TECHNICAL MEMORANDUM

DATE: FEBRUARY 7, 2024

TO: VLADIMIR POPOVIC

FROM: CARA RUDDLE, P.ENG.

RE: VINCENT MASSEY PUBLIC SCHOOL BUS LOOP
745 SMYTH ROAD
STORMWATER MANAGEMENT BRIEF

Novatech has been retained to prepare a Stormwater Management Brief for a proposed bus loop to be constructed on the south side of Vincent Massey Public School located at 745 Smyth Road in Ottawa. ***Figure 1*** is a Key Plan showing the site location. The purpose of this brief is to provide the stormwater management concept for the proposed bus loop.

The existing property is currently developed and includes the Vincent Massey Public School building, a parking lot, football field, outdoor basketball court, grassed areas with some trees. The property is approximately 3.84 hectares in size and is bound to the north by several residential properties, to the south by Smyth Road, to the east by Haig Drive and to the west by Edgecombe Street. The topography of the proposed work area generally slopes from west to east. ***Figure 2*** Existing Conditions Plan shows the existing site conditions and topography.

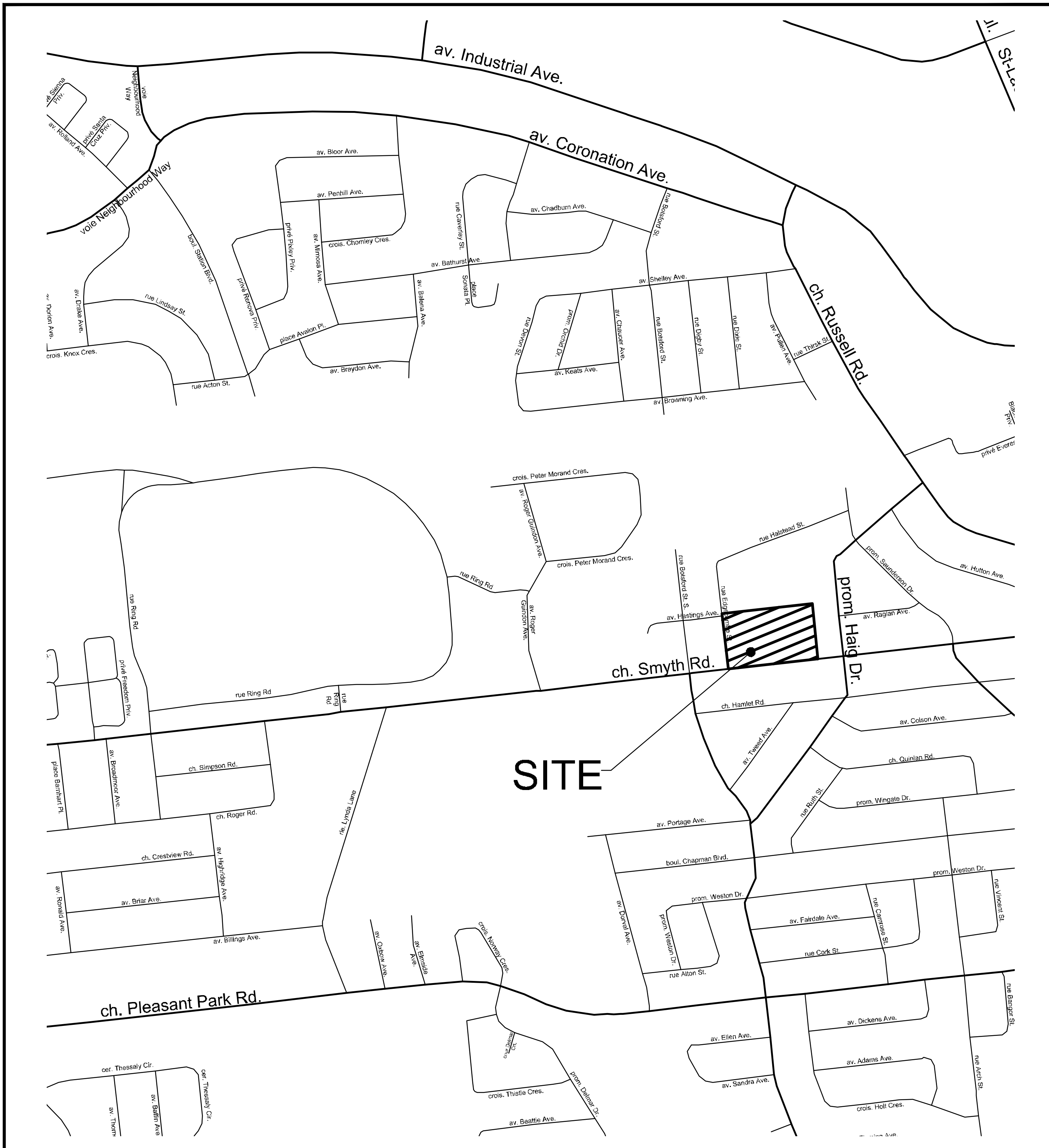
It is proposed to construct a bus loop along the front of the school that will include an ingress and an egress to Smyth Road. The existing parking lot access from Smyth Road will be closed and the parking lot will be accessed using one of the existing entrance from Edgecombe Street (the second entrance from Edgecombe will be removed). ***Figure 3*** shows the proposed Bus Loop Plan. Only modifications relating to staff parking and school bus access are proposed, there will not be any modifications or expansions to the school building. Therefore, stormwater management will be provided for the re-constructed area only.

