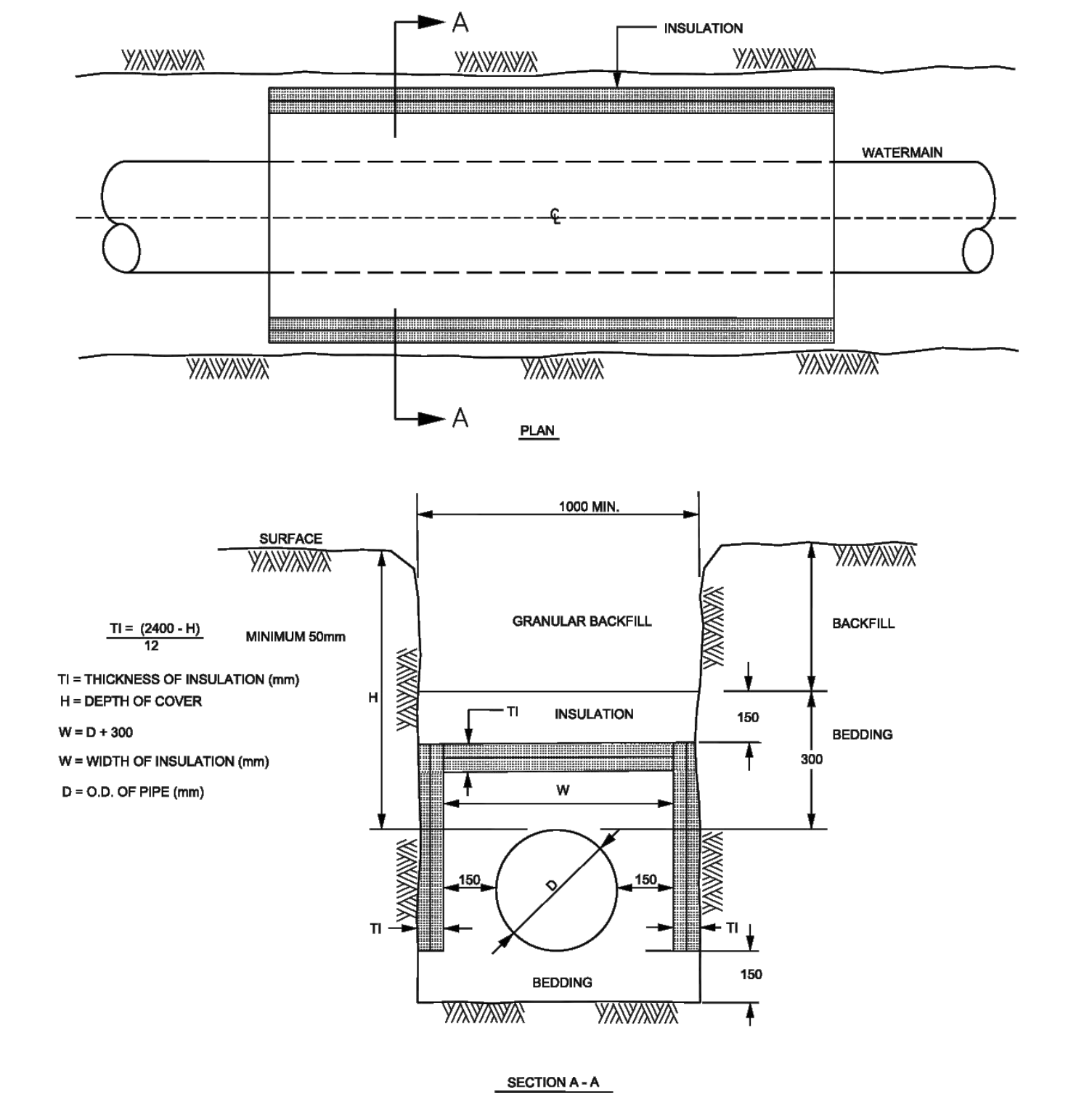
NOTES:

FOR ALL WATERMAINS

1. SEE DETAIL W20 FOR HYDRANTS IN DITCH AREAS
2. FOR WATERMAINS 400mm AND UNDER, LOCATE VALVE WITHIN 1.0m OF CENTRELINE. RETAINING/RESTRAINING DEVICES TO BE UTILIZED. FOR WATERMAINS 600mm AND OVER, BOLT VALVE WITH FLANGED END DIRECTLY TO FLANGED TEE
3. RETAINING/RESTRAINING DEVICES TO BE UTILIZED
4. HYDRANT BREAKABLE FLANGE ELEVATION TO BE ESTABLISHED PRIOR TO INSTALLATION. REFER TO MW-19.4 AND F-4414
5. SEE SPF-2120 FOR BACKFILL REQUIREMENTS IN THIS AREA
6. SEE F-4414 FOR HYDRANT LOCATION REQUIREMENTS
7. ALL MEASUREMENTS ARE IN MILLIMETRES UNLESS OTHERWISE NOTED
8. FOR ALL 300mm WATERMAINS USE A 300 x 150 TANGENTIAL TEE WITH THE 150mm OUTLET ON TOP
9. FOR ALL 400mm WATERMAINS USE A 400 x 150 TANGENTIAL TEE WITH THE 150mm OUTLET ON TOP
10. *DUCTILE IRON ONLY* THERMITE WELD TWO #8 RWU90 CABLES ACROSS EACH PIPE/FITTING JOINT OR CONNECTION TO ENSURE ELECTRICAL CONTINUITY ALONG ALL METALLIC COMPONENTS
11. ALL MATERIALS SHALL BE IN ACCORDANCE WITH MW-19.15
12. TRACER WIRE BOLT CONNECTIONS TO BE COMPLETED PER W55
13. TRACER WIRE SPLICES TO BE COMPLETED PER W47

TITLE:	HYDRANT INSTALLATION - NEW CONSTRUCTION	DATE:	MAY 2001
		REV:	MAR 2023
		DWG No:	W19

KEY PLAN
N.T.S.

