UEM Project No.: 21-102
Date: February 9, 2024

Prepared for:

1984351 Ontario Limited

Contact and Location:
Dennis Sargeson
5881 Dunn Street
Niagara Falls, ON, L2G 2N9

Functional Servicing Brief
5881 Dunn Street Residential Development

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1.0 INTRODUCTION

The proposed Dunn Street development is a residential townhome development consisting of 30 townhome units (located within 4 blocks) on a 2.89 ha parcel of land. The proposed development is located at 5881 Dunn Street on the north side of the road between Orchard Avenue and Ailanthus Avenue in the City of Niagara Falls in the Regional Municipality of Niagara. The site location is displayed in Figure 1-1 below. The proposed development fronts onto both Dunn Street and Dixon Street. The subject property is currently being used as an office building and parking lot. The proposed development includes keeping the existing office building and constructing 30 new townhome units on a 1.49 ha portion of the site. The existing site access and parking layout will be revised to accommodate the new development. An existing watermain, sanitary sewer and storm sewer are available along Dunn Street. The existing infrastructure along Dixon Street is nearing the end of its service life. The design of the road reconstruction and sewer and watermain improvements between level Avenue to Orchard Avenue is anticipated to commence in 2024 with construction to follow in 2025. This road reconstruction would be similar to the sewer separation project completed on Level Avenue, east of the subject property. This stormwater management (SWM) and servicing study brief will evaluate the serviceability of the site with respect to sanitary, water and storm services as well as provide a preliminary SWM strategy that will be implemented. This brief will also satisfy the zoning bylaw requirements for the proposed residential development. The following standards and guidelines were reviewed in preparing this brief:

- The City of Niagara Falls Engineering Design Guidelines Manual
- Ontario Provincial Standards (OPS),
- Ministry of Environment, Conservation and Parks (MECP)
    - Stormwater Management Planning and Design Manual (2003)
    - Design Guidelines for Sewage Works (2008)
    - Design Guidelines for Drinking-Water Systems (2008)
- Niagara Peninsula Conservation Authority (NPCA) Stormwater Management Guidelines (2010)
- Fire Underwriters Survey, Water Supply for Public Fire Protection (2020)

Figure 1-1: Site Location

2.0 WATER DISTRIBUTION SYSTEM

2.1 EXISTING WATER DISTRIBUTION SYSTEM

The City of Niagara Falls has an existing 300mm PVC watermain (constructed in 2016) along the south side of Dunn Street and a 150mm cast iron watermain (constructed in 1951) along the north side of Dixon Street.

2.2 PROPOSED WATER DISTRIBUTION SYSTEM

The proposed private water distribution system for the townhome development will consist of a 250mm (10") diameter PVC DR18 pipe that will connect to the 300mm (12") PVC watermain on Dunn Street, refer to Appendix C for water servicing plan sketch. The private watermain will feed the development from a single source per City requirements for site development projects and will service the 3 internal townhome blocks located adjacent to the private roadway. Two fire hydrants are proposed on site to provide fire protection coverage for the townhouse blocks. The most northerly private hydrant will also act as a blowoff for flushing and removal of air buildup in the dead-end system. In addition, existing municipal fire hydrants are located adjacent to the townhome site, one at the southeast corner of the Dunn Street townhome entrance and another located on the north side of Dixon Street central to the site. These hydrants will provide additional coverage and a second source of water for fire protection. The fourth townhome block fronting Dixon Street will be serviced from the existing 150mm CI watermain along Dixon Street or the future 150mm PVC watermain extension if completed before the proposed residential development. Each dwelling unit will have its own water service with a curb stop located in front of the building unit. The proposed water service size required will be 38mm (1-1/2") diameter Type K soft copper tubing or an alternative material would be 50mm (2") diameter crosslinked polyethylene (PEX) tubing.

The proposed water distribution system was designed using municipal guidelines and the MECP Design Guidelines for Drinking-Water Systems (2008). The distribution system was designed to provide maximum day demand plus fire flow. The peak hour flow and maximum day flow were calculated based on number of dwelling units and population. The required fire flow for the proposed residential development was calculated based on Fire Underwriters Survey: Water Supply for Public Fire Protection (see Appendix B for calculations). Fire walls rated for 2 hours are proposed between every two townhome units. Therefore, the townhome block floor area was subdivided when determining the fire flow requirements. Fire flows were estimated using non-combustible construction (unprotected metal structural components, masonry, or metal walls. The total required flow for the proposed site will be the maximum day flow plus the fire flow. Therefore, the total required flow for this site will be approximately 8294 L/min (2191 USgpm). The following table summarizes the required water demands. Static pressure in the area is approximately 520 KPa (75 PSI), based on info provided by the City, see appendix C. The pressure loss for approximately 220 m of 250mm diameter PVC pipe in the dead-end main is estimated to be approximately 79.3 KPa (11.5 PSI) under max day plus fire flow conditions. Peak velocity is estimated at 2.73 m/s. (8.95 ft/s). Based on the size of the 300mm diameter watermain along Dunn Street and pressure available, sufficient flow and pressure exists to support the proposed residential development.

It is proposed to install water meters in each townhome unit versus providing a meter chamber with meter sized for fire protection. It was confirmed by City staff this would be acceptable, and metered hydrants are not required.

Table 2-1: Total Water Demand for Block A, serviced from Dixon Street

Land Use	Population	Average Daily Demand (320 L/c/day)	Peaking Factors		Peak Hour	Maximum Day	Fire Flow	Total Required Fire Flow
			Max. Day	Peak Hour				
Residential	120 (8 units x 15 people/unit)	0.44 L/s, 26.4 L/min	6.05	9.13	4.06 L/s, 243.6 L/min	2.69 L/s, 161.4 L/min	7000 L/min	7161.4 L/min

Table 2-2: Total Water Demand for Blocks B, C and D, serviced from Dunn Street

Land Use	Population	Average Daily Demand (320 L/c/day)	Peaking Factors		Peak Hour	Maximum Day	Fire Flow	Total Required Fire Flow
			Max. Day	Peak Hour				
Residential	428 (8 units x 15 people/unit) + (14 units x 22 people/unit)	1.59 L/s, 95.4 L/min	3.09	4.63	7.34 L/s, 440.4 L/min	4.90 L/s, 294 L/min	8000 L/min	8294 L/min

3.0 SANITARY SEWAGE SYSTEM

3.1 EXISTING SANITARY SEWER SYSTEM

The City of Niagara Falls has an existing 525mm diameter sanitary sewer that runs along the north side of Dunn Street. This sewer will be used to service the 3 blocks of internal townhome units located along the development private roadway. There is an existing 225mm diameter combined sewer that runs along the north side of Dixon Street. This sewer will be used to service the 8 townhome units that front Dixon Street. However, if the proposed road reconstruction of Dixon Street is completed before the development construction begins, the new sanitary sewer will be used to service the townhome units.

3.2 PROPOSED SANITARY SEWER SYSTEM

The proposed sanitary sewer servicing the 3 blocks (22 residential units) of internal townhome units will consist of 200mm diameter PVC DR35 pipe conforming to CSA B182.2 and CSA B182.1. This sanitary sewer will connect to the existing sanitary sewer on Dunn Street. It is estimated that the development will generate an additional 7.66 L/s to the 525mm diameter Dunn Street sanitary sewer. In our opinion, based on the size of the sanitary sewer along Dunn Street and since it was previously a combined sewer, we believe sufficient capacity exists to support the proposed development.

