

Figure A.1 – Historic Watermain Breaks - 2016



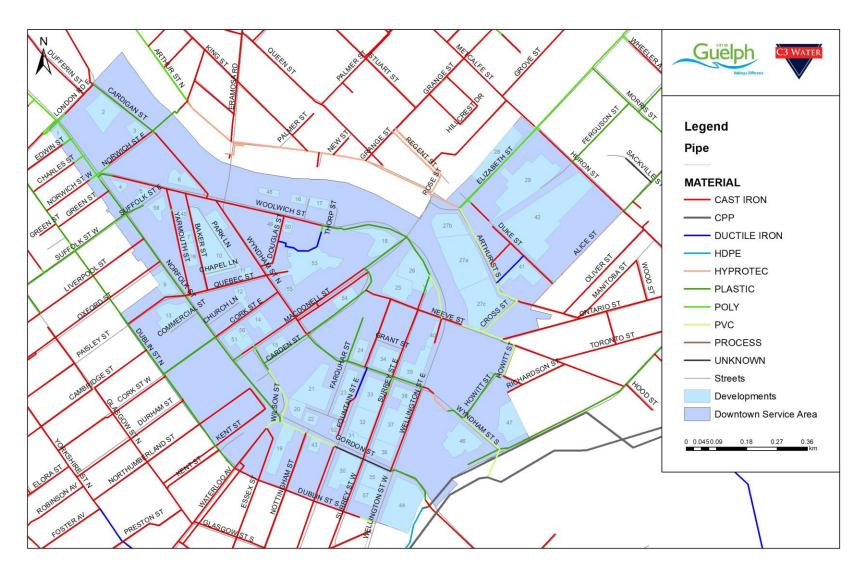
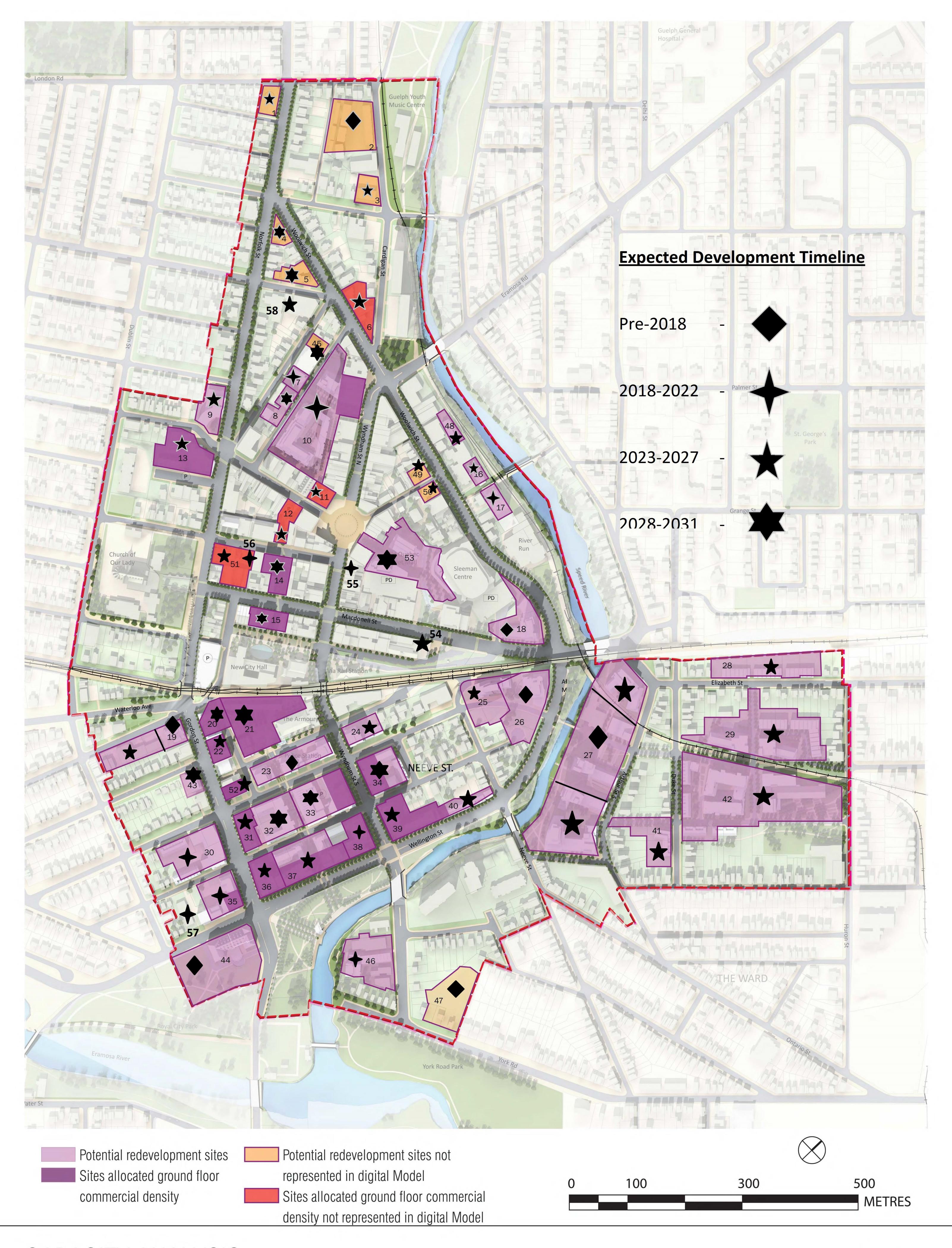


Figure A.2 – Existing Pipe Materials – 2018

APPENDIX B

Downtown Secondary Plan Area Planning Information





Guelph UGC Ca		Pre-2018				-														
FOR DISCUSSION, Rev	rised Jan 17, 2018	2018-2022 2023-2027					Con	nmercial	Commercial		ffice/Institutional	Projected New Uses		Residential		Residential				
		2023-2027						ed on FSI	based on model		based on FSI	Office/Inst. based on model		based on FSI		based on model		Existing		
				1																
							Ground floor											Estimated Estimated	I	
Site # Timeline addre	ess Description	Gross area (sq. m)	Public realm dedication %	Net Area (sq.	Total Density (FSI) Total	al GFA (sq.m)	commercial Com density (FSI)	nmercial GFA (sq.m) Jobs/37	GFA from Digital m2 Model (sq.m) 20:	Office 31 Density (FSI)	GFA Jobs/27n	GFA from Digital n2 Model (sq.m) 20	Residential F density (FSI)	tesidential GFA (sq.m) (GFA)		GFA from Digital Units People (Units Model (sq.m) (GFA/100m2) *2 p)	2031 Current use	Existing Existing Jobs Residential Units (sitex0.25/37)	Brownfield	COMMENTS
1 2023-2027		1,518	0%	1518	1.0	1,518	0.0	0	0				1.0	1,518	15 30)	vacant	(======================================		
2 Pre-2018		6,994	0%	6994	approved									5,070	51 101		vacant			units being marketed now (2009)
3 2023-2027 4 2028-2031		1,969 1,040	0%	1969 1040	1.0	1,969 1,560	0.0	0 312	8	0.5	985	36	0.5 1.2	985 1,248	10 20 12 25	9	commercial commercial	13		Office expansion approved (2008) but not pursued
5 2028-2031		1,934	0%	1934	1.5	2,901	0.3	580	16				1.2	2,321	23 46		res/comm	13		
6 2023-2027		2,928	0%		1.5	4,392	0.3	878	24				1.2	3,514	35 70		commercial	4 20		
7 2018-2022 8 2028-2031		1,167 1,898	15%	991.95 1898	2.5	2,480 4,745	0.2	198 190	5				2.3	2,281 4.555	23 46 46 91	6,959 4,250	6,959 vacant	12		
9 2023-2027	Existing Library	2,970	0%		2.0	5,940	0.3	891	24				1.7	.,	50 101	•	11,847 library	20		
10 2018-2022	Baker Street	16,010	50%	8005	4.3	34,422	0.3	2,402	65 3,090 3,09	90 1.0	8,005	96 9,268 9,2	3.0	24,015	240 480	35,530	35,530 parking	28 108		
11 2023-2027		1,272	25%	954	3.5	3,339	0.9	859	23				2.6	2,480	25 50		bank	9		
12 2023-2027 13 2023-2027		1,827 5,821	25% 30%		3.0 2.0	4,111 8,149	0.3	411 1,222	33 1,566				2.7 1.7	3,700 6,927	37 74 69 139	10,358	parking	39		
14 2028-2031	MacDonnell/Cork Parking Lot	2,126	25%		2.5	3,986	0.6	957	26 634 6	34			1.9	3,030	30 61	1,841	parking			
15 2028-2031		1,829	25%	1371.75	2.5	3,429	0.7	960	26 1,365 1,3	55			1.8	2,469	25 49	4,095	4,095 commercial	12		
16 2023-2027		1,092	10%	982.8	2.0	1,966 4,345	0.0	0	0				2.0		20 39	1,725	church pkg.			
17 2018-2022 18 Pre-2018		2,414 4,652	10% 10%	2172.6 4186.8	2.0 4.5	18,841	0.0	1,256	34				2.0 4.2	4,345 17,585	43 87 176 352		parking 24,573 commercial	31		
Market		***						,	-					, , , , , , , , , , , , , , , , , , , ,						
Completed /																				
Res is 2023- 19 2027		5,386	0%	F 200	3.5	13,465	0.3	1.515	44				2.2	11.840	110 22	4 000	4.000			
20 2028-2031	Existing Farmers Market	2,248	30%	5386 1573.6	3.0	4,721	0.3	1,616 472	13 1,505				2.2	11,849 4,249	118 237 42 85		4,990 parking market/pkg.	15		
21 2028-2031	DND Armoury	8,921	40%		3.0	16,058	0.3	1,606	43 2,693 2,69	93			2.7	14,452	145 289		armoury pkg.	60		
22 2023-2027		1,320	0%	1320	3.0	3,960	0.3	396	11 1,082				2.7	-7	36 71	5,411	commercial	9		
23 Pre-2018 24 2023-2027	Police Station	4,722 1,070	15% 0%	4013.7 1070	3.0 4.0	12,041 4,280	0.2	803 321	22				2.8	11,238	112 225 40 79	24,021	police station office	32		
25 2023-2027	Neeve Street Parking Lot	4,145	30%		3.0	8,705	0.2	580	16				2.8	-,	81 162	,	parking	/	у	
26 Pre-2018	Marsh Tire	8,717	30%		4.0	24,408	0.2	1,220	33	0.0	0	0	2.8		171 342		20,672 vacant	59	у	
Pre-2018 - 2023-2027																				
(Phase 4 and																				
27 Phase 5) 28 2023-2027	Woods Plant #1	33,340 5,799	35% 0%	21671 5799	2.0	65,013 11,598	0.1	2,167 0	0	0.1	. 2,167	80	2.8		607 1214 116 232		82,833 industrial indus/comm	225	y v	-
29 2023-2027		16,095	25%	12071.25	1.5	18,107	0.0	0	0				1.5	18,107	181 362		industrial	109		
30 2018-2022		6,942	0%		2.5	17,355	0.3	2,083	56				2.2		153 305		17,742 commercial	47		
31 2023-2027 32 2028-2031		2,107 5,173	0% 10%	2107 4655.7	2.5 3.0	5,268 13,967	0.6	1,264	34 1,626 1,63	26			1.9 3.0	4,003 13,967	40 80 140 279		8,132 commercial comm/res	7 35		-
33 2028-2031	Fountain Street Parking Lot	6,399	20%		3.0	15,358	0.3		42 1,599 1,5	99 2.7	13,822 5	12 21,317 21,3			0 0)	parking	, 33	у	
34 2028-2031	Provincial Courts	4,315	0%		3.0	12,945	0.5	2,158	58				2.5		108 216		19,701 civic	29		
35 2018-2022 36 2023-2027		4,135 3,031	0%	4135 3031	3.0	10,338 9.093	0.5	2,068 1,516	56 2,798 2,79 41 1.767	98			2.0	8,270 7.578	83 165 76 152	13,988 8,835	13,988 commercial	28		
37 2023-2027		6,310	20%	5048	3.0	15,144	0.2	1,010	27 2,473				2.8	.,	141 283		commercial	43		
38 2018-2022		2,765	0%		4.0	11,060	0.5	1,383	37 2,216				3.5	9,678	97 194		gas station	3 19	У	
39 2023-2027 40 2023-2027	Fire Station	1,713 4,927	0%	1713 4927	4.0 3.0	6,852 14,781	0.5	857 985	23 2,853 2,85	53			3.5 2.8	5,996 13,796	60 120 138 276		24,714 comm/fire stn. 8,182 fire stn.	12	v	
41 2023-2027		9,568	20%	7654.4	2.0	15,309	0.0	0	0				2.0	15,309	153 306		3,628 industrial	65	y	
42 2023-2027	Woods Plant #2	27,653	30%	19357.1	1.5	29,036	0.0	0	0				1.5	29,036	290 581		industrial	187	у	
43 2028-2031 44 Pre-2018		DELETED							0						0 0	4,017 11,296	4,017 comm/vacant 11,296 commercial		y v	Gordon St southwest corner Wellington and Gordon
45 2028-2031		743	0%	743	2.0	1,486	0.0	0	0				2.0	1,486	15 30	11,250	22,230 Commercial	4	,	SSEEMEST COME WEININGTON and GOLDON
46 2018-2022		7,031	0%	7031	2.0	14,062	0.0	0	0				2.0		141 281		commercial	48		Affordable housing site (61 Wyndham S) 2009
47 Pre-2018 48 2023-2027		6,512 1,190	15%		approved 2.0	2.023	0.0	0	0				2.0	2,860	29 57		residential parking			Approved 2008 not yet constructed
49 2023-2027		855	0%	855	3.0	2,565	0.6	513	14				2.4	,	21 41	-7	vacant			
50 2023-2027		830	0%	830	3.0	2,490	0.6	498	13				2.4	1,992	20 40					
51 2023-2027 52 2023-2027		4,200 274	0% 0%		2.5	10,500 685	0.7	2,940 164	79 4 759				1.8	7,560 521	76 151 5 10		commercial	2		
53 2028-2031	Quebec St. Mall	2/4	0/0	2/4	2.3	003	0.0	104	735				1.9	321	J 10	9,869	Commercial	2		Quebec Street Mall site
54 2023-2027	Royal Suites H																			
55 2018-2022 56 2018-2022 C	Dougees and Pla																			
56 2018-2022 C 57 2018-2022	Cork Street (9 Cork and adjacent prope Maple																			
58 2023-2027	St.Andrews (F																			
- 	Removal of Wellington southside			+																
2028-2031	development	16,350																110		
+																				
Total				Т		500,762		39,270 1,0	28,025 16,65	57	24,978 92	30,585 30,5	35	438,342	4,383 8,767	586,885 5,869 11,738	302,900	46 1533	l _	