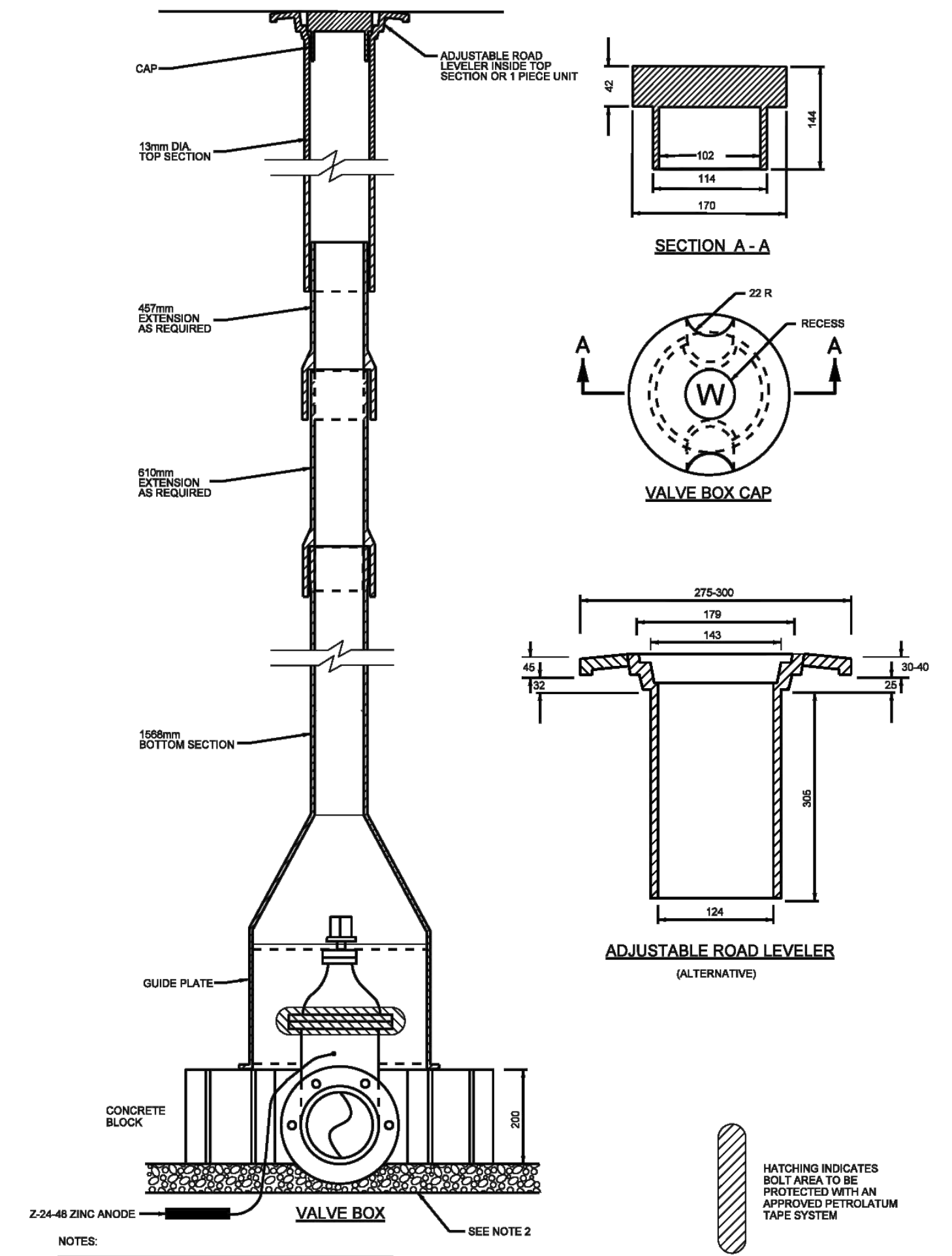


NOTES

FOR 150 - 400mm (NOMINAL DIAMETER) WATERMAINS, WHERE THE DEPTH OF COVER IS LESS THAN 2400mm

1. INCREMENTS OF THICKNESS SHALL BE ADJUSTABLE TO 25mm.
2. IN PROXIMITY OF MAINTENANCE HOLES, CULVERTS, CATCHBASINS, ETC., INSULATION SHALL BE PLACED PER DETAIL W23
3. DEPTH OF COVER LESS THAN 1200mm REQUIRES SPECIAL DESIGN
4. STAGGER JOINTS OF MULTIPLE SHEETS.
5. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS SHOWN OTHERWISE.