The townhome units fronting Dixon Street will be serviced from the existing 225mm diameter combined sewer subject to City acceptance or will be serviced to the future sanitary sewer proposed for the Dixon Street reconstruction project. The 8 units will contribute 4.09 L/s to the Dixon Street sewer. All sanitary services laterals will be 100m diameter DR28 pipe in accordance with the City of Niagara Falls Engineering Design Guidelines Manual.

4.0 STORMWATER DRAINAGE

4.1 EXISTING DRAINAGE

The existing site has a storm sewer system with a series of catchbasins throughout the parking lot. The existing storm flows from the site through a 525mm concrete pipe (see Pre-Development Drainage Area Plan in Appendix A) connect to the existing 675mm diameter municipal storm sewer that runs along the north boulevard of Dunn Street and flows east towards Ailanthus Avenue. The entire site is included in the Ailanthus Avenue storm sewer catchment area (see Appendix D).

4.2 PROPOSED DRAINAGE

The proposed storm sewer for the residential development will consist of manholes and rear yard catchbasins (RYCB) to drain stormwater from the 4 internal townhome blocks. The grading of the townhome blocks will utilize split drainage. The fronts of the townhome block will drain onto the development roadway and stormwater will be collected by the catchbasins. The rear of the townhomes will drain towards the rear property line where stormwater will be collected by the RYCB's and be directed to the larger storm sewer within the development roadway. The fronts of the townhome units that front Dixon Street will drain onto the municipal ROW. The remaining townhome site will discharge flows to the existing 675mm storm sewer along Dunn Street via 450mm storm sewer extension to the vicinity of the townhome entrance (see Post-Development Drainage Area Plan in Appendix A).

5.0 STORMWATER MANAGEMENT

The stormwater management system proposed for the site consists of two separate systems. One system for the townhouse condominium site and another system for the office building site with a reconfigured parking lot. Each system consists of a catchbasin and sewer pipe collection system, oversized pipes (super pipes) for temporary runoff storage, a control structure with an orifice plate to control flows, and an oil-grit separator (OGS) for quality control. Both sites will discharge to the Dunn Street Storm sewer system with flows not exceeding the pre-development rates for a 5-year storm event. Major storm event runoff is directed to the site entrances located off Dunn Street, being the low end of the site.

The OGS's are sized for normal protection as per the Region's comments in the pre-consultation meeting minutes on April 1st, 2021, with a minimum of 70% total suspended solids (TSS) removal.

A detailed Stormwater Management Plan is provided in a separate report titled "Storm Water Management Report, Residential and Commercial Development, 5881 Dunn Street Niagara Falls".

6.0 CONCLUSION

In conclusion, the proposed residential infill development is serviceable utilizing existing municipal sanitary, storm and watermain infrastructure on Dunn Street and Dixon Street.

The proposed servicing for the development is summarized as follows:

1. A 450mm diameter storm sewer extended along Dunn Street approximately 33m west of the existing 675mm diameter storm sewer will provide a storm outlet for the townhome development.
2. Separate SWM facilities will provide quality and quantity control between the townhome and office building sites to minimize or eliminate the need for easements and a maintenance agreement.

Quantity control will be achieved using oversized pipe and orifice plate installed in a flow control structure prior to discharge to the Dunn Street storm sewer system. Quality control will be achieved using oil grit separators. Refer to report titled "Storm Water Management Report, Residential and Commercial Development, 5881 Dunn Street Niagara Falls" for stormwater plan details.

3. A 200mm diameter sanitary sewer will be extended up the townhome private roadway, connected to the 525mm diameter municipal sanitary sewer located on Dunn Street.
4. A 250mm diameter watermain will be extended up the townhome private roadway, connected to the 300mm diameter municipal watermain located on Dunn Street.
5. Two private hydrants will provide fire protection coverage for the townhome blocks in addition to the hydrant located in the vicinity of the entrance off Dunn Street and hydrant located on the north side of Dixon Street, central to the site.
6. Water meters will be located within the individual townhome units.
7. Coordinate the timing for the construction of the 8 proposed units fronting Dixon Street with the City's road reconstruction project to utilize the new municipal services. It is assumed sanitary and storm sewer capacity will be available once the road and underground infrastructure have been upgraded, or if accepted by the City to connect to existing infrastructure on Dixon Street.

Respectfully Submitted,
Urban & Environmental Management Inc.