STORMWATER MANAGEMENT

Stormwater currently sheet drains from the front of the building towards roadside catchbasins along Smyth Road. The following stormwater management criteria was provided by the City of Ottawa at the Pre-Consultation meeting with City staff:

- The 2-yr storm or 5-yr storm event using IDF information derived from the Meteorological Services of Canada rainfall data, taken from the MacDonald Cartier Airport, collect 1966 to 1997.

Suite 200, 240 Michael Cowpland Drive, Ottawa ON K2M 1P6 Tel: 613.254.9643 Fax: 613.254.5867 www.novatech-eng.com



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

VINCENT MASSEY PUBLIC SCHOOL
745 SMYTH ROAD

KEY PLAN

SCALE		
N.T.S		
DATE	JOB	FIGURE
FEB 2023	122204	FIG 1

SHT8X11.DWG - 216mmx279mm

M:\2022\122204\CAD\Civil\Figures\Servicing\122204-KP.dwg, Fig 1, Mar 20, 2023 - 8:13am, madeoli

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

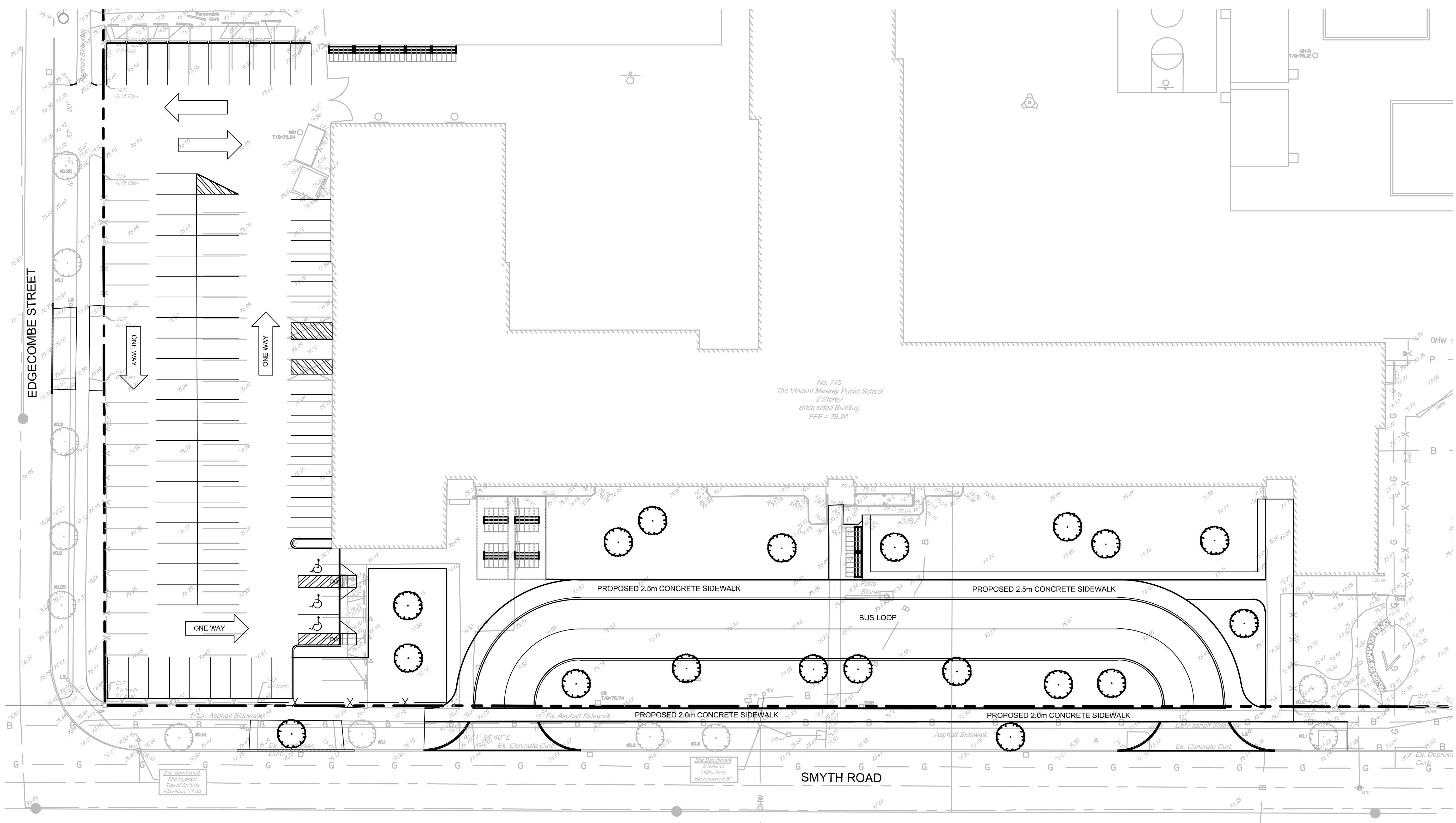
VINCENT MASSEY PUBLIC SCHOOL
745 SMYTH ROAD