THERMAL INSULATION FOR WATERMAINS IN SHALLOW TRENCHES	DATE:	MAY 2001
	REV. DATE:	MARCH 2013
	DWG. No.:	W22

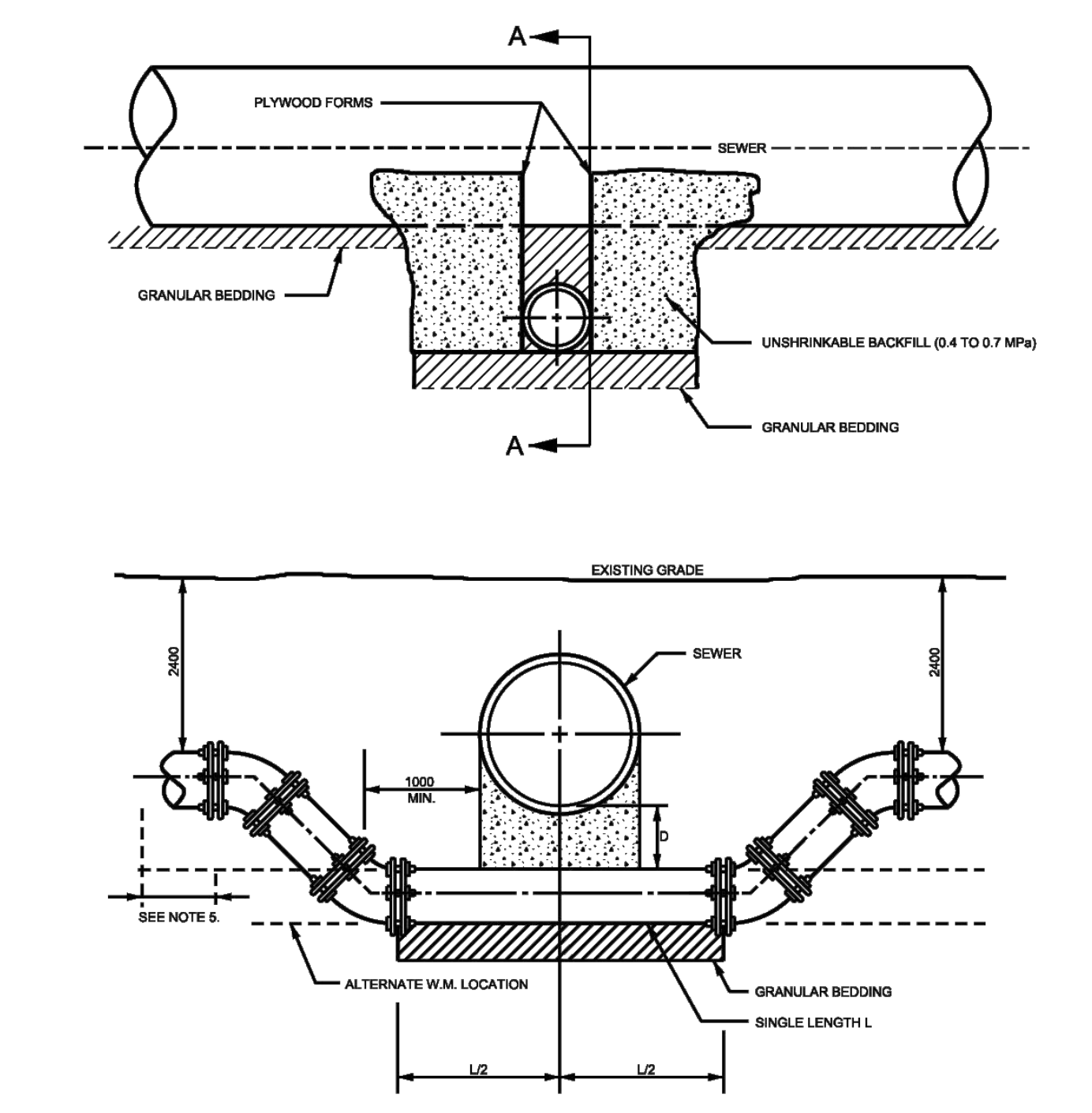


NOTES:

FOR AUXILIARY, SERVICES AND ISOLATION VALVES.

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS SHOWN OTHERWISE.
2. FOR 200 AND 250mm VALVES, ADD BEDDING BELOW THE CONCRETE BLOCKS AS REQUIRED TO RAISE BELL HIGH ENOUGH TO PREVENT CONTACT WITH THE VALVE BONNET.