JSlovak

Prepared by:
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APPENDIX A

PRE-DEVELOPMENT AND POST-DEVELOPMENT DRAINAGE AREA PLANS

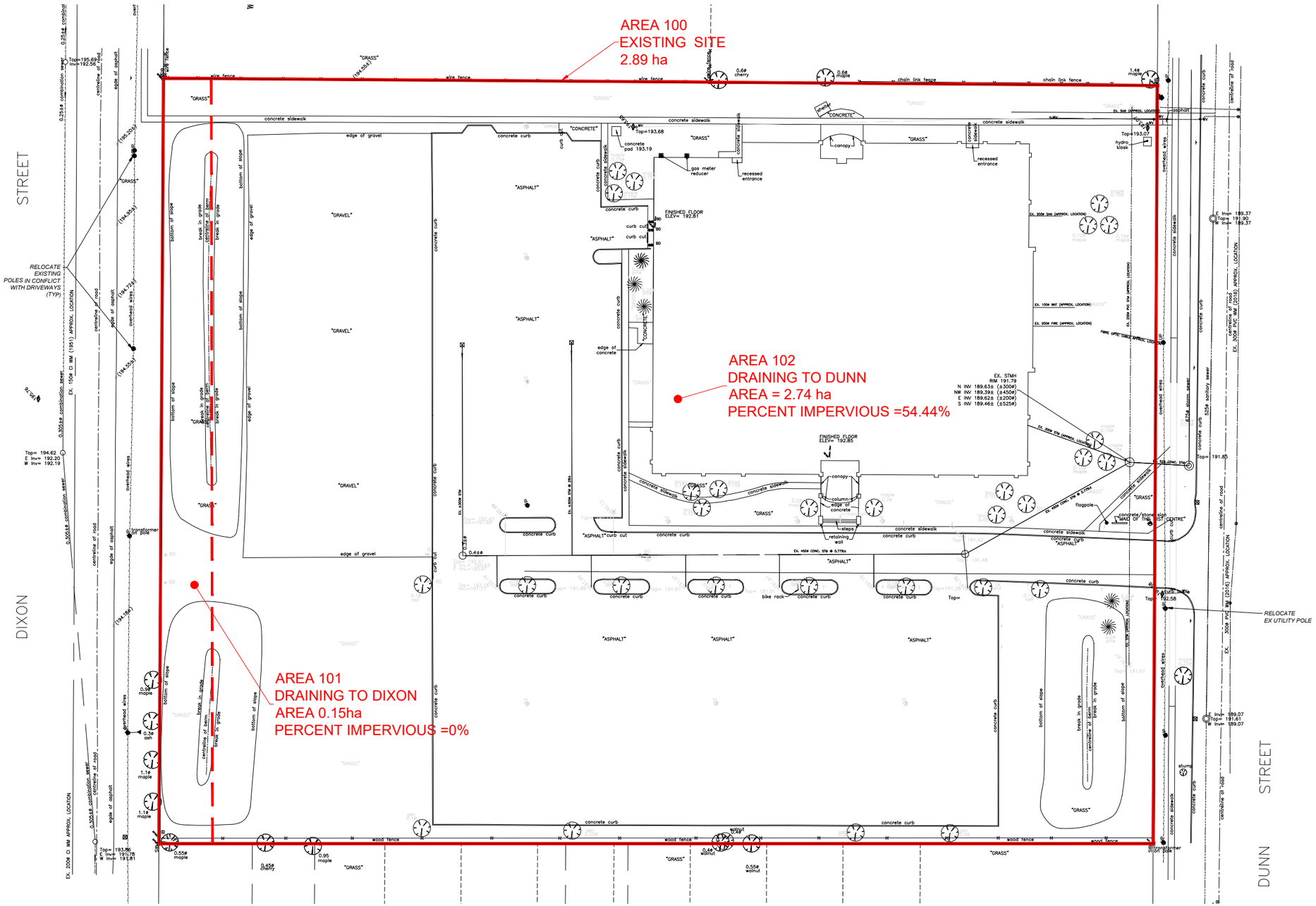


FIGURE 2
PRE-DEVELOPMENT DRAINAGE AREA PLAN

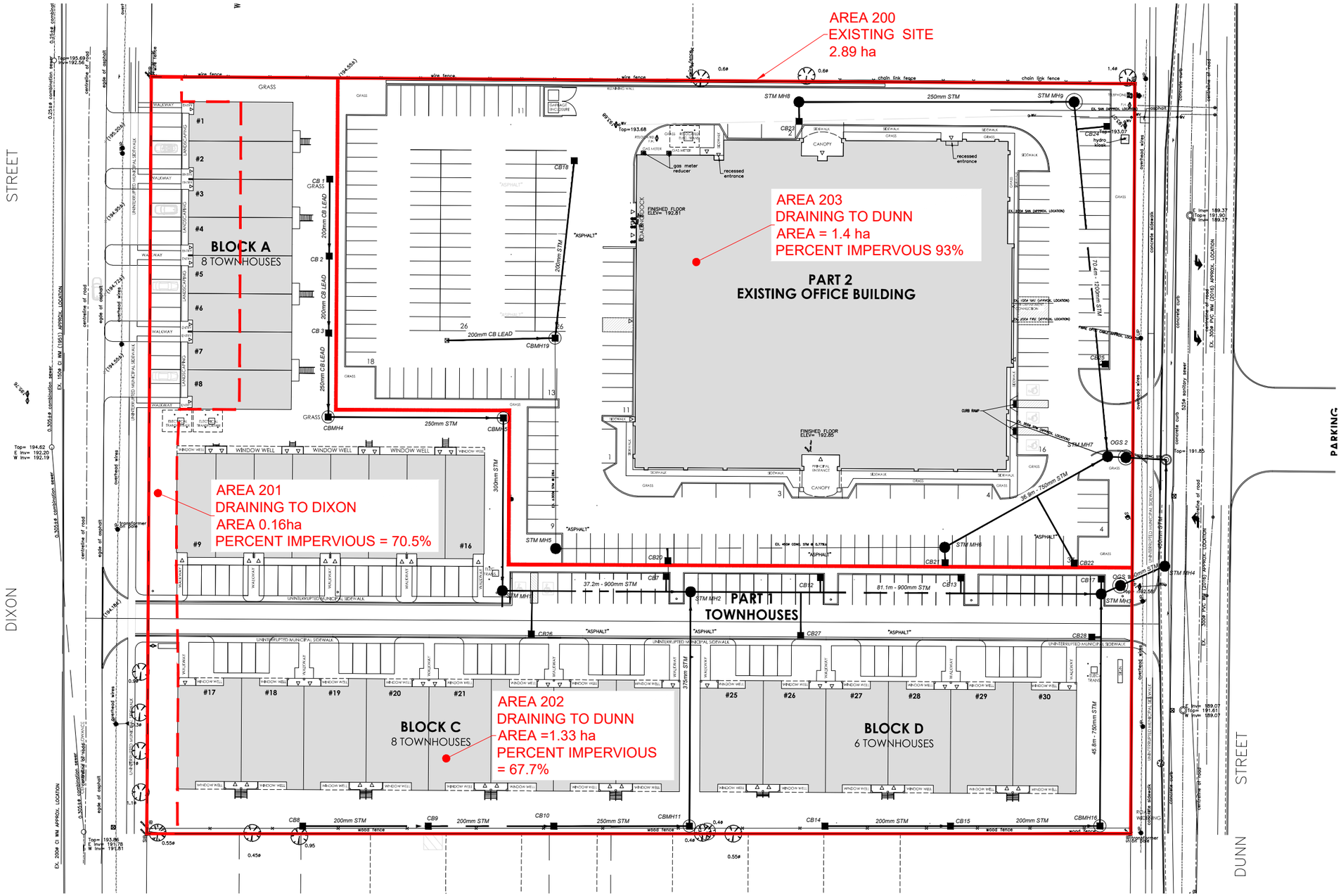


FIGURE 3
POST-DEVELOPMENT DRAINAGE AREA PLAN

APPENDIX B

SANITARY SEWAGE DEMANDS

Sewage Generation Calculations

The MOECC Design Guidelines for Sewage Works 2008 and Design Guidelines for Drinking-Water Systems 2008 were used for the following calculations

Townhouse Block A (Fronting Dixon Street)

Total Units = 8 - 15 bedroom units
Using 15 people/dwelling unit

P = 8 x 15 = 120/1000 = 0.12
q = 320 L/per/day
I = 0.286 L/ha·s
A = 0.12 ha
M = 9.13 (Table 3-3; interpolation)

$$Q\,(d) = \frac{P \times q \times M}{86.4} + IA$$

$$Q\,(d) = \frac{0.12 \times 320 \times 9.13}{86.4} + (0.286 \times 0.12)$$

$$Q\,(d) = 4.09\ L/s$$

Townhouse Block B, C & D

Block B = 8 - 15 bedroom units
Using 15 people/dwelling unit
P = 8 x 15 = 120/1000 = 0.12

Block C & D = 14 - 22 bedroom units
Using 22 people/dwelling unit
P = 14 x 22 = 308/1000 = 0.308

Total Population = 0.428
M = 4.63 (Table 3-3; interpolation)