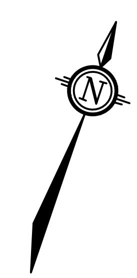
EXISTING CONDITIONS PLAN

SCALE	DATE	JOB	FIGURE
1 : 500 (0 5 10 15 20)	DEC 2022	122204	FIG 2

M:\2022\122204\CAD\Civil\Figures\Servicing\122204-Ex con.dwg, Ex Con, Mar 20, 2023 - 8:30am, madeoli

SHT11X17.DWG - 279mmX432mm





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

VINCENT MASSEY PUBLIC SCHOOL
745 SMYTH ROAD

PROPOSED BUS LOOP PLAN

SCALE	DATE	JOB	FIGURE
1 : 500	DEC 2022	122204	FIG 3

M:\2022\122204\CAD\Civil\Figures\Servicing\122204-Pro con.dwg, Pro Con, Mar 20, 2023 - 8:36am, madeoli

SHT11X17.DWG - 279mmX432mm

- For separated sewer system built pre-1970 the design of the storm sewer is based on a 2-year storm
- The pre-development runoff coefficient or a maximum equivalent 'C' of 0.5, whichever is less (subsection 8.3.7.3).
- A calculated time of concentration (Cannot be less than 10 minutes).
- Flows to the storm sewer in excess of the 2-year storm release rate, up to and including the 100-year storm event, must be detained on site.
- For a combined sewer system, the maximum C=0.4 or the pre-development C value, whichever is less. In the absence of other information, the allowable release rate shall be based on a 2-year storm event.

Existing drainage patterns will be maintained under post-development conditions. All runoff from the proposed bus loop will be collected in a swale and outlet to the existing storm sewer system along Smyth Road per existing conditions. Only the bus loop portion of the development is considered in the stormwater management design. There are minimal changes proposed to the existing parking lot and existing drainage patterns will be maintained. Refer to the attached pre-development and post-development drainage area plans (**Figure 4** and **Figure 5**) for details.

Stormwater from the bus loop area will sheet drain and drain through curb cuts to a grassed swale in the central grassed area of the bus loop. The swale drains to a catchbasin which connects to a proposed 525mm diameter storm sewer below the travelled portion of the bus loop and outlets to the existing 600mm diameter storm sewer on the south side of Smyth Road. Quantity control of stormwater is provided and stormwater will be stored on the surface within the grassed swale and below the surface within a proposed subdrain and granular surround below the grassed swale as well as underground within the 525mm diameter storm sewer. The release of stormwater will be controlled by an orifice control prior to releasing to the City storm sewer system. In storm events greater than the 100-year storm, stormwater will continue to drain to the grassed swale and flow through a depressed curb cut at the entrance of the bus loop and into the Smyth Road right-of-way. The table below summarizes the flow, storage required, and storage provided for the proposed development.