remove from 2031 model

City Owned

	500,762	39,270	1,061 28,025	16,657	24,978	925	30,585
		based on FSI	based on mode		by 2031 (model)	2031 targets (L	.GMS)
New commercial employees		1,061	757	'	450		500
New office employees		925	1,133	i e	1,133		1,000
New residents		8,767	11,738	1	6,058		5,950
Less Existing People + Jobs on Redevelopment Sites		-1,597	-1,597	'	-1,000 est.	-	-1,000
		9,156	12,031		6,641		6,450
UGC area (ha)		106	106	i	106		106
Existing UGC Density (from Places to Grow/GMS)		96	96	i	96		96
Additional density (P+J/ha)		86	113		63		61
OVERALL DENSITY		182 p+j/ha	209		159		157

APPENDIX C

Memorandum: Wastewater Collection System Model Update Methodology









Memorandum

DATE: February 6, 2018

TO: Arun Hindupur

FROM: Mark de Lange, Harold Chard, Philip Gray

CC:

OUR REF.#: 2017-0309

SUBJECT: Proposed Modelling Methodology for the Downtown Secondary Planning Area

Sanitary System Assessment

1. Introduction

The City of Guelph (the "City") retained the services of Cole Engineering Group Ltd. (COLE) to provide engineering assistance for the planning of wastewater servicing to accommodate future developments within the downtown area. As part of this undertaking, COLE will be updating the existing City-wide hydraulic/hydrological sanitary sewer model to reflect current conditions, and increase level of detail in the downtown area. This memorandum details the proposed methodology that will be applied in updating the model.

2. Background

The existing city-wide wastewater collection model was developed in Innovyze's InfoSWMM software package as part of the 2008 Water and Wastewater Servicing Master Plan. The intent of this project was to assess infrastructure needs at a macro level, while the current project is focused on a much smaller area. For this project, the model will only be updated within the limits of the area defined by the Downtown Secondary Plan (the study area).

The study area, as it exists today, covers an area of approximately 120 ha which is divided into 665 land parcels. Of these parcels, 326 are classified as residential with the remaining majority being commercial, with a few industrial properties and vacant lots. It is also noted that due to the unique nature of the downtown area, many parcels are made up of a mix of commercial and residential space (i.e. ground floor commercial with residential units above). An initial review of parcel data indicates that the majority of mixed use properties are classified as commercial. Special consideration will be given to mixed-use properties during the model update process.

There are currently 53 developments proposed in the study area, the details of which are included in planning information provided by the City. Developments include a mix of residential, commercial and institutional projects, with completion timelines ranging from 2018 to 2032. In total, an additional residential population of 5,950 is anticipated for the build out condition as well as an additional employment population of 1,500.

S:\Projects\In Progress\2017-0309 (Guelph Downtown)\3 Reporting\Memos\17-0309 Model Update Methodology Memo_FEB0618.docx



3. Model Update Methodology

The following section provides details of the proposed approach for updating the wastewater collection system model of the study area. We recommend the updated model be based on applying wastewater generation estimates at an individual parcel level. This approach is ideal under the current project as it will allow for each proposed development to be represented individually and independently. Furthermore, using this model structure will allow City staff to easily evaluate capacity for further developments or changes to the proposed developments beyond the duration of this project.

Proposed steps for updating the model for existing conditions include the following:

- 1. Model migration to PCSWMM software: The existing sewer model, developed in InfoSWMM, will be brought into PCSWMM for COLE to conduct its analysis. This conversion will not affect model results as both software platforms use the same EPA SWMM engine. Following project completion, should City staff wish to preform further analyses, model data sets can be brought back into InfoSWMM. The migration will include a comparison of modelling results between the original InfoSWMM and the PCSWMM model to ensure they are consistent.
- 2. Updates to the sanitary sewer network: Several changes to the sanitary sewer network layout, within or in close proximity to, the study area have occurred in the time since the existing model was built. The City provided GIS shapefiles of sanitary sewers and manholes accurate to the current system layout that will be used to update the model. Updates will be limited to pipes and manholes within, or directly affecting, the study area.
- 3. **Assigning parcels to load points:** Each parcel within the study area will be assigned a manhole to which flows generated within the parcel will be loaded to the network. Loads will be assigned to the upstream manhole of the receiving sewer. The "Service Laterals" shapefile provided by the City will be used to allocate parcels to the appropriate sewer.
- 4. **Generate initial sanitary flows:** For existing conditions, wastewater flows from each parcel will be estimated based on 2016 water distribution data that was provided to COLE as GIS shapefiles. A base average daily wastewater flow will be determined for each parcel by overlaying the parcel data with the water consumption data. An average of water usage will be taken for months where water losses are expected to be minimal (January –March). An initial review of water billing data revealed some issues in matching water meter records to the parcel data (i.e. some parcels have no meter while others have multiple). The total water usage will be summed within each parcel, assuming no wastewater is generated on parcels with no meters. Simulated wastewater generation rates will later be checked with recent flow data (see point 6).
- 5. **Apply diurnal flow pattern:** Diurnal patterns from the existing model will be assigned to the same load point in the updated model. This process will include separating the baseflow value in the existing model from the new average daily flow determined from water billing data. The accuracy of diurnal flow patterns will be assessed using recent flow data (see point 6).
- 6. Model checking with sewer flow data: Following the model update, simulated sewer flows will be compared to observed flows to confirm the accuracy of the updated model. The City currently has three sanitary flow monitors and one rainfall gauge installed in the study area. Data from these sites will be used in model checking. Sewer flow data collected to support the original model build is also available, however it was decided not to use this data as it is likely significant land use changes have occurred in the time since it was collected. Table 3.1 presents details of the flow



monitoring locations that will be used in checking the updated model. The downtown rainfall gauge is located on the roof of Guelph City Hall at 1 Carden Street.

Site ID	Manhole ID	Pipe Diameter (mm)	Location	Installation Date
FM-06	MH 3511	450	Near 150G Wellington Street E	January 9 and 19, 2017
FM-07	MH7417	375	Intersection of Wyndham Street S and Wellington Street E	January 19, 2017
FM-08	MH 1577	450	Intersection of Bristol Street and Surrey Street W	December 21, 2016

Table 3.1 Details of Active Flow Monitoring Locations

7. **Adjustments to model flows as required:** Based on the model assessment described under task 6, model inputs will be adjusted to ensure the model is representative of existing flows to within common industry standards. If required, adjustments will be made to the average daily wastewater flow input the model by application of a uniform area-wide scaling factor. Model checks will be conducted for both dry and wet-weather flow periods, however at this time, it is assumed no adjustments will be needed to the wet-weather component of the model. Should adjustments be required to the wet-weather component, COLE will advise on a process for doing such.

4. Future Condition Modelling Methodology

In order to accurately assess system capacity to accommodate new developments, a representative methodology is needed to generate future flows. The City's current design standard for sanitary sewers is outlined in the Development Engineering Manual (DEM), which was adopted in November 2016. This guideline uses an area based approach to generate design flows, applying a constant rate for specific land use types. These rates are inclusive of a peaking factor and an extraneous flows allowance.

In our experience, the area based approach to flow generation is useful in the early planning stages to get a general sense of servicing requirements, however when detailed planning information is available, estimates of future residential and employment populations are a more appropriate basis for estimating future wastewater design flows.

In the current study, detailed population information is available for all commercial, office/institutional and residential developments within the downtown core. Due to the unique nature of the downtown area (high density with mixed land use types), subject to further review, we recommend using a population-based approach to flow generation under future conditions. A potential methodology that can be applied is the MOECC's Design Guidelines for Sewage Works, which recommends using an average domestic flow rate of 225 to 450 L/cap/d. Based on discussions with City staff, it was decided to use a per capita flow generation rate of 300 L/cap/d as was applied in the development of the 2013 Master Plan model development. To allow for comparison of methods; the City's current approach will also be applied to assess the proposed developments, to help with a final decision on the most appropriate method.

Due to the parcel based approach that will be used to develop the updated model of existing conditions, existing flows for each development site can be removed and replaced by updated design flows. Further investigation is required to confirm if this is an appropriate approach on each redevelopment parcel, or if flows from new developments should be added to existing flows.



5. Conclusions

Upon conformation that the methodology outlined above is acceptable COLE will move forward with updating the model.

6. Response to City Comments

This memorandum was originally submitted to the City on January 22, 2018. Following the receipt of comments from City staff minor adjustments were made to the modelling methodology. **Table 6.1** presents comments from City staff and the corresponding adjustments that were made to the modelling plan.

1	Section 2	Confirm w/ planning data	Text adjusted to confirm planning timeline is from 2018 to 2032.
2	Section 3, task 4 and task 6	What about existing sanitary flow data? (UrbanX)	Water billing data will be used to generate initial estimates of existing flows from each parcel. This method is considered the most accurate estimate of wastewater generation at a parcel level given that wastewater generation is generally proportional to water consumption. Estimating flows at a parcel level from sewer flow data would evenly distribute flows across all properties, and not take into consideration high/low water users. Following flow assignments to properties, under task 6, we will check the resulting wastewater flows calculated by the model at the sewer flow metering locations (3 sewer flow meters) and then scale the parcel-based wastewater flows to match the flow meters.
3	Section 3, task 4	What about data from parcels with no water meter data?	In updating the model it will be assumed parcels with no water meter do not generate wastewater (vacant lots). There are only a small number of lots that do not match up with a water meter, and it is anticipated this will be negligible to the later analysis. A note has been added to clarify this in the text.
4	Section 3, task 5	Use diurnal flow pattern from sanitary flow data (UrbanX)	The accuracy of diurnal patterns from the existing model will be confirmed through a comparison against recent flow data. If these patterns are not representative, new diurnal patterns will be developed from recent data.
5	Section 3, task 7	4-7 -> speak to calibration & validation?	Note added that model performance will be evaluated using accepted industry standards (ex. WaPUG Code of Practice for Hydraulic Modelling of Sewer Systems)



6	Section 4	They do account for extraneous flows.	Text was adjusted to reflect that I/I is accounted for in the City's design standard.
7	Section 4	Use Master Plan flow generation criteria	Note added that a per capita flow generation rate of 300L/cap/d will be used as was applied in the 2013 Master Plan.
8	Section 4	We look forward to your investigation and recommendation on this.	No adjustments to text.