$$Q\,(d) = \frac{P \times q \times M}{86.4} + IA$$

$$Q\,(d) = \frac{0.428 \times 320 \times 4.63}{86.4} + (0.286 \times 1.12)$$

$$Q\,(d) = 7.66\ L/s$$

$$Q\,(d) = \frac{P \times q \times M}{86.4} + IA$$

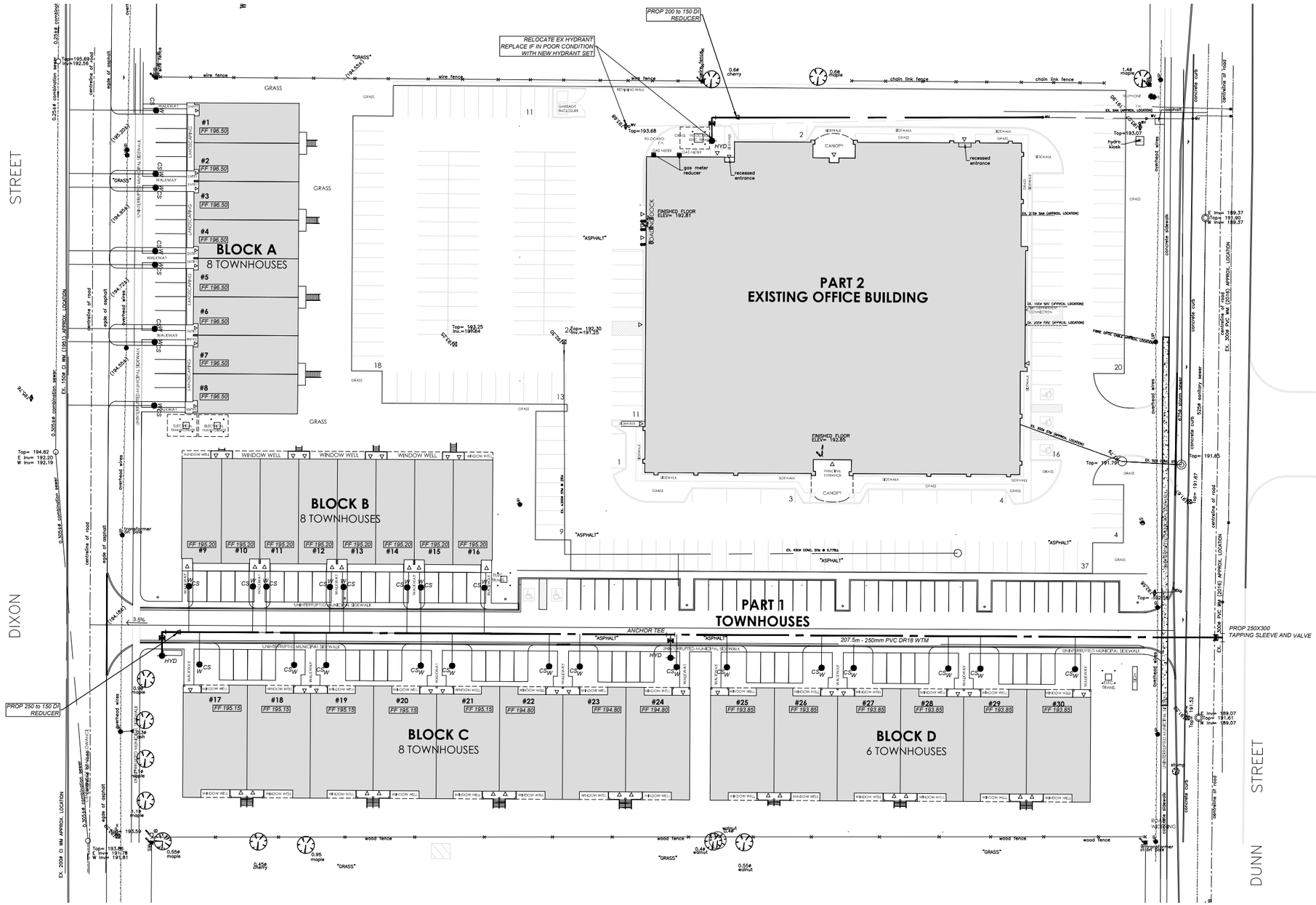
P = Design population, in thousands
q = Average daily per capita domestic flow in L/cap·d (exclusive of extraneous flow)
I = Unit of peak extraneous flow, in L/(ha·s)
A = Gross tributary area in hectares
M = Peaking factor (as determined from Table 3-3 since population is less than 500 people)

Table 3-3: Peaking Factors for Drinking-Water Systems Serving Fewer than 500 People

DWELLING UNITS SERVICED	EQUIVALENT POPULATION	NIGHT MINIMUM HOUR FACTOR	MAXIMUM DAY FACTOR	PEAK HOUR FACTOR
10	30	0.1	9.5	14.3
50	150	0.1	4.9	7.4
100	300	0.2	3.6	5.4
150	450	0.3	3.0	4.5
167	500	0.4	2.9	4.3

APPENDIX C

WATER SERVICING PLAN AND FIRE FLOW CALCULATIONS



SKETCH
WATER SERVICING PLAN
250mm DEAD END WM OFF DUNN STREET

The fire flow demand for the proposed 30-unit residential development was calculated based on non-combustible construction[1], using the equation in the *Fire Underwriters Survey Guide* and the stated assumptions as follows:

Townhome Units: 2-unit block

A two-hour rated firewall will be constructed between every second townhome unit. The two units at the west end of Block A were used for these calculations. Three-storey townhome units are proposed consisting of no sprinklers and non-combustible construction.

Subdivided Ground Floor Area (GFA) = 335 m^2 (based on two-units)

1. $\mathrm{F} = 220\mathrm{C}\sqrt{\mathrm{A}}$

Where,
F = The required fire flow in litres per minute

C = Coefficient related to the type of construction
0.8 for non-combustible construction (unprotected metal structural components, masonry or metal walls)

A = The total effective area in square metres (based on 3 story-townhome unit)
$\mathrm{A} = 1005\ \mathrm{m}^2$

$F = 220\ x\ 0.8\sqrt{1005}$
$\mathbf{F = 5579.51\ L/min}$
Rounded off to the nearest 1000 L/min,
$\mathbf{F = 6000\ L/min}$

2. Assuming limited combustible fire contents hazard – 15% reduction

$F = 6000\ \mathrm{L/min}\ \times 0.15 = -900\ \mathrm{L/min}$
$F = 6000\ \mathrm{L/min} - 900\ \mathrm{L/min} = \mathbf{5100\ L/min}$

3. Assuming no sprinkler system – 0% reduction

[1] Non-combustible construction (Type): All structural elements, walls, arches, floors and roofs are constructed with a minimum 1-hour fire resistance rating.

4. A percentage should be added for structures exposed within 45m by the fire area under consideration:

Exposed Structures	**Separation**	**Charge**	**Adjustment**
North single-family home	38.3 m	5%	5%
East adjacent townhome	0 m	10%	10%
West townhome block	8.7 m	20%	20%
Total Adjustment			**35%**

Therefore, the total adjustment applied in **35%**

$5100\ \mathrm{L/\ min} \times 0.35 = \mathbf{1785\ L/min}$
$5100\ \mathrm{L/\ min} + 1785\ \mathrm{L/min} = \mathbf{6885\ L/min}$

Rounded off to the nearest 1000 L/min,
$\mathbf{F = 7000\ L/min}$

The fire flow demand for the proposed 30-unit residential development was calculated based on non-combustible construction[1], using the equation in the *Fire Underwriters Survey Guide* and the stated assumptions as follows:

Townhome Units: 2-unit block

A two-hour rated firewall will be constructed between every second townhome unit. The two-units at the north-west end of the site (Block C) were used for these calculations. Three-storey townhome units are proposed consisting of no sprinklers and non-combustible construction.

Subdivided Ground Floor Area (GFA) = 570 m^2 (based on two-units)

1. $\mathrm{F} = 220\mathrm{C}\sqrt{\mathrm{A}}$

Where,
F = The required fire flow in litres per minute

C = Coefficient related to the type of construction
0.8 for non-combustible construction (unprotected metal structural components, masonry or metal walls)

A = The total effective area in square metres (based on 3 story-townhome unit)
$\mathrm{A} = 1710\ \mathrm{m}^2$

$F = 220\ x\ 0.8\sqrt{1710}$
$\mathbf{F = 7277.98\ L/min}$
Rounded off to the nearest 1000 L/min,
$\mathbf{F = 7000\ L/min}$

2. Assuming limited combustible fire contents hazard – 15% reduction

$F = 7000\ \mathrm{L/min}\ \times 0.15 = -1050\ \mathrm{L/min}$
$F = 7000\ \mathrm{L/min} - 1050\ \mathrm{L/min} = \mathbf{5950\ L/min}$

3. Assuming no sprinkler system – 0% reduction

[1] Non-combustible construction (Type): All structural elements, walls, arches, floors and roofs are constructed with a minimum 1-hour fire resistance rating.