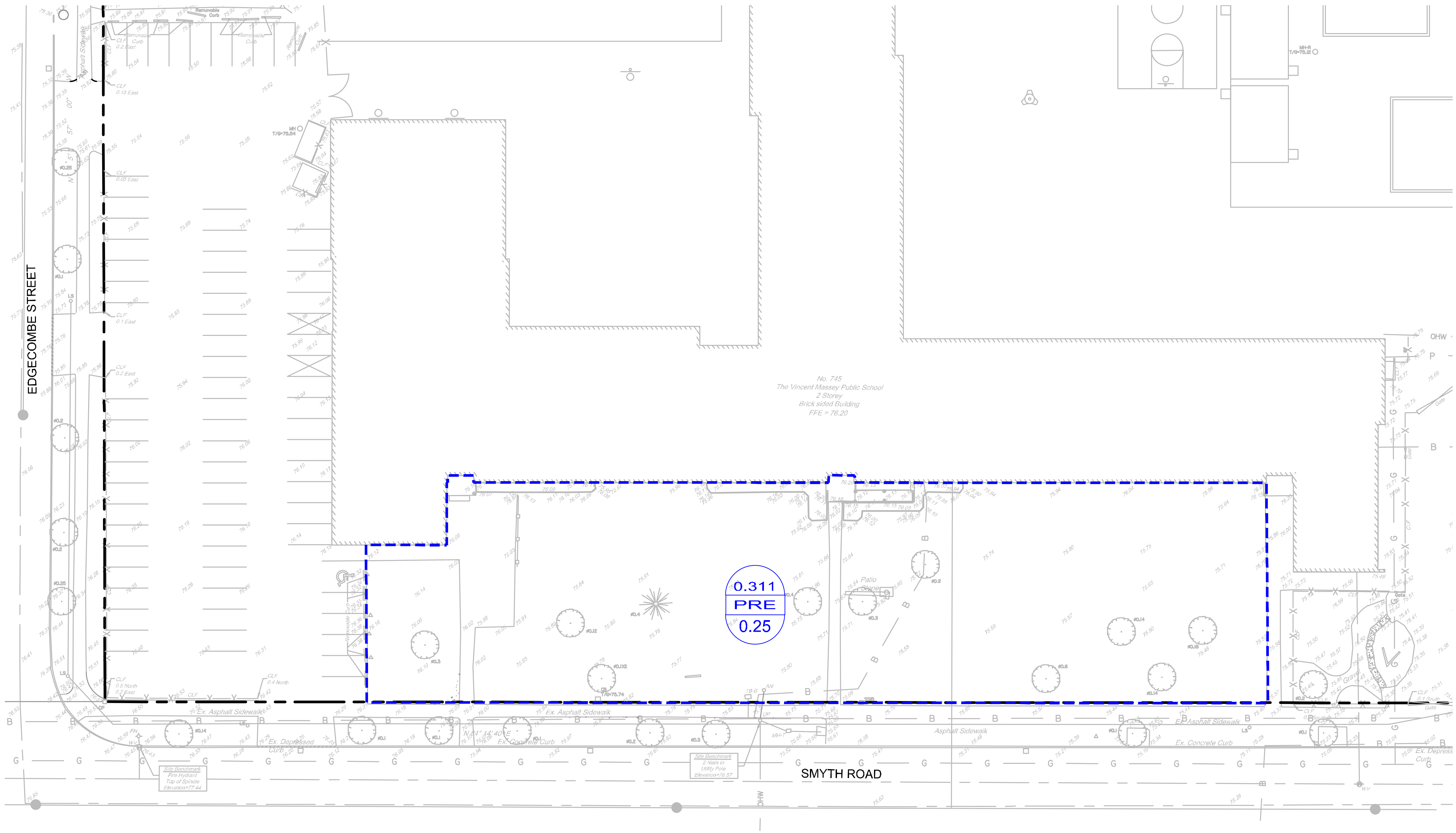
Stormwater Management Summary

Area ID	Area (ha)	Weighted Cw	Outlet Location	100 Year Storm Event		
				Flow (L/s)	Required Vol (cu.m)	Max. Vol. Provided (cu.m.)
A1	0.317	0.61	Smyth Rd	8.4	78.15	80.62
Total Flow				**8.4**		
Allowable Flow*				**8.4**		

* As per City requirements, the release rate has been reduced to half.

Refer to the appendix for stormwater calculations and drainage area plans. Refer to the Grading and Servicing Plan (dwg 122204-GS) for details.

Suite 200, 240 Michael Cowpland Drive, Ottawa ON K2M 1P6 Tel: 613.254.9643 Fax: 613.254.5867 www.novatech-eng.com