APPENDIX D

Water Modelling Results - Thematic Maps (2022 to 2031)





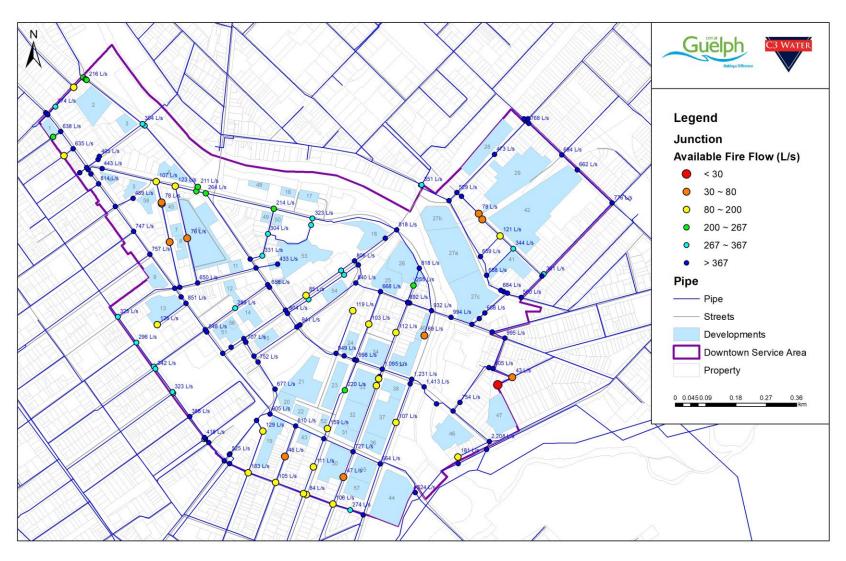


Figure D-1 Fire Flow Conditions – MDD 2022



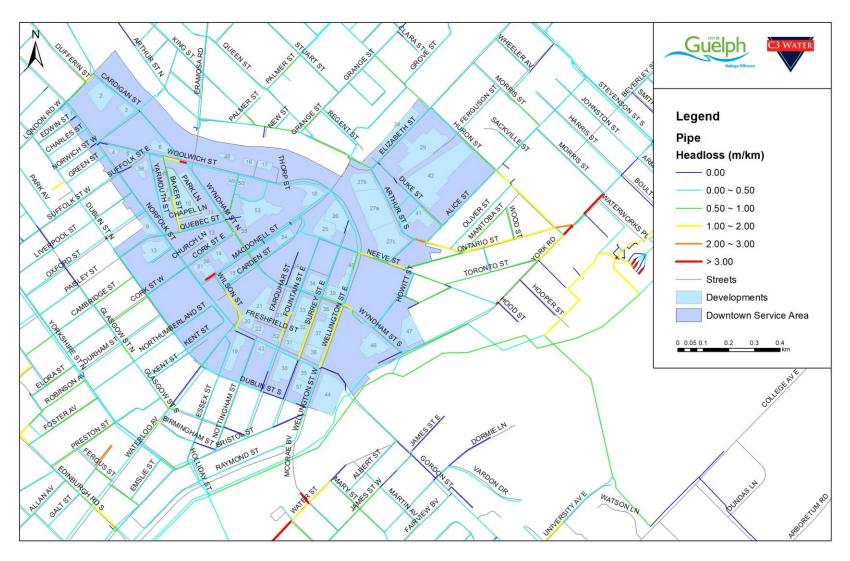


Figure D-2 Head Loss Conditions – MDD 2027



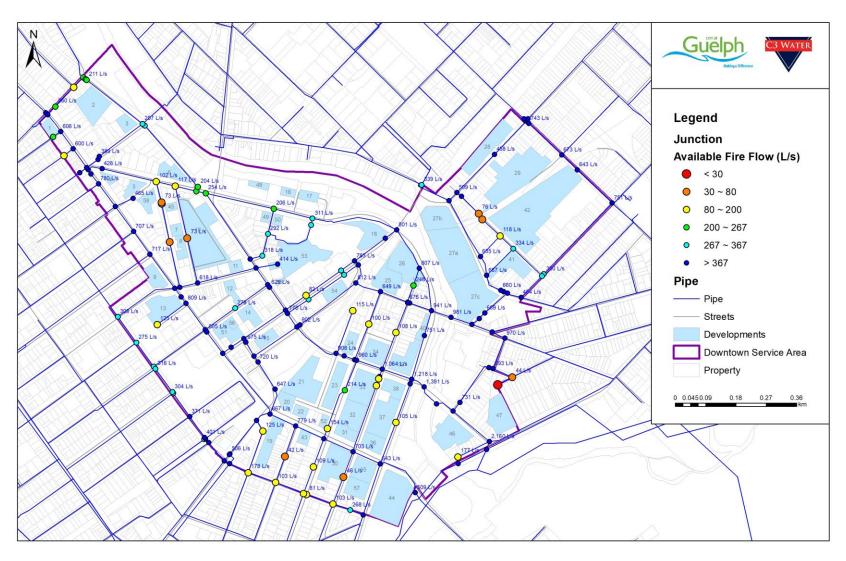


Figure D-3 Fire Flow Conditions – MDD 2027



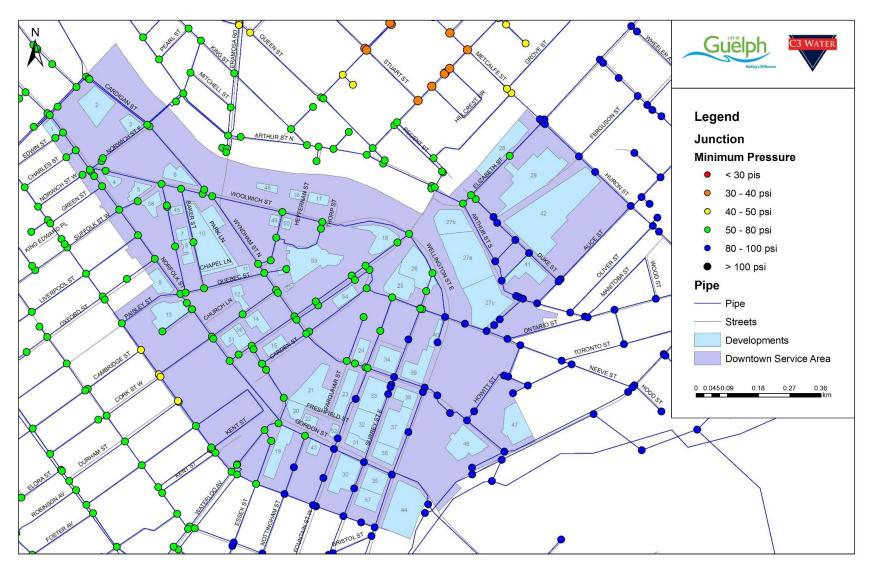


Figure D-4: Minimum Pressure Conditions - MDD 2031



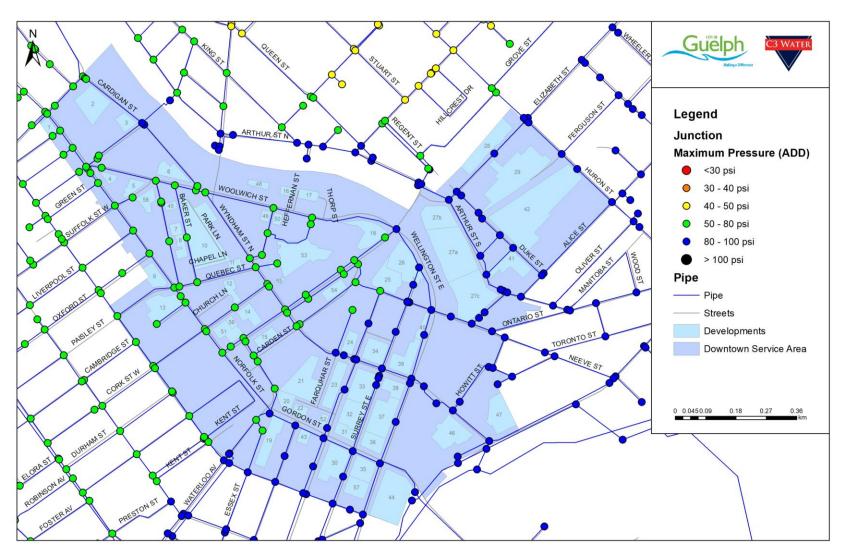


Figure D-5: Maximum Pressure Conditions – ADD 2031



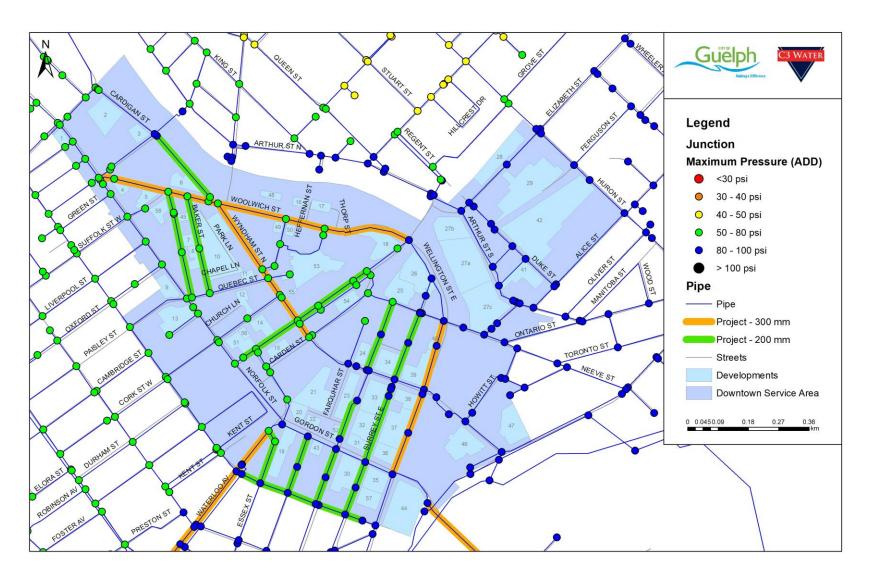
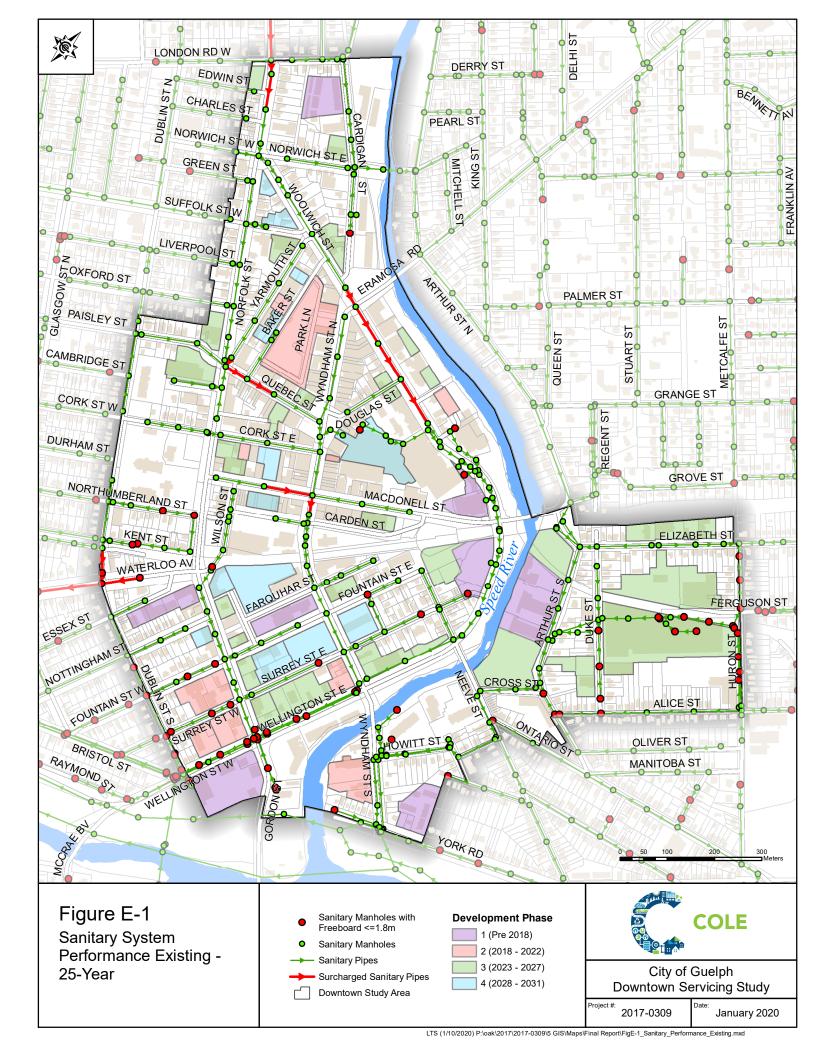