4. A percentage should be added for structures exposed within 45m by the fire area under consideration:

Exposed Structures	**Separation**	**Charge**	**Adjustment**
North single-family home	38.3 m	5%	5%
South adjacent townhome	0 m	10%	10%
East townhome units	21.3 m	10%	10%
West single-family home	14.9 m	15%	15%
Total Adjustment			**40%**

Therefore, the total adjustment applied in **40%**

$5950\ \mathrm{L/min} \times 0.40 = \mathbf{2380\ L/min}$
$5950\ \mathrm{L/min} + 2380\ \mathrm{L/min} = \mathbf{8330\ L/min}$

Rounded off to the nearest 1000 L/min,
$\mathbf{F = 8000\ L/min}$

Hydrant Report Form		Hydrant # 03459.
Date: (mm/dd/yyyy) 10/27/2020	**Arrival Time:** 1105.	**Departure Time:** 1125.
Hydrant ID Matches: Yes ☑ No ☐	**Address:** 5858 DUNN	

Hydrant Make:

AVK☐ Darling☐ Canada Valve ☐ Concord☐ Bullet ☐ Brigadier☑ Other☐

Storz☑ Steamer☐ No Steamer☐

Cap Colour: Blue ☑ Green ☐ Red ☐ Orange ☐ None ☐

Hydrant Valve: Located: Yes☐ No☑

Open☑ Closed☐ Plugged☐

Hydrant Barrel: Solid☐ Flange☐ Break Away☑

Dry☑ Black Ring☐

If Black Ring: Re-taped: Yes☐ No☐ N/A☑

Pumped: Yes☐ No☐

Cap Gaskets: OK☑ Replaced☐ | Caps Greased: Yes☑ No☐

Check Bonnet: Yes☑ No☐ | Comments:

Hydrant Greased: Yes☑ No☐ | Hydrant Nut: Operable☑ Inoperable☐

Number of Turns: 18 Comments:

Flushing Start Time: 1110	Flushing Stop Time: 1121
Static Pressure: 520 KPA	Flow Pressure: 520 KPA
Total Flushing Time: 11 min	Chlorine Residual: .89. mg/L

Additional Information

Does Hydrant Need Repair Yes☐ No☑

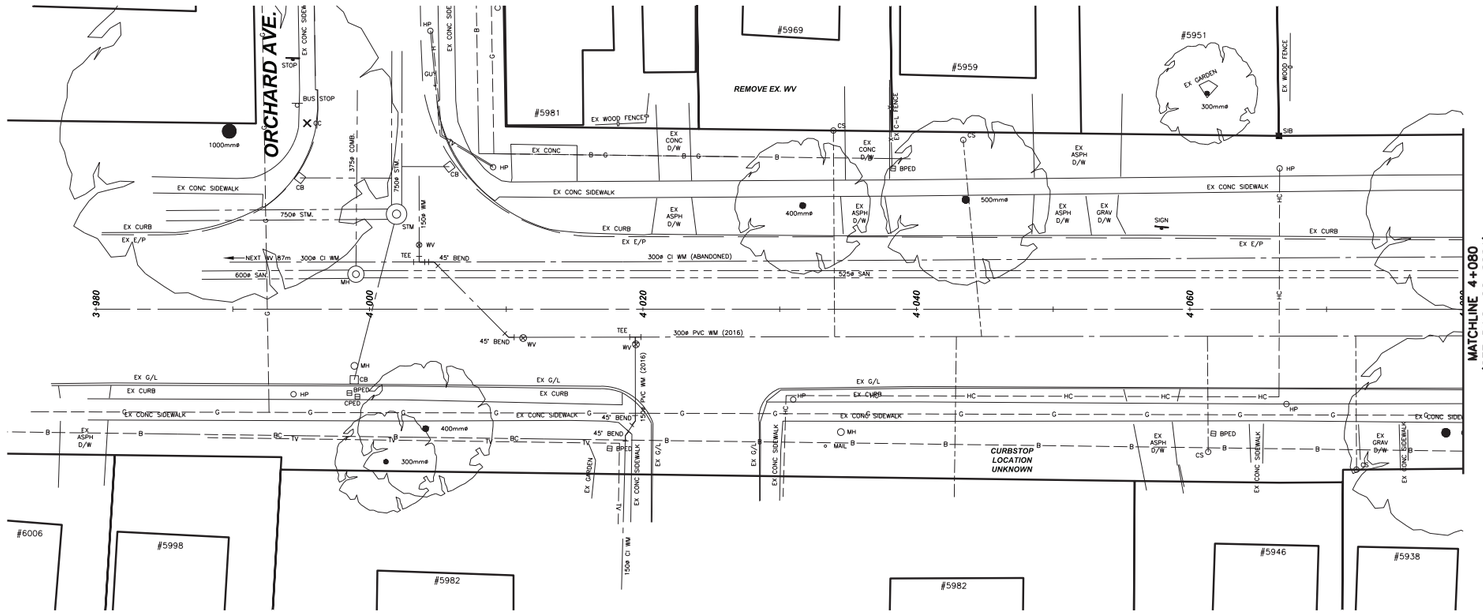
Print: RAUL R. | Sign:

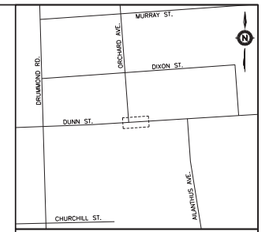
Document #: MW-ES-DWS-FRM-011-001 No. of Pages: 1 of 1

Issue / Revision Date: March 23, 2017 Revision #: 2

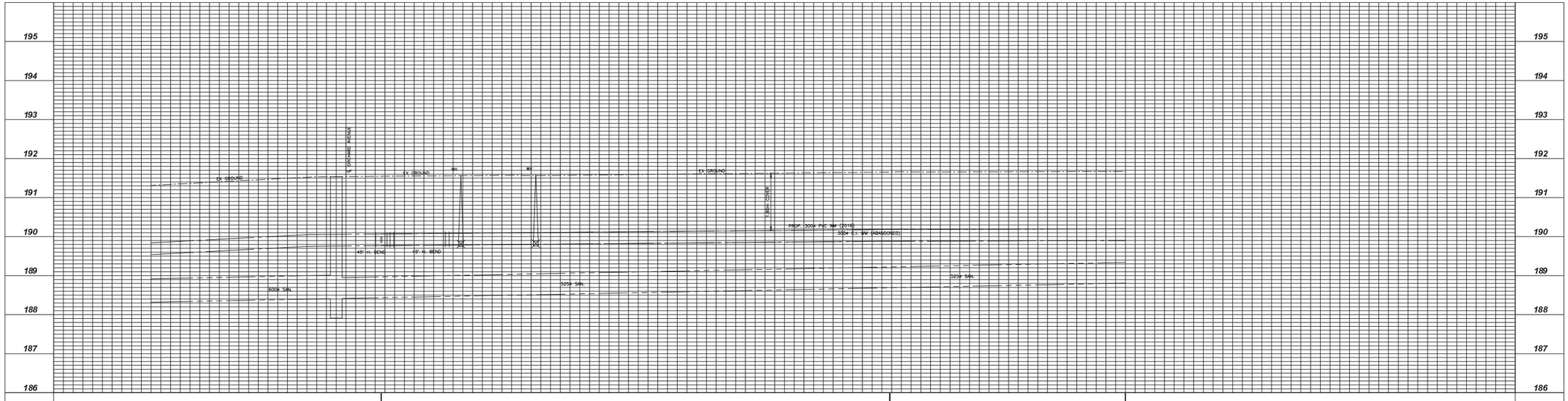
APPENDIX D

PLAN AND PROFILE DRAWINGS AND STORM DRAINAGE AREA PLAN





DUNN STREET



NO.	REVISION	DATE	INIT.
3	AS CONSTRUCTED	2017-05-16	M.J.K.
2	ISSUED FOR CONSTRUCTION	2016-05-30	T.A.
1	ISSUED FOR TENDER	2016-02-16	T.A.