LEGEND

PROPERTY LINE
EXISTING STORM SEWER
PRE DEVELOPMENT DRAINAGE AREA

0.183 — DRAINAGE AREA ha
PRE — DRAINAGE AREA IDENTIFIER
0.5 — RUNOFF COEFFICIENT

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

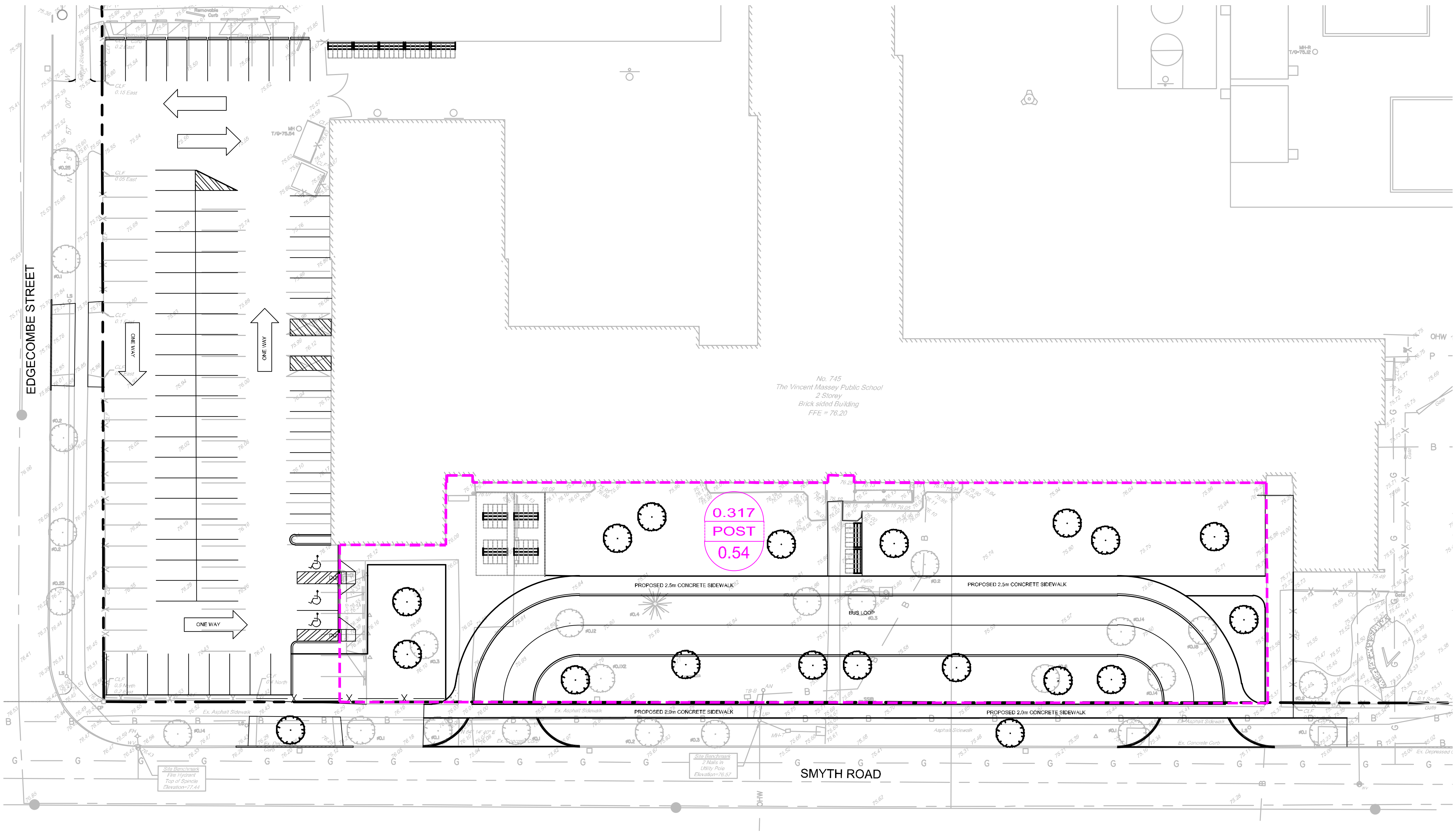
VINCENT MASSEY PUBLIC SCHOOL
745 SMYTH ROAD

PRE DEVELOPMENT DRAINAGE AREA PLAN

SCALE	DATE	JOB	FIGURE
1 : 500	DEC 2022	122204	FIG 4

M:\2022\122204\CAD\Civil\Figures\Servicing\122204-Pro con.dwg, PRE, Mar 20, 2023 - 8:36am, madeoli

SHT11X17.DWG - 279mmX432mm



LEGEND

PROPERTY LINE
EXISTING STORM SEWER
PRE DEVELOPMENT DRAINAGE AREA

0.183 / PRE / 0.5

DRAINAGE AREA ha
DRAINAGE AREA IDENTIFIER
RUNOFF COEFFICIENT

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

VINCENT MASSEY PUBLIC SCHOOL
745 SMYTH ROAD

POST DEVELOPMENT DRAINAGE AREA PLAN

SCALE		
1 : 500		
DATE: DEC 2022	JOB: 122204	FIGURE: FIG 5

M:\2022\122204\CAD\Civil\Figures\Servicing\122204-Pro con.dwg, POST, Mar 24, 2023 - 3:57pm, madeoli

SHT11X17.DWG - 279mmX432mm

Stormwater quality control is provided where possible since this is a small drainage area within an existing developed site. Stormwater quality control is provided through routing storm drainage to the grassed island on the inside of the bus loop area and along a vegetated grassed swale prior to entering into the private storm sewer system. The grassed swale is at minimum slope and the catchbasin at the end of the grassed swale is perched above the grass elevation to promote infiltration of stormwater and reduction of sediment.

Best Management Practices

The proposed development will use the following stormwater best management practices (BMPs) to mitigate the reduction in groundwater infiltration/recharge resulting from development:

- Surface drainage will sheet drain through the grassed swales where possible,
- Construction of swales at minimal slopes where possible.

By implementing stormwater management BMPs as part of the storm drainage design, the impacts of development on the hydrologic cycle can be reduced.

EROSION AND SEDIMENT CONTROL

Temporary erosion and sediment control measures will be implemented during construction in accordance with the Best Management Practices for Erosion and Sediment Control. This includes the following temporary measures:

- Silt fences will be placed as per OPSS 577 and OPSD 219.110 along the surrounding construction limits;
- Filter bags will be placed under the grates of nearby existing catchbasins and will remain in place until vegetation has been established and construction is completed.
- Street sweeping, and cleaning will be performed, as required, to suppress dust and to provide safe and clean roadways adjacent to the construction site.

The erosion and sediment control measures are to be installed to the satisfaction of the engineer, and the City of Ottawa prior to construction and will remain in place during construction until vegetation is established. The erosion and sediment control measure will also be subject to regular inspection to ensure measures are operational.