VALVE BOX ASSEMBLY	DATE:	MAY 2001
	REV. DATE:	MARCH 2021
	DWG. No.:	W24



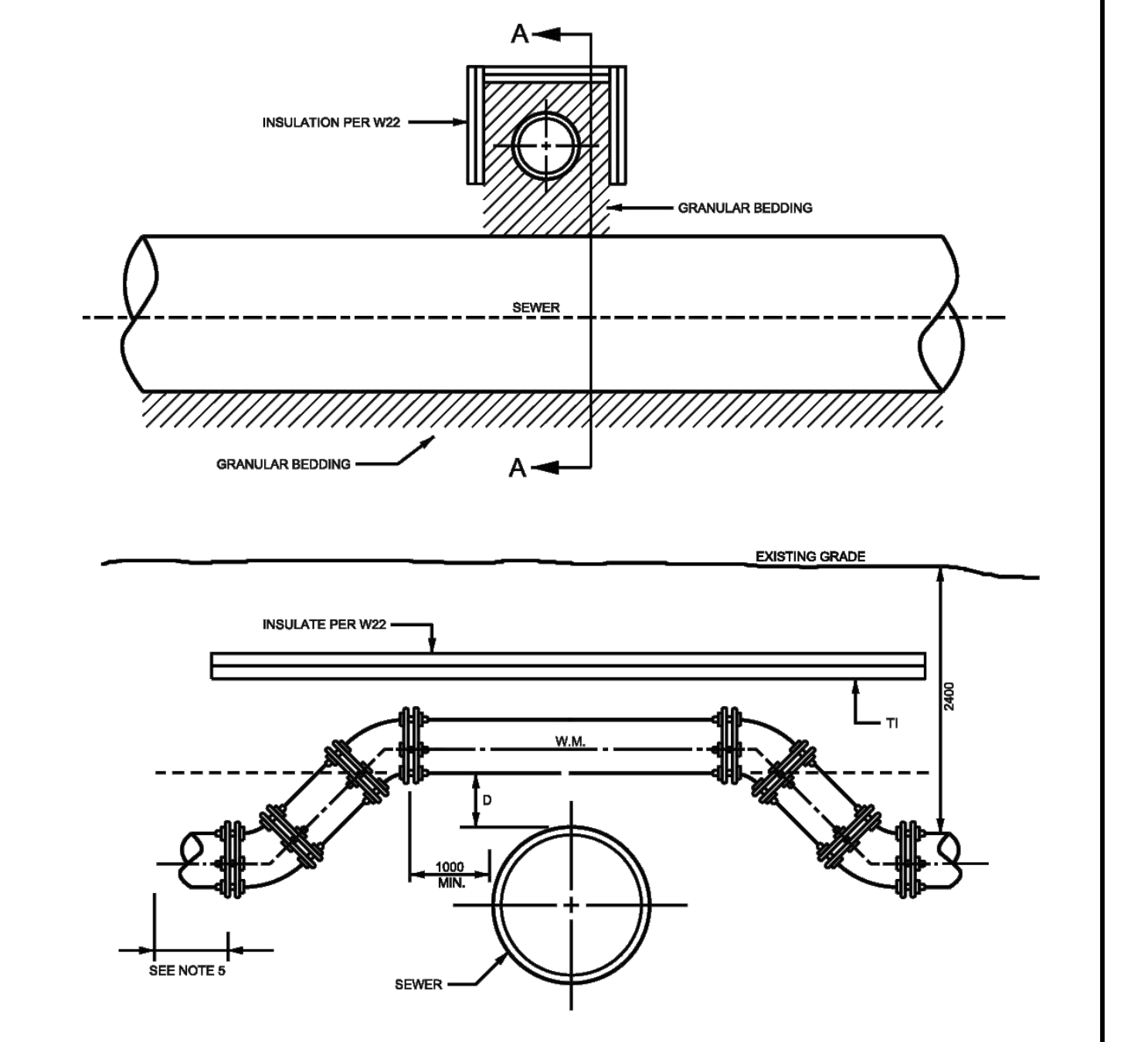
SECTION A - A

NOTES:

FOR WATERMAIN 100mm (NOMINAL) TO 400mm (NOMINAL)

1. BARREL TO INVERT SEPARATION (D) SHALL BE 500mm MINIMUM.
2. THRUST BLOCKS FOR MAINS LARGER THAN 400mm (NOMINAL) SHALL BE PER SPECIAL DESIGN.
3. FOR 300mm (NOMINAL) AND 400mm (NOMINAL) MAINS, BENDS SHALL BE MAX. 22° 30'.
4. CONCRETE FOR THRUST BLOCKS SHALL BE 20 MPa.
5. REFER TO W25.6 FOR RESTRAINED LENGTH REQUIREMENTS.
6. REFER TO W25.3 AND W25.4 FOR THRUST BLOCK REQUIREMENTS.
7. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS SHOWN OTHERWISE.
8. DESIGNED TO MEET THE INTENT OF THE MOE WATERMAIN DESIGN CRITERIA JUNE 2012.
9. CATHODIC PROTECTION MEASURES SHALL BE INSTALLED IN ACCORDANCE WITH W39, W40, AND W42.
10. TRACER WIRE REQUIRED FOR PVC, PEX AND HDPE WATERMAIN PIPE ONLY AS PER W36.

WATERMAIN CROSSING BELOW SEWER	DATE:	MAY 2001
	REV. DATE:	MARCH 2021
	DWG. No.:	W25



SECTION A - A

NOTES:

FOR WATERMAIN 100mm (NOMINAL) TO 400mm (NOMINAL)

1. BARREL TO BARREL SEPARATION (D) SHALL BE 250mm MINIMUM.
2. THRUST BLOCKS FOR MAINS LARGER THAN 400mm (NOMINAL) SHALL BE PER SPECIAL DESIGN.
3. FOR 300mm (NOMINAL) AND 400mm (NOMINAL) MAINS, BENDS SHALL BE MAX. 22° 30'.
4. CONCRETE FOR THRUST BLOCKS SHALL BE 20 MPa.
5. REFER TO W25.6 FOR RESTRAINED LENGTH REQUIREMENTS.
6. REFER TO W25.3 AND W25.4 FOR THRUST BLOCK REQUIREMENTS.
7. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS SHOWN OTHERWISE.
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9. CATHODIC PROTECTION MEASURES SHALL BE INSTALLED IN ACCORDANCE WITH W39, W40, AND W42.
10. TRACER WIRE REQUIRED FOR PVC, PEX AND HDPE WATERMAIN PIPE ONLY AS PER W36.

WATERMAIN CROSSING OVER SEWER	DATE:	MAY 2001
	REV. DATE:	MARCH 2021
	DWG. No.:	W25.2

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M:\2023\123089\CAD\Civil\123089-NDT.dwg, CIVIL DET 2, Nov 28, 2025 - 5:57pm, kdsa

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LICENSED PROFESSIONAL ENGINEER
F.S. THAUVETTE
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November 28, 2025
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LOCATION
CITY OF OTTAWA
QUEENSWAY CARLETON HOSPITAL

DRAWING NAME
CIVIL DETAILS
PART 4 EXPANSION

PROJECT No. 123089
REV REV #1
DRAWING No. 123089-DET-2

PLANA0.DWG - 1189mmx841mm