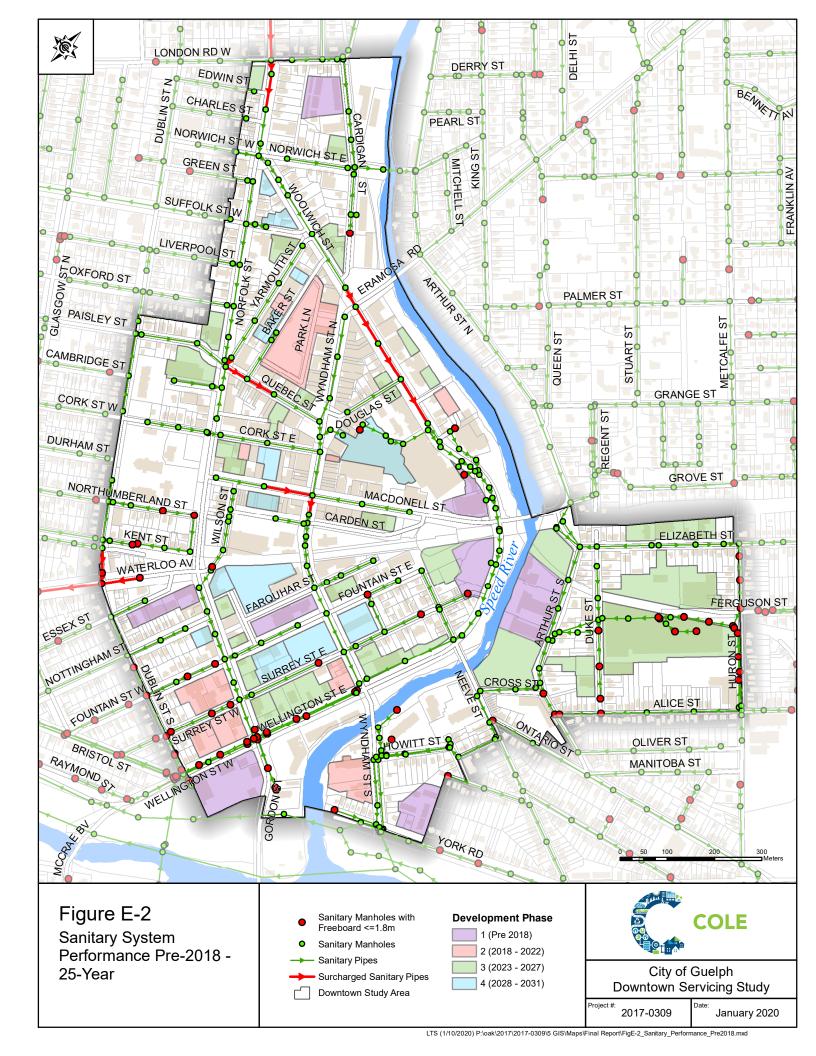
Figure D-6: Proposed Maximum Pressure Conditions - ADD 2031

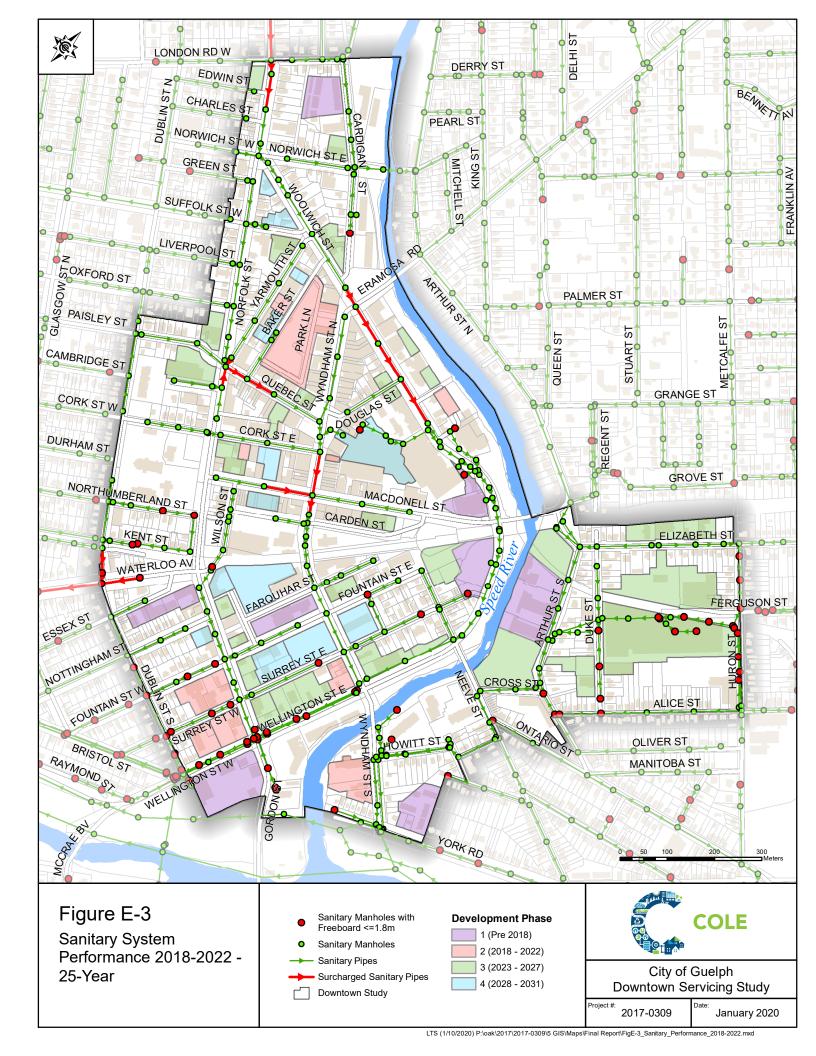
Wastewater Modelling Results - Thematic Maps and HGL Profiles

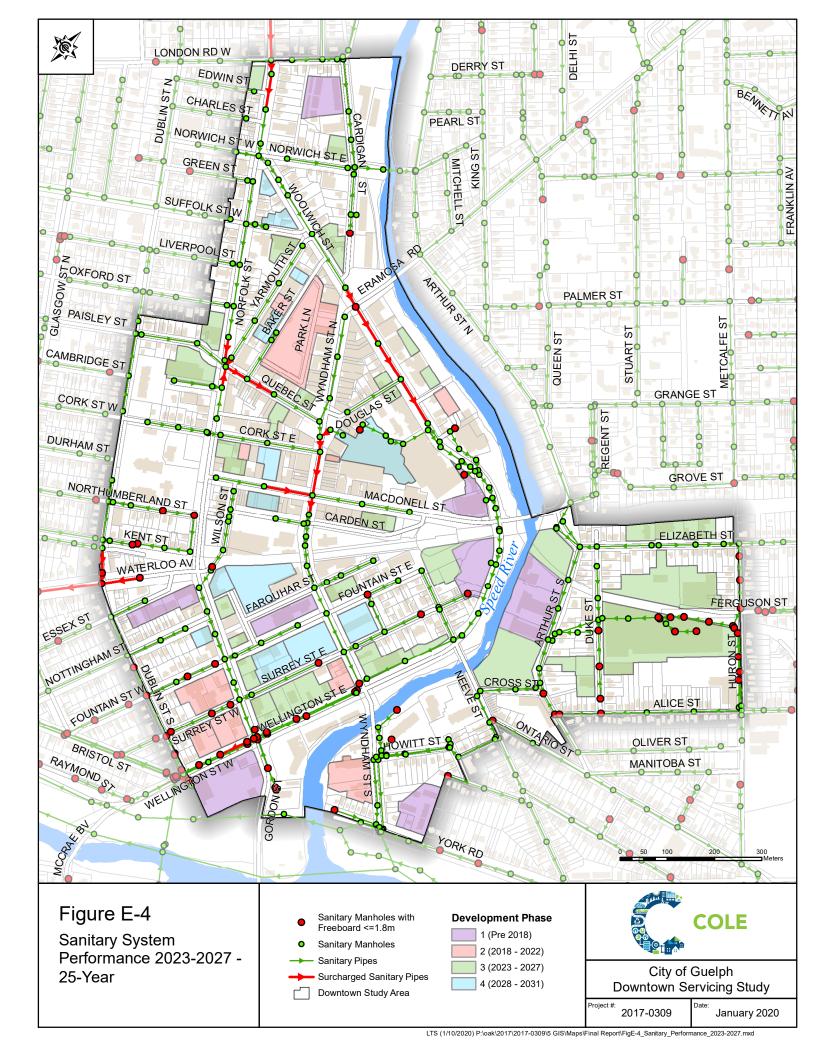


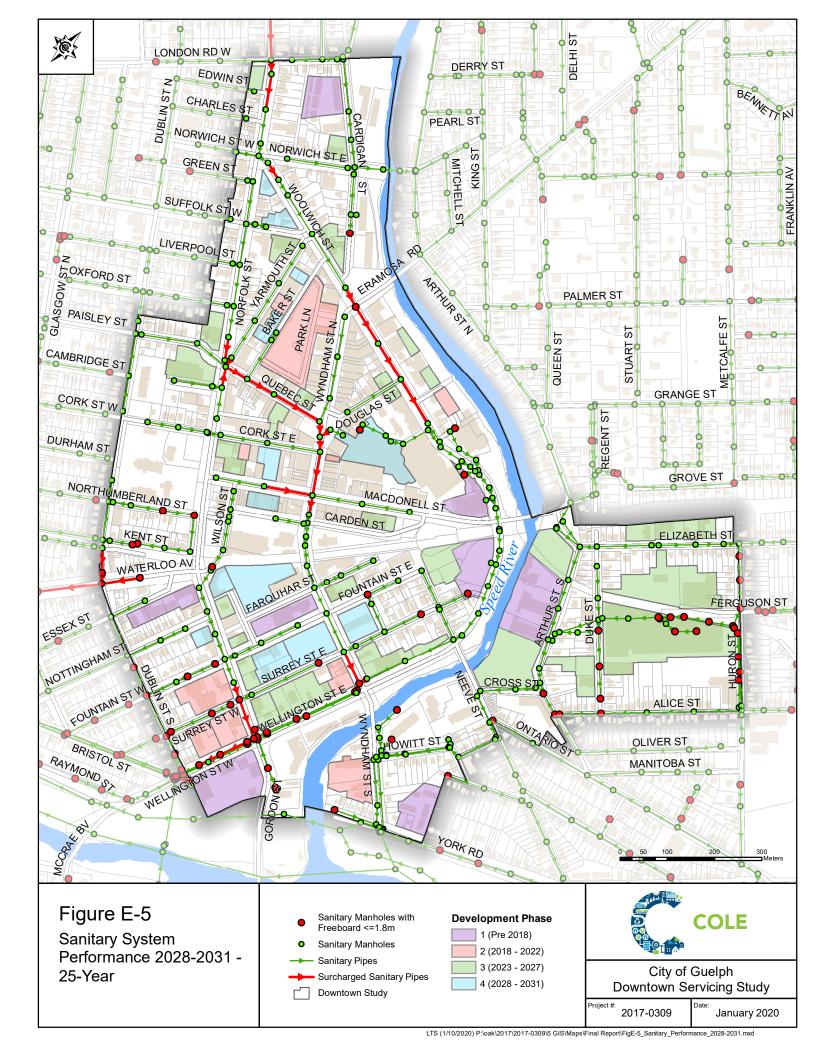












APPENDIX F Detail Project Sheets for Each Recommended Improvement Projects





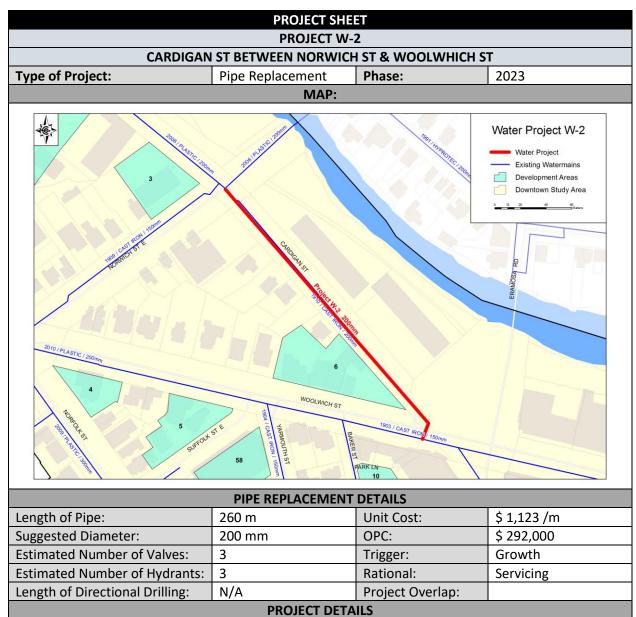




PROJECT SHEET **PROJECT W-1 WOOLWICH ST BETWEEN NORWICH ST & MACDONELL ST** 2018 Type of Project: Pipe Replacement Phase: MAP: Water Project W-1 Water Project Existing Watermains Development Areas Downtown Study Area CHAPEL LN PIPE REPLACEMENT DETAILS Length of Pipe: 950 m Unit Cost: \$921/m \$ 875,000 Suggested Diameter: 300 mm OPC: **Estimated Number of Valves:** Growth/Non-Growth 10 Trigger: Estimated Number of Hydrants: 10 Rational: System Resilience N/A Length of Directional Drilling: Project Overlap: SAN-1 **PROJECT DETAILS**