Suite 200, 240 Michael Cowpland Drive, Ottawa ON K2M 1P6 Tel: 613.254.9643 Fax: 613.254.5867 www.novatech-eng.com

Conclusions

The conclusions of this brief are as follows:

- Quantity control of stormwater will be provided through surface storage in a grassed swale with the release rate controlled prior to release to the existing storm sewer system along Smyth Road.
- Quality control of stormwater is provided by draining stormwater through a grassed swale and granular system prior to entering into a storm sewer system.
- An overland flow route will be provided to Smyth Road.
- Erosion and sediment control measures will be implemented during construction.

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

NOVATECH

Prepared by:

Leonel Perez
Design Technologist
Land Development Engineering

Reviewed by:

Cara Ruddle, P.Eng.
Senior Project Manager
Land Development Engineering

Suite 200, 240 Michael Cowpland Drive, Ottawa ON K2M 1P6 Tel: 613.254.9643 Fax: 613.254.5867 www.novatech-eng.com

Appendix

Suite 200, 240 Michael Cowpland Drive, Ottawa ON K2M 1P6 Tel: 613.254.9643 Fax: 613.254.5867 www.novatech-eng.com

<u>**Time to Peak Calculations - Existing Conditions**</u>

TABLE 1A: Time of Concentration (Uplands Overland Flow Method)

	Overland Flow						Channel Flow			Overall	
Area ID	Length (m)	Elevation U/S (m)	Elevation D/S (m)	Slope (%)	Velocity (Uplands) (m/s)	Travel Time (min)	Length (m)	Velocity * (m/s)	Travel Time (min)	Time of Concentration (min)	Time to Peak (min)
PRE	103.9	76.13	75.37	0.7%	0.3	6	N/A	N/A	N/A	6	4

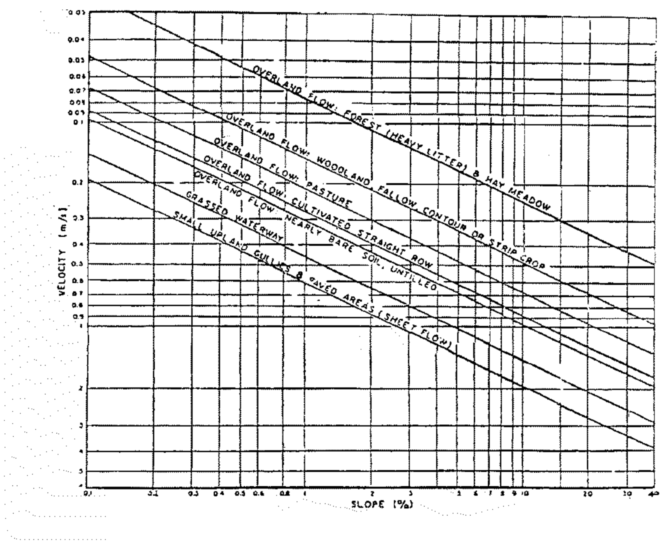


Figure A.5.2: Upland Method for Estimating Time of Concentration (SCS National Engineering Handbook, 1971)

TABLE 2A: Pre-Development Runoff Coefficient "C" - PRE

Area	Surface	Ha	"C"	C_{avg}	*C_{100}
Total	Hard	0.023	0.90	0.25	0.31
0.311	Soft	0.288	0.20		

Runoff Coefficient Equation

$C = (A_{hard} \times 0.9 + A_{soft} \times 0.2)/A_{Tot}$

* Runoff

TABLE 2B: Pre-Development Flows

Outlet Options	Area (ha)	C_{avg}	Tc (min)	$Q_{2\ Year}$ (L/s)	$Q_{5\ Year}$ (L/s)	$Q_{100\ Year}$ (L/s)
Smyth Road	0.311	0.25	10	**16.7**	**22.7**	**47.2**

Time of Concentration	Tc=	10	min
Intensity (2 Year Event)	I_2=	76.81	mm/hr
Intensity (5 Year Event)	I_5=	104.19	mm/hr
Intensity (100 Year Event)	I_{100}=	178.56	mm/hr

100 year Intensity = 1735.688 / (Time in min + 6.014) $^{0.820}$
5 year Intensity = 998.071 / (Time in min + 6.053) $^{0.814}$
2 year Intensity = 732.951 / (Time in min + 6.199) $^{0.810}$

Equations:
Flow Equation
$Q = 2.78 \times C \times I \times A$
Where:
C is the runoff coefficient
I is the rainfall intensity, City of Ottawa IDF
A is the total drainage area

TABLE 3A: Post-Development Runoff Coefficient "C" - A-4

			5 Year Event		100 Year Event	
Area	Surface	Ha	"C"	C_{avg}	"C" + 25%	*C_{avg}
Total	Hard	0.152	0.90	0.54	1.00	0.61
0.317	Roof	0.000	1.00		1.00	
	Soft	0.165	0.20		0.25	

TABLE 3B: 2 YEAR EVENT QUANTITY STORAGE REQUIREMENT - A-4

0.317 =Area (ha)
0.54 = C

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	Allowable Runoff (L/s)	Net Flow to be Stored (L/s)	Storage Req'd (m^3)
2 YEAR	5	103.57	48.89	10.8	38.09	11.43
	10	76.81	36.26	10.8	25.46	15.27
	15	**61.77**	**29.16**	**10.8**	**18.36**	**16.52**
	20	52.03	24.56	10.8	13.76	16.51
	25	45.17	21.32	10.8	10.52	15.78