NOTES/LEGEND

1 THE POSITION OF POLE LINES, CONDUITS, WATERMAINS, SEWER 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, THE CONTRACTOR SHALL INFORM HIMSELF OF THE EXACT LOCATION OF ALL SUCH UTILITIES AND STRUCTURES AND SHALL ASSUME ALL LIABILITY FOR DAMAGE TO THEM.

2 PROPERTY LINES WERE PLOTTED USING REGISTERED PLANS AND BARS LOCATED IN THE FIELD. TO VERIFY THE ACCURACY OF THESE PROPERTY LINES, A LEGAL SURVEY SHOULD BE PERFORMED PRIOR TO CONSTRUCTION.

DRAFTING	CJB
DESIGN	CJB
CHECKED BY	TA
APPROVED BY	TA

Niagara Falls CANADA

Hatch Mott MacDonald

CONTRACT No. 2016-308-13
WATERMAIN REPLACEMENT PROGRAM
DUNN STREET
from ORCHARD AVE. to AILANTHUS AVE.
NIAGARA FALLS
PLAN AND PROFILE

CONSULTANT FILE No.	328899
DATE	2013-10-21
SCALE	Hor : 1:200 m Ver : 1:50 m
REF. No.	328899-P04
DWG No.	CC-8280
REV.	3

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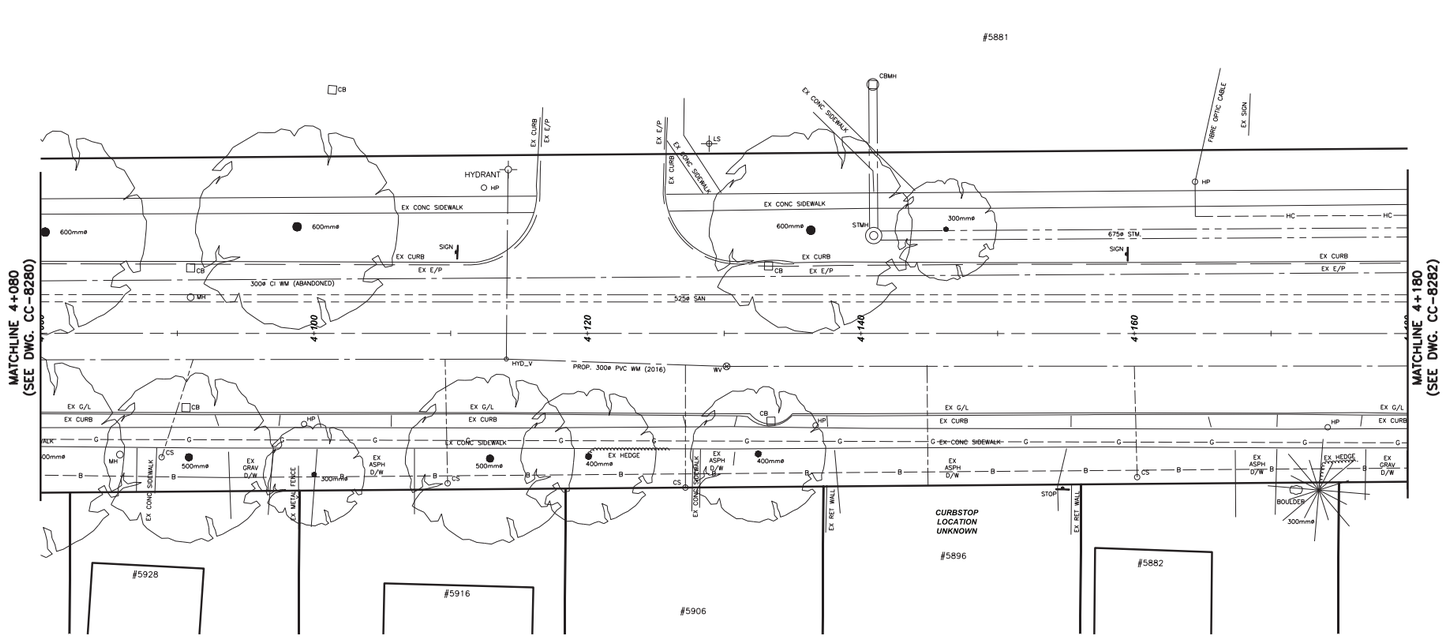
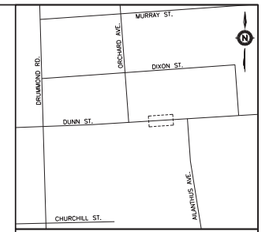
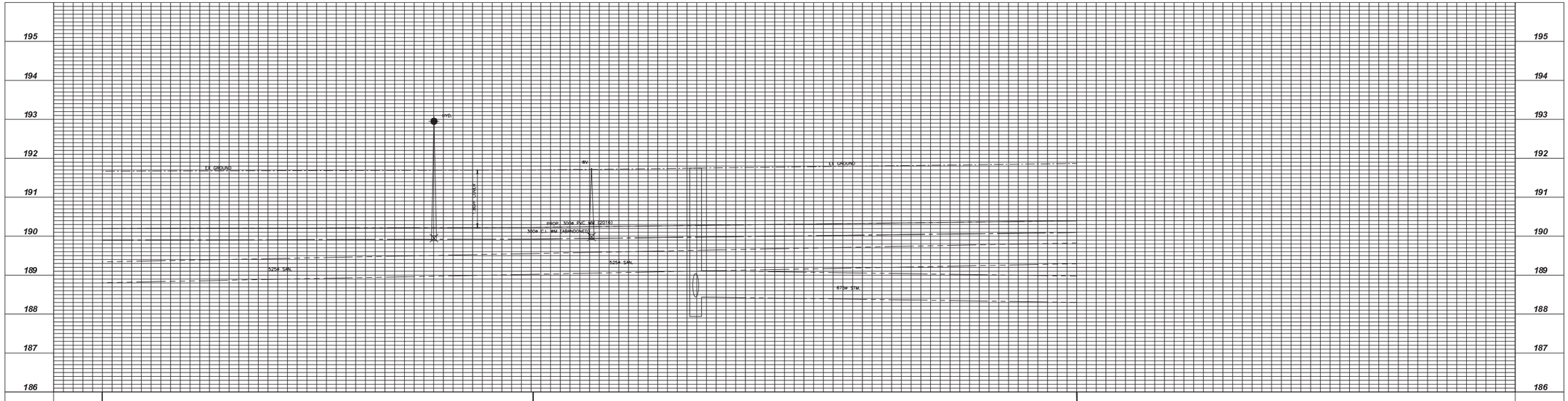




KEY PLAN
N.T.S.

DUNN STREET



WATERMAIN GRADE		68.39m 300ø PVC DR 18 WM @ 0.07% (2016)	56.84m 300ø PVC DR 18 WM @ 0.30% (2016)
TOP OF WATERMAIN	190.20	190.21 / 190.22 / 190.23 / 190.27 / 190.33	190.39
STATION	4+080	4+100 / 4+120 / 4+140 / 4+160	4+180

NO.	REVISION	DATE	INIT.
3	AS CONSTRUCTED	2017-05-16	M.J.K.
2	ISSUED FOR CONSTRUCTION	2016-05-30	T.A.
1	ISSUED FOR TENDER	2016-02-16	T.A.