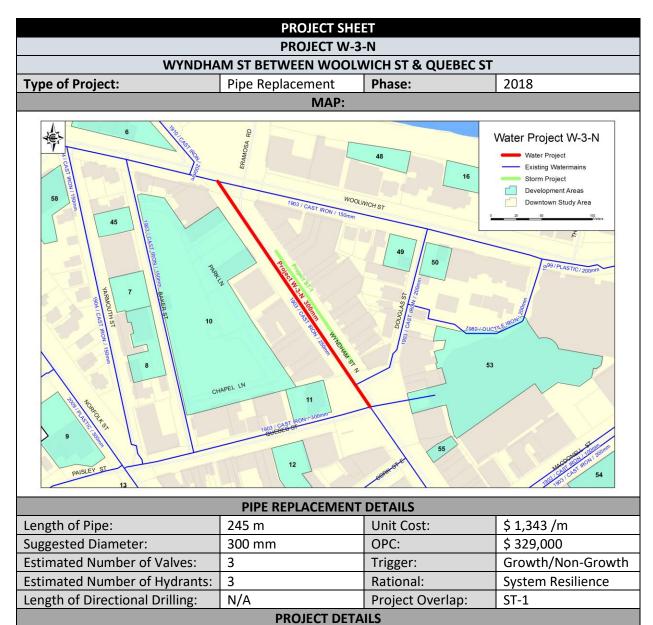
- Project W-1 is recommended for the replacement of the 1903 150mm Cast Iron pipe along Woolwich Street from Norwich Street to Thorp Street, and upgrading the 2012 200 mm PVC pipe to Macdonell Street.
- The project is recommended to create a 300mm loop around the downtown core and provide strong connections to existing and planned river crossings.
- W-1 would address areas of concern HL-1 & HL-4, and improve fire flows in the DSP area.
- Overlaps with SAN-1 from Norwich Street to Thorp Street





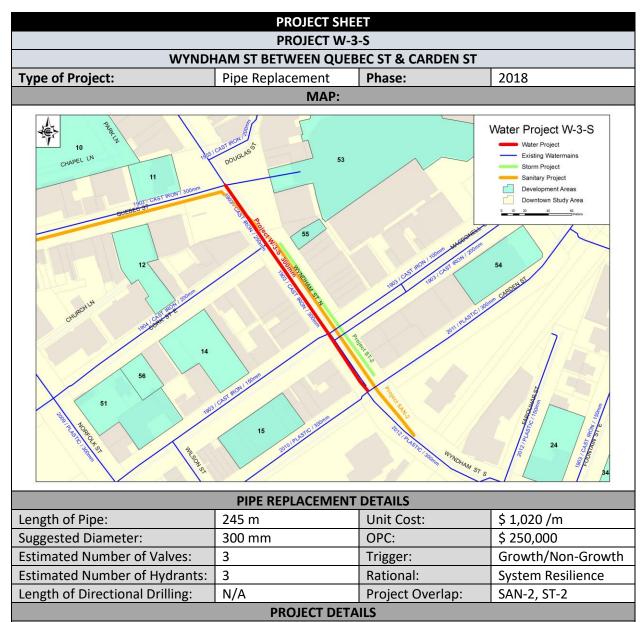
- Project W-2 is recommended for the replacement of the 1910 200mm Cast Iron pipe along Cardigan Street from Norwich Street East to Woolwich Street.
- The project is recommended to provide enhanced connectivity to the river crossing north of the DSP area and improved servicing for proposed developments.
- W-2 would address area of concern HL-1, and improve fire flows in the DSP area.





- Project W-3-N is recommended for the replacement of the 1903 250mm Cast Iron pipe along Wyndham St from Woolwich Street to Quebec Street.
- The project is recommended to create a 300mm loop through the downtown core and improve fire flows in the DSP area.
- W-3 was divided into two sections, since the north half overlaps with ST-1 and the south half overlaps with SAN-2.





- Project W-3-S is recommended for the replacement of the 1903 250mm and 300mm Cast Iron pipe along Wyndham St from Quebec Street to Carden Street
- The project is recommended to create a 300mm loop through the downtown core and improve fire flows in the DSP area.
- This southern section of W-3 overlaps with SAN-2 and ST-2 resulting in a lower unit cost estimate.



PROJECT SHEET **PROJECT W-4 MACDONELL ST BETWEEN NORFOLK ST & CARDEN ST** 2023 **Type of Project:** Pipe Replacement Phase: MAP: Water Project W-4 Water Project Existing Watermains Storm Project Development Areas 26 Downtown Study Area 56 PIPE REPLACEMENT DETAILS Length of Pipe: 450 m Unit Cost: \$1,213/m \$ 546,000 Suggested Diameter: 200 mm OPC: **Estimated Number of Valves:** 5 Trigger: Growth Estimated Number of Hydrants: 5 Rational: Servicing N/A Length of Directional Drilling: Project Overlap: ST-4

PROJECT DETAILS

- Project W-4 is recommended for the replacement of the 1903 150mm Cast Iron pipe along Woolwich Street from Norfolk Street to Wyndham Street, and the 100mm Cast Iron pipe along Woolwich Street from Wyndham Street to Carden Street.
- The project is recommended to improve servicing and connectivity through the downtown core.
- W-4 would address area of concern HL-2 & HL-7, and improve fire flows in the DSP area.
- W-4 overlaps with ST-4.



PROJECT SHEET **PROJECT W-5 DUBLIN ST BETWEEN WATERLOO AVE & WELLINGTON ST** 2028 **Type of Project:** Pipe Replacement Phase: MAP: Water Project W-5 Water Project Storm Project Existing Watermains Development Areas Downtown Study Area PIPE REPLACEMENT DETAILS Length of Pipe: 450 m Unit Cost: \$889/m OPC: \$ 400,000 Suggested Diameter: 200 mm **Estimated Number of Valves:** Growth 5 Trigger: Estimated Number of Hydrants: 5 Rational: Servicing Length of Directional Drilling: N/A Project Overlap: ST-13

PROJECT DETAILS

- Project W-5 is recommended for the replacement of the 1903 150mm Cast Iron pipe along Dublin Street from Waterloo Avenue to Nottingham Street, and the 1930's 100mm Cast Iron pipe from Nottingham Street to Wellington Street
- The project is recommended to improve servicing, connectivity and fire flows in the DSP area.
- W-5 overlaps with ST-4 and has a lower unit cost.



PROJECT SHEET **PROJECT W-6 WATERLOO AVE BETWEEN YORKSHIRE ST & ESSEX ST** 2023 **Type of Project:** Pipe Replacement Phase: MAP: Water Project W-6 Water Project **Existing Watermains** Development Areas Downtown Study Area PIPE REPLACEMENT DETAILS Length of Pipe: 530 m Unit Cost: \$ 1,232 /m \$ 653,000 Suggested Diameter: 300 mm OPC: **Estimated Number of Valves:** Growth/Non-Growth 6 Trigger: Estimated Number of Hydrants: 6 Rational: System Resilience N/A Length of Directional Drilling: Project Overlap: N/A

Project W-6 is recommended for the replacement of the 1903-1905 150mm Cast Iron pipe along Waterloo Avenue from Yorkshire Street to Dublin Street and the 200mm Cast Iron pipe along

PROJECT DETAILS

- The project is recommended to enhance connectivity of the DSP area to the future feedermain along Yorkshire St S.
- W-6 would address area of concern HL-8, and improve fire flows in the DSP area.

from Dublin Street to Essex Street.



PROJECT SHEET PROJECT W-7 YARMOUTH ST BETWEEN WOOLWICH ST & QUEBEC ST 2023 **Type of Project:** Pipe Replacement Phase: MAP: Water Project W-7 WOOLWICHST Water Project Existing Watermains Storm Project Development Areas Downtown Study Area 45 CHAPEL LN PIPE REPLACEMENT DETAILS Length of Pipe: 330 m Unit Cost: \$ 903 /m OPC: \$ 298,000 Suggested Diameter: 200 mm **Estimated Number of Valves:** Growth 4 Trigger: Estimated Number of Hydrants: 4 Rational: Servicing Length of Directional Drilling: N/A Project Overlap: ST-6

- **PROJECT DETAILS**
- Project W-7 is recommended for the replacement of the 1904 150mm Cast Iron pipe along Yarmouth Street from Woolwich Street to Quebec Street.
- W-7 would address area of concern FF-1 and improve servicing for proposed developments.
- W-7 overlaps with ST-6 and has a lower unit cost.

Length of Directional Drilling:



PROJECT SHEET **PROJECT W-8 BAKER ST BETWEEN WOOLWICH ST & QUEBEC ST** 2018 **Type of Project:** Pipe Replacement Phase: MAP: Water Project W-8 Water Project Existing Watermains Development Areas Downtown Study Area CHAPEL LN PIPE REPLACEMENT DETAILS Length of Pipe: 300 m Unit Cost: \$ 1,103 /m OPC: \$ 331,000 Suggested Diameter: 200 mm **Estimated Number of Valves:** Growth 3 Trigger: Estimated Number of Hydrants: 3 Rational: Servicing

PROJECT DETAILS

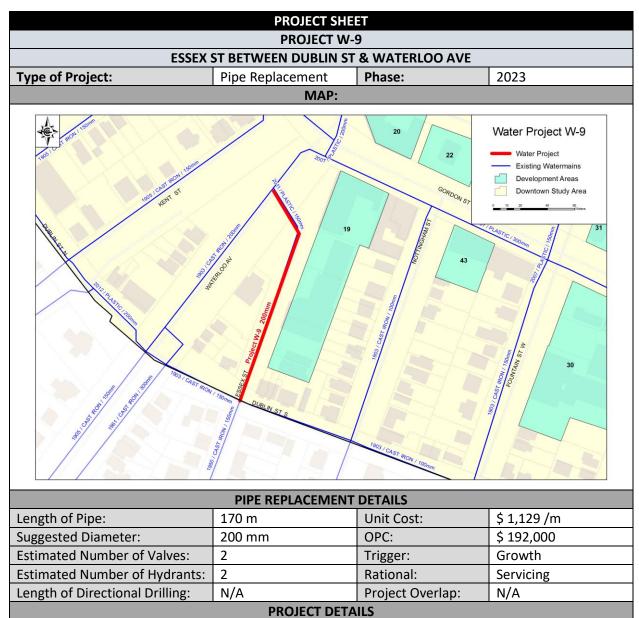
Project Overlap:

N/A

N/A

- Project W-8 is recommended for the replacement of the 1903 150mm Cast Iron pipe along Baker Street from Woolwich Street to Quebec Street.
- W-8 would address area of concern HL-6 & FF-1, and improve servicing for proposed developments.





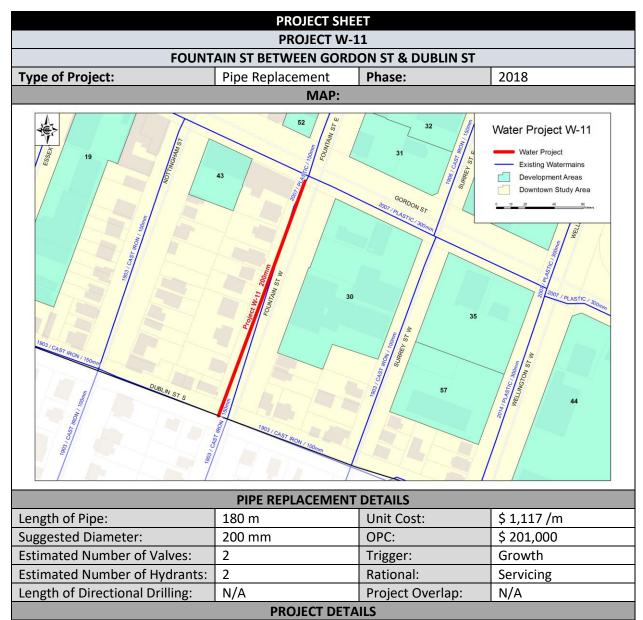
- Project W-9 is recommended for the replacement of the 1950 150mm Cast Iron pipe along Essex Street from Waterloo Avenue to Dublin Street to improve fire flows in the DSP area.
- W-9 would improve servicing and fire flows for proposed developments.