TABLE 3C: 5 YEAR EVENT QUANTITY STORAGE REQUIREMENT - A-4

0.317 =Area (ha)
0.54 = C

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	Allowable Runoff (L/s)	Net Flow to be Stored (L/s)	Storage Req'd (m^3)
5 YEAR	10	104.19	49.18	13.3	35.88	21.53
	15	83.56	39.44	13.3	26.14	23.53
	20	**70.25**	**33.16**	**13.3**	**19.86**	**23.83**
	25	60.90	28.75	13.3	15.45	23.17
	30	53.93	25.46	13.3	12.16	21.88

TABLE 3D: 100 YEAR EVENT QUANTITY STORAGE REQUIREMENT - A-4

0.317 =Area (ha)
0.61 = C

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	Allowable Runoff (L/s)	Net Flow to be Stored (L/s)	Storage Req'd (m^3)
100 YEAR	45	69.05	37.10	8.4	28.75	77.62
	50	63.95	34.36	8.4	26.01	78.03
	55	**59.62**	**32.03**	**8.4**	**23.68**	**78.15**
	60	55.89	30.03	8.4	21.68	78.04
	65	52.65	28.28	8.4	19.93	77.74

Equations:

Flow Equation

$Q = 2.78 \times C \times I \times A$

Where:

C is the runoff coefficient
I is the rainfall intensity, City of Ottawa IDF
A is the total drainage area

Runoff Coefficient Equation

$C_5 = (A_{hard} \times 0.9 + A_{soft} \times 0.2)/A_{Tot}$

$C_{100} = (A_{hard} \times 1.0 + A_{soft} \times 0.25)/A_{Tot}$

TABLE 3E: Structure information

Structures	Size Dia.(mm)	Area (m^2)	T/G	Inv IN	Inv OUT
CB 1	600	0.37	75.00	74.26	74.21
STMMH 101	1200	1.13	75.37	73.82	73.76
STMMH 102	1200	1.13	75.80	-	73.96

TABLE 3F: Pipe / Stone Trench Information

Structures	Width (m)	Depth (m)	Length (m)	Void Ratio	Inv UP	Inv DOWN
Stone Trench	2.0	0.64	50.0	40%	74.36	74.30

Pipe	Dia(mm)	Length (m)	Volume(m^3)	Slope	Inv UP	Inv DOWN
STM Pipe	525	70.00	15.15	0.20%	73.96	73.82
CB Lead	200	7.06	0.22	0.60%	74.21	74.17
Subdrain Pipe	150	50.00	0.88	0.20%	74.37	74.27
		Total	16.26			

TABLE 3G: Storage Provided - A-4

Storage Table							Total Storage		
Elevation (m)	System Depth (m)	CB 1 Volume (m^3)	STMMH 101 Volume (m^3)	STMMH 102 Volume (m^3)	Trench Volume (m^3)	Pipes Volume (m^3)	Underground Volume (m^3)*	Ponding Volume (m^3)	**Total Volume (m^3)**
73.760	-	-	0.00	0.00	-	0.00	0.00	0.00	**0.00**
73.820	-	-	0.07	0.00	-	0.00	0.07	0.00	**0.07**
73.960	-	-	0.23	0.00	-	0.00	0.23	0.00	**0.23**
74.210	-	-	0.51	0.28	-	0.00	0.79	0.00	**0.79**
74.270	0.06	0.02	0.58	0.35	-	0.00	0.66	0.00	**0.66**
75.000	0.79	0.29	1.40	1.18	25.25	16.26	44.38	0.00	**44.38**
75.050	-	-	1.46	1.23	-		47.07	1.07	**48.14**
75.100	-	-	1.52	1.29	-	-	47.18	4.51	**51.69**
75.150	-	-	1.57	1.35	-	-	47.30	9.83	**57.13**
75.200	-	-	1.63	1.40	-	-	47.41	16.24	**63.65**
75.250	-	-	1.69	1.46	-	-	47.52	23.89	**71.41**
75.300	-	-	1.74	1.52	-	-	47.63	32.99	**80.62**

TABLE 3H: Orifice Sizing information - A-4

Control Device
Round Plate Orifice 85 mm

Design Event	Flow (L/S)	Head (m)	Elev (m)	Outlet dia. (mm)	Volume (m^3)	Area (m^2)	Dia. (mm)
1:2 Year	10.8	0.31	74.64	250	16.52	0.0071	95.0
1:5 Year	13.3	0.56	74.89	250	23.83	0.0065	91.0
1:100 Year	8.4	0.96	75.29	250	78.15	0.0031	63.0

**The design Head is calculated based on the centre of the outlet pipe

Orifice Control Sizing

Q = 0.62 x A x (2gh) x 0.5
Q is the release rate in m^3/s
A is the orifice area in m^2
g is the acceleration due to gravity, 9.81 m/s^2
h is the head of water above the orifice centre in m
d is the diameter of the orifice in m