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DRAFTING	CJB
DESIGN	CJB
CHECKED BY	TA
APPROVED BY	TA

Niagara Falls CANADA

Hatch Mott MacDonald

CONTRACT No. 2016-308-13
WATERMAIN REPLACEMENT PROGRAM
DUNN STREET
from ORCHARD AVE. to AILANTHUS AVE.
NIAGARA FALLS
PLAN AND PROFILE

CONSULTANT FILE No.	328899
DATE	2013-10-21
SCALE	Hor : 1:200 m Ver : 1:50 m
REF. No.	328899-P05
DWG No.	CC-8281
REV.	3

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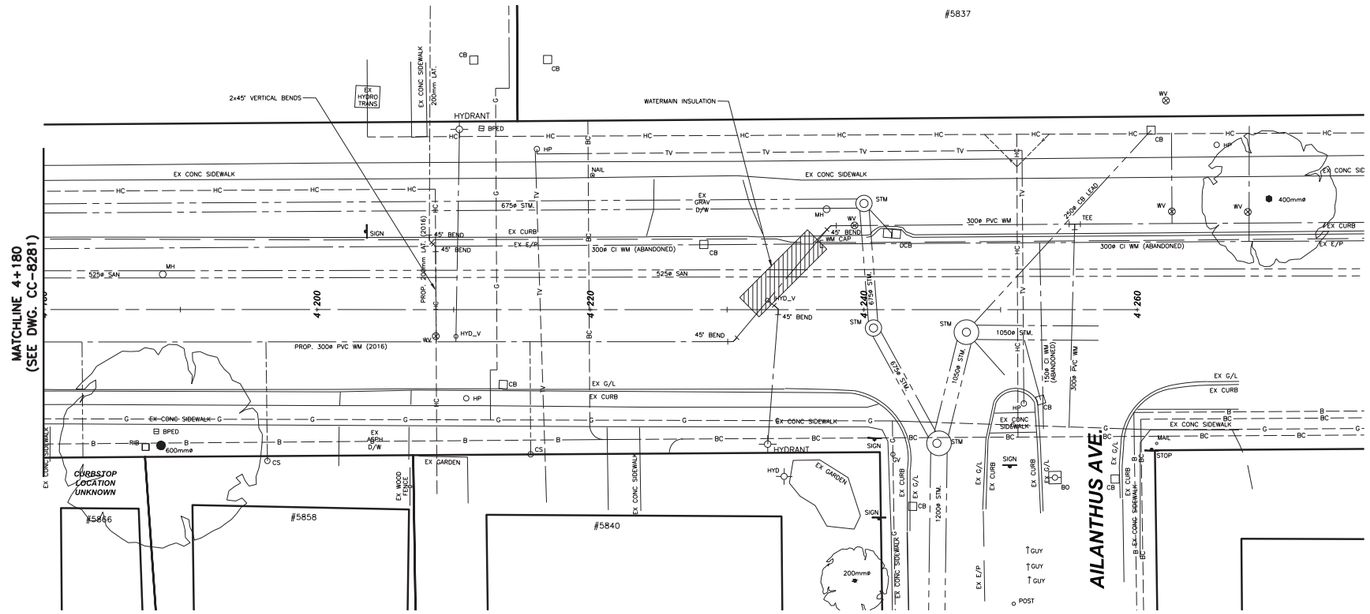
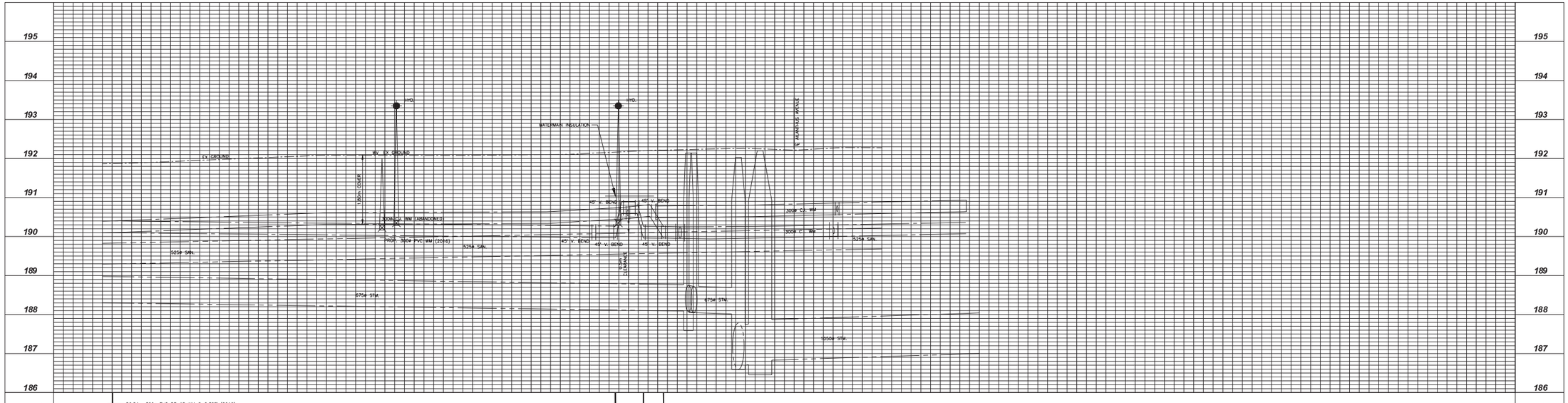


KEY PLAN
N.T.S.

DUNN STREET



NO.	REVISION	DATE	INIT.
3	AS CONSTRUCTED	2017-05-16	M.J.K.
2	ISSUED FOR CONSTRUCTION	2016-05-30	T.A.
1	ISSUED FOR TENDER	2016-02-16	T.A.

NOTES/LEGEND

1 THE POSITION OF POLE LINES, CONDUITS, WATERMAINS, SEWER 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, THE CONTRACTOR SHALL INFORM HIMSELF OF THE EXACT LOCATION OF ALL SUCH UTILITIES AND STRUCTURES AND SHALL ASSUME ALL LIABILITY FOR DAMAGE TO THEM.

2 PROPERTY LINES WERE PLOTTED USING REGISTERED PLANS AND BARS LOCATED IN THE FIELD. TO VERIFY THE ACCURACY OF THESE PROPERTY LINES, A LEGAL SURVEY SHOULD BE PERFORMED PRIOR TO CONSTRUCTION.

DRAFTING	CJB
DESIGN	CJB
CHECKED BY	TA
APPROVED BY	TA

Niagara Falls CANADA

Hatch Mott MacDonald

CONTRACT No. 2016-308-13
WATERMAIN REPLACEMENT PROGRAM
DUNN STREET
from ORCHARD AVE. to AILANTHUS AVE.
NIAGARA FALLS
PLAN AND PROFILE

CONSULTANT FILE No.	328899
DATE	2013-10-21
SCALE	Hor : 1:200 m Ver : 1:50 m
REF. No.	328899-P06
DWG No.	CC-8282
REV.	3

DRAWING FILE: S:\1. Capitol and Current Projects\2015 Contracts\2015-308-13 WM Replacement Program\Construction Phase II\Asconstructed\NFO As Constructed - 328899 Dunn Base.DWG PLOTTED: May 26, 2017 - 1:11pm PLOTTED BY: mk337

1	ADDED OAKES-LIVINGSTONE DRAINAGE AREA	03/24/93

NO. REVISION DATE INIT.

NOTES

LEGEND

LIGHT STANDARD
TRAFFIC LIGHT
SIGN
BELL POLE
HYDRO POLE
HYDRANT
GUY AND ANCHOR
MANHOLE EXISTING
MANHOLE PROPOSED
CATCHBASIN EXISTING
CATCHBASIN PROPOSED
DS.A STANDARD IRON BAR

UNDERGROUND UTILITIES
HYDRO CABLES
WATERMAINS
GAS MAINS
BELL CABLES
GAS OR FUEL
SANITARY SEWER
STORM SEWER
COMBINED SEWER

DRAFTING B.E.S.
DES.
F.H.
CHECKED BY
PROJ. SUPVR.