PROJECT SHEET PROJECT W-10 NOTTINGHAM STREET BETWEEN DUBLIN ST & GORDON ST 2028 **Type of Project:** Pipe Replacement Phase: MAP: Water Project W-10 Water Project **Existing Watermains** Development Areas Downtown Study Area PIPE REPLACEMENT DETAILS Length of Pipe: 180 m Unit Cost: \$1,117/m OPC: \$ 201,000 Suggested Diameter: 200 mm **Estimated Number of Valves:** 2 Growth Trigger: Estimated Number of Hydrants: 2 Rational: Servicing Length of Directional Drilling: N/A Project Overlap: N/A **PROJECT DETAILS**

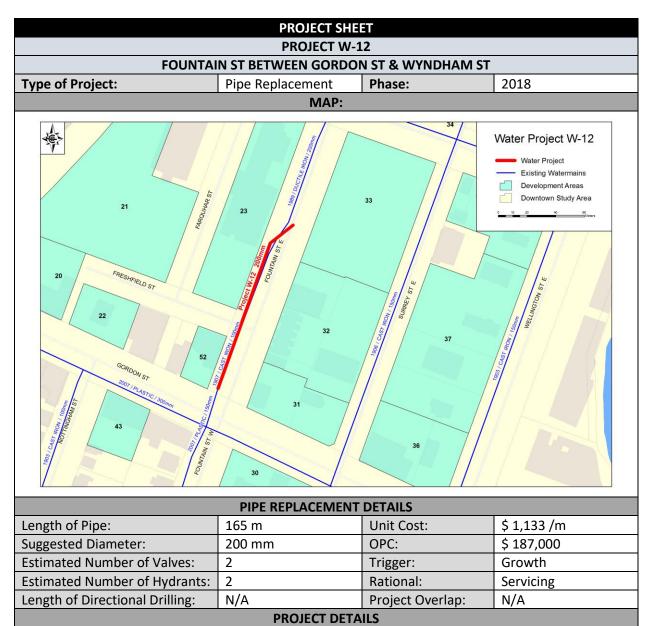
- Project W-10 is recommended for the replacement of the 1903 100mm Cast Iron pipe along Nottingham Street from Gordon Street to Dublin Street to improve fire flows in the DSP area.
- W-10 would address area of concern FF-5, and improve servicing for proposed developments.





- Project W-11 is recommended for the replacement of the 1903 150mm Cast Iron pipe along Fountain Street from Gordon Street to Dublin Street to improve fire flows in the DSP area.
- W-11 would improve servicing and fire flows for proposed developments.





- Project W-12 is recommended for the replacement of the 1907 100mm Cast Iron pipe along Fountain Street between Gordon Street and Wyndham Street
- W-12 would address area of concern HL-5, and improve fire flows and servicing for proposed developments.



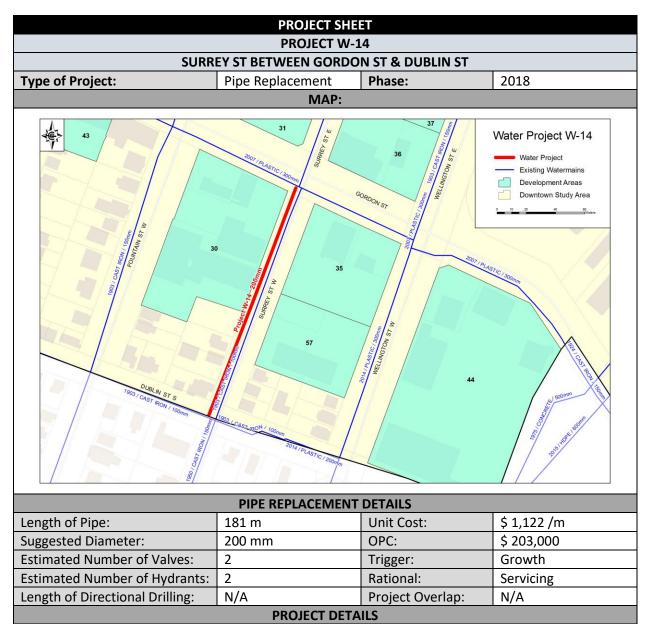
PROJECT SHEET PROJECT W-13 FOUNTAIN ST BETWEEN WYNDHAM ST & NEEVE ST 2023 **Type of Project:** Pipe Replacement Phase: MAP: Water Project W-13 Water Project **Existing Watermains** Development Areas Downtown Study Area 21 PIPE REPLACEMENT DETAILS Length of Pipe: 220 m Unit Cost: \$ 1,155 /m OPC: \$ 254,000 Suggested Diameter: 200 mm **Estimated Number of Valves:** Growth 3 Trigger: Estimated Number of Hydrants: 3 Rational: Servicing Length of Directional Drilling: N/A Project Overlap: N/A

- Project W-13 is recommended for the replacement of the 1903 150mm Cast Iron pipe along Fountain Street from Wyndham Street to Neeve Street.

PROJECT DETAILS

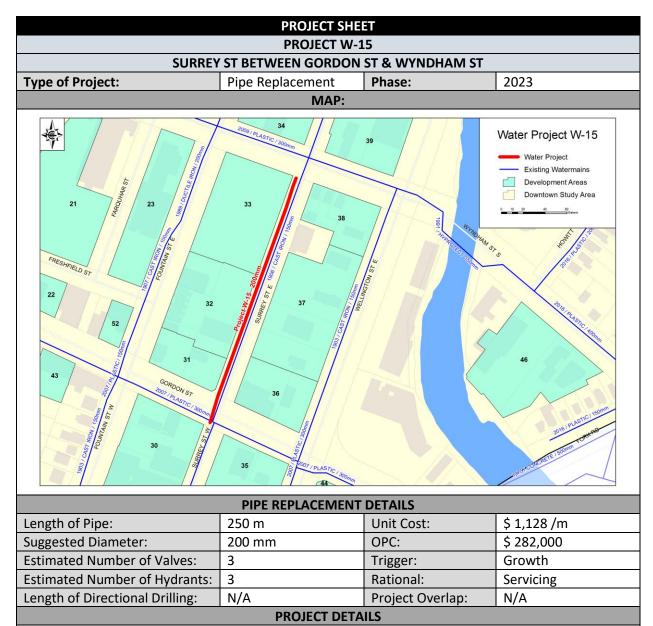
- W-13 would improve servicing and fire flows for proposed developments.





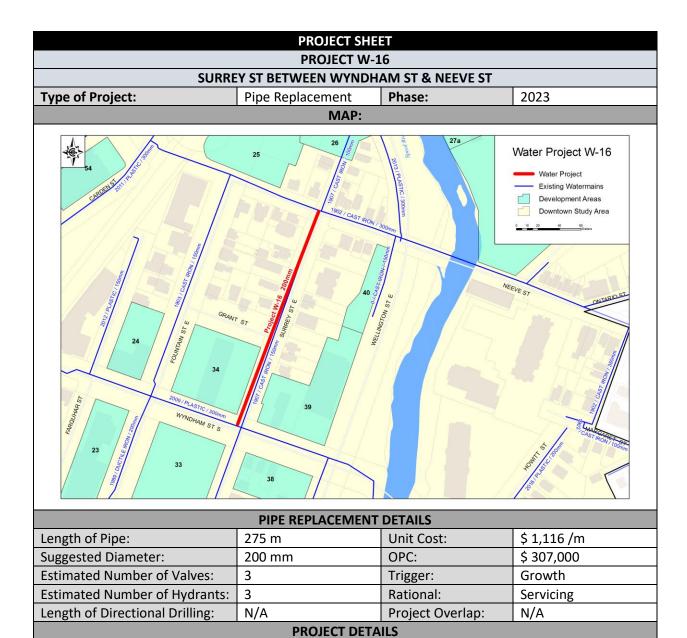
- Project W-14 is recommended for the replacement of the 1903 100mm Cast Iron pipe along Surrey Street from Gordon Street to Dublin Street.
- W-14 would address area of concern FF-5, and improve servicing for proposed developments.





- Project W-15 is recommended for the replacement of the 1906 150mm Cast Iron pipe along Surrey Street from Gordon Street to Wyndham Street.
- W-15 would improve servicing and fire flows for proposed developments.





- Project W-16 is recommended for the replacement of the 1907 150mm Cast Iron pipe along Surrey Street from Wyndham Street to Neeve Street.
- W-16 would improve fire flows and servicing for proposed developments.



PROJECT SHEET PROJECT W-17 WELLINGTON ST BETWEEN GORDON ST & WYNDHAM ST 2018 **Type of Project:** Pipe Replacement Phase: MAP: Water Project W-17 **Existing Watermains** Development Areas Downtown Study Area PIPE REPLACEMENT DETAILS Length of Pipe: 260 m Unit Cost: \$ 1,235 /m OPC: \$ 321,000 Suggested Diameter: 300 mm **Estimated Number of Valves:** Growth/Non-Growth 3 Trigger: Estimated Number of Hydrants: 3 Rational: System Resilience N/A Length of Directional Drilling: Project Overlap: N/A

- Project W-17 is recommended for the replacement of the 1903 150mm Cast Iron pipe along Wellington Street from Gordon Street to Wyndham Street.

PROJECT DETAILS

 W-17 would address area of concern HL-7 & HL-9, and improve fire flows and servicing for proposed developments.



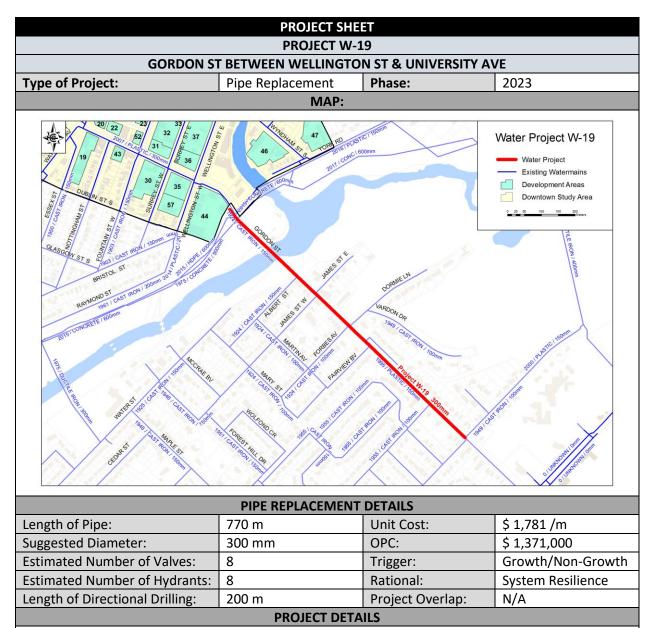
PROJECT SHEET **PROJECT W-18 WELLINGTON ST BETWEEN WYNDHAM ST & NEEVE ST Type of Project:** Pipe Replacement Phase: 2023 and New Pipe MAP: Water Project W-18 Water Project 27c Existing Watermains Development Areas Downtown Study Area PIPE REPLACEMENT DETAILS Length of Pipe: 220 m \$1,273 /m Unit Cost: Suggested Diameter: 300 mm OPC: \$ 280,000 Growth/Non-Growth **Estimated Number of Valves:** 3 Trigger: Estimated Number of Hydrants: 3 System Resilience Rational: N/A Length of Directional Drilling: Project Overlap: N/A

 Project W-18 is recommended for the replacement of the 150mm Cast Iron pipe along Wellington Street starting at Neeve Street and installation of new pipe to connect the existing dead-end pipe to Wyndham St.

PROJECT DETAILS

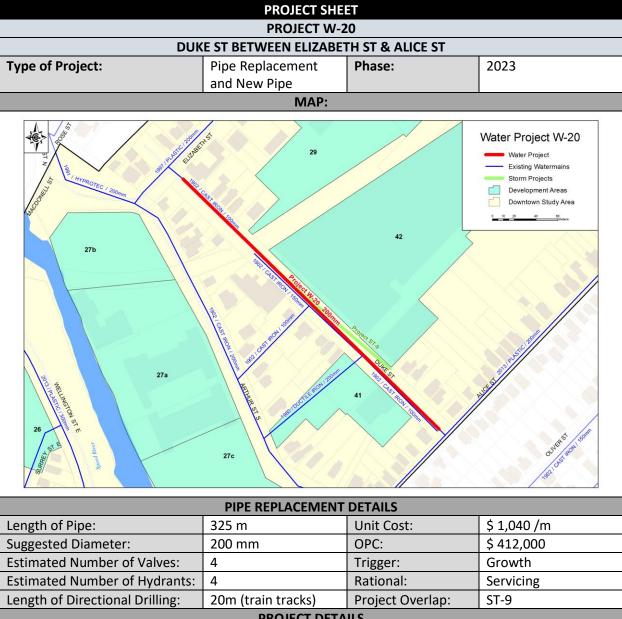
- W-17 would address area of concern HL-7 & FF-3, and servicing for proposed developments.





- Project W-19 is recommended for the replacement of the 1924 150mm Cast Iron pipe along Gordon street between Wellington Street and Albert Street and 1995 150mm Polyethylene pipe along Gordon Street from Albert Street to University Avenue.
- The project is recommended to enhance connectivity of the DSP area to the old university area and improve existing river crossings. Connection to the existing Wellington Road feedermains is recommended if feasible.
- W-19 would address area of concern HL-3 & HL-8, and improve fire flows in the DSP area.
- Directional drilling is recommended to install the pipe under the Speed River.



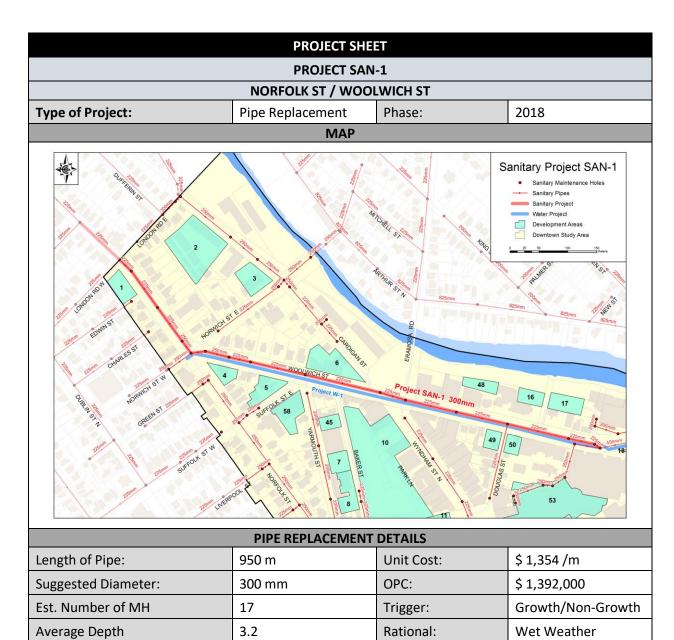


- Project W-20 is recommended for the replacement of the 1902 100mm and 150mm Cast Iron pipe along Duke Street from Elizabeth Street to Alice Street.
- This project is expected to be addressed through a separate assignment with the City, but impacts the DSP.
- W-20 would address area of concern FF-2, and improve servicing to proposed developments.
- Directional drilling for a length of 20m is estimated at the train tracks.
- W-20 overlaps with ST-9 and has a lower unit cost.







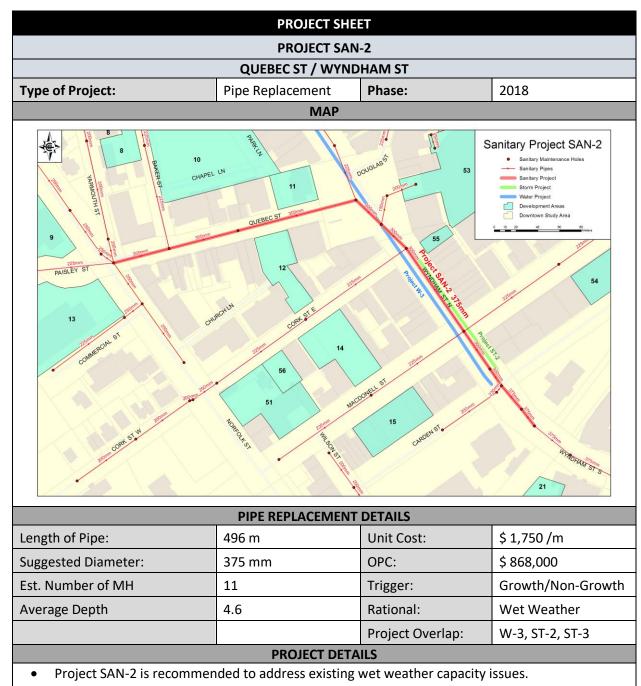


Project Overlap:

W-1

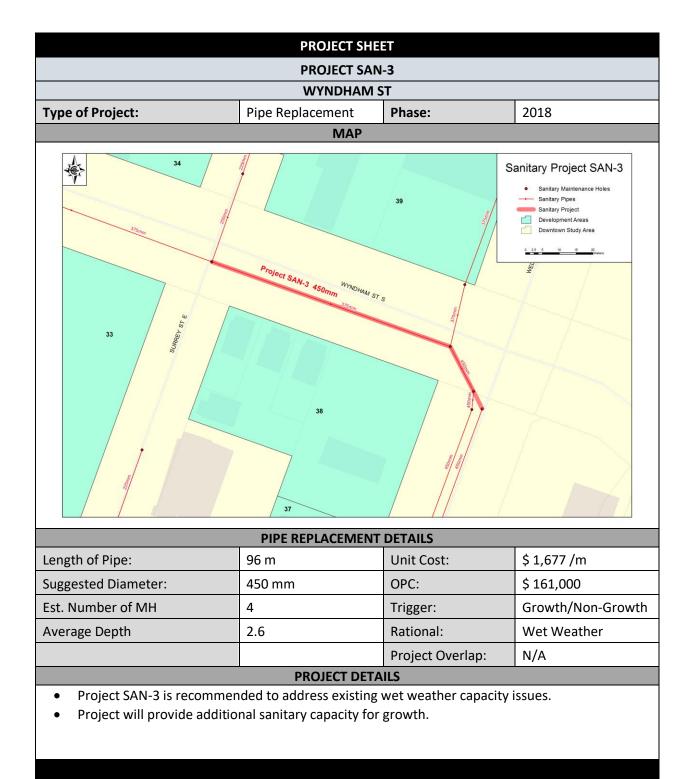
- Project SAN-1 is recommended to address existing wet weather capacity issues.
- Project will provide additional sanitary capacity for growth
- Overlaps with W-1 from Norwich Street to Thorp Street



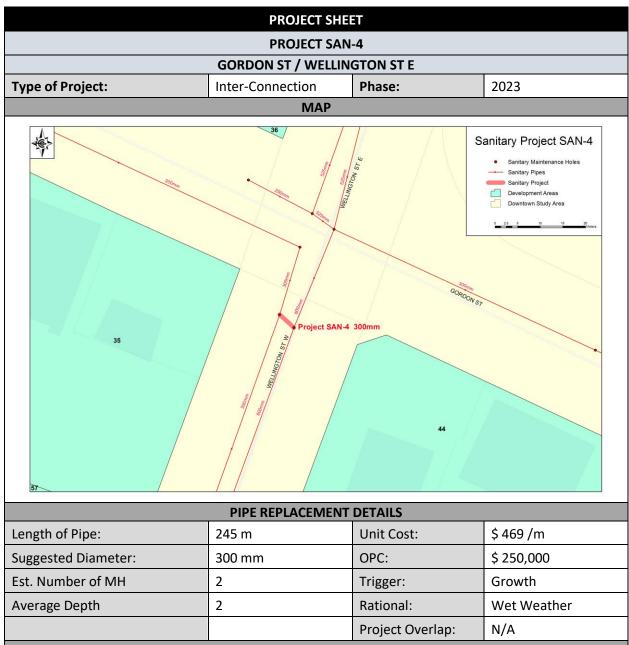


- Project will provide additional sanitary capacity for growth.
- Overlaps with W-3, ST-2 and ST-3 on Wyndham Street.









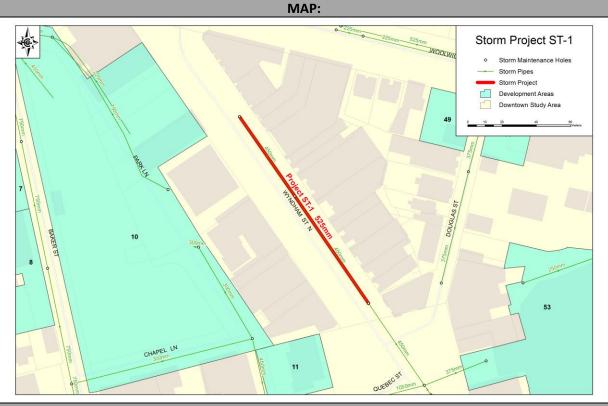
- Project SAN-4 is recommended to maximize the capacity in existing systems by sharing flow between systems.
- The connections is not required until after 2023.







PROJECT SHEET PROJECT ST-1 WYNDHAM ST BETWEEN WOOLWICH & QUEBEC ST Type of Project: Pipe Replacement Phase: 2023



PIPE REPLACEMENT DETAILS			
Length of Pipe:	133 m	Unit Cost:	\$ 1,781/m
Suggested Diameter:	525 mm	OPC:	\$ 237,000
Estimated Number of	2	Trigger:	Growth and
maintenance holes:			performance
Estimated Number of new CBs:	0	Rationale:	100-yr
Length of Directional Drilling:	N/A	Project Overlap:	N/A

- Project ST-1 recommends the replacement of 133 m of 375 mm and 450 mm pipe with 525 mm pipe.
- This project increases the LOS from 5-year to 100-year
- The average depth of excavation for this project is 3 m



PROJECT SHEET PROJECT ST-2 WYNDHAM ST BETWEEN CORK ST &CARDEN ST Type of Project: Pipe Replacement Phase: 2023 MAP:



PIPE REPLACEMENT DETAILS			
Length of Pipe:	144 m	Unit Cost:	\$ 3,434/m
Suggested Diameter:	1350 mm	OPC:	\$ 494,000
Estimated Number of	3	Trigger:	Growth and
maintenance holes:			performance
Estimated Number of new CBs:	0	Rationale:	100-yr
Length of Directional Drilling:	N/A	Project Overlap:	W-3, SAN-2

- This project is to provide additional capacity to the sewers on Wyndham St that receive flows from the various side streets
- This project is driven by the need for extra capacity cause by upgraded pipes on side streets conveying additional flow to these sewers on Wyndham
- This project will increase the LOS from 5-year to 100-year
- The average depth of excavation for this project is 3.3 m

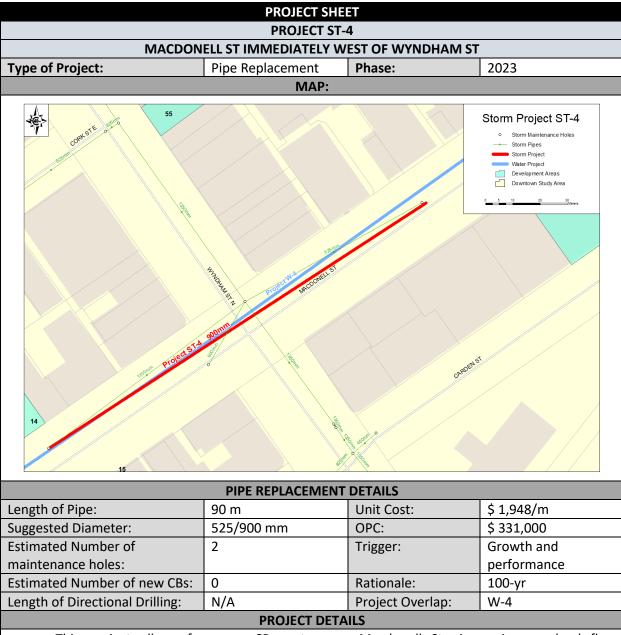


PROJECT SHEET **PROJECT ST-3 CORK ST IMMEDIATELY WEST OF WYNDHAM ST** 2023 **Type of Project:** Pipe Replacement Phase: MAP: Storm Project ST-3 Storm Maintenance Holes 53 Storm Project Development Areas Downtown Study Area 12 PIPE REPLACEMENT DETAILS Length of Pipe: 48 m Unit Cost: \$ 2,550/m Suggested Diameter: 825 mm OPC: \$ 122,000

Suggested Diameter: 825 mm OPC: \$ 122,000 Estimated Number of 1 Trigger: Growth and performance Estimated Number of new CBs: 2 Rationale: 100-yr Length of Directional Drilling: N/A Project Overlap: N/A

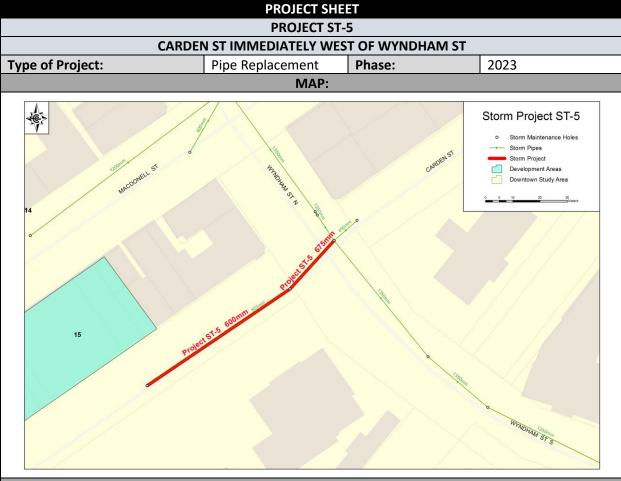
- The purpose of this project is to mitigate overland flow depth issues on Cork St. by adding two (2) additional CBs, or replacing the two (2) existing CBs with DCBs
- The new CBs requires the pipe immediately downstream to be upgraded to convey the extra captured flow
- This project increases the LOS from 50-year to 100-year
- The average depth of excavation for this project is 2.6 m





- This project allows for more CB capture on Macdonell St., improving overland flow performance and reducing surcharge.
- This project increases the level of service from 5-year to 100-year
- The average depth of excavation for this project is 2 m



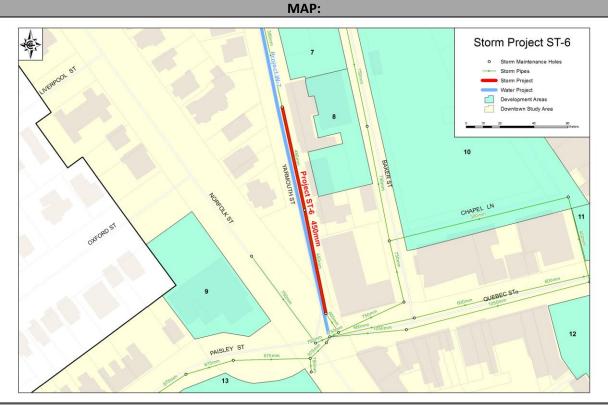


PIPE REPLACEMENT DETAILS			
Length of Pipe:	87 m	Unit Cost:	\$ 2,046/m
Suggested Diameter:	600/675 mm	OPC:	\$ 177,000
Estimated Number of	2	Trigger:	Growth and
maintenance holes:			performance
Estimated Number of new CBs:	0	Rationale:	100-yr
Length of Directional Drilling:	N/A	Project Overlap:	N/A

- These proposed pipe upgrades mitigate surcharging and overland flow depth issues on Carden St.
- Upsizing these pipes allows more CB flow to be conveyed to the large sewers on Wyndham St.
- This project increases the LOS from 2-year to 100-year
- The average depth of excavation for this project is 2.9 m



PROJECT SHEET PROJECT ST-6 YARMOUTH ST NORTH OF QUEBEC ST Type of Project: Pipe Replacement Phase: 2023



PIPE REPLACEMENT DETAILS			
Length of Pipe:	122 m	Unit Cost:	\$ 1,678/m
Suggested Diameter:	450 mm	OPC:	\$ 205,000
Estimated Number of	2	Trigger:	Growth and
maintenance holes:			performance
Estimated Number of new CBs:	0	Rationale:	100-yr
Length of Directional Drilling:	N/A	Project Overlap:	W-7

- This project is to mitigate surcharging issues and increase the LOS from 5-year to 100-year.
- The average depth of excavation for this project is 1.8 m

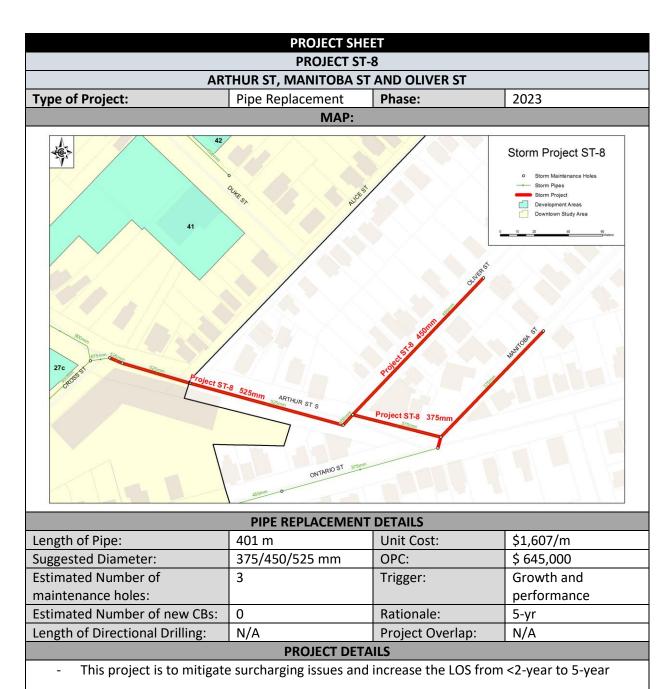


PROJECT SHEET PROJECT ST-7 ONTARIO ST BETWEEN MANITOBA ST &NEEVE ST Type of Project: Pipe Replacement MAP: Storm Project ST-7 Basen Manitomace Holds Basen Plans Development Anna Develo

PIPE REPLACEMENT DETAILS				
Length of Pipe:	234 m	Unit Cost:	\$ 1,586/m	
Suggested Diameter:	375/450 mm	OPC:	\$ 371,000	
Estimated Number of	7	Trigger:	Growth and	
maintenance holes:			performance	
Estimated Number of new CBs:	0	Rationale:	5-yr	
Length of Directional Drilling:	N/A	Project Overlap:	N/A	

- This project is to mitigate surcharging issues and increase the LOS from <2-year to 50-year
- The average depth of excavation for this project is 1.3 m





- The average depth of excavation for this project is 1.3 m



PROJECT ST-9 DUKE ST SOUTH OF RAIL EASEMENT Type of Project: Pipe Replacement Phase: 2023 MAP: Storm Project ST-9 9 Storm Marinamere rioles 1 Storm Project ST-9 1 Storm Project 2 Storm Project 3 Storm Project 4 Storm Project 2 Storm Project 3 Storm Project 4 Sto

PIPE REPLACEMENT DETAILS			
Length of Pipe:	140 m	Unit Cost:	\$ 1,930/m
Suggested Diameter:	600 mm	OPC:	\$ 270,000
Estimated Number of	1	Trigger:	Growth and
maintenance holes:			performance
Estimated Number of new CBs:	0	Rationale:	5-yr
Length of Directional Drilling:	N/A	Project Overlap:	W-20

PROJECT DETAILS

- This project is to mitigate surcharging issues and increase the LOS from <2-year to 5-year
- The average depth of excavation for this project is 1.6 m

27c



PROJECT SHEET PROJECT ST-10 HURON ST BETWEEN RAIL EASEMENT AND ELIZABETH ST, ELIZABETH STREET WEST OF HURON ST Type of Project: Pipe Replacement Phase: 2023 MAP: Storm Project ST-10 Bland Maintenance House Bland Maintenance House Bland Market Bland Area Bland

PIPE REPLACEMENT DETAILS			
Length of Pipe:	320 m	Unit Cost:	\$1,864 /m
Suggested Diameter:	375/450/675 mm	OPC:	\$ 597,000
Estimated Number of	8	Trigger:	Growth and
maintenance holes:			performance
Estimated Number of new CBs:	0	Rationale:	5-yr
Length of Directional Drilling:	N/A	Project Overlap:	N/A

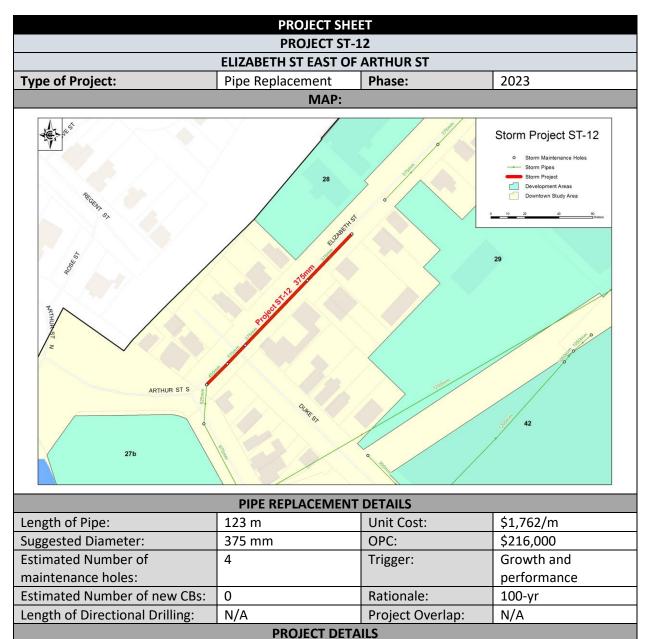
- This project is to mitigate surcharging issues and increase the LOS from <2-year to 5-year
- Helps improve conveyance to the collector sewer running southwest on Ferguson along the rail easement
- The average depth of excavation for this project is 1.6 m



PROJECT SHEET PROJECT ST-11 FERGUSON ST SOUTHWEST OF HURON ST ALONG RAIL EASEMENT TO ARTHUR ST **Type of Project:** Pipe Replacement Phase: 2023 MAP: Storm Project ST-11 Storm Maintenance Holes Storm Pipes Storm Project Downtown Study Area ARTHUR ST S 27b 27a PIPE REPLACEMENT DETAILS Length of Pipe: 494 m Unit Cost: \$4,493/m Suggested Diameter: 1,200 mm OPC: \$2,221,000 **Estimated Number of** Growth and Trigger: maintenance holes: performance Estimated Number of new CBs: 0 Rationale: 5-yr N/A N/A Length of Directional Drilling: Project Overlap:

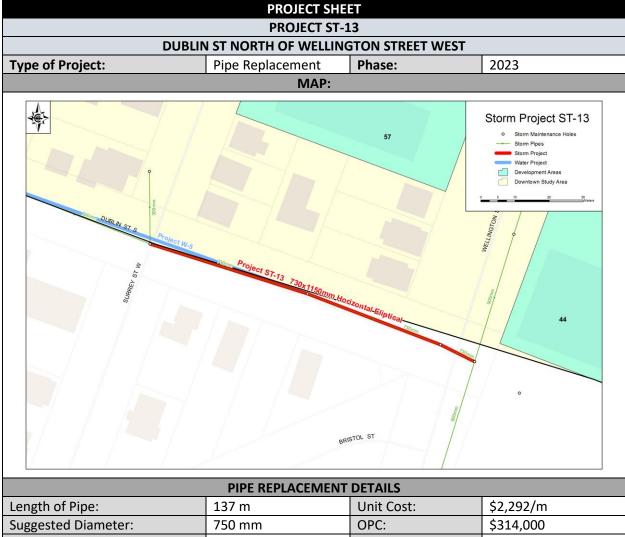
- This project is to mitigate surcharging issues and increase the LOS from <2-year to 5-year
- Helps improve conveyance to the collector sewer on Arthur St., and reduces the stormwater control requirements for the adjacent development sites.
- This project includes a rail crossing on Arthur St.
- The average depth of excavation for this project is 1.8 m.
- The cost has a premium added for the rail crossing.





- This project is to mitigate surcharging issues and increase the LOS from <2-year to 100-year
- Helps improve conveyance to the collector sewer on Arthur St., and reduces the stormwater control requirements for the adjacent development sites.
- The average depth of excavation for this project is 2 m





PIPE REPLACEIVIENT DETAILS			
Length of Pipe:	137 m	Unit Cost:	\$2,292/m
Suggested Diameter:	750 mm	OPC:	\$314,000
Estimated Number of	5	Trigger:	Growth and
maintenance holes:			performance
Estimated Number of new CBs:	0	Rationale:	25-yr
Length of Directional Drilling:	N/A	Project Overlap:	W-5

- This project is to mitigate surcharging issues and increase the LOS from <2-year to 25-year
- Helps improve conveyance to the collector sewer on Arthur St., and reduces the stormwater control requirements for the adjacent development sites.
- The average depth of excavation for this project is 2 m

APPENDIX G

Wastewater Maximum HGL Profiles for Recommended Projects