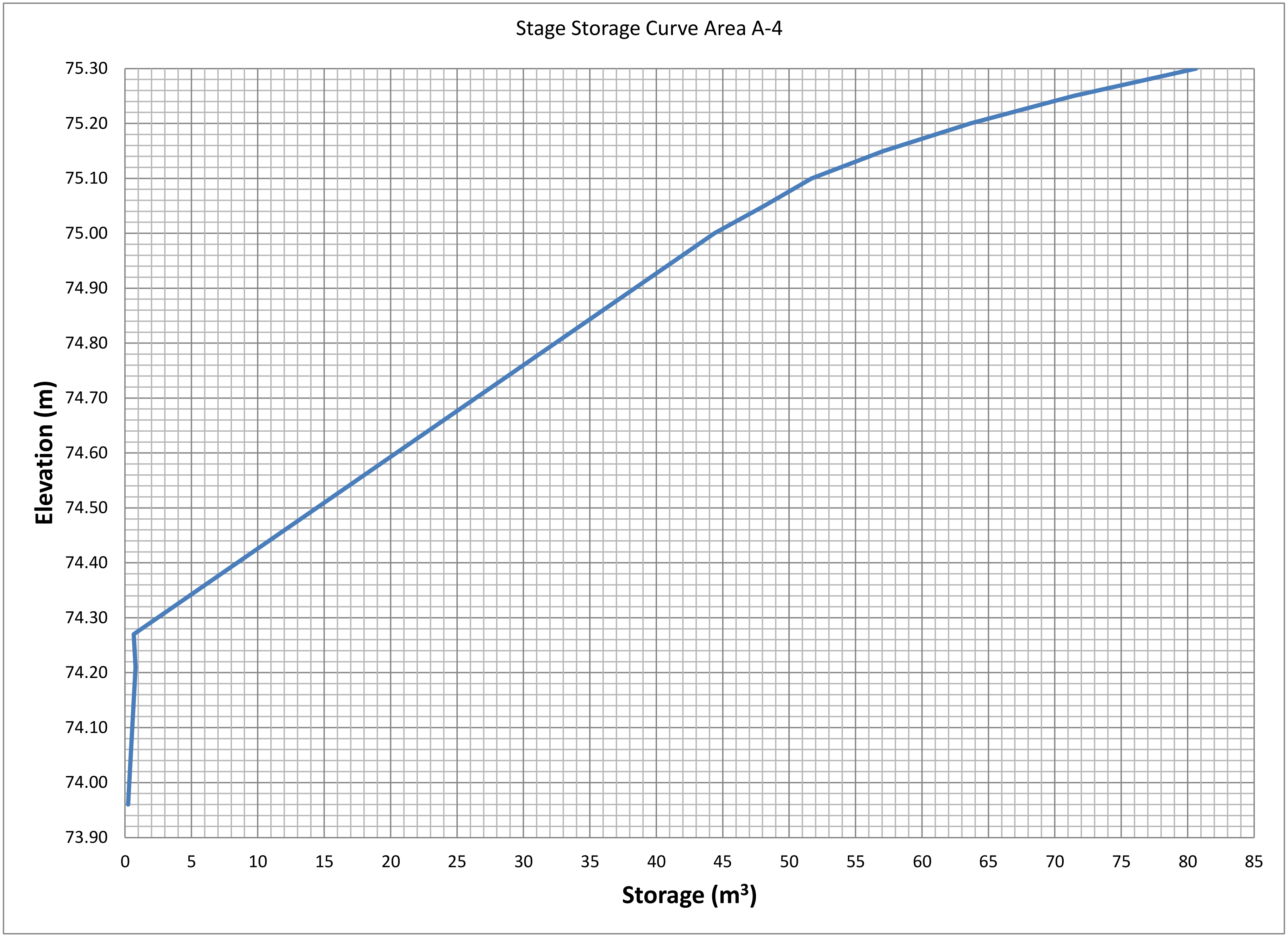

Stage Storage Curve Area A-4
Elevation (m)
75.30
75.20
75.10
75.00
74.90
74.80
74.70
74.60
74.50
74.40
74.30
74.20
74.10
74.00
73.90
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
Storage (m^3)

Table 4: Post-Development Stormwater Mangement Summary

Area ID	Area (ha)	1:5 Year Weighted Cw	Oulet Location	2 Year Storm Event			5 Year Storm Event			100 Year Storm Event		
				Release (L/s)	Req'd Vol (cu.m)	Max. Vol. Provided (cu.m.)	Release (L/s)	Req'd Vol (cu.m)	Max. Vol. Provided (cu.m.)	Release (L/s)	Req'd Vol (cu.m)	Max. Vol. Provided (cu.m.)
A1	0.317	0.54	Smyth Rd	10.8	16.52	44.38	13.3	23.83	80.62	8.4	78.15	80.62
Total				**10.8**			**13.3**			**8.4**		
Allowable				**16.7**			**16.7**			**16.7**		