DESIGN & CONST. ENG.

The City of Niagara Falls

BENCH MARK DATUM

AILANTHUS AVENUE
STORM DRAINAGE PLAN

FIELD NOTES
DATE FEB.
SCALE 1"=2
DWG. No.
MUN. REF. No.

81-

Ic Falls
do

STORM SEWER DESIGN
COMPUTATION SHEET

81-CA-39
86-CA-1

REVISED ☐☐☐ ☐☐☐

PROJECT AILANTHUS AVENUE
LOCATION INCLUDES FREEWAY
REF. PLAN NO.
☐ PRELIMINARY ☒ FINAL

DATE 81 05 12
DESIGN BD
CHECK
FILE NO. CE-6-2
SHEET 1 OF 2

STREET	MANHOLE FROM	MANHOLE TO	AREA	DRAINAGE AREAS A (HECTARES)	RUNOFF COEFFICIENT R	AR	Σ AR	TIME OF CONCENTRATION T (MINUTES)	RAINFALL INTENSITY I (mm/HR)	FLOW IN PIPE Q (l/s)	PIPE SIZE (mm)	SLOPE % S	n	PIPE CAPACITY (l/s)	FLOW VELOCITY (m/s)	PIPE LENGTH (m)	TIME IN PIPE (MIN.)	FALL IN METRES	INVERT ELEVATION UP STREAM	INVERT ELEVATION DOWN STREAM
ALLENDALE AVE.			A_1	1.578	0.75	1.184	1.184	10	88.9	292.6	450	2.00	0.013	421.4	2.57	90	0.58		FUTURE	
DIXON ST.			B_1	0.482	0.75	0.362														
"			C_1	4.573	0.40	1.829														
				0.259	0.65	0.168	3.543	10.58	87.2	858.9	750	0.60	0.013	900.4	1.97	210	1.78		FUTURE	
"			D_1	4.087	0.20	0.817														
				3.573	0.40	1.429														
LEVEL AVE.			E_1	1.639	0.40	0.656	6.445	12.36	82.4	1476.4	825	1.00	0.013	1499.2	2.72	220	1.35		FUTURE	
DUNN ST.			F_1	1.971	0.75	1.478														
				1.554	0.95	1.476														
CLEVELAND AVE.			G_1	1.340	0.60	0.804														
				0.724	0.40	0.290														
DUNN ST.			H_1	0.741	0.50	0.371														
"	8	7	I_1	1.113	0.60	0.668	11.532	13.71	79.1	89.6 cfs 2535.9	1050	0.80	0.013	2550.2	2.85	180	0.76			
"			J_1	4.330	0.50	2.165	11.532	14.47	77.4	2481.4	1050	0.80	0.013	2550.2	2.85	10.2	0.06		FUTURE	
	9	7	—	0.478	0.60	0.287	2.452	10	88.9	606.0	675	0.60	0.013	679.5	1.84	35	0.32			
AILANTHUS AVE	7	6	K_1	1.688	0.40	0.675	2.452	10.32	88.0	591.8	675	0.60	0.013	679.5	1.84	10.0	0.01		FUTURE	
				0.243	0.75	0.182														
				1.392	0.50	0.696	15.537	14.53	77.2	3334.5	1200	0.70	0.013	3406.0	2.92	177.2	1.01			
"	6	5	K_2	1.619	0.50	0.810	16.347	15.54	75.0	3408.4	1200	0.74	0.013	3501.9	3.00	40.0	0.22			
SUNNYLEA CRES.			L_1	2.817	0.40	1.127														
AILANTHUS AVE (FREEWAY)			R_1	1.465	0.50	0.732														
				1.522	0.20	0.304														
AILANTHUS AVE.	5	4	M_1	3.978	0.40	1.591	20.101	15.76	74.6	4168.7	1350	0.86	0.013	5168.0	3.50	144.0	0.68			
AILANTHUS AVE (FREEWAY)			S_1	1.477	0.50	0.739														
				0.870	0.20	0.174														
AILANTHUS AVE	4	3	N_1	0.287	0.20	0.057														
				8.660	0.40	3.464														
				1.481	0.50	0.741	25.276	16.44	73.2	5143.6	1350	0.86	0.013	5168.0	3.50	144.0	0.68			

LAND USE :-
INDUSTRIAL : WAREHOUSE, PRESTIGE, HEAVY.
COMMERCIAL : DOWNTOWN, SUBURBAN, TOURIST

RUNOFF COEFFICIENT		
0.75	0.65	0.75
0.85	0.75	0.75

LAND USE :-
OTHER HIGHWAY PAVEMENT, SODDED SLOPE, PARK
RESIDENTIAL SUBDIVISION, ROWHOUSING, APARTMENT

RUNOFF COEFFICIENT		
0.95	0.30	0.20
0.40	0.50	0.60

$Q = K A i$ $\quad i = \frac{2667}{T + 20}$ $\quad K = 2.78$

Niagara Falls
Canada

STORM SEWER DESIGN
COMPUTATION SHEET

REVISED ☐☐☐ ☐☐☐

PROJECT AILANTHUS AVENUE.
LOCATION INCLUDES FREEWAY
REF. PLAN NO.
☐ PRELIMINARY ☒ FINAL

DATE 81 05 12
DESIGN BD
CHECK
FILE NO. CE-6-2
SHEET 2 OF 2

STREET	MANHOLE FROM	MANHOLE TO	AREA	DRAINAGE AREAS A (HECTARES)	RUNOFF COEFFICIENT R	AR	Σ AR	TIME OF CONCENTRATION T (MINUTES)	RAINFALL INTENSITY I (mm/HR)	FLOW IN PIPE Q (l/s)	PIPE SIZE (mm)	SLOPE % S	n	PIPE CAPACITY (l/s)	FLOW VELOCITY (m/s)	PIPE LENGTH (m)	TIME IN PIPE (MIN.)	FALL IN METRES	INVERT ELEVATION UP STREAM	INVERT ELEVATION DOWN STREAM
AILANTHUS AVE. (FREEWAY)			T_1	1.530	0.50	0.765														
				0.652	0.20	0.130														
AILANTHUS AVE.	3	2	O_1	1.356	0.40	0.542														
				0.117	0.20	0.023	26.736	17.12	71.8	5336.6	1350	0.86	0.013	5168.0	3.50	144.0	0.68			
AILANTHUS AVE. (FREEWAY)			U_1	1.534	0.20	0.307														
				2.238	0.40	0.895														
"	2	1	P_1	1.368	0.20	0.274														
				2.274	0.40	0.910	29.122	17.80	70.6	5715.7 (201.8 cfs)	1500	0.60	0.013	5715.9	3.13	127	0.68			
"	1	EX. PIPE	Q_1	0.506	0.40	0.202	29.324	18.48	69.3	5649.4	1500	0.50	0.013	5217.9	2.86	64.1	0.60			

LAND USE :-
INDUSTRIAL : WAREHOUSE, PRESTIGE, HEAVY.
COMMERCIAL : DOWNTOWN, SUBURBAN, TOURIST

RUNOFF COEFFICIENT
0.75 0.65 0.75
0.85 0.75 0.75

LAND USE :
OTHER : HIGHWAY PAVEMENT, SODDED SLOPE, PARK
RESIDENTIAL SUBDIVISION, ROWHOUSING, APARTMENT

RUNOFF COEFFICIENT
0.95 0.30 0.20
0.40 0.50 0.60

$Q = K A i R$ $K = 2.78$
$i = \frac{2667}{T + 20